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Recent Image Denoising Techniques (A Review)

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Abstract - *This paper presents a review of recent algorithms for noise reduction in images. The techniques discussed here deals with the impulse, multiplicative and Gaussian noise. Image fusion technique is employed as a general model for impulse noise meanwhile the static based median filter is mentioned for the salt and pepper noise reduction. Multiplicative noise reduction techniques involves the application of adaptive windowing along with Lee filtering. Additive White Gaussian Noise reduction made use of a new technique called Sliding double window filtering, which is a frequency domain concept. Fibonacci Fourier Transform is used in this technique. The simulation results and the quantitative analysis show that these techniques possess good edge preserving as well as noise suppression capability.*

Keywords: Noise reduction, multiplicative noise, impulse noise, AWGN, SBMF, IMF1, IMF2, SDWF.

1. Introduction

Noise Corruption in digital images usually occur during acquisition by camera sensors and transmission in the channel Different types of noise that affect digital images include Additive White Gaussian Noise (AWGN), impulse noise, multiplicative noise etc [1]. Hence, the image denoising is one of the most common and important image processing operation. The impulse noise can be caused by a camera due to the faulty nature of the sensor or during transmission of coded images in a noisy communication channel. The nonlinear-median filter is widely used for impulse noise removal. Most of the median based techniques alter the entire image pixels and hence produces poor quality recovered images. In this paper a novel idea for impulse noise reduction is discussed, which employs the technique called image fusion [2] and a new algorithm using the Statistics Based Median Filter (SBMF) [3] to deal with the salt and pepper noise [1] is mentioned.

Multiplicative noise, specifically called as speckle noise [4] usually appears in synthetic aperture radar (SAR) images, and it degrades the quality of images significantly. In this paper, an analysis of recent noise reduction algorithms for different noises is carried out. A brief discussion of a new filtering algorithm based on adaptive windowing [4] and local structure detection [5] is done. The filtering scheme employed in this scheme is Lee filtering [6].

A frequency domain technique for AWGN reduction based on Sliding Double Window Filtering (SDWF) is proposed in [7]. The sliding double window filter contains two window types, the transformed window and the spatial window. For AWGN reduction, several techniques such as averaging and Wiener filtering has already been implemented. The sliding double window algorithm relies on the concept of threshold filtering. The transform used here is the Fibonacci Fourier Transform [7], a modification of the Discrete Fourier Transform.

The selection of a suitable noise reduction technique primarily depends on the noise type, its statistics, intensity and the application. So a comparison of different denoising techniques based on these aspects would be very useful. This paper aims to analyze different noise reduction techniques for the three commonly occurring noises in the images, namely impulsive, multiplicative and Gaussian, to determine the suitable methods for each type of noise. The paper provides only the analysis of different types of noises separately.

The paper is organized as follows. In section 2 a review of noise reduction techniques for the three types of noise are discussed. In order to compare the performance of the discussed filtering algorithms with the conventional methods, some experimental results and a PSNR versus noise density plot are given in section 3. Finally, this paper is concluded in section 4.

2. Review of noise reduction techniques

A. Impulse noise reduction

Impulse noise is very common in digital images. It is independent and uncorrelated to the image pixels and is randomly distributed over the image. There are different types of impulse noise namely salt and pepper and random valued [3] etc.

For the general impulse noise model, two different techniques based on image fusion are briefly discussed in this section for obtaining better quality images. Fusion implies the method of combining two or more images captured by different sensors. It involves two closely related methods, the first one uses fusion followed by filtering, while the other relies on filtering followed by fusion. First technique (IMF1) involves the fusion of the images captured by different sensors with the help of a binary map. The fused image is filtered using median filter . In the second technique (IMF2) [2], each of the captured images is subjected to filtering with the help of a noise detection technique [8] and the creation of a binary map. The filtered images are further fused together using a fidelity factor [2]. First technique is computationally faster than the second technique, since each image is not denoised before fusion in it.

Another technique called SBMF is employed exclusively for salt and pepper noise. This algorithm involves the application of a sliding window for each pixel and is a modification of the median filter with application of a robust estimation algorithm [3].

B. Multiplicative noise reduction

Image yielded to multiplicative noise is represented by

$$y(i, j) = x(i, j).\, n(i, j), \qquad (1)$$

where y(i, j) is the noisy image, x(i, j) is the original image and n(i, j) is the multiplicative noise. In the noisy image, the ratio of local standard deviation to local mean is called the coefficient of variation, C_{ij} [4]. In the image area with constant intensity, C_{ij} is equal to the standard deviation of noise, σ_n. However, the ratio is greater than the standard deviation of the noise in the area with the intensity changing. If the coefficient of variation in current window is less than or equal to the standard deviation of the noise, it means that the texture of the image is homogenous.

Adaptive Window Based Lee Filtering (AWBLF) proposed by Zengguo Sun et.al [4] is a recent algorithm used for multiplicative noise reduction. The techniques involved in this algorithm are adaptive windowing and local structure detection. Adaptive windowing means the size of the window is changing according to the variation in C_{ij}. If C_{ij} is greater than a specified threshold T_{ij} [4], the window size is decreased continuously until its minimum, otherwise increased until its maximum predefined value. Local structure detection is employed to determine the appearance of point target and edge feature [4]. In order to determine the point target, the homogeneous semi-window using the gradient masks is fixed. Lee filtering is used in this technique.

C. Gaussian noise reduction

The Sliding Double Window Filtering is a recently developed technique proposed by Sos S. Agaian et.al [7] for Gaussian noise reduction. This algorithm is based on the concept of threshold filtering and it uses two windows, a transformed window and a spatial window. The former is selected for filtering process, while the latter decides a sub-block within the former window for pixel replacement. Since the pixels in the spatial domain windows will be substituted after the filtering process, the method avoids overlapping between spatial domain windows. The transform employed in this algorithm is Fibonacci Fourier Transfor, which exploits the relationship between the conventional DFT and the Fibonacci numbers . This algorithm is compared with the Wiener filter and Wavelet Based Adaptive Thresholding (WBAT) technique in the following section.

3. Results and Discussion

This section provides a comparison of the techniques discussed in the section 2 with the conventional methods for each noise. The algorithms are simulated using different 256 x 256, 8-bits/pixel standard images such as Pepper (Gray), Lena (Gray) etc. This paper includes only the simulation results obtained with Lena image lest of the brevity. The performance of the different techniques is tested for various noise levels. The performance of the discussed algorithms are quantitatively measured using Peak Signal to noise Ratio (PSNR). PSNR is given by the expression

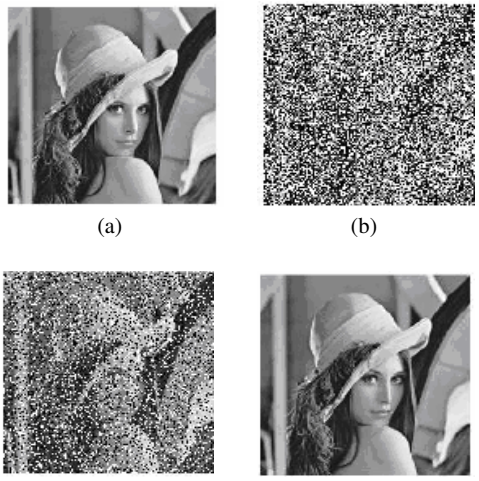
$$PSNR = \frac{2^b - 1}{\frac{1}{MN}\sum_i \sum_j (r_{ij} - x_{ij})^2} \qquad (2)$$

where b is the bit depth of the image and r_{ij} and x_{ij} denote the pixel values of the restored image and the original image respectively and M x N is the size of the image.

A. Impulse noise

A comparison between the impulse noise reduction techniques discussed in section 2 is done quantitatively through the noise density versus PSNR plot. The simulation is carried out with the test

images yielded to noise densities ranging from 10% to 90%.



(a) (b)

(c) PSNR = 13dB (d) PSNR = 23dB

Figure: 1 Performance of different techniques on salt and pepper noise: (a) Original Lena image (b) Noisy image With 70% noise density. Restoration result of (c) SMF (d) SBMF

Figure 1(b) and 1(c) shows the images recovered from those corrupted by salt and pepper noise, using SMF and SBMF techniques. It is obvious from the figure that SBMF performs much better than SMF. Figure 2 implies that the images recovered from those corrupted by the impulsive noise which may include salt and pepper, random valued impulses etc. using fusion techniques IMF1 and IMF2.

(a) PSNR = 29dB (b) PSNR =26dB

Figure: 2 Recovered Lena image from the impulsive noisy images corrupted with noise densities 81, 85, 90 % by image fusion techniques (a) IMF1 (b) IMF2

Figure 3 shows the noise density versus PSNR graph for impulse noise reduction techniques. It gives a quantitative comparison between different techniques at various noise densities ranging from 10% to 90% .

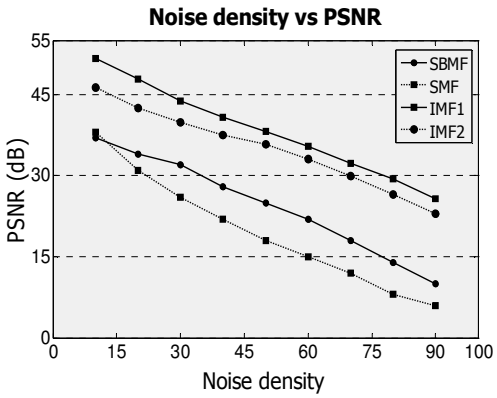


Figure: 3 Noise density versus PSNR for different impulse noise reduction techniques

The graph is plotted using the simulation results obtained with different standard images subjected to the noise densities ranging from 10 to 90 %. In the graph, PSNR at each noise density is an average value of the PSNR of each recovered image at that particular noise density. Figure 3 indicates that for lower noise densities, IMF1 performs much better than IMF2, while for higher noise densities IMF2 is also as good as IMF1, but IMF2 is computationally intensive. In short, IMF1 is algorithmically simple and computationally efficient and hence it is suitable for real-time application. Moreover IMF1 is better among the discussed techniques for the impulsive noise, whether it is salt and pepper or random valued.

A. Multiplicative noise

AWBLF algorithm for speckle noise reduction is compared with the median filter using the simulation results with the noisy images having the noise Standard Deviation (S.D) ranging from 0.15 to 0.3. The range of noise S.D selected is not arbitrary, rather it is the usual range of noise S.D for the multiplicative noise. The comparison is also done in terms of PSNR. Figure 4(c) and 4(d) show that for multiplicative noise, the image obtained from AWBLF algorithm is visually much better than the median filtered image. AWBLF algorithm is a better trade off between noise suppression and fine detail preserving compared to the conventional fixed-size median filtering, since this algorithm chooses different window size for homogeneous and heterogeneous area. Also the point targets and the edge details are appropriately preserved. From figure 5, it is obvious that efficiency of the AWBLF algorithm becomes more evident at higher noise S.D than at lower.

(a) (b)

(c) PSNR = 21dB (d) PSNR =28dB

Figure: 4 Comparison of the discussed technique for multiplicative noise reduction with median filtering (a) Original image (b) Image corrupted by multiplicative noise with unitary mean and 0.05 variance (c) Median filtered image with 3×3 window (d) Adaptive windowing with Lee filtered image with minimum window size 3×3 and maximum window size 11×11.

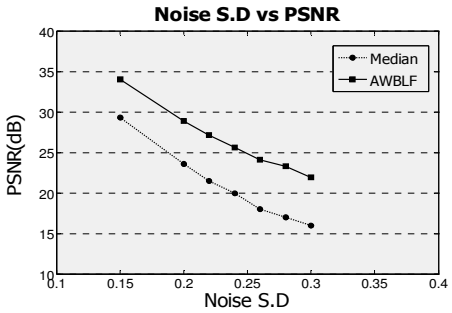
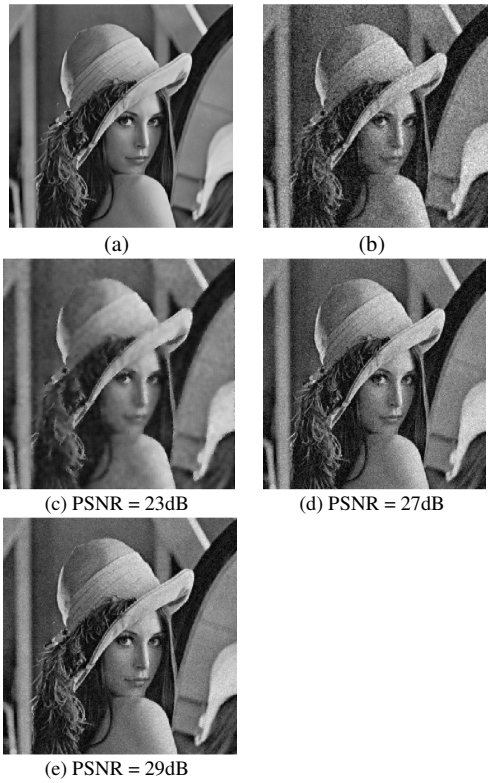


Figure: 5 Noise density versus PSNR for different multiplicative noise reduction techniques

In the graph, PSNR at each noise S.D is an average value of the PSNR of each recovered image at that particular noise S.D.

C. Gaussian noise

SDWF algorithm for the Gaussian noise reduction is compared with the wiener filter and the WBAT algorithm. SDWF algorithm is simulated with different window sizes and the experimental results reveal that the quality of the filtered images is better when the outer transformed window size is 5X5 and inner spatial window size is 1X1. The simulation is carried out at different noise S.D ranging from 0.03 to 0.09. The range selected is not arbitrary, rather it is the usual range of the Gaussian noise.



(a) (b)

(c) PSNR = 23dB (d) PSNR = 27dB

(e) PSNR = 29dB

Figure: 6 Comparison of the SDWF algorithm with wiener filter and WBAT algorithm through visual inspection (a) The original image (b) Noisy image, added Gaussian noise with zero mean and 0.005 variance. (c) Wiener filtered image with window size 5 (d) Filtered image using WBAT algorithm (e) Sliding double window filtered image with outer window of size 5X5, inner window 1X1 and threshold value 86%.

Figure 6 shows the images recovered from those corrupted by AWGN, using different techniques. From the Figure 6(c), 6(d) and 6(e), the image obtained by wiener filtering is blurred, while the image obtained from the WBAT algorithm appears more noisy than that obtained using SDWF algorithm. It is obvious by visual inspection that SDWF performs better. Figure7 shows a quantitative comparison between these techniques using PSNR plot. SDWF algorithm performs much better than the wiener filter and the WBAT algorithm for the entire range of noise variance considered. However, the performance of WBAT algorithm approaches towards the SDWF at high noise variance.

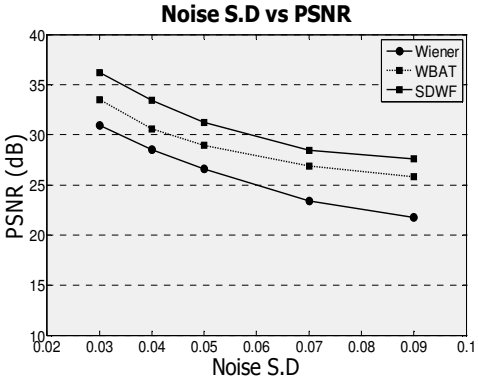


Figure: 7 Noise density versus PSNR for different AWGN reduction techniques

The graph is plotted using the simulation results obtained with different standard images subjected to the noise S.D ranging from 0.02 to 0.09. In the graph, PSNR at each noise S.D is an average value of the PSNR of each recovered image at that particular noise S.D. In this section, the simulation results show that for the three noise, the discussed algorithms have a good noise suppression capability while retaining the natural edges.

Table 1
Comparison of different noise reduction techniques

Noise Type	Denoising Techniques	NSEPC	Optimum Technique
Impulsive	SMF	Low	IMF1
	SBMF	Medium	
	IMF1	High	
	IMF2	High	
Multiplicative	MF	Low	AWBLF
	AWBLF	High	
Gaussian	WF	Low	SDWF
	WBAT	Medium	
	SDWF	High	

Table 1 compares different noise reduction techniques based on the Noise Suppression and Edge Preservation Capability(NSEPC).

4. Conclusion

In this paper, an analysis of the recent image noise reduction algorithms for three common types of noise namely, impulsive, multiplicative and Gaussian is presented. Suitable techniques for denoising different types noises are also identified. The SDWF algorithm uses the window of fixed size and fixed threshold. It could be further optimized by introducing the adaptive windowing as well as adaptive thresholding. Digital images may often be corrupted by mixed noise as well. Hence further research should be focussed on an efficient algorithm, which combines the advantages of the novel techniques discussed, to deal the mixed noise.

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EFFICIENT ARQ MECHANISM FOR WIRELESS MULTIHOP RELAY NETWORKS

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Abstract- Recently, relay technology has been adopted to enhance the coverage and performance of wireless networks such as Worldwide Interoperability for Microwave Access and Long-Term Evolution Advanced (LTE-A). However, using relays to forward packets may induce more packet losses than traditional single-hop wireless networks because transmissions are conducted through multiple radio links. When there are lost packets, relay stations (RSs) decide whether to retransmit these packets with automatic repeat request (ARQ) strategies. An improper ARQ strategy increases latency, blocked packets, and workloads on the multihop relay network. This paper proposes a new relay ARQ (RARQ) scheme, providing efficient acknowledgement to reduce packet latency and the number of blocked packets with small workloads. This paper proposes an analytic model to evaluate the performance of the proposed mechanism. Simulation results have validated the proposed model and demonstrated that the proposed ARQ scheme outperforms conventional approaches.

Keywords- Automatic Repeat-reQuest (ARQ), relays, wireless communication.

I. INTRODUCTION

Industrial interest in wireless relay networks has increased in recent years. IEEE 802.16j specifies a relay system based on the IEEE 802.16e wireless network; the Third-Generation Partnership Project Long-Term Evaluation Advance (3GPP LTE-A) also uses relay functionalities. Relay stations (RSs) with packet decoding and buffering functions can improve the coverage, throughput, and capacity of a relay system. Relays are crucial enablers for dense small-cell deployment and can improve user experience. The backhaul link issues, the performance bottleneck of future networks can be reduced using multihop relay transmission. In the relay network, the base station (BS) administrates network radio resources and can use RSs to retransmit directly corrupted packets. Compared with conventional single-hop wireless networks, a relay network may suffer more packet losses, thus increasing the overhead for handling packet losses. A conventional way to manage packet losses is to use the automatic repeat request (ARQ) mechanisms.

There exist three conventional relay ARQ (RARQ) schemes that may be applied in the relay network. They are end-to- end (E2E) RARQ, hop-by-hop (HbH) RARQ and two-link (TL) RARQ schemes. The conventional RARQ schemes utilize the concept of relay acknowledgment (RACK) and relay negative acknowledgment (RNACK) to confirm successful and failed receptions between RSs, respectively. There are potential drawbacks of applying RACK and RNACK in a multihop relay network. First, RNACK may cause an ambiguous error report to the BS and trigger redundant retransmissions. This is because an RNACK packet cannot explicitly indicate which RS loses a data packet.

Second, RSs may transmit a number of RACKs for a successful reception, thus increasing transmission overhead and ARQ workload. Third, a packet may be retransmitted several times between RSs if the packet is lost during the relay transmission, and the retransmissions among relays may prolong E2E latency. If the BS cannot know the retransmissions between relays, then the delay may significantly grow from a BS's perspective, and the BS is unable to manage the buffer resources for transmitted packets and to handle new incoming packets.

This paper proposes an enhanced RARQ mechanism, called the local E2E (LE) RARQ, inheriting the assumptions that RSs are able to buffer ARQ blocks, to decode packets, and to confirm the correctness of ARQ blocks for better coverage and performance of a relay system. The basic idea behind this scheme is to facilitate RSs with relay error control by appending RACKs or RNACKs to acknowledgement packets so that ARQ states on each RS can be known by the BS and the MS. In this scheme, an RS locally decides whether to append its RACK or RNACK in E2E feedback (i.e., E2E ACKs or NACKs) to the BS. The BS can know the overall transmission states along a relay path according to the explicit RACK and RNACK information. The BS can trigger retransmissions from a designated RS, thus avoiding the redundant retransmissions of a packet through the entire relay path. Moreover, the proposed RARQ appends error control information only when error packets are present so that the RARQ workload can be considerably reduced.

II. EXISTING RARQ MECHANISMS

Fig.1. shows three conventional relay ARQ (RARQ) schemes that may be applied in the relay network. The first scheme is the end-to- end (E2E) RARQ, in which all RSs simply relay packets, and the error control is delegated to packet senders and receivers. The second scheme is the hop-by-hop (HbH) RARQ, in which RSs are responsible for detecting errors, sending acknowledgements, and retransmitting packets. More specifically, each RS must guarantee the correct transmissions with its preceding RS before it can continue relaying the packets. The third scheme is the two-link (TL) RARQ scheme, which divides an E2E path into a multihop relay link and a single-hop access link, and a specific RS has to recover packet losses for both links.

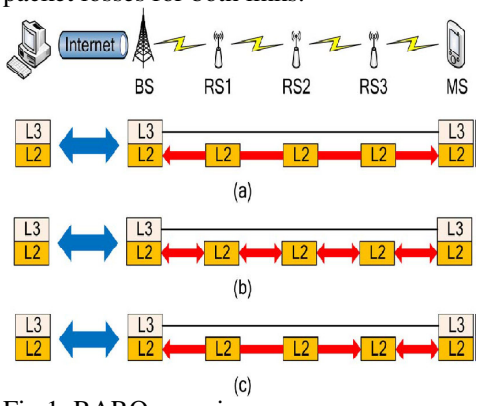

Fig.1. RARQ overview

The red arrows in Fig.1. indicate the RARQ controls among a BS, RSs, and a mobile station (MS).

The conventional RARQ schemes utilize the concept of relay acknowledgment (RACK) and relay negative acknowledgment (RNACK) to confirm successful and failed receptions between RSs, respectively. There are potential drawbacks of applying RACK and RNACK in a multihop relay network. First, RNACK may cause an ambiguous error report to the BS and trigger redundant retransmissions. This is because an RNACK packet cannot explicitly indicate which RS loses a data packet. Second, RSs may transmit a number of RACKs for a successful reception, thus increasing transmission overhead and ARQ workload. Third, a packet may be retransmitted several times between RSs if the packet is lost during the relay transmission, and the retransmissions among relays may prolong E2E latency. If

the BS cannot know the retransmissions between relays, then the delay may significantly grow from a BS's perspective, and the BS is unable to manage the buffer resources for transmitted packets and to handle new incoming packets.

III. THE PROPOSED RARQ MECHANISM

This paper proposes an enhanced RARQ mechanism, called the local E2E (LE) RARQ, inheriting the assumptions that RSs are able to buffer ARQ blocks, to decode packets, and to confirm the correctness of ARQ blocks for better coverage and performance of a relay system. The basic idea behind this scheme is to facilitate RSs with relay error control by appending RACKs or RNACKs to acknowledgement packets so that ARQ states on each RS can be known by the BS and the MS. In this scheme, an RS locally decides whether to append its RACK or RNACK in E2E feedback (i.e., E2E ACKs or NACKs) to the BS. The BS can know the overall transmission states along a relay path according to the explicit RACK and RNACK information. The BS can trigger retransmissions from a designated RS, thus avoiding the redundant retransmissions of a packet through the entire relay path. Moreover, the proposed RARQ appends error control information only when error packets are present so that the RARQ workload can be considerably reduced.

As per LE RARQ scheme the procedure for the downlink transmission of a packet from the BS via RSs to an MS and its acknowledgement as follows:

1) When an RS*i* receives a data packet from the BS or its preceding RS and successfully decodes it, RS*i* triggers a timer for receiving a feedback message and forwards the packet to the next hop. If RS*i* fails to decode the received packet, the timer is also triggered, and RS*i* waits for a feedback message from the MS. Go to Step 2 if RS*i* does not receive the feedback message from the MS, or go to Step 3 if it receives a feedback message before the timer expires.

2) If the data packet is successfully decoded, RS*i* sends a standalone RACK message to the BS; otherwise, RS*i* transmits a stand-alone RNACK message to the BS.

3) When RS*i* receives an E2E ACK from its preceding node, RS*i* forwards it to the BS directly. However, if an E2E NACK, a stand-alone RACK, or a RNACK is received, RS*i* attaches its local RARQ state (e.g., RACK*i* or RNACK*i*) to the feedback message and forwards it to the BS.

4) After sending a data packet, the BS waits feedback messages from the RSs and the MS. When the BS receives an E2E ACK from the MS, the transmission is complete. The BS can release the buffer space that temporarily keeps the packet. If the BS receives an E2E NACK from the MS, or a stand-alone RACK or RNACK from RSs, the BS can determine the intermediate RS RS*j* in which the packet was lost. RS*j* is identified by examining the feedback message in which RS*j* attaches a RACK, whereas RS*j*+1 appends a RNACK.

5) The BS then arranges radio resources and triggers the retransmission from RS*j*. Note that each RS appends a local ARQ state to an E2E NACK in Step 3. The BS that receives an E2E NACK can know the transmission states of RSs and initiate a retransmission at a proper RS if necessary, and redundant retransmissions can be avoided.

The proposed RARQ can be further improved, and the RARQ workload can be reduced by eliminating RACK feedback if the acknowledgement errors rarely happen. In addition, the workload is minimized because RARQ states are attached only in E2E NACKs for packet corruption cases.

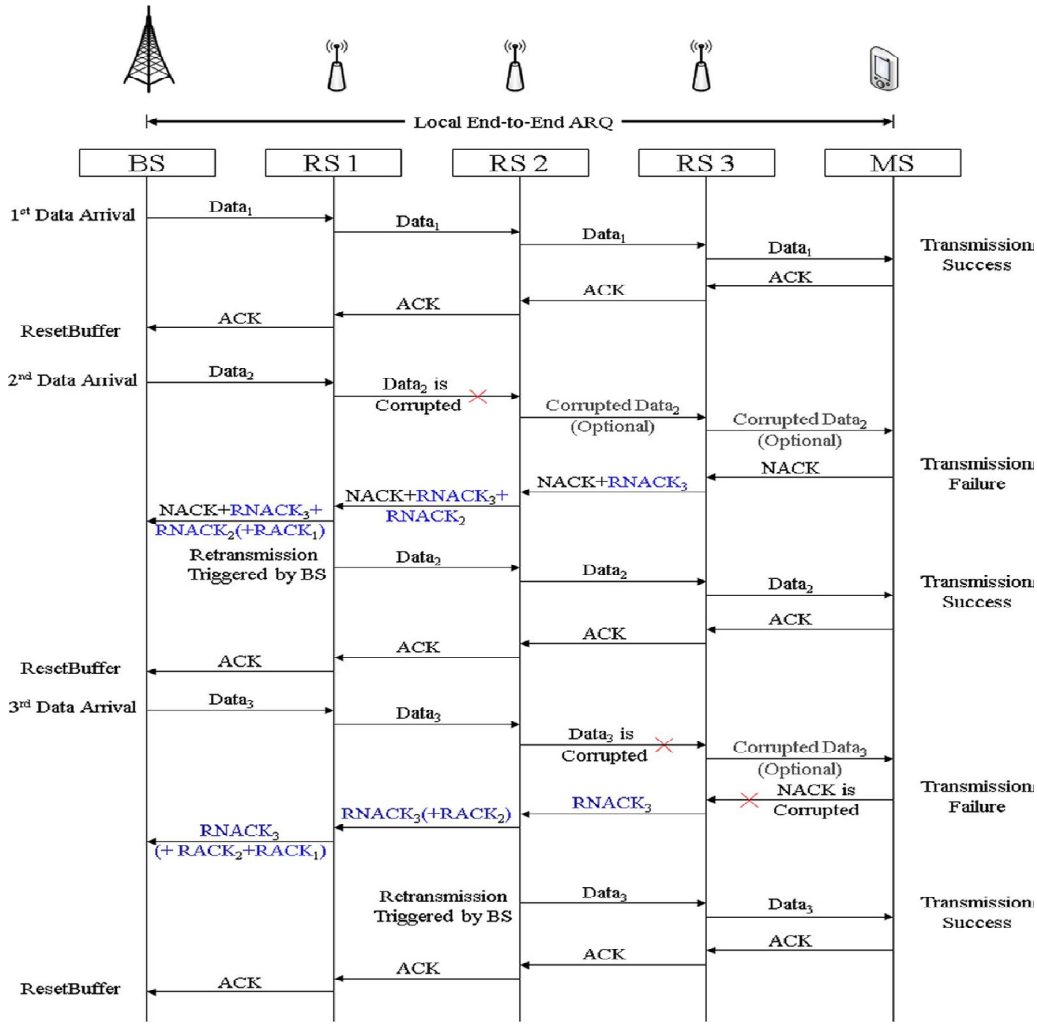

Fig. 2. Message flow for the LE RARQ

Fig. 2. gives examples to illustrate the proposed scheme. In the first case, RS1 relays Data1 to RS2 if RS1 receives the packet correctly. RS2 and RS3 also relay the packet to the MS, which replies with an E2E ACK that is forwarded by RS3, RS2, and RS1 to the BS. In the second case, Data2 is corrupted in the second hop. When RS3 receives a NACK from the MS, RS3 appends RNACK3 to the NACK message because it does not receive the packet.

RS2 also indicates the failure of relaying the transmission by appending RNACK2 to the NACK message. RS1 appends the message with RACK1 that indicates successful reception of the packet. By checking the received NACK message, the BS triggers the retransmission at RS1. In the third case, a packet error occurs in the third hop. Moreover, the feedback message is also corrupted in the last hop, causing the E2E NACK missing in RS3. Triggered by its timer, RS3 generates a stand-alone RNACK3. RS2 and RS1 provide local ARQ states by appending, respectively, a

RACK2 and a RACK1 to RNACK3. Upon receiving the RNACK3, the BS triggers retransmission of Data3 at RS2.

Compared with the three conventional RARQ schemes, the proposed scheme causes no ambiguous error report problem because all RSs along a relay path indicate their ARQ states using RACKs and RNACKs. The BS triggers retransmissions at the RS nearest to the MS that has the packet, thus avoiding redundant retransmissions and reduce E2E transmission time. Moreover, the proposed LE RARQ avoids sending redundant RACKs by appending RARQ indicators only in the cases of packet corruption. Finally, the RSs trigger no additional retransmissions in LE RARQ because the BS completely controls the transmission/retransmission process.

IV. ANALYTIC MODEL

In an actual wireless system, the BS has a limited buffer. This paper proposes an analytic model that models the entire system as an M/M/1/K queuing system. This paper analyze the ARQ behaviour for static multihop backhaul links and use deterministic metrics, namely, per-hop transmission rate *R*, per-hop packet error probability *P*, and hop count *N* to calculate the expected packet service time S_{system}. Here we assume that the distribution of the time for the system to serve each multihop transmission is identical and independent. It is reasonable to expect that the packet service time approaches an exponential distribution. In this paper, we regard S_{system} as exponentially distributed and model the relay system as an M/M/1/K queue to analyze the packet-blocking rate and the RARQ workload. With the proposed model, we can analyze the RARQ behaviours with reduced computation complexity since only the expected value of system service time is used in calculation.

Also, here we assume that the relay network uses the same architecture as that of the IEEE 802.16j and LTE-A systems. Therefore, we generalize the proposed models and schemes for both the Worldwide Interoperability for Microwave Access and LTE-A systems. Without loss of generality, this paper use the terms from LTE-A to describe the models and methods.

In this system, the BS and RSs serve each incoming packet with relay transmissions destined to an MS. The packets arrive in this system with rate λ and depart if they are received by the MS or dropped after retrying $Retry_{MS}$ times. To simplify the modelling, we assume that all radio links are stable with constant and identical *R* and *P*. Let *R* be the number of transmitted packets per second. The transmission time between two RSs (including the queuing and processing delay at each RS) is 1*/R*. The transmission latency through *N* hops is *N/R*. Because a packet departs from the relay system in a received or dropped case, the packet service time S_{system} can be formulated as the following equation:

$$S_{system} = (1 - P_{Drop}) \times S_{success} + P_{Drop} \times S_{Drop}$$

Where P_{Drop} is the packet-dropping probability, $S_{Success}$ is the service time for a successful transmission, and S_{Drop} represents the service time of a dropped packet.

$$S_{success} = \frac{N}{R} + \sum_{i=0}^{Retry_{MS}-1} Total\_T_{wait} \times P_{Complete\_before\_(Retry_{MS}-1)\_Retries}$$

where *i* is the count of retransmissions, Total TWait shows the summation of TWait, and $P_{Complete}$_before_($Retry_{MS}$ −1)_Retries is the probability that the relay service is completed before retrying

$Retry_{MS}$ – 1times. Since T_{Wait} is the waiting time for MS to reply an acknowledgement and associates with the remaining transmitting hops, it can be represented as $(N - n)/R$, in which n is the hop count for the completed relay transmission. Therefore, Total_ T_{Wait} and $P_{Complete}$_before_(Retry MS −1)_Retries can be expressed as

$$\text{Total\_T}_{\text{wait}} = \sum_{n=1}^{N} (1-\text{P})^{n-1} \times \text{P} \times (\text{N} - \text{n/R})$$

$$\text{P}_{\text{Complete\_before\_(Retry}_{\text{MS}}-1)\text{\_Retries}} = (1-\text{P})^{\text{N}} \times \text{P}^{\text{i}}$$

$$\text{S}_{\text{Drop}} = \sum_{\text{i}=0}^{\text{Retry}_{\text{MS}}} \frac{\text{N}}{2^{\text{i}}} \Big/ (\text{R})$$

Because each packet error may occur in any hop along the relaying path, the probability of one error is $P1 \times NC1$. Moreover, multiple errors may occur for a packet to be relayed in each hop. This model uses simple mathematical combination and permutation to derive the probability; the probability of two errors is $P2 \times N{+}1C2$, and that of (RetryMS− 1) errors is $P\text{RetryMS}-1 \times N{+}\text{RetryMS}-2C$ RetryMS−1 . Consequently, the success probability $P_{Success}$ can be obtained as follows:

$$\text{P}_{\text{Drop}} = 1 - \text{P}_{\text{Success}}$$

$$P_{Success} = (1-P)^{N} \sum_{i=0}^{Retry_{MS}-1} \times P^{i} \times C_{i}^{N+i-1}$$

In this relay system, the BS blocks incoming packets when the buffer overflows, and the packet blocking rate γ_b is derived by considering the whole system as an M/M/1/K queue, as discussed earlier. The blocking probability is P_b, and we use $1/S_{system}$ as the service rate μ in the derivation

$$\gamma_b = \lambda \times \text{P}_{\text{b}}$$

$$\text{P}_{\text{b}} = \frac{\left(1-\frac{\lambda}{\mu}\right)\left(\frac{\lambda}{\mu}\right)^{\text{k}}}{1-\left(\frac{\lambda}{\mu}\right)^{\text{k}+1}}$$

The workload of RARQ indicates the number of ARQ feedback messages, including RACKs and RNACKs that the BS and RSs process for error control per second. Because only one ARQ feedback message is replied for each relay transmission in the proposal, we use the packet service rate μ to approach the AFR. The following equation shows the feedback rate as μ if the system is fully loaded and as λ in light-load cases:

$$\text{AFR}_{\text{LE}} = \min(\lambda, \mu)$$

V. PERFORMANCE COMPARISON

Fig. 3. shows the transmission service time, which represents the duration for completing an E2E relay transmission. In the figures, the curves with prefix "M_" indicate the results produced by the proposed analytic model, whereas the others show the simulation results. This figure suggests that the path extension by multiple RSs not only increases the first transmission delay but the latency caused by retransmissions as well. HbH RARQ shows the lowest service time among all mechanisms, and it shows that HbH relaying can reduce the delay.

According to the simulation results in the ten-hop cases, the LE solution outperforms the E2E and TL schemes, respectively, by 15.7% and 37.9% in packet service time, indicating the benefit of local retransmissions of our proposed scheme. E2E RARQ does not have favourable outcome because of the high retransmission probability and ambiguous report problem.

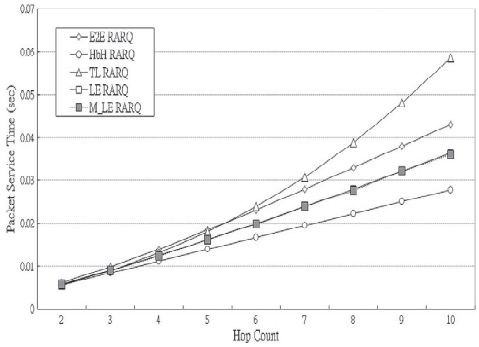

Fig. 3. Packet service time (K = 20, P = 0.1, R = 400 packet/s)

TL RARQ also inherits the ambiguous error reporting from E2E RARQ, and the unexpected retransmissions lead to the least favourable results. Furthermore, Fig. 3. also shows that the analytic result is quite close to the simulation result.

Fig. 4. shows the outcomes of packet blocking and dropping. The results indicate that the length of a relay path dramatically affects the packet-blocking rate because a long relay path increases the transmission time and causes more packets to be blocked by the BS. Similar to the results of packet service time in the previous experiments, the E2E and TL RARQ schemes also perform poorly in packet blocking. Regarding packet dropping, the ratio of dropped packets to transmitted packets is less than 5% for all the RARQ methods. According to the results, the low packet-dropping rate comes from the help of multiple retransmissions, but more packets are blocked due to the extended transmission time. Numerical results show that the HbH and LE RARQ schemes outperform the other two schemes in packet dropping and blocking. According to the simulation result, the proposed LE RARQ can reduce 5.9% and 7.9% of packet blocking for E2E and TL RARQs in the ten-hop case, respectively.

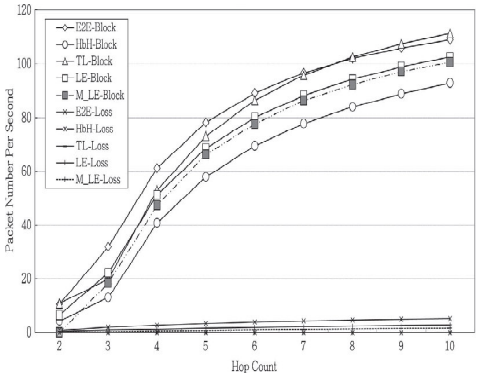

Fig. 4. Packet blocking and loss rate (*K* = 20, *P* = 0.1, *R* = 400 packet/s)

Fig. 5. shows the RARQ workload regarding AFR, confirming that the analytic results are close to those of simulation. In the two-hop case, the workloads by HbH and TL methods almost double those of E2E and our LE schemes. This is because the HbH and TL RARQs transmit one more feedback message than the E2E and LE RARQs. Moreover, the AFR of the HbH RARQ depends on the hops of a relay path, and it cannot effectively perform because all RSs excessively launch feedback messages, despite most of them being redundant.

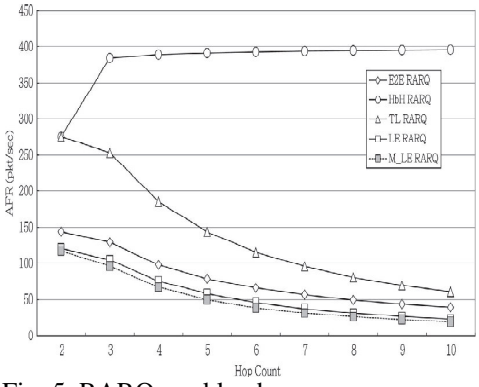

Fig. 5. RARQ workload

Results for E2E, TL, and LE RARQs decrease with the relay path extension because the rate of E2E transmissions also decreases. Note that the LE RARQ shows the smallest AFR among

all simulations and requires only 5.7% of the workload of the HbH RARQ.

VI.CONCLUSION

This paper has investigated the RARQ problems created by multihop transmissions and proposed a new RARQ mechanism with efficient feedback to overcome the problems of transmission delay, packet blocking, and RARQ workload. The proposed mechanism attaches RSs' ARQ states with RACKs and RNACKs in E2E feedback so that the BS knows the overall transmission states along the relaying path to minimize retransmissions. Moreover, the proposed RARQ appends the states only when error packets are present. With the efficient RARQ acknowledgement design, the proposed mechanism can alleviate the packet-blocking problem with adequate E2E transmission latency in a low RARQ workload. An analytic model is also presented to evaluate the performance. According to the simulation results, the proposed RARQ reduces the packet delay by 15.7% and 37.9%, respectively, as compared with E2E and TL RARQs. The simulation results also confirm the performance improvement over these two traditional RARQ schemes in packet blocking. Furthermore, the proposed LE RARQ requires significantly lower the workload than that of the HbH RARQ to obtain superior RARQ performance. The simulation results confirm the proposed analytic models of RARQ mechanisms and demonstrate that the new RARQ scheme outperforms conventional approaches.

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Smart Wheelchair Controlled by Brain Waves

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***Abstract*—With the advancement in the areas of information technology and neurosciences, there has been a surge of interest in turning fiction into reality. The major goal of Brain Computer Interface (BCI) research is to develop a system that allows disabled people to interact with the external environments. The advancements in technology and healthcare facilities, results in the number of senior citizens and thus the number of elderly who find it difficult to walk also increases. Hence there is a need for designing a wheelchair that is user friendly and involves fewer complexities. Our project, propose a wheelchair controlled by brain waves, which uses the captured signals from the brain and process it to control the wheelchair. This wheelchair can also be used by the physically challenged who depend on others for locomotion. Rehabilitation centers at hospitals can also make use of this wheelchair. But it is mostly suitable for those who can only use eyes and brain to exercise their willpower.**

***Index Terms*— Brain waves, wheelchair.**

I. INTRODUCTION

Total physical paralysis is the worst possible medical diagnosis, short of imminent death. Paralysis from the neck down can result from spinal cord injuries or diseases such as Amyotrophic Lateral Sclerosis. Sufferers become totally dependent upon others, but they often feel isolated because they have lost the ability to talk. Most of us take for granted the ability to walk from one room to another, but for the severely disabled, even this common action requires assistance from someone else.

Whenever we perform a physical action, neurons in our brain generate minute electric signals. These signals move from the brain and travel along axons and dendrites, passing through our nervous system. When they reach the right area of the body, motor neurons activate the necessary muscles to complete the action.

Almost every signal passes through the bundle of nerves inside the spinal cord before moving on to other parts of the body. When the spinal cord is severely damaged or cut, the break in the nervous system prevents the signals from getting where they need to be. In the case of neuromuscular disease, the motor neurons stop functioning. The signals are still being sent, but there's no way for the body to translate them into actual muscle action. Here comes the significance of the proposed system

The parts of this system include an electric wheelchair, an interface circuit, an EEG headset. The EEG headset, connects to the Controller, which allows the operator to cause movement of wheelchair simply by focusing. High concentration cause wheelchair to move "forward" and low concentration cause wheelchair to move "backward". Performance is related to practice by the user, proper configuration of the software, and good contact made by the EEG electrodes on the scalp of the operator.

II. PROPESED SYSTEM

The system is broadly divided into four sections, thought acquisition, thought transmission, thought processing and motor control each of which aims at acquisition of the EEG signal from user scalp and processing it for controlling a wheelchair. EEG scalp potentials obtained are amplified, digitized and transmitted to a processor and after processing the output of the processed signals are used to control the wheelchair.

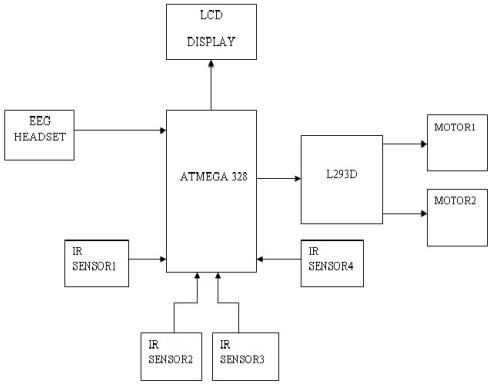

Figure 1: Block diagram

A. *Thought Acquisition*

Thought acquisition primarily targets at the careful extraction of the EEG signal from the user scalp. It is made up of different blocks such as instrumentation amplifier, operational amplifier, high pass, low pass and notch filters. The purpose of the instrumentation amplifier is to extract the EEG signal. The extracted EEG signal is passed through the operational amplifier block for proper amplification. It is then, passed through the high pass, low pass and notch filters. The high pass filter, removes the noise in the signal. Low pass filter extracts the signal frequencies of interest. As DC power supplies are used, one common problem to encounter is the 60 Hz power line signal. This 60 Hz power line signal will distort the EEG scalp potentials. Integration of a notch filter will filter out this undesirable power line signal.

B. *Thought transmission*

Thought transmission section focuses on the transmission of the acquired EEG signal (thought) to a processor. It consists of

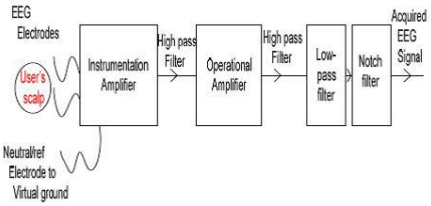

Figure.2: Schematic Outlining various stages involved in thought acquisition

12-bit A/D converter for digitizing the EEG signal. The ATMega644 microcontroller is used for UART transmission The FTDI USB RS232 is an opto-coupler used for electrical isolation to prevent electrical hazards during the transmission of the digitized EEG signal to a DSP It is also used for converting the RS232 signals to USB signals so that this setup can be interfaced to a processor.

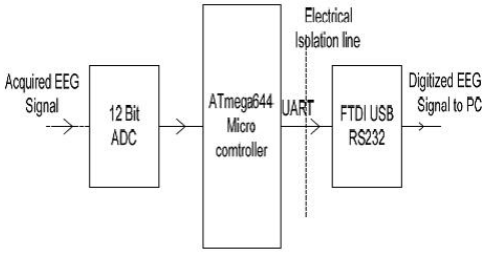

Figure.3: Schematic outlining various stages involved in thought transmission

C. Thought processing section

Thought processing section consists of processor which processes the signal that is transmitted from the thought acquisition section to processor through the thought transmission section.

The wheelchair controller has the functionality of controlling the direction and speed of the wheelchair based on the output bits obtained from the signal processing block. L293D motor driver IC is used in between the Arduino and the Direct Current (DC) motors. Two motors connected to the rear wheels of the wheelchair have to be controlled to define its motion. The DC motors can be controlled using Pulse Width Modulation (PWM) techniques that can be generated using the Arduino Board. The wheelchair can be directionally controlled using suitable motor driver. The control signals which include PWM and direction signals are given by Arduino board to motor driver. The motor driver acts as a switch between the input 5V signal and required 12V output signals. The wheelchair moves at considerably good speed when it is given 15 volts. So to avoid jerk or a sudden unwanted vibration when the wheel chair starts or stops or changes direction, the PWM signal is incremented or decremented according to the needs in linear steps rather that a sudden transition.

The thought processing section detects the brain signals for attention and corresponding to this signal drives the wheelchair forward or backward. There are four IR leds connected on the four sides of the wheelchair to detect the obstacles.

D. EEG headset

EEG headset is a device used to extract EEG signals from brain. This will reads the brain activity via the scalp of our head and translates it into various actions. This provides eight values representing the amount of electrical activity at different frequencies. It is found that the degree of mental control over the signal varies from person to person. A run down of the frequencies involved follows, along with a grossly oversimplified summary of the associated mental states.

- Delta (1-3Hz): sleep
- Theta (4-7Hz): relaxed, meditative
- Low Alpha (8-9Hz): eyes closed, relaxed
- High Alpha (10-12Hz)
- Low Beta (13-17Hz): alert, focused
- High Beta (18-30Hz)
- Low Gamma (31-40Hz): multi-sensory processing
- High Gamma (41-50Hz)

Figure 4: EEG headset

In addition to these power-band values, the headset provides a pair of proprietary, black-box data values dubbed attention and mediation.

- Attention: Indicates the intensity of a users level of mental focus or attention, such as that which occurs during intense concentration and directed (but stable) mental activity. Distractions, wandering thoughts, lack of focus, or anxiety may lower the attention meter levels.
- Meditation: Indicates the level of a users mental calmness or relaxation. Meditation is related to reduced activity by the active mental processes in the brain, and it has long been an observed effect that closing ones eyes turns off the mental activities which process images from the eyes, so closing the eyes is often an effective method for increasing the Meditation meter level.

Figure 5: Block diagram of EEG headset

E. Microcontroller

The high-performance Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-

while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8- channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.
The most common implementation of this chip is on the ever popular Arduino development platform, namely the Arduino Uno and Arduino Nano models.

F. IR Sensors

The obstacles during the movement of wheelchair is detected by four IR sensor modules. Each module will contain an IR transmitter and an IR receiver. Infrared transmitter will continuously transmit IR waves and the receiver will continuously receive IR waves. LEDs can sense the edges near to the chair. Whenever an obstacle is detected then its output goes high.

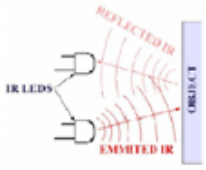

Figure 6: IR sensor

G. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

H. DC Motor Driver

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

III. IMPLEMENTATION

A. Circuit Diagram and Description

The main components of the system are microcontroller, EEG headset, IR circuitry, Motor circuitry, LCD and Power Supply. The power supply unit consists of a half wave rectifier & a voltage regulator. The voltage regulator used is 7805, which regulates the input voltage to +5V. To check the proper working of this unit a LED is provided in this section.

Microcontroller is the main part of the system. ATMEG328 is used here. It is an 8 bit MC. MC interface with all other components of the system and process according to different inputs. EEG headset captures the electric signal from brain waves according to different activities. These signals after different processes like amplification, digitalization etc is given to MC which gives instructions to other section of the system according to this input. For this the transmitter and receiver input of headset is connected to pin 4 and 5 of microcontroller.

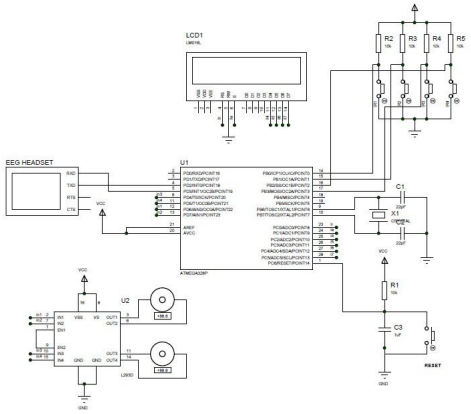

Figure 7: Circuit diagram

LCD display used in the system is to monitor the different stages of EEG signal. LM016 16 x 2 display is used. The Four data lines as well as the RS and Enable pin of the LCD are interfaced with the microcontroller. The RW pin is grounded. A crystal is used to give the 16 MHz operating frequency for the operation of ATMEG328.Two capacitors of value 22pf are used to compensate or filter the internal capacitance of crystal.

Motor circuitry consists of two dc motors and a driver IC. L293D is used for this purpose. This can be used to drive two motors at a time. 12 volt, 100 rpm dc motors are used here. The microcontroller cant provide the high current required by the motor. So the driver IC is used to provide the required current to drive motor. The 12 and 13 pin of microcontroller is given to the 2 and 7th pin of L293D which forms the first input of the driver IC. Similarly 6 and 11 is connected to 10 and 15 which forms the second input. The output is taken from the pins(3,6) and (11,14). We have used two 100 rpm motors for providing the motion to the Wheels.We have used two rubber wheels and one caster wheels for providing motion. We selected wheels which would fit our project requirement so as to move easily without frictional loss on the floor.

There are four IR sensors in the four sides of the

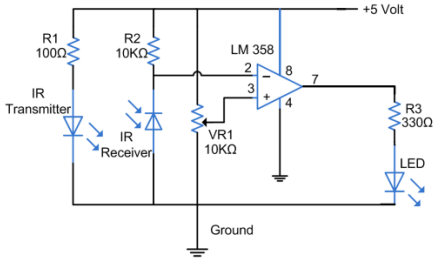

Figure 8: Circuit diagram of IR section

wheel chair to detect the obstacles in the way. IR sensors act as a switch, when an obstacle is detected its output goes high which stops the wheelchair. These IR pairs gives +5v whenever the obstacle and edges are detected. This output is given to microcontroller for decision making.

The wheel chair works as follows: The head set sense the electrical variations in our brain and returns some data. These data are in the following format: "signal strength, attention, meditation, delta, theta, low alpha, high alpha, low beta, high beta, low gamma, high gamma". Signal strength ranges from 0 - 200. Counter intuitively, 0 means the unit has connected successfully, and 200 means there is no signal. The attention and meditation values both run from 0 - 100. Intuitively, higher numbers represent more attention or meditation. The EEG power values delta, theta, etc... are a heavily filtered representation of the relative activity in different brain wavelengths. These values cannot be mapped directly to physical values (e.g. volts), but are still of use when considered over time or relative to each other. The wheelchair also consists of two pairs of IR LEDs. These are placed in front, back, left and right side of the wheel chair, so these LEDs can sense the edges near to the wheel chair. The microcontroller receives the data from the head set as serially. Based on the signal strength variation the wheel chair moves forward or backward and based on the status of the IR LEDs the wheel chair turns left or right.

B. Software Description

We had used arduino as the programming software of the microcontroller. It is based on the embedded C language. It is very easy to program a microcontroller in an arduino board. No burning of programs into the IC is required here. The USB compatibility is provided in most arduino board and by just copying the program into the microcontroller memory we can load the program.

The Arduino Uno is a microcontroller board based on the ATmega328.The board used for programming the microcontroller in our prototype is arduino Uno.

Proteus is the software used in this systemfor microprocessor simulation, schematic capture, and printed circuit board (PCB) design .

C. Algorithm

1. Start
2. Include the Required Header Files (Brain.H)
3. Declare the Variables That Are Used In the Code
4. Initializing All Components
5. Calibrating Headset
6. Identify the Value of Attention
7. Change Direction According to the Value
8. Obstacle Detection
9. If Obstacle is detected
10. Choose appropriate action
11. Else
12. Go to step 6
13. Stop

D. Developed System

Our aim for a wheelchair that is controlled by brain waves has become a reality through this project. For this, we conducted a detailed study about brain waves and understood that it is possible to decode the brain waves which can further be utilized to control the wheelchair movements. The project, SMART WHEELCHAIR CONTROLLED BY BRAIN WAVES is based on embedded system. Because of the ease of programming and wide availability of sample programs, Arduino software is used for programming the hardware and Proteus for the simulation.

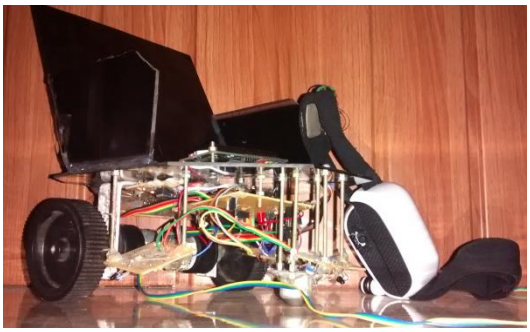

Figure 9: Photograph of the developed system

IV. CONCLUSION

Our system deals with EEG signal to control the wheelchair motion. This system uses an EEG headset to capture the minute EEG signals. Usually paralyzed people need a third person's help to move from one place to another. So our aim is to help handicapped persons and paralyzed peoples to control the motion of wheelchair with the help of their brainwaves.

The main problem we had faced is to capture the high quality EEG signals. We have found that more powerful headset could provide more accurate signals. The EEG signal from person to person also varies.

This concept would become one of the major development in the Medical field as well as in the field of Research. Further improvements on the developed system will result in more accurate functioning of the system. Use of more powerful EEG headset is capable to extract highly accurate EEG signals.

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Control device for the efficient use of stored renewable power

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Abstract— **The major challenge faced by Indian power grid system is the excess use of energy and that results in the imbalance in the power generated and power consumed. The utility regulates the amount of consumption by introducing power cuts and time of use billing methods leading to decrease in the comfort level of consumers. The existing systems such as smart grid and devices that work on the basis of peak hour concept could be a solution to this problem, but problems with such a system is that the power management is no efficient and effective. The solution to such a problem is the use of a smart device. 'Control device for the efficient use of stored renewable power, is a design for a smart control device, for efficient use of stored renewable energy, is proposed in this paper. The proposed system has a number of aspects. Firstly, this proposed system collects and analyses user consumption data. Dependent on the data the system makes a decision on the source of power to be made available: either renewable power from a battery or power from the grid. The system also calculates the amount of power to be stored, in a storage device. In addition, the system is able to make decisions on who gets priority to continue receiving power in the case of power shortage/failure. The system has numerous scopes in our country, where power management is such a serious issue. The system can be implemented in each industry for efficient management of power.**

I. INTRODUCTION

Indian power grid is one of the largest in the world, but the major challenges faced by Indian power grid system are the excess use of energy and that results in the imbalance in the power generated and power consumed. The utility regulates the amount of consumption by introducing power cuts and time of use billing methods leading to decrease in the comfort level of consumers. Only way to avoid this problem is the use of renewable energy resources. But while using the renewable energy power we must take into account its applicability, availability and cost effectiveness. One of the most accepted method for the use of renewable power is solar energy. But while implementing the system on a large scale such as an industry, we have to buy large solar panels and solar power availability is not constant, leading to the decrease in efficiency of the system. A smart device which provide automatic switching of the devices between the mains and battery, could be a better solution to this problem. It also reduces the over dependency of the user from the mains.

The device collects and analyses user consumption data. Dependent on the data the system makes a decision on the source of power to be made available: either renewable power from a battery or power from the grid. The system also calculates the amount of power to be stored, in a storage device. In addition, the system is able to make decisions on who gets priority to continue receiving power in the case of power shortage/failure. The efficient utilization of renewable resources is done with the help of an energy management system consists of relay systems, microcontroller unit and a RF transceiver. This energy management system will help to use the stored renewable power efficiently; there by dependency of the power from grid especially during peak hours can be minimized. The system works in two phases, in the first phase the user behaviour is studied and an analysis table is prepared from the analysis in the PC side Slab table is prepared. From the slab table considering the priorities and the available power levels switch the devices.

II. RELATED WORK

The existing systems and other related works are mainly based on demand response, delay tolerance, wattzup, linear programming etc. some of that methods are mentioned below.

A. Automatic load scheduling according to demand and price

This paper deals with the real-time two-way communications available in a Smart Grid and that will allow customers to be compensated for their efforts to save energy and to sell energy back into the grid through Advanced Metering technologies. DSM program is used for the energy management.

With such effective engagement, the users could contribute and control electricity demand paving the way towards achieving improved electrical supply services. The load curve will show a peak point where electricity consumption reaches critical points causing undesired consequences. Providing consumers with such a load curve will enable users to switch off certain load when the state of electricity demands reaches certain limit according to time. Here user controls the load according to DSM program and which is a main disadvantage of these work. This paper made us to think about an automatic load scheduling system.

B. User-sensitive scheduling of home appliances

This paper describes a system that helps users to respond to real-time electricity prices while being sensitive to their context and lifestyle. Yupik combines sensing, analytics, and optimization to generate appliance usage schedules that may be used by households to minimize their energy bill as well

as potential lifestyle disruptions. Yupik uses jPlugs, appliance level energy metering devices, to continuously monitor the power usage by various home appliances. The consumption patterns as well as data from external sources are analyzed using data mining algorithms to infer users preferred usage profile. Using the preferred profile as a reference, Yupiks optimization engine generates multiple usage plans that attempt to minimize energy and inconvenience costs. Some of Yupiks capabilities are demonstrated with the help of preliminary data collected from a home that was instrumented with jPlugs to monitor the power usage of a few devices.

In this paper the consumption data collected via jPlugs is correlated with external data such as the day of week, holiday, etc to determine the regular or preferred operating routines of devices. Devices are scheduled close to their regular usage times by taking into account their time and load elasticities so that user inconvenience is minimized. It represents preliminary experimental results based on jPlug data collected from a few low power devices in a single home. In the future it is able to collect and analyze data from more homes with devices consuming more power as well as experiment with data from external sources such as weather database.

C. Learning to be energy-wise: discriminative methods for load disaggregation

The system in this project works on the basis of demand response. Grid supply power, supply from grid according to the peak demand rather than the average demand. But while considering the peak demand, there is a chance loss in the distribution network. To avoid this problem they are trying to use demand response.

The demand response is implemented with the help of a system called Wattzup. It has got two components-First one is data collection component collect information regarding appliance consumption and the total consumption using sensors. Keep these recorded results as the baseline. Second component support the specified usage pattern for a particular time and relate between the usage and consumer interest, such as the demography, external factor, and major events etc. Thus according to the baseline as well as consumer interest the consumer can demand more power from the grid.

We are taking the concept of data collection and demand response from this paper. The main limitation of this paper is the dependency of individual likes and dislikes which are subjective and there is no particular standard for it also the dependency of the social media and news for considering external factor and in case major event making it more un reliable.

D. Smart (in-home) power scheduling for demand response on the smart grid

This paper implements the concept of smart power scheduling for home. In this system there is a smart meter which gives the real time pricing of the power for making the power usage below the threshold level.

The appliances in our home may be classified into two-First one is real time devices, which will receive the power as they desire and second one is schedulable devices, which can be scheduled according to our needs. The main component is Energy Management Controller (EMC) which is embedded inside the smart meter, which uses the real time pricing as well as the user preference. The system is implemented using smart devices which are connected by Human Area Network (HAN) with the help of Wi-Fi or Zigbee. The schedulable device operation can be adjusted to achieve target maximum power consumption. In this project the EMC monitors the power consumption as well as admit new appliances to the set. The active devices will be turned ON without any delay while schedulable devices according to demand wait for the next timeslot or can be started with in the time slot with a delay.

We are taking the concept of time slot analysis from this paper. The main limitation of this paper is that the allocation of time slot for schedulable devices without considering the peak and off peak hours of the load also the time slot allocated in this paper is very large during this time modifications are not possible for schedulable devices, which can be improved by selecting a lower time slot. Also system fails to operate successfully when a number of real time appliances are activated simultaneously.

E. Scheduling heterogeneous delay tolerant tasks in smart grid with renewable energy

This paper is based on smart grid which is the combination of renewable resources and real time pricing for the purpose of cost minimization. In this paper the renewable energy are stored and can be utilized at a time when the price is high.

The paper is implemented by considering some of the tasks as delay tolerant, which are not activated immediately. These devices are made to operate in the time slots were the prices are low, while the remaining devices are moved to battery backup when the prices are high. The system has many advantages that we can buy energy from the grid when the prices are low while we can sell it back the stored power when the prices are high.

We are taking the concept of real time pricing from this paper. It is a very novel idea that the consumers are always aware of their present electricity and manage their consumption accordingly to achieve their target. The main limitation of this paper is the consideration of delay tolerant load, which may vary from person to person and time to time and there is no particular standard for selecting these loads. Also the access to grid information for power management making it very complicated, due to unavailability of such a system nowadays.

F. RTP based residential power scheduling scheme for smart grids

In this system, the energy management controller in each home and service provider form a stack elberg game, in which the EMC who schedules appliances operation plays the follower level game, and the provider who sets the realtime

prices according to current power usage profile plays the leader level game. The sequential equilibrium Is obtained through the exchange between them. Simulation results indicate that scheme can not only save money for consumers, but also reduce peak load and the variance between demand and supply, while avoiding the rebound peak problem.

We are using the same method of this scheme for appliances scheduling. Based on the power consumption of appliances, gives the priority and schedules the appliances. From this paper we can add real time pricing in and our system is more reliable than this system.

G. Scheduling smart home appliances using mixed integer programing

This paper considers the minimum electricity cost scheduling problem of smart home appliances. Operation characteristics, Such as expected duration and peak power consumption of the Smart appliances, can be adjusted through a power profile signal. The optimal power profile minimizes cost, while satisfying technical operation constraints and consumer preference. Constraints such as enforcing uninterruptable and sequential operations are modeled in the proposed frame work using mixed integer linear programming. Based on the time depend power assignments (called as power profile) schedules the appliances using MILP.

It represents a MILP based smart appliance scheduling framework , capturing all relevant appliance operations. With appropriately defined tariff, the proposed framework can result in a scheduling achieving about 47% of maximum cost saving. In addition, it is demonstrated that good quality approximate solutions can be obtained in a reasonable amount of computation time (e.g. in about 1 second an approximate solution with relative error less than 0.5% can be obtained). In future the proposed framework can be extended to incorporate renewable energies, battery and the multi-objective optimization with respect to energy consumption and CO2 footprint.

The system is more complex, because it uses mathematical modeling MILP for appliance scheduling. Both systems are similar in the way of scheduling appliances based on the power consumption data table.

H. Energy consumption scheduler for demand response systems in the smart grid

This paper presents a design and evaluates the performance of a power consumption scheduler in smart grid homes or buildings, aiming at reducing the peak load in them as well as in the system-wide power transmission network. It is based on the two-way digital communication to fully take advantage of information technologies in delivering electricity from suppliers to consumers. The smart grid allows customers to smartly consume electricity both by selecting a preferred supplier and scheduling the operating of each appliance according to the various conditions including the price change and current load.

Current smart grid technologies can control the power consumption in homes and buildings more intelligently and autonomously, home controllers playing a key role.The operation of each appliance can be started, suspended, resumed, and stopped by a smart meter under the management of a home controller. Aiming at reducing the peak load in the individual homes as well as in the system wide power transmission network, this paper has presented a design, implemented a pilot version, and evaluated the performance of a power consumption scheduler in smart grid homes. The main problem with this paper is that the number of tasks that can be included to the system is limited also the system does not consider the user behavior, it only depends on the demand response.

III. PROPOSED SYSTEM

Control device for the efficient use of stored renewable power is a concept based on real time switching of devices according to the demand response. The existing systems for the load switching include smart grid system and peak hour concept based system main problems in implementing such a system is that for the smart grid system we get real time electricity pricing and once the consumption goes beyond our threshold we can control the consumption manually. The manual system of power switching is inefficient and for the second type of system that is the peak hour concept based system, we are considering only two time slots that is peak hour and off peak hours and control is established for peak hour only and during peak hours when the consumption exceeds a threshold devices are switched off from the mains according to their priority levels. The system that cuts supply from the mains when the consumption exceeds is also ineffective. Our system is a combination of these existing systems overcoming their drawbacks and also introducing the new concept of demand response which works on the basis of the study of the user behavior.

A. Block diagram

1) Transmitter section: The transmitter section consists of power supply, relays for switching the supply, three sets of current sensor, two sets of voltage sensor, LCD display and a microcontroller.

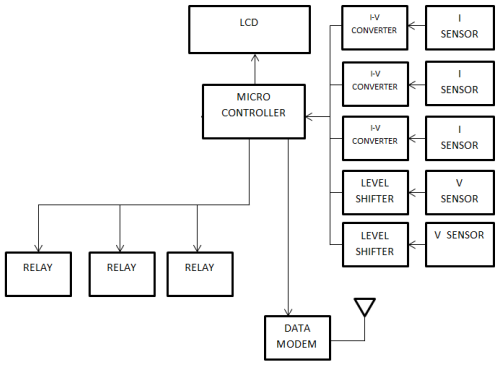

Fig. 1. Block diagram of Transmitter section.

2) Receiver section: The receiver section consists of a data modem, level shifter and PC. The power supply is common to both transmitter and receiver.

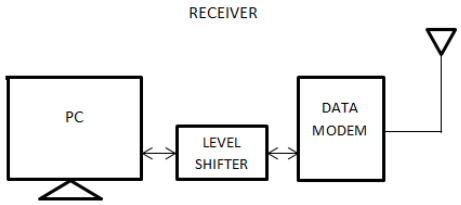

Fig. 2. Block diagram of Receiver section.

B. Block diagram description

The system is implemented in two stages in the first stage there is data collection and in the second stage there is switching of devices according to the user behavior. It consist of a transmitter section and a receiver section. The transmitter section consists of current sensors, I-V converter, voltage sensors, level shifter, and microcontroller and relay circuits. There are three separate current sensors and two voltage sensors. The real time values are taken using these current sensors that are kept for three types of loads namely; heavy, medium and low level loads. Since the microcontroller cannot detect current values it is converted in terms of voltage with the help of I-V converter and then given to the microcontroller. The voltage sensors in the circuit will give the voltage levels of mains as well as inverter and using a level shifter it is also given to the microcontroller. Once the data is collected the information about the user behavior are send to the PC using a data modem.

In the receiver section there is data modem, level shifter and PC. The data send from the transmitter part is received with the help of a data modem, which is at low level for a PC and is boosted using a level shifter. In the PC the slab table is prepared from the analysis table. Once analysis table is prepared then the slab table is updated and the rate of update of the slab table depend on the time slot allocated by the user according to his/her comfort level. For better efficiency the time slot can be kept as small as possible. Once the slab table is updated then the hardware unit acts according to the user behavior that is the average power consumption for that particular time slot is maintained. This system is implemented with help of real time value of power consumption and the values in the slab table. The cutoff of the load from line to inverter is done using 10A relay switching circuits and is allocated for the three separate loads. Priorities are set among different loads, to overcome the situation of lower battery backups. So according to the data in the slab table as well as the priority of the load, the system behaves in switched mode with the help of a microcontroller, here we use Atmega 328 microcontroller. Atmega is an 8 bit microcontroller which can be programmed using an Arduino software. The combination of both hardware and software is called Arduino.

C. Software section

1) Software tools: The software tools mainly consists of Arduino software for programming the hardware and Proteus for the simulation. The data storage and processing were done using Visual basic in the PC side.

a) Arduino software: Arduino is an open source physical computing platform based on simple I/O board and development environment that implements processing/wiring language. Arduino can be used to develop standalone interactive or can be connected to software on computer.

To program the Arduino we use the Arduino IDE (Integrated Development Environment), which is a piece of free software that enables to program in the language that the Arduino understands. The language used in Arduino is C. The IDE enables us to write a computer program, which is a set of step-by-step instructions that then upload to Arduino. Then Arduino will carry out those instructions and interact with the world outside.

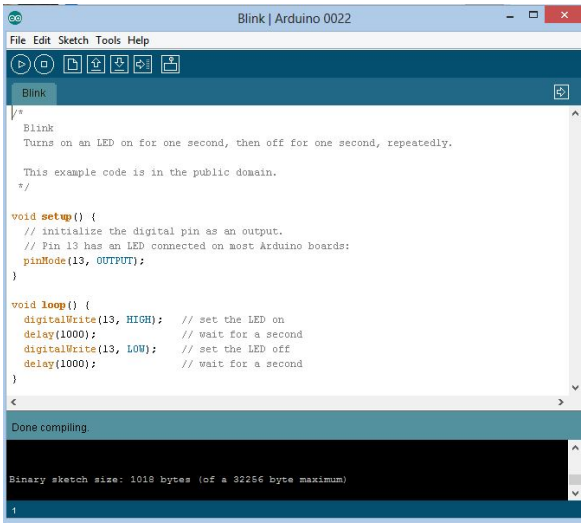

Fig. 3. Arduino window.

Software programs, called sketches, are created on a computer using Arduino integrated development environment (IDE). The IDE enables you to write and edit code into instructions that Arduino hardware understands. The IDE also transfer that instruction to Arduino board (a process called uploading).

Arduino programs can be divided in three main parts: **structure**, **values** (variables and constants), and **functions**.

b) Proteus: Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design. It is developed by Labcenter Electronics

Proteus 7.0 is a Virtual System Modelling (VSM) that combines circuit simulation, animated components and micro-

processor models to co-simulate the complete microcontroller based designs. This is the perfect tool for engineers to test their microcontroller designs before constructing a physical prototype in real time. This program allows users to interact with the design using on-screen indicators and/or LED and LCD displays and, if attached to the PC, switches and buttons.

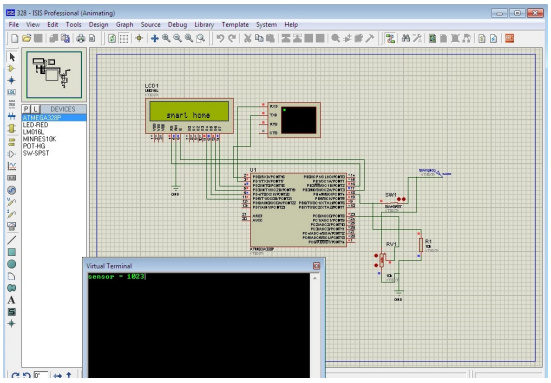

Fig. 4. Proteus window.

One of the main components of Proteus 7.0 is the Circuit Simulation – a product that uses a SPICE3f5 analogue simulator kernel combined with an event-driven digital simulator that allow users to utilize any SPICE model by any manufacturer. Proteus VSM comes with extensive debugging features, including breakpoints, single stepping and variable display for a neat design prior to hardware prototyping. In summary, Proteus 7.0 is the program to use when you want to simulate the interaction between software running on a microcontroller and any analog or digital electronic device connected to it.

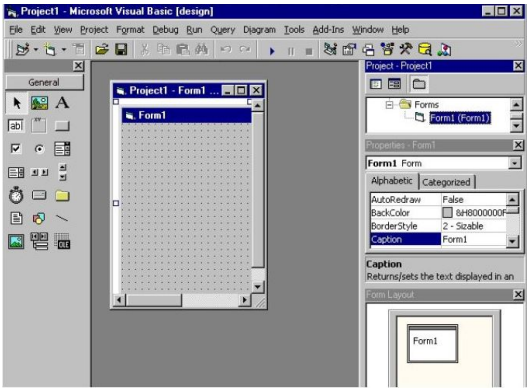

Fig. 5. Visual basic window.

c) Visual basic: Visual basic is a high level programming language evolved from the earlier DOS version called BASIC. BASIC means Beginners' Allpurpose Symbolic Instruction Code. It is a fairly easy programming language to learn. The codes look a bit like English Language. Different software companies produced different version of BASIC, such as Microsoft QBASIC, QUICKBASIC, GWBASIC ,IBM BASICA and so on. VISUAL BASIC is a VISUAL and events driven Programming Language.These are the main divergence from the old BASIC. In BASIC, programming is done in a text-only environment and the prgram is executed sequentially. In VISUAL BASIC, programming is done in a graphical environment. Because users may click on a certain object randomly, so each object has to be programmed indepently to be able to response to those actions(events).Therefore, a VISUAL BASIC Program is made up of many subprograms, each has its own program codes, and each can be excecuted indepently and at the same time each can be linked together in one way or another.

d) Algorithm:

1) Start
2) Include the required header files (LCD, USART)
3) Declare the variables that are used in the code
4) Initialize LCD,DIGITAL Pins
5) Initialize Serial communication
6) Read Current ,Voltage Sensors
7) Read the digital inputs to set device in Manual or Automatic mode
8) In Manual mode checks the status of input button and switch the relay
9) In Automatic mode wait for time slot command from PC
10) When command comes read it
11) Send individual command to PC for specified data
12) Compare user behavior from PC with the real time values
13) Switch the relays to satisfy the condition for minimum consumption from mains
14) Go to step 10
15) Stop

IV. Conclusions & Future Scope

One of the major challenges faced by Indian power grid system is the excessive use of energy and that results in the imbalance in the power generated and power consumed. Industrial sector make use of seperate power sub stations for its needs, our aim is to make constant billing of this sector so that it reduce the dependency of the industry from the main supply upto some extent and thus a better utilization of the renewable energy is possible. So our project Control device for the efficient use of stored renewable power will be a better solution to these problems. All the drawbacks of existing systems can be overcomed by our system.

The future work includes the development of a hybrid system (that includes power from wind and solar resources) thus with more than one renewable resource to meet the total daily consumption for a consumer. By using the forecasting method, we can store the extra power needed for future use. This method will increase the comfort level of consumers, consider power failure and reschedule the operation of devices.

V. ACKNOWLEDGEMENT

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HUMAN RESCUING SPY ROBOT AT DISASTER ZONE WITH PERSON IDENTIFICATION

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***Abstract*—** This paper is intended to develop a robot that can replace humans in rescue operations during disasters like wars or natural disasters. It makes use of various ideas of electronics and communication techniques. That means here we are using the techniques like image processing, sensing techniques, voice controlled operation, wireless transmission etc.Absolutely this robot can replace human beings in disaster areas. This robot will enter in to the area & catch the images from there. By processing that image & after comparison it can take necessary actions. At the same time it will send the live videos from there to the centers outside so that we are able to control its operation by our voice. If it detects the presence of human being by its virtual eye, it will go near to it and checks whether that body is alive or not. It can be achieved by checking the body temperature and pulses. Then it will alarm. This alarming helps the people to find the alive people. As a final stage of rescue, it helps in identifying that person by comparing thumb impression along with the datas stored in AADHAR.

I. INTRODUCTION

During disasters and wars, human rescuing operations have much more importance.Natural disasters like earthquakes, floods as well as human made disasters like wars,building collapses need a faster rescue operation to save lives.Many lives may be lost due to inaccurate rescue operations. When humans areemployed in rescue operations, they may suffer due to many limitations. They cant enter in to difficult terrains. So to avoid these problems we can use robots. Now a days robots have already implemented in these fields. These systems have their own demerits. These existing systems are not able to identify the person which is a problem in disaster or warzone. Here comes the importance of person identification system in the rescue robot.

Due to flood in Uttarakhand and frequent attacks in Indo-Pak border, several common people lost their lives; They are buried even without identifying them. So rescue operations need much more faster robots as well as person identification system.

This paper emphasis on the rescue operation accompanied by robotics; That means it helps the people engaged in rescue operations. It makes use of various sensors. Theonly sensor used to detect the aliveness of the detected human body is temperature sensor.Another important sensor is to detect the presence of suspected objects like bombs, thisfinds application in war fields. This system can communicate with controlling section.

It consists of RF camera to take photographs of disaster zone. It takes the video as well as the picture. This will help the controlling people to control the system properly and efficiently. When the robot is navigating through the disaster zone or through a war zone, it will take the video of surrounding place and sends it to the controller. It also takes the still images. Its motion is controlled using ultrasonic sensor which detects the presence of obstacle in its path. If it detects any obstacle it will produce a beeping sound to aware the rescue people. Then it checks if it is a human being or not then aliveness is checked using temperature sensor.

II. PROPOSED SYSTEM

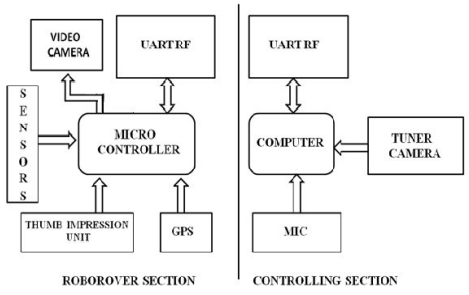

Figure 1: Block diagram

The block diagram consists of mainly two section 1) Roborover section 2) Controlling section. Roborover section consists of following components:
Microcontroller
RF wireless communication module
Video camera
GPS
Thumb impression unit
Sensors

The roborover section receive instructions from the controlling section through the IR wireless communication module and these are fed to the microcontroller. The microcontroller do the roborover movement controls according to the received signals. Also the output of various sensors are managed by the microcontroller. The camera in the roborover is kept as ON always hence it is able to help in navigation of robot. It also enable the system to detect any unburied humans. The PIR sensor also helps to detect the alive human. If some human is found, the next step is to take the images of face and iris of detected human. This camera directly transmits the data to the controlling section.

There is a radio AV receiver which will collect the data and give it to microcontroller.The microcontroller compares and identifies the person. Roborover section have some sensors too, they are gas sensor and metal detector. The gas sensor senses the toxic gases. It will help to analyze the condition of the region through which the roborover is navigating. The metal detector helps to find the presence of mines and bombs. The GPS module provides the exact location of the roborover and hence rescue team can reach the actual place and can take necessary actions.

III. IMPLEMENTATION

A. Circuit Diagram and Description

The microcontroller used is PIC16F877A. PIC microcontroller has 2 VDD pins (11& 32) for 3.3v supply and 2 VSS pins (12 & 31) for ground. First pin of PIC IC isMCLR pin , when this pin is grounded or active low PIC get reset. So for making IC in working mode, MCLR pin is pulled up through resistor R2 1K. A switch sw1 is given to ground MCLR pin and to reset the program.

For working in 1 micro second clock, a 4MHZ crystal is used. The capacitors c8 & c10 connected to the crystal is the stabilizing capacitors which stabilizes oscillations from the crystal.

As the power is received by all parts of circuit, it gets activated. Then it checks for the inputs available at various points of the microcontroller and then only the microcontroller is able to make necessary decisions. PIR sensor is utilized here to detect the aliveness of the human body. If PIR output at the pin numbers 33 and 34 of the PIC is high, then system gives a message that alive human body is detected. Then the controlling system is able to take the corresponding actions to rescue the human being .The identification of the person can be done simultaneously by transmitting the images of thumb impression or iris to the controlling section. Then it is processed and the person is identified.

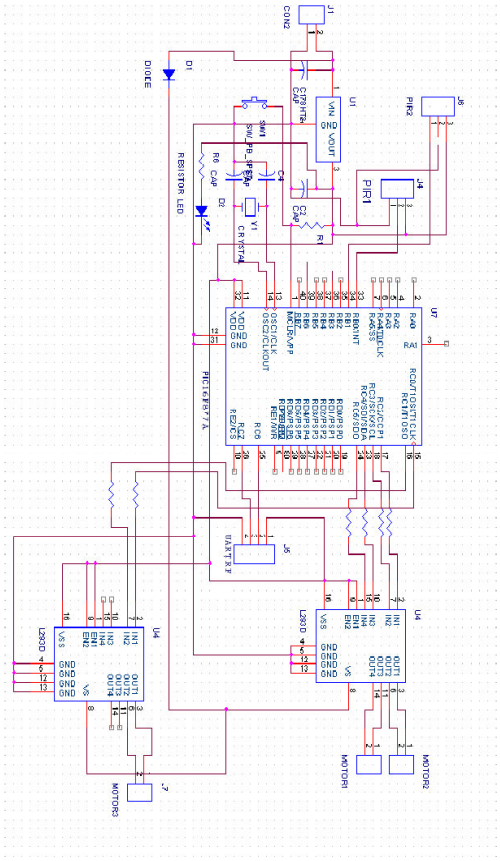

Figure 2: Circuit diagram

The gas sensors and the metal detectors are employed at the rover side to analyze the conditions of the navigating area. The output of all sensors are connected to port B of the PIC. Gas sensor senses the presence of various gases

present there. There may be some poisonous gases or something like that there. Similarly the metal detector is enable to detect the presence of mines or bombs.

There is dc motor, which requires high current. But the microcontroller cannot produce high current so we use motor driver .where we use L293D. It is connected to pin 17,18,23 and 24. The IR wireless communication module is connected with port c of the PIC, pins 25 and 26.

B. Software Description

MPLAB Integrated Development Environment (IDE) is the software used for programming microcontroller. MPLAB IDE provides functions that allow us to:

Create and edit source files
Group files in to projects
Debug source code
Debug executable logic using the simulator or emulator

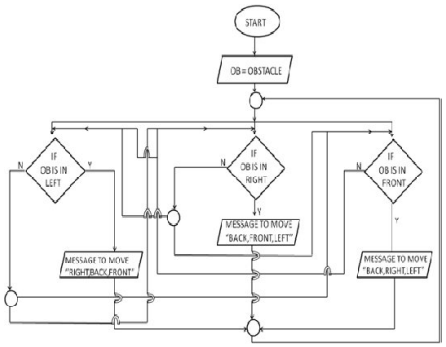

Figure 3: Flow chart of Roborover controlling section

MATLAB is used for the identification of the person by processing the image of thumb impression ..

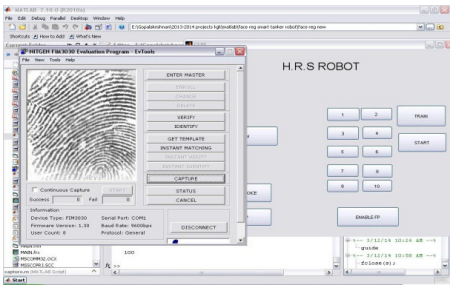

Figure 4:fingerprint comparison

Data base for the images can also be created with the help of GUI. GUIs (also known as graphical user interfaces) provide point-and click control of software applications, eliminating the need to learn a language or type commands in order to run the application.

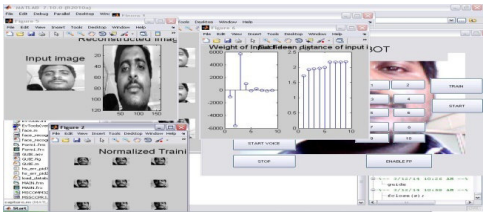

Figure 5:image comparison

Figure 6: Photograph of the developed system

IV. CONCLUSION

Human rescuing spy robot at disaster zone with person identification provides a bet-ter way for successful rescuing operations. The existing rescuing systems have no person identification facilities. By employing this facility in addition to the rescuing operations, many more advantages are there.Government or relating authority is then able to provide the information about suffered people in the disaster or war. The system contains two sections, a moving section and another controlling section.The visible actions or the op-erations in the field is done by the moving section under

the guidance of the controlling section. As the roborover employs the various type of sensors and detectors,it will help the controlling section to analyze the situation.Along with these cameras are also used to get a visual about the place.So that controller can control it easily. Still images are also captured by the roborover. This will send to the controlling section for further processing, after the processing it is possible to identify the person.This process includes the compar-ison of obtained image with the stored images in the database. So efficient rescuing can be done in variety of situations like natural disasters, building collapse,wars.

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SAFETY SYSTEM FOR BIKES WITH PARENTAL CONTROL

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***Abstract*— Nowadays accidents are increasing due to over speed of vehicles. Comparing to heavy vehicles two wheelers are the victims of such accidents. In this project the speed of the bike of a person can be controlled by his or her guardian or parent. At first the speed of the bike is continuously monitored and if it rises above a preset speed, the system will give warnings to the rider as a voice alert and LCD display to reduce the speed. But if the rider reduces himself, the system wont interrupt his freedom. The warning is given only once and the second time he over speeds, a message indicating the speed will be sent to the guardian's mobile. The guardian can now set the maximum speed of the bike from his mobile if he wishes to do so. Alcoholic driving, driving without helmet and triple driving are also prohibited using this technique. Also, the bike will be started if and only if the particular helmet is wore. As the thefts are increasing day by day this feature of the system protects bikes from thieves up to a limit. So it makes the system more effective. If the parent is not able to send the SMS, he can set the speed manually by using the keypad provided. The keypad is password protected.**

I. INTRODUCTION

Nowadays accidents are increasing due to over speed of vehicles. Mainly youths are facing these types of incidents. Most of these accidents are caused because the automobiles are driven at high speeds even in the places where sharp turnings and junctions exist. Comparing to heavy vehicles two wheelers are the victims of such accidents. According to the survey conducted by media more than 500 of accidents have been occurred in Kerala in the last year. Many people especially youth lost their life in roads. Most of the youth are not aware about road accidents and about traffic rules and they drives carelessly and become the victims of death. So remedies for the reduction of number of such accidents are the prime step to be taken.

Road accidents can be prevented by adopting measures such as Traffic management, improving quality of road infrastructure and safer vehicles.To Ensure decline in accidents and to improve road safety, speed control techniques such as speed control in school and college zones by using RF transceiver, automatic braking systems, Camera based detection, RFID technology based detection are implemented. The existing techniques still doesnt able to reduce the number of accidents. First step towards this to make the people aware through different programs and to avoid the death due to accident especially two wheelers, helmet security and speed control is necessary. This should form the part of government. But the checking of these is not found to be efficient. The latest system introduced to control the speed is the Speed Governor. These are implemented only in busses and not supposed to fit in other vehicles. So there should be an efficient automatic speed controlling mechanism for all vehicles. And this will be a blessing to the authority.

The driving task of judging a vehicle's speed is becoming more difficult with the trend to quieter, smoother vehicles. Some roadways are known to be over-designed and can induce unsafe traffic speeds. Motorists often do not appreciate the distance they travel between the point when a hazard first became visible (but not necessarily seen) and the point where their foot hits the brake pedal. In summary, motorists cannot be expected to make correct judgments about appropriate travel speeds for th e conditions. Objectively set speed limits fulfil the purpose of setting an upper limit but there needs to be an improvement in the credibility of speed limits.

Here the proposed system is particularly designed for two wheelers. And it aims to save the lives of people,particularly youth. This safety system can also be used for any other vehicles. The system is capable of preventing driving without helmet, alcoholic driving, and triple driving.These features enhances the degree of safety further. Also the system is a countermeasure for over speeding. In case of over speed,an alert is given to the rider to reduce speed.And for the next time when he overspeeds a message is sent to parents mobile concerning the speed. Then parent can set the speed just through a message according to his wish. If this is implemented in all vehicles, the authority can control the speed of any vehicles from anywhere. Hence traffic problem and number of accidents can be made under control.The proposed safety system provides safety for the two wheeler also,because the bike will be started if and only if the particular helmet is wore. As the thefts are increasing day by day this feature of the system protects bikes from thieves up to a limit. So the proposed system has good speed control performance and is relatively inexpensive.

A. OBJECTIVES OF STUDY

The main objectives of this project were to make a low cost, reliable and security system for two wheeler riders. Our bike security system is targeting on people who are riding two wheelers very carelessly and thereby reducing the number of

two wheeler accidents. To accommodate all users, this system was designed to be as simple and user friendly as possible. This system will sense the speed of the vehicle and will give alert to both rider and to the parent. There are number of sensors to find out overweight driving and whether the rider is alcoholic or not also the system ensures that the rider has worn the helmet.

II. EXISTING SYSTEMS

The speed Governors are usually used for controlling the speed of the vehicles by setting a fixed speed. Thus we can reduce the amount of accidents. The main disadvantage is that the vehicles cannot increase its speed beyond that a threshold value in case of any overtaking. It makes the riding very difficult even in the safe zones. Also the driver can remove the equipment without informing the authority. So this does not create any benefit to the society and the traffic authority. And also this set up does not ensures the safety of the driver. Also driver can take the vehicle even if he is alcoholic. And in case of two wheelers helmet wearing cannot be ensured. So equipment which can meet almost all these requirements has to be developed.

A. DESIGN OF MC BASED SPEED GOVERNOR FOR AUTOMOTIVE ENGINE

The engine speed controller of a conventional diesel engine is called a Governor.The basic task of electronic speed governor system is to prevent the engine from exceeding the maximum revving speed specified by the engine manufacturer. In order to control engine speed, the governor controls the amount of fuel using fuel rack. The fuel rack is connected to throttle actuator lever and driven from microcontroller. The actuator motion is controlled to achieve set-point rpm so required pulse width modulation duty cycle to drive actuator is calculated from digital PID algorithm. PIC 16F877A microcontroller based hardware is developed for the implementation of the controller. This system controls speed by controlling the amount of fuel using fuel rack. But the main disadvantage is that the rider cannot increase speed beyond the limit. Also they can remove the system with informing authority. This is a serious issue.In our system the speed can be varied according to the wish of parent. This makes the system more efficient.

B. SYSTEM TO PREVENT HELMET THEFT AND WIRELESS MONITORING OF STATUS OF THE BIKE

In a motor vehicle, various conditions need to be checked, like engine oil condition, battery health, and engine health and service remainder of the bike a microcontroller is fixed under the vehicle seat. Inside the helmet core, an electric wire is inserted through the strap making a loop such that wire goes throughout the whole core via the strap and after going through the core it comes out through that same strap. A signal is sent from the microcontroller &the signal reaches to another pin of microcontroller. But when someone cuts the strap, the sent signal is lost and no signal is received and an alarm is produced. Hence gaining attraction of security at the site of theft and will also activates the GSM module which will send the message to the owner of the bike. Here the rider cannot ride his bike without wearing the helmet and some extra feature is added to the helmet. Here the rider cannot ride if he is alcoholic and the helmet should be placed properly on head. These are done with the help of contact switches, humidity sensor and alcohol sensor.

C. DESIGN AND IMPLEMENTATION OF A MC BASED ALCOHOL DETECTOR

Many methods have been devised and many instruments have been invented to check the social problem of drunken-driving. The most easy-to-use and convenient of all such instruments is the Passive Alcohol Detector. They are hand-held, portable and accurate as well. They are held at a distance of about 6-8 inches from the suspects face and sample the exhaled air to detect the presence of alcohol. They can detect low levels of alcohol, down to 0.01 percent breath alcohol concentration. These sensors can be designed as a portable device and can be used by police officers to detect alcohol presence and establish reasonable suspicion for further sobriety testing. Passive alcohol testing is non-invasive, accurate and only requires passive contact from the individual being tested.

III. PROPOSED SYSTEM

The proposed safety system for bikes opens a way to control the speed of the bike extremely by the rider's parent or guardian. For the first time of over speed, a warning is given to the rider and for the second time he over speeds, a message indicating the speed will be sent to the guardians mobile. The guardian can now set the maximum speed of the bike. Alcoholic driving, helmetless driving and triple driving are also prevented using sensors and RF modem. The proposed system consists of three parts namely vehicle side, helmet side and parent side. These three parts are shown in the block diagram.

A. VEHICLE SIDE

Heart of this section is a Microcontroller, ATMEGA 328. And consist of voice record and play back module for giving voice alarm, speed sensor, flex sensor relay driver, relay and power supply circuit. GSM module is used to send and receive message. The voice recorder and play back module is an IC with a capacity approximately 3600 sec. It can store audio input in digital form with the help of an ADC and play back at any desired time using DAC. The data input can of length 3600 sec or it can be sub divided in to 30 slots. These can be accessed using 5 selector lines. In addition to other ICs it has an inbuilt amplifier and filter circuits. This gives a louder audio output with higher clarity. The speed sensor can be implemented with the help of a two shaft motor and tachometer. The rotating part is connected at one shaft and other end tachometer is connected. So speed can be measured easily .In this system triple driving is restricted

with the help of a flex sensor. For every weight the sensor will change the resistance. For an average weight threshold is set. If weight increases in case of triple travelers the bike will get off whenever the bike is just started. The threshold speed is set in the microcontroller. The speed sensor will continuously check the speed of the vehicle. If the speed exceeds the preset threshold value, a voice alert is given and message will be displayed on the LCD screen. The warning is given only once and the second time he over speeds, a message indicating the speed will be sent to the guardian's mobile. The guardian can now set the maximum speed of the bike from his mobile if he wishes to do so. Now the bike will move with that speed and cannot be change until another message is sent by parent. Also parent can set the speed and allowed weight manually using a four button key pad, which is password protected.

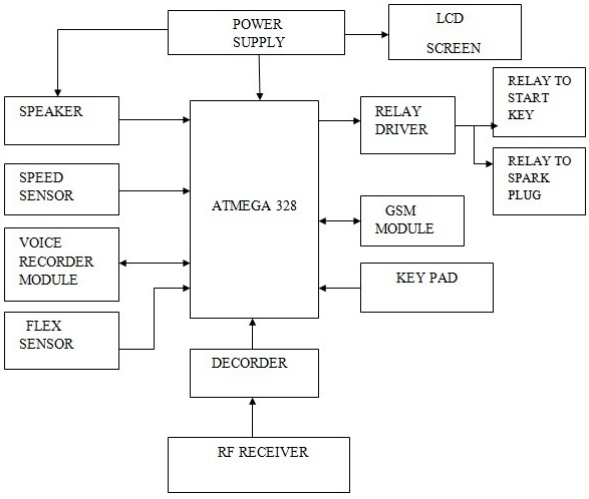

Fig. 1. Block Diagram of Vehicle section

B. HELMET SIDE

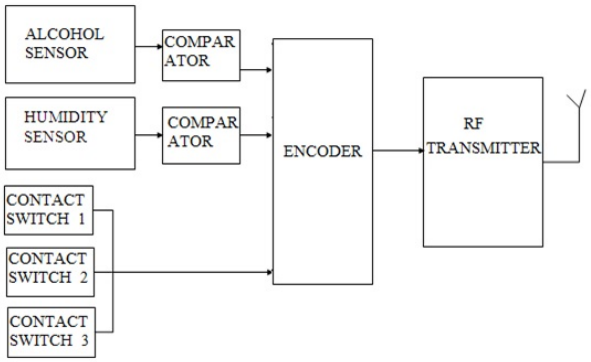

Fig. 2. Block Diagram of Helmet section

The section consists of a humidity sensor, alcohol sensor & switches. The bike can be started only if the switches are at ON state. The sensor will compare the humidity and alcohol content in breath with a threshold value. The state of switches and sensor output are given to microcontroller through a wireless transmitter. The receiver will decode the received signal. Microcontroller will check the status and respective decision is taken. So to start the bike helmet should be place properly and the person should not be alcoholic. Hence this provides both security and protection to both bike and rider.

C. PARENT SIDE

This section simply consists of a GSM mobile through which they receive message regarding the speed. And they can sent message to set the speed as their wish. Otherwise we can use a PC.

Fig. 3. Cellular Phone

D. CIRCUIT DIAGRAM

The circuit diagram of Safety System For Bikes With Parental Control is shown in figure below. This consisting of two sections, one is vehicle section and other one is helmet section.

VEHICLE SECTION

POWER SUPPLY

The power supply circuit shown consists of a step down transformer, a bridge rectifier, filter capacitor and a 7805 voltage regulator. The output voltage obtained is 5 V supply. A 12V ac from a step down transformer is fed to a voltage regulator IC LM7805 through a rectifier.the regulator is capable of providing a constant voltage at its output.the capacitors(C1,C2)are used for filtering of unwanted signals.then

the output of 7805 is a constant +5v.at the output side the capacitors are used to reduce fluctuations.the output is taken across the resistor R16 and a LED is provided to indicate the presence of +5V at the output.

MICROCONTROLLER SECTION

This section consists of microcontroller, sensors, keypad, GSM modem, LCD display, RF receiver, HT12D Decoder, a voice play back recorder with speaker. The sensors used here are a flex sensor and a speed sensor. The speed sensor used here is a two shaft motor.The one end of the two shaft motor is connected to the speedometer cable of the bike and another end is connected to the another ADC pin of the microcontroller which will convert the analog voltage produced at the motor into the corresponding digital value in the rage of 0-1024. When the bike is start to move, then the motor is start to rotate and produce a voltage in it as like a dynamo. The remaining shaft of the motor is connected to the speedometer to view the speed by the rider. The flex sensor is used here to ensure that the vehicle is not overloaded. It is a flexible resistor that will be connected with the shock-ups. When ever a person is getting on to the bike the flex sensor will bend and produce a voltage corresponding to the action of the shock-ups. The microcontroller will activate the relay that is placed between battery and start key, if the flex sensor indicated a triple load. Then the bike will be stopped. The flex sensor is connected to the ADC pin of the microcontroller. The ADC will convert the analog value into the corresponding digital value in the range of 0-1024. The response of the flex sensor will not be read during the ride.

After starting the bike the speed sensor will sense the speed of the bike. When ever an over speed is detected, the microcontroller will activate the speaker to warn the rider and if the over speeding is continuing for a predefined time a message will be send to the parent by GSM modem. And according to reply from the parent the microcontroller will activate the relay to the spark plug. The relay is placed between start key and spark plug.

A key pad is used here to set the maximum speed and maximum load can handle by the bike by parent for a whole day.The keypad is password protected. Four button key pad is used here to set the speed and weight. For that two modes are used here, mode1 and mode2 for manual entry and automatic checking respectively. The entire microcontroller section along with the keypad is placed on the petrol tank of the bike.

HELMET SECTION

It consist of three contact switches, a humidity sensor and an alcoholic detector.The sensors are placed at the inner portion of front side of the helmet. Contact switches are placed in the inner part of the helmet at various positions to ensure the contact. A 6F22 9V battery is used to supply power for the helmet section. The output of these switches and sensors are encoded by a HT12E encoder. The output of the encoder is send to the vehicle section through the RF transmitter. The three switches are used to ensure the helmet is placed on

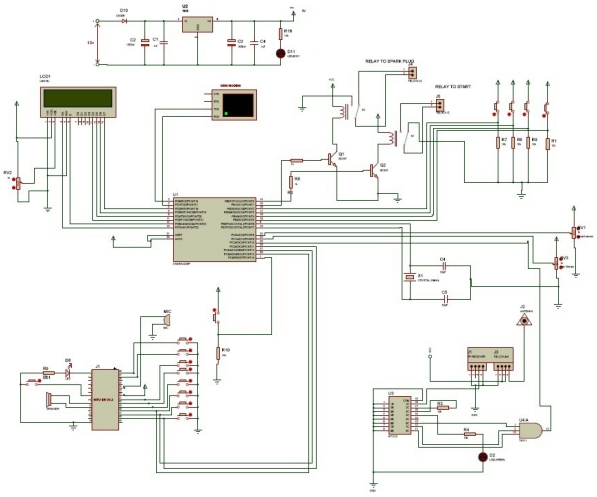

Fig. 4. Circuit diagram of vehicle section

the head correctly. If the helmet is placed correctly the three switches will get pressed and get a high voltage at the output of these switches. These three outputs are given to an AND gate to produce a single high voltage. This voltage fed to a HT12E encoder.

The humidity sensor will sense the relative humidity of the atmosphere inside the helmet and produce a corresponding analog voltage. This voltage is given to a comparator to convert into a digital value. As well as a alcoholic detector detects the presence of alcohol and generate corresponding voltage output. These three outputs are given to an HT12E encoder and the output bit is transmitted through the RF bit transmitter.

E. MAJOR COMPONENTS

ATMEGA 328p

ATMEGEA 328 is an 8-bit microcontroller with 32K in-system self programmable flash memory. It consist of 28 pins and in which 14 of them are digital pins and 6 of them are ADC pins. It provides high performance with advanced RISC(Reduced Instruction Set Computer) architecture. It has 32 registers with 8 bit storage capacity. So it meets the memory capacity demanded by the proposed safety system.Also 6-PWM channels are available. It provides a programmeble serial USART for serial communication.

SPEED SENSOR

Speed sensor is accomplished by a motor having two shafts. One of the shafts is connected to the wheel of the bike to obtain the speed and the remaining shaft is used for obtaining the speed in speedometer by rider.

FLEX SENSOR

Flex sensors are sensors are sensors that change in resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance-the more the bend

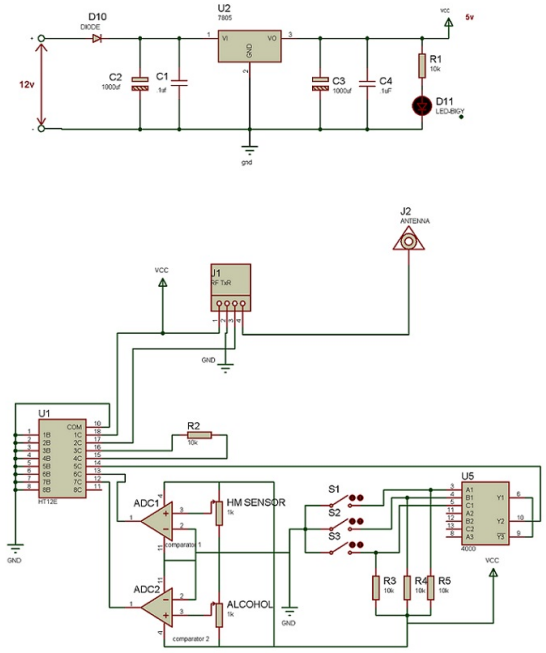

Fig. 5. Circuit diagram of helmet section

the more the resistance value. They are used to detect the overloading or triple loading.

ALCOHOLIC DETECTOR

MQ-3 semiconductor sensor for alcohol is used as alcoholic detector.Sensitive material of MQ-3 gas sensor is SnO2, which with lower conductivity in clean air. When the target alcohol gas exist, The sensors conductivity is more higher along with the gas concentration rising. MQ-3 gas sensor has high sensitity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor.

GSM MODULE

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem is that we can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. It can be used to send and receive SMS or make/receive voice calls. It supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP or IP stack.

LCD

Liquid crystal display (LCD) is an electronically-modulated optical device shaped into a thin, flat panel made up of any number of color or monochrome pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector.

Here we uses a 16x2 LCD for the message display. In 16x2 the number 16 represents the number of columns and 2 represents the number of rows in the display.

RF BIT TRANSMITTER AND RECEIVER

RF modem can be used for applications that need two way wireless data transmission. It features high data rate and longer transmission distance. The communication protocol is self controlled and completely transparent to user interface.

HT12E ENCODER

It is a 2^{12} series encoder.The 2^{12} encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12-N data bits. Each address/ data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF transmission medium upon receipt of a trigger signal.

HT12D DECODER

It is a 2^{12} series decoder.The 2^{12} decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holteks 2^{12}series of encoders.For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

F. SOFTWARE TOOLS

ARDUINO

Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible. The hardware consists of an open-source hardware board designed around an 8-bit AtmelAVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller.

Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. Arduino programs are written in C or C++. The Arduino IDE comes with a software library called ”Wiring” from the original Wiring project, which makes many common input or output operations much easier.

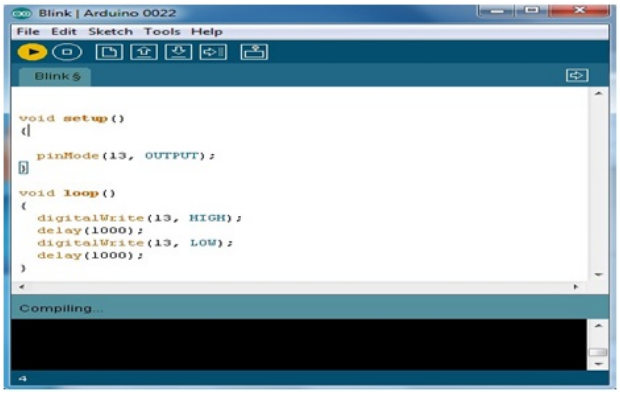

Fig. 6. Arduino window

PROTEUS

This software is for microprocessor simulation, schematic capture. It is developed by Lab center Electronics. The XGame Station Micro Edition was designed using Lab center's Proteus schematic entry and PCB layout tools. Proteus 7.0 is a Virtual System Modeling (VSM) that combines circuit simulation, animated components and microprocessor models to co-simulate the complete microcontroller based designs. This is the perfect tool for engineers to test their microcontroller designs before constructing a physical prototype in real time. This program allows users to interact with the design using on-screen indicators and/or LED and LCD displays and, if attached to the PC, switches and buttons. One of the main components of Proteus 7.0 is the Circuit Simulation – a product that uses SPICE3f5 analogue simulator kernel combined with an event-driven digital simulator that allows users to utilize any SPICE model by any

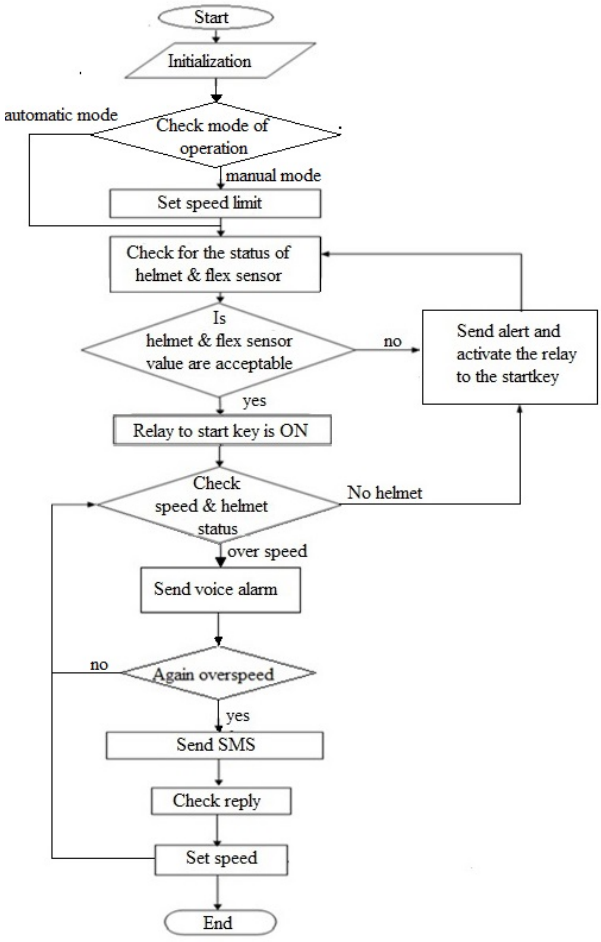

Fig. 7. Flowchart

FLOWCHART

Flowchart Explanation

Initially the header files are included, variables and constants are declared and initialization of LCD and serial communication is done. After the initialization, the mode in which the system is operating is checked. There are two modes of operation for this safety system. They are manual mode and automatic mode. In manual mode the parent sets the speed limit using keypad and in automatic mode the speed limit is set using the software. Then the status of helmet and flex sensor is checked. If it is satisfactory relay to the start key is ON also send an alert via the speaker. After starting the bike check speed and helmet status periodically and if an over speed is detected, then send a voice alarm.After sending voice alarm, if rider goes on with the over speed, then an SMS is send to the parent and speed is set after checking the reply. If misplacement of helmet is detected, then activate relay to the start key to stop the bike. This process repeats periodically.

G. PCB DESIGNING AND FABRICATION

A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate. It is also referred to as printed wiring board (PWB) or etched wiring board. A PCB populated with electronic components is a printed circuit assembly (PCA), also known as a printed circuit board assembly or PCB Assembly (PCBA). Printed circuit boards are used in virtually all but the simplest commercially produced electronic devices.

Alternatives to PCBs include wire wrap and point-to-point construction. PCBs are often less expensive and more reliable than these alternatives, though they require more layout effort and higher initial cost. PCBs are much cheaper and faster for high-volume production since production and soldering of PCBs can be done by automated equipment. Much of the electronics industry's PCB design, assembly, and quality

control needs are set by standards that are published by the IPC organization. That can be chosen to provide different insulating values depending on the requirements of the circuit. Some of these dielectrics are poly tetra fluoro ethylene (Teflon), FR-4, FR-1, CEM-1 or CEM-3. Well known prepreg materials used in the PCB industry are FR-2 (Phenolic cotton paper), FR-3 (Cotton paper and epoxy), FR-4 (Woven glass and epoxy), FR-5 (Woven glass and epoxy), FR-6 (Matte glass and polyester), G-10 (Woven).

IV. OBSERVATION AND DISCUSSION

The safety system for bikes is designed to be a strong tool for reducing bike accidents. We could control the speed of the bike externally using the proposed system. The implementation of the system using hardware and software tools was done successfully. The microcontroller section of the circuit is placed on the petrol tank of the bike. The flex sensor is placed on the shock-ups of the back wheel. The humidity sensor, alcoholic detector and contact switches are placed inside the helmet along with a RF bit transmitter. The speedometer cable of the bike is cut and a two shaft motor is connected between the ends. At the onset a message is displayed on LCD as system enabled and by starting the bike the status of helmet is displayed on the LCD. I f the helmet is not wore the LCD shows the message 'please wear helmet', also when more than two people are sitting on the bike LCD will show 'over weight'. If all the conditions specified above are satisfied, the bike will ON. If the riding speed is greater than the predefined threshold for the first time, a message has been displayed on LCD as 'over speed'. When the rider remain to be over speed for more than 10sec, then only the message is send to the parent. So the system provides freedom for overtaking up to a limit. The safety system could reduce the speed of the bike by checking the reply from the parent with a small amount of delay. When there was no reply from the parent, the system wasted for a few seconds and reduced the speed automatically to the preset threshold. In other case, when speed and wait was set using the keypad, the rider was unable to increase the speed beyond the limit. The keypad is active only after entering the password. The bike is unable to start in the absence of a particular designed helmet.

On comparing the two modes of operation, manual mode gives higher performance. But in manual mode there is no scope of external speed control.

Thus this system provides maximum security for the rider as well as for the bike.

V. CONCLUSION AND FUTURE SCOPE

The proposed system that is Safety System for Bikes with Parental Control will be very beneficial to society, since the number of accidents can be reduced considerably. One of the major advantages of the system is that the parent/authority can control the speed of the vehicle using their mobile or PC. In the prosed system alcoholic driving, triple driving and driving without helmet and also be prevented apart from the speed controlling. The bike will be started if and only if the particular helmet is wore. As the thefts are increasing day by day this feature of the system protects bikes from thieves up to a limit. So it makes the system more effective. If the parent is not able to send the SMS he can set the speed manually by using the keypad provided. The keypad is password protected. Hence bike security and protection of rider can be ensured at the maximum extent by the proposed system. It can be implemented using low cost components. The proposed system is reliable and there is a wide scope of improvements in the future.

In case of thefts, the bike can be tracked by the cybercell, with the help of GSM modem. The parent can locate the bike, if a GPS is interfaced with the system. This is an important, and advantageous scope of the system.

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Air Quality Management With Sensormap and Monitoring System

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***Abstract*— The system is a real time monitoring system for air quality management. It is a system which makes use of various sensor nodes that are used for detecting the main pollutants.The output of sensor varies according to the intensity of gases in the atmosphere.The output values from the sensor is given to the microcontroller where it is compared with the threshold levels.Once these values exceed the limits, the data points are tagged with location using GPS and are uploaded to the Google map. An estimate of pollution level and also the location are being shown in the Google map. It is a real time monitoring and updating system indicating the amount of pollutant present in air.It also uses a GSM module for sending message and voice alert to the authorities if the pollutant level exceeds a predetermined level. LCD section is placed in the area under observance and can be utilized to provide pollution information to the people residing in the region and thereby creating a public awareness.**

***Keywords*—pollutants, sensors, Google map.**

I. INTRODUCTION

Air pollution is one of the most important factors affecting the quality of life and the health of the increasingly urban population of industrial societies. Air pollution has been aggravated by developments that typically occur as countries become industrialized: growing cities, increasing traffic, rapid economic development and industrialization, and higher levels of energy consumption.Vehicular emissions are of particular concern since these are ground level sources and thus have the maximum impact on the general population.Air pollution is highly location dependent i.e,in the vicinity of traffic or certain industrial installations has much worst air quality than average, furthermore currently the data of the different pollutants measured at the different stations in the city are being uploaded in a yearly basis.

The system aims at providing a solution for changing the current situation. It is a prototype which makes use of various sensor nodes that are used for detecting the main pollutant and the data points are tagged with location using on board GPS and are uploaded to a Google map. The position in longitude and latitudes along with the data of pollutant levels in that place is send to the PC via a data modem. An estimate of pollution level and also the location are being shown in the Google map. This is a prototype of a real time monitoring and updating system indicating the amount of pollutant present in air in a particular region. A GSM module can be provided to inform the official authorities about the exceeding level.

II. RELATED WORKS

A. A Mobile GPRS-sensors array for air pollution monitoring

The system consists of Mobile Data-Acquisition Unit (Mobile-DAQ) and a fixed Internet-Enabled Pollution Monitoring Server (Pollution-Server). The Mobile- DAQ unit gathers air pollutants levels (CO, NO_2, and SO_2), and packs them in a frame with the GPS physical location, time, and date. The frame is subsequently uploaded to the GPRS-Modem and transmitted to the Pollution-Server via the public mobile network. A database server is attached to the Pollution-Server for storing the pollutants level for further usage by various clients such as environment protection agencies, vehicles registration authorities, and tourist and insurance companies. The Pollution-Server is interfaced to Google Maps to display real-time pollutants levels and locations in large metropolitan areas.

B. Air Pollution Measuring System with Mobile Sensor Arrays

This system shows an effective solution for pollution measuring using wireless sensor networks (WSN).The gas sensors are integrated with the ARM controller and location tracer GPS in User terminal. Other parameters like temperature are also sensed along with gas pollutant to enable data analysis through data aggregation techniques. Experimentation carried out using the developed air pollution measuring system under different physical conditions show that the system collects reliable source of fine-grain pollution data along with location of mobile vehicle. The system collects pollution data using mobile hardware modules, transmits the data regularly using GSM Modem to a back-end server, and integrates the data to generate a pollution frame with geographical location and send to handheld devices of the user.

III. SYSTEM ARCHITECTURE

A. Sensing section

The sensing section consists of several sensors that senses the gaseous pollutants and estimates the intensity of these gases in the exhaust. The sensor values changes when pollutants come into contact .The data sensed by the sensors are

analog values and is given to the microcontroller for analsis. Microcntroller consist of inbuilt ADC and these values are processed by the microcontroller where it compares these values with the threshold.

- **GPS section:** The GPS module is used to identify and locate the exact position of the ambient where air pollution is being monitored.
- **GSM section:** The primary function of the GSM system is to provide speech or voice calls and short message services. It forwards call or messages to a specified number to inform authorities according to the sensed pollutant level.
- **Interfacing section:** An interface is a tool and concept that refers to a point of interaction between components and is applicable at the level of both hardware and software. The interfacing is mainly carried out using radio frequency modem that consists of a transmitter and receiver. The sensors detect the presence of various gases and this data is analyzed and processed by the microcontroller. This processed data is transmitted through RF module.

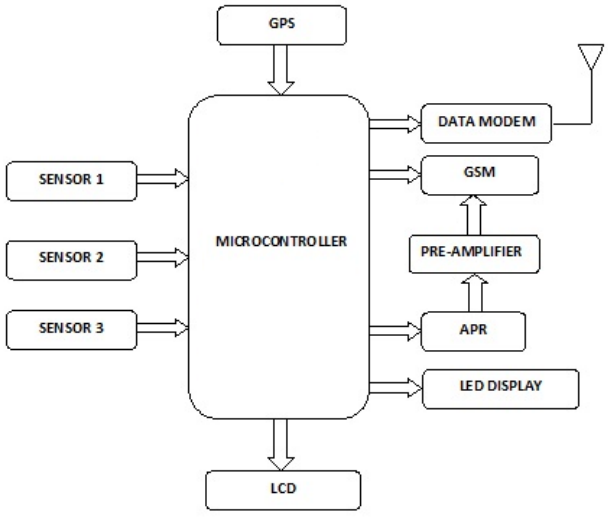

Fig. 1. *Sensing section.*

B. Data mapping section

The RF modem transmits the data through bi-directional antenna which can be used both for transmitting and receiving purpose. The data mapping section includes RF modem receiver which receives the data transmitted from the RF modem transmitter. The receiver is connected to a personal computer which helps in the processing and analyzing data and the data can be uploaded to the Google maps with the help of internet. The uploaded data in Google maps gives the exact position specified in latitudes and longitudes. The extent of air pollution in desired region can be easily identified through this.

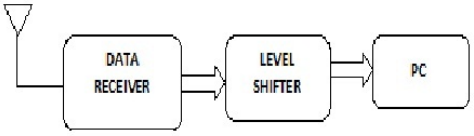

Fig. 2. *Data mapping section.*

The table below shows the NMEA(National Marine Electronics Association) output sequence obtained from the GPS consist of several strings and among that we select the string ($GPRMC,064951.000,A,2307.1256,N, 12016.4438,E,0.03,165.48,260406,,,A*55) and from this latitude and longitude datas are separated.Using these datas location is detected.

TABLE I
RMC data format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	064951.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2307.1256		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.4438		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.03	knots	
Course Over Ground	165.48	degrees	True
Date	260406		ddmmyy
Magnetic Variation		degrees	E=east or W=west (MTK does support magnetic declination)
Mode	A		A= Autonomous mode D= Differential mode E= Estimated mode
Checksum	*65		
<CR> <LF>			End of message termination

IV. Software section

A. Arduino

The programming of ATMEGA328 microcontroller is done by using the arduino IDE environment. The program codes sketched in this software using the C language is burned to the microcontroller.The program is burned to the microcontroller via Arduino Uno board through USB-to-serial adapter chips. And in this Arduino IDE workspace the program code is written and compiled for checking errors.After completion of compiling process if no error occured then the program is loaded into the microcontroller ATMEGA328 through Arduino Uno board using USB chips. Thus program written in arduino

C is uploaded to the microcontroller using Arduino Uno board.And in case of any modification in program then it can be easily updated again to the microcontroller.

B. Google map

The most important part is the Google mapping module. Here, pollutant level in a particular area can be displayed in Google through maps.exe coding software. The code for the mapping of data to the Google map is done in the visual basic language. The VB code used here is mentioned as maps.exe file. In order to run the Google mapping process the maps.exe file has to be installed along with the serial to USB convertor port number.Figure 5.8 shows output obtained in our project and in this we obtain the location where pollution is detected and also the status of the sensor is also uploaded in the Google map.

V. Observation and Discussion

The outcome of the system deals with both hardware and software sections. The sensors used in the system have detected the desired pollutants in the atmosphere to its accuracy. MQ-4 sensor has detected the presence LPG, MQ-6 sensor detected the excessive levels of carbon monoxide whereas MQ-135 sensor detected the presence of methane in the atmosphere. Status of the sensors are displayed on the LCD on each cycle of its operation. The GSM section has automatically forwarded a call and a message to the specified numbers when a dangerous mode is encountered at the sensing section. The exact location where the pollutants are detected is mapped on the Google map along with the status of exceeding pollutant.

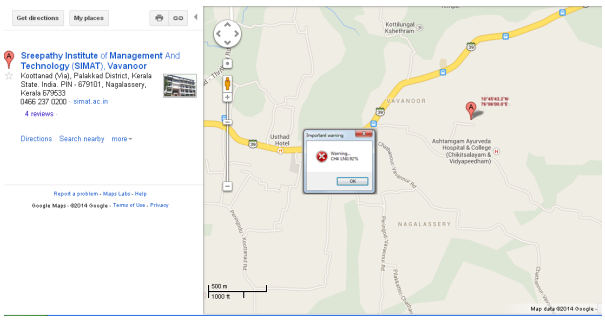

Fig. 3. *Google map output.*

VI. Conclusions & future scope

This system helps in monitoring the extent of air pollution in our atmosphere. It not only helps in monitoring but also helps in creating an awareness among individuals about the extent of pollution. After implementing the system we are able to detect the pollutants such as methane, CO and LPG. Status of each sensors are displayed on LCD and in case of danger situations message is sent to the mentioned mobile number. In addition to this a voice alert is also sent to another specified mobile number. The location were pollution is detected is published on Google map so that an individual can find out the level of air pollution in that particular region. Thus, the system enables real-time monitoring of pollutant level in a particular area by providing alert to the authorities as well as the public. Using high level programming database as well as high quality sensors we can improve the accuracy of the system.

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ELECTRONIC TOLL SYSTEM USING RFID WITH MOBILE VERIFICATION

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Abstract— In order to implement contemporary system of ELECTRONIC TOLL COLLECTION SYSTEM BASED ON RFID the Embedded systems platform is utilized. For this purpose, a new RFID technology based on micro-controller was implemented and tested in this study. The verification system consists of data base about the user of RFID multipurpose card. The microcontroller AT89C51 is the main part of the electronic toll collection system.LCD, IR sensor, RFID reader, GSM module and stepper motor are interfaced with the microcontroller.

I. INTRODUCTION

The main objective of this module development is to implement an automated check in and checkout in Electronic Toll collection system. Electronic toll collection system (ETC) is one of the means that have been adopted by all developed countries to solve traffic jam problem by the manual toll collection and to improve service quality. A GSM module is also used as a part of mobile verification to the vehicle owner.

At present, tolls are collected by manual procedures, which is time consuming and leads to traffic jams. Here a a GSM module with the toll system is introduced, up to a limit, vehicle security can also be improved. That is, each vehicles are provided with a RFID tag which have an unique identification number at the time of registration or at the time when a desired amount of toll is prepaid. The RFID tag ID with the owner details containing their respective contact numbers are uploaded to the vehicle department. When the RFID reader at the toll gate identifies the unique identification code, the system will check the details of the vehicle and of the vehicle owner from the database. Then a verification message about the toll payment will be send to the owner's mobile number.

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be applied to or incorporated into a product, animal, vehicle, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. The model developed uses an active RFID technology and wireless communicator as it helps to improve data transfer between the tag and the host database over a long distance. As an evolutionary automatic identification technology, RFID was considered a niche technology a few years ago. As the costs associated with RFID hardware have decreased, and standards defined for managing data, RFID has gone main stream. It has the potential of powering business systems such that they become the competitive backbone of organizations.

II. EXISTING SYSTEM

In the present situation, tolls are collected by manual procedures. The vehicles have to stay in the long queue in the toll booths to know the toll amount and then to pay the toll. This process consumes much time and leads to traffic jams.

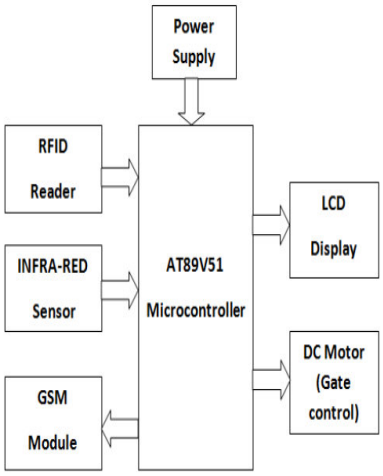
III. PROPOSED SYSTEM

The new system avoids the above difficulties by electronically collecting the toll. Each vehicles have to be provided with a RFID tag which have an unique identification number at the time of registration or at the time when a desired amount of toll is Prepaid. The RFID tag ID with the owner details containing their respective contact numbers are uploaded to the vehicle department..When the RFID reader at the toll gate identifies the unique identification code, the system with check the details of the vehicle and of the vehicle owner from the database. The toll collection is done automatically. Then a verification message about the toll payment will be send to the owner's mobile number with the address of the toll booth.

IV. BLOCK DIAGRAM

The major building blocks are Microcontroller, Power supply, LCD Display, DC Motor, RFID Reader, IR Sensor, and GSM Module. The system is mainly depending on Micro controller and RFID. AT89V51 Micro controller is used, which controls the whole operation of the system. The RFID section consists of an RFID reader and corresponding tags. The reader collects the data from the tag when the tag is placed within the range of the receiver. The data is a code having a length of 10 bytes. This code is unique for a tag so that an individual holding this tag can be uniquely identified. This is the ID contained by

the tag. The ID can be used as the input data to a micro controller that performs the tag authentication process. The micro controller manages the authentication process for each tag. That is, when an ID from a tag is received, it decides whether it is valid or not. RFID (radio frequency identification) is a new technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum.



V. WORKING

An RFID tag has to be provided with each vehicle at the time of registration or at the time when a desired amount of toll is prepaid. The RFID tag ID with the owner details containing their respective contact numbers are uploaded to the vehicle department. When the RFID reader at the toll gate identifies the unique identification code, the system will check the details of the vehicle and the vehicle owner from the database. The toll payment will be made automatically. Then a verification message about the toll payment will be send to the owner's mobile number.

VI. RESULT

Electronic toll collection using RFID with mobile verification is a project aimed to reduce traffic jam and problems created at toll centers due to manual toll collection. This project helps to reduce the dependency on manpower for toll collection and does it automatically using electronic system. This system also sends mobile verification to the vehicle owner, informing him about the toll center through which the vehicle has passed. The circuit for the entire system was connected on PCB and proper working of the system was verified. The system has a motor for the opening and closing of gate for the vehicle to pass after the transactions have been done. IR transceivers have also been incorporated in the system to extend the duration of time for which the gate remains opened. Developed the entire system and demonstration was done successfully.

VII. CONCLUSION

Currently, vehicles on highways will have to stop at all the toll plazas and pay cash to pass through. Once the RFID system is introduced across all NHs, the RFID chip-embedded sticker on vehicle can be used for toll collection at all toll plazas. Toll statements will be made available online to the road users and they need not have to stop for receipt. Money collected from the vehicle will be pooled at one place electronically and distributed among all toll gates managements as used by vehicles

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GESTURE RECOGNITION SYSTEM

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Abstract: **There are millions of deaf people around the globe. One of the biggest challenges faced by them is their limit to communicate with others. For people who cannot hear or talk, it is not an easy task to match up with the oral communication system in the society. The only possible solution to overcome this problem is to develop a gesture recognition system which will convert the signs into text or speech. The aim of the project is to implement such a system with the help of image processing techniques and convert the identified gesture to a form that is easily understood by common people. This study explores the use of such sign language interpreters for aiding deaf and dumb people.**

1. INTRODUCTION

Sign language is a language system in which hand shapes, orientation and movement of the hands, arms or body, and facial expression are used to express speaker's thoughts. The difficulties and challenges faced by people who are deaf and/or dumb are very well known to all of us. They are unable to communicate effectively with others, since they cannot either hear the sound or talk. Like variance of spoken languages from place to place, sign language can also develop locally wherever a community of deaf people exists. The scope of sign language in human-computer interaction has been an area of great interest which leads to development of machinated sign language interpreters. This study explores the use of such sign language interpreters for aiding deaf and dumb people. A sign language interpreter is a system that effectively converts signs or gestures into their corresponding written or spoken form. So it can be said that this system is not assisting deaf people to use sign language in a better way, instead it assists others to better understand the sign language. The project aims at a comparative study of existing methods and arriving at a modified method. 3 different methods to detect signs were studied and compared for the same. The methods rely on collected and processed reference data and the basic principles are pixel wise comparison and matching algorithms.

2. PROPOSED SYSTEM

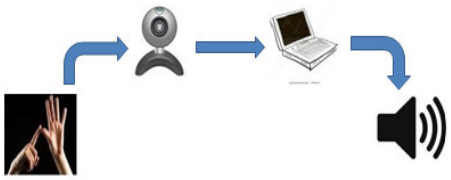

Fig 2.1: proposed system

2.1 BLOCK DIAGRAM

2.2.1 Data Base: Database serves the role of a standard reference of signs used in a sign language system. Before starting out on a sign language recognition system, the essential data one must have is a reference set of images. This may also be used for comparison with input image, based on certain properties which may be calculated by performing the same set of operations and normalizations performed on the input images. In the block diagram, this is shown in 3 blocks; signer, webcam, palm image extraction

2.2.2 Data Acquisition: This is the input part of the system. Data is acquired with a webcam device coupled with the processing unit. Camera captures the image that is shown by the signer. This would be in video format, for the system will serve its purpose only if it can take input continuously, rather than a single image at a time. The frame rate of the video, storage

location etc. is set to adequate values (30 frames per second, logged to disk). The video, as it is being captured, is separated into frames and stored to specified location. The precision of the system is also dependent on the input device configuration.

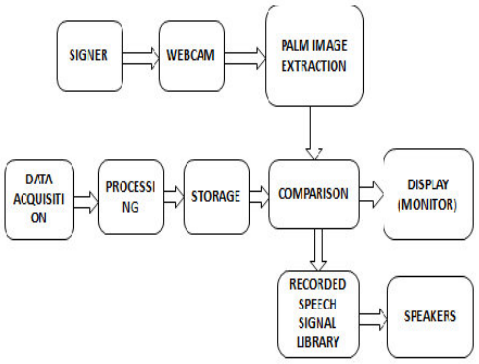

Fig 2.2 Block Diagram

2.2.3 Processing: Processing refers to the set of operations performed on the raw image (frames of video), so that it is either converted to a form suited for the task to be performed, or necessary information is extracted from the image. It could be any function like a simple filter or a change in format. The acquired values may be assigned to variables, so that it can be used to callback those functions. The processing is to be carried out in parallel with the capturing of video for real time operation and calls for the computational capability of DSP processor or the processor of the computer being used.

2.2.4 Storage: The processed data can be stored in memory or disk. Memory available to the system should always be taken care of, for reliable performance.

2.2.5 Recorded speech signal library: This is a collection of speech signals recorded and stored as a library. Whenever a sign in the output set is identified and corresponding alphabet/number is being displayed, the speech signal for that alphabet/number is retrieved and played through speakers.

2.2.6 Output Device: This is where the system delivers its result or processed data. In Gesture Recognition System, it should be in a form easily accessed and understood by the user.

3. FLOWCHART

The development of a gesture recognition system requires efficient methods to bring together many computationally difficult algorithms together, to perform as a single entity. Vision based analysis, are mainly based on the way human beings perceive information about their surroundings, yet it is probably the most difficult to implement in a satisfactory way.

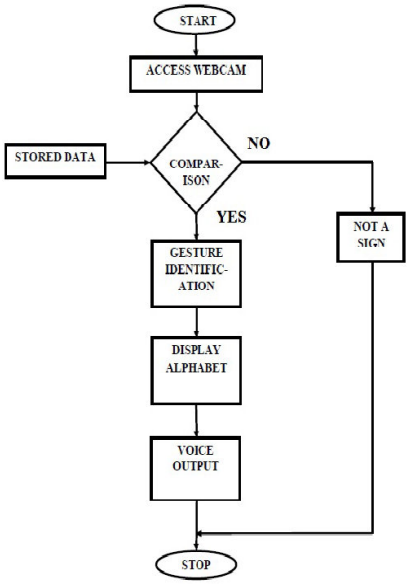

Fig 3.1 Flowchart

Initially the camera is turned on & it starts recording video. The video is

simultaneously being converted to frames. The stored frames are processed successively. Once the necessary parameters are extracted from the input data, we move on to the comparison part. It is in this phase of the program that we identify the hand sign. The 3 different comparison methods are:

- RGB Detection
- Background Noise Removal
- Skin Color Detection

A set of predefined data is stored before the program is executed. Such calculated parameters like area are represented as stored parameters in the flowchart, which act as the reference data. The area of the hand region is calculated for each frame in real-time from the captured video, and is simultaneously being compared with the stored data. Once area is matched to some predefined value, assigned alphabet is displayed on screen with the corresponding frame. This displayed output vary with the sign as palm region area varies according to movement, corresponding area calculations are also being performed and result is updated accordingly, i.e. real time operation is facilitated.

4. OBSERVATIONS & DISCUSSIONS

4.1 System requirements & Reliability: The hand gesture recognition system has stringent requirements for the efficient working of the system. First concern is the lighting in the environment where the system is working. Since this is a computer vision based system, lighting plays a key role. Variation in intensity, illumination and brightness of colors may affect system performance. Shadowing may also cause undesirable effects. However, these hurdles can be overcome up to a limit using good programming strategies and using appropriate filters. The next big issue is the memory. The project deals with video files so that real time operation is achieved. Video files are massive in size, and a long continuous stretch of video capturing will cause overflow of the system RAM and affect the performance. This is the major challenge faced by the system. The memory should be periodically cleared for reliable working.

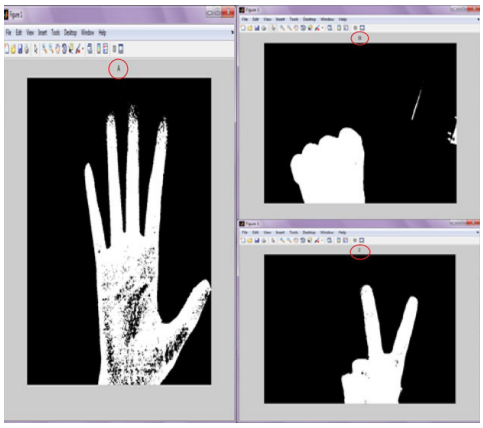

Fig 4.1 Output

5.CONCLUSION

The Hand Gesture Recognition System is a very useful assist for deaf and dumb people. The system once implemented could prove to be a reliable communication aid for deaf and if widely employed will bring about a revolutionary change to their world. Hence we have tried to implement such a system that uses minimum hardware and thereby costs less. The system is accessible with a personal computer and a webcam which again add on to the advantages of the project. We have tried 3 methods to complete the task and the skin color based detection was the better method compared to other two. In order to keep the programming part away from the common user, user friendly GUIs are also used, making the system simple and easy to use.

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Image Forgery Localization via Fine-Grained Analysis of CFA Artifacts

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***Abstract*—The advent of low-cost and high-resolution digital cameras, and sophisticated photo editing software, digital images can be easily manipulated and altered. Although good forgeries may leave no visual clues of having been tampered with, they may nevertheless alter the underlying statistics of an image.This project Image Forgery Localization , a forensic tool, which able to discriminate between original and forged regions in an image captured by a digital camera. Most digital cameras employ a single sensor in conjunction with a color filter array (CFA).The assumption that the image is acquired using a Color Filter Array, and that tampering removes the artifacts due to the demosaicking algorithm. Then interpolate the missing color samples to obtain a three channel color image. This interpolation introduces specific correlations which are likely to be destroyed when tampering with an image .The proposed method is based on a new feature measuring the presence of demosaicking artifacts at a local level, and on a new statistical model allowing deriving the tampering probability of each 2X2 image block without requiring to know a priori the position of the forged region.This quantify the specific correlations introduced by CFA interpolation, and describe how these correlations can be automatically detected in any portion of an image. Here show the efficacy of this approach in revealing traces of digital tampering in lossless and lossy compressed color images interpolated with several different CFA algorithms. This paper introduces a new methodology for the forensic analysis of digital camera images.**

I. INTRODUCTION

IMAGE forensics is a multidisciplinary science aiming at acquiring important information on the history of digital images, including the acquisition chain, the coding process, and the editing operators. The extraction of such data can be exploited for different purposes, one of the most interesting is the ver- ification of the trustworthiness of digital data. Image forensic techniques work on the assumption that digital forgeries, al- though visually imperceptible, alter the underlying statistics of an image. These statistical properties can be interpreted as *dig- ital fingerprints* characterizing the image life-cycle, during its acquisition and any successive processing. One of the tasks of image forensics is then to verify the presence or the absence of such digital fingerprints, similar to intrinsic watermarks, in order to uncover traces of tampering.

As a first basic application of the above principle, the presence/absence of forensic fingerprints can be verified on the whole image (or a given suspected region, as a sort of subimage), thus providing information about the authenticity of the entire image (or the entire region). However, a more sophisticated result would be a sort of map indicating for each image pixel (or small image block) its trustworthiness: in this case no manual choice of suspected regions would be necessary. Currently, several fingerprints have been studied for acquiring information on an image at a global level, but only few examples of tools that provide a fine-grained localization of forgery within a digital image have been proposed, in particular for double JPEG compression artifacts detection. In many cases a sufficiently large portion of the image (e.g., a $B \times B$ block, with $B \geq 100$) is needed for a reliable statistical analysis of the chosen feature, so even if the image is processed block-wise only a coarse grained localization of tampering is possible.

In this project, we are trying to solve the fine grained forgery localization problem, assuming to have no information on the position of possibly manipulated pixels. Among the numerous fingerprints considered in image forensic literature, we consider the traces left by the interpolation process. Image interpolation is the process of estimating values at new pixel locations by using known values at neighboring locations.
During the image life cycle, there are two main phases in which interpolation is applied:

- Acquisition processing, to obtain the 3 color channels (red, green, and blue). The light is filtered by the *Color Filter Array* (CFA) before reaching the sensor (CCD or CMOS), so that for each pixel only one particular color is gathered. Thus, starting from a single layer containing a mosaic of red, green, and blue pixels, the missing pixel values for the three color layers are obtained by applying the interpolation process, also referred to as *demosaicking*.
- Geometric transformations, to obtain a transformed image.When scaling (shrinking and zooming), rotation, translation, shearing, are applied to an image, pixels within the to-be-transformed image are relocated to a new lattice, and new intensity values have to be assigned to such positions by means of interpolation of the known values, also referred to as *resampling* operation. The artifacts left in the image by the interpolation process can be analyzed to reveal image forgery. Ideally, an image coming from a digital camera, in the absence of any successive processing, will show demosaicking artifacts on every group of pixels corresponding to a CFA element. On the contrary, demosaicking inconsistencies between different parts of the image as well as resampling artifacts in all or part of the analyzed image will put image integrity in doubt. Our effort is focused on the study of demosaicking artifacts at a local level: by means of a local analysis of such traces we aim at localizing image forgeries whenever the presence of CFA interpolation is not present.Obviously our approach is based on the hypothesis that unmodified images coming from a

digital camera are characterized by the presence of CFA demosaicking artifacts. Starting from such an assumption, we propose a new feature that measures the presence/absence of these artifacts even at the smallest 2x2 block level, thus providing as final output a forgery map indicating with fine localization the probability of the image to be manipulated.

PROPOSED ALGORITHM

In the proposed system , given a suspected/forged image, produces the corresponding forgery map: each pixel in the forgery map indicates for each CxC image block its probability to contain CFA artifacts, so that low values in the output map correspond to likely forged areas. As a first step, the green channel is extracted from the image, and the prediction error is computed. Because in-camera processing algorithms are usually unknown, a fixed predictor is used. The weighted local variance is then estimated and the feature L (k, l) is obtained for each B x B block. The GMM parameters are globally estimated exploiting the EM algorithm and used for the generation of the forgery map. When C=B the forgery map is generated using the likelihood ratios in, whereas for C > B we use the cumulated likelihood map. Optionally, the intermediate log-likelihood map can be filtered using either a mean filter or a median filter.

Algorithms in each step are shown below:

Green channel extraction

The green channel is extracted from the RGB image using the following command

g(:, :, 2)

'2' indicates the channel 2 which is the green channel.

Predictor

The image is filtered using a predictor kernel (Interpolation operation) The predicted value is subtracted from the original green channel and is given by

$e(x,y) = s(x, y) - \sum Ku,vs(x + u, y + v)$

where ku,v is the bidimensional prediction filter.

Calculation of mean and variance

Statistical parameters of the acquired and interpolated pixels are computed in the next level that is mean, variance .According to the proposed model, the prediction error has zero mean and variance proportional to the variance of the acquired signal. However, when the prediction kernel is close to the interpolation kernel, the variance of prediction error will be much higher at the positions of the acquired pixels than at the positions of interpolated pixels.

Weighted variance

In this step we first separate acquired and Interpolated pixels and calculate the mean and variance of each. The variance map is equal to the sum of Variance map of acquired plus the variance map of predicted pixels. The weighted variance of the predicted error is given by

$$\sigma_e^2(x,y) = \frac{1}{c}\left[\left(\sum_{i,j=-K}^{K} \alpha_{ij}\, e^2(x+i, y+j)\right) - (\mu_e)^2\right]$$

where αij is a Gaussian error.

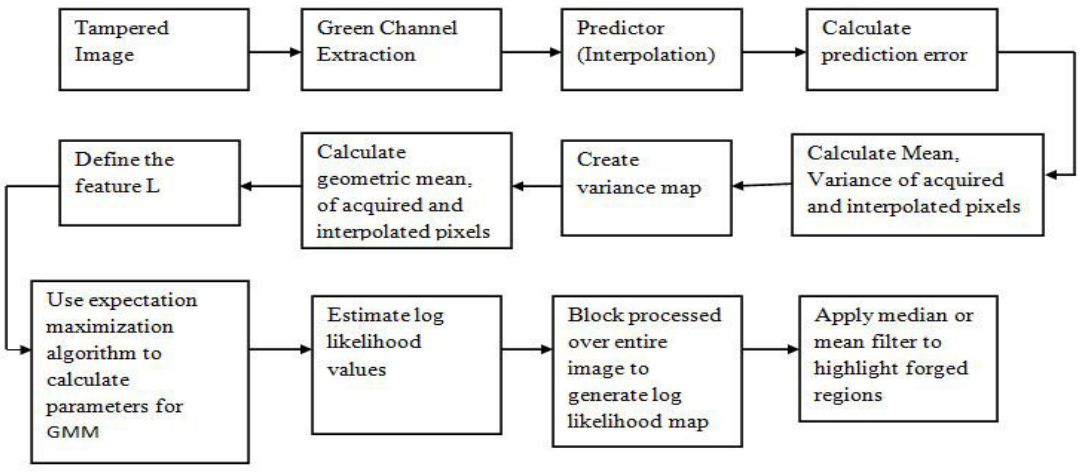

Fig:The work flow of our algorithm

Geometric mean

The Geometric mean of the error variance for both the acquired and interpolated pixels can be calculated by the equation

$GM_A(k,l) = [\pi_{i,j \epsilon \beta Ak,l}\ \sigma_e^2(i,j)]^{\frac{1}{\beta Ak,l}}$

where GMA(k, l) is the Geometric mean of the variance of the prediction errors at the acquired pixel positions.

The generic block in position (k, l) is represented as β(k,l). Each block is composed by disjoint sets of acquired and interpolated pixels, indicated as βA(k, l) and βI(k, l).

Defining the feature L

The feature L is defined in this block as

L(k, l) = log [GMA(k, l)/GMI(k, l)]

The proposed feature L allows us to evaluate the imbalance between the local variance of prediction errors when an image is demosaicked: indeed, in this case the local variance of the prediction error of acquired pixels is higher than that of interpolated pixels and thus the expected value of is a nonzero positive amount. On the other hand, if an image is not demosaicked,this difference between the variance of prediction errors of acquired and interpolated pixels disappears, since the content can be assumed to present locally the same statistical properties, and the expected value is zero. Let us now suppose that a demosaicked image has been tampered by introducing a new content, and that in order to make this forgery more realistic, some processing (blurring, shearing,rotation, compression, etc.) has been likely applied to the added content, thus destroying the demosaicking traces on the forged region. The proposed feature will assume inconsistent values within the tampered image: in some regions (the untampered ones) it will be signicantly greater than zero, while other regions (the tampered ones) the feature will be close to zero. We can thus employ these inconsistencies to finely localize forgeries.

EM Algorithm

By using a Bayesian approach, for each block β(k,l),it is possible to derive the probability that CFA artifacts are present/absent conditioned on the observed values of L(k,l).Let M1 and M2 be the hypotheses of presence and absence of CFA artifacts respectively. In order to have a simple and tractable model, we assume that L(k,l) is Gaussian distributed under both hypothesis and for any possible size B of the blocks.For a fixed β(k,l) we can characterize our feature using the following conditional probability density functions:

$\Pr\{L(k,l)|M1\} = N(\mu_1, \sigma_1^2)$

with $\mu_1 > 0$ and

$\Pr\{L(k,l)|M2\} = N(0, \sigma_2^2)$

If a demosaicked image contains some tampered regions in which CFA artifacts have been destroyed (as it may occur in a common splicing operation), both hypotheses M1 and M2 are present, therefore L(k,l) can be modeled as a mixture of Gaussian distributions. The first component, with $\mu_1 > 0$,is due to regions in which CFA artifacts are present, whereas the second component, with μ_2=0, is due to tampered regions in which CFA artifacts have been removed.In order to estimate simultaneously the parameters of the proposed Gaussian Mixture Model (GMM), we employ the Expectation-Maximization(EM) algorithm . This is a standard iterative algorithm that estimates the mean and the variance of the component distributions by maximizing the expected value of a complete log-likelihood function with respect to the distribution parameters. In our case, the EM algorithm is used to estimate only μ_1, σ_1 and σ_2 since we assume $\mu_2 = 0$.

Estimation of loglikelihood values

By exploiting Bayer's Theorem and relying on the observed feature L(k,l)for each block β(k,l),we achieve:

$\Pr\{M1|L(k,l)|\} = \Pr\{L(k,l)|M1\}/[\Pr\{L(k,l)|M1\} + \Pr\{L(k,l)|M2\}]$

which can be expressed as :

$\Pr\{M1|L(k,l)|\} = 1/[1 + £(L(k,l))]$

Where £ is the likelihood ratio of L(k, l) defined as:

$£(L(K,l)) = \Pr\{L(k,l)|M2\}/\Pr\{L(k,l)|M1\}$

Applying the equation to each block of an image, we obtain a likelihood map (LM), where each pixel of the map is the likelihood ratio associated to a B X B block.

Highlighting the forged region

The tampered regions can be further highlighted by applying to the map a simple low-pass spatial filter, like a mean filter or a median filter. For better numerical stability, such filters are applied to the logarithm of the likelihood map.

CONCLUSION

In this paper, a forensic algorithm to localize forged regions in a digital image without any a prior knowledge about the location of the possibly tampered areas has been presented. Considering the CFA demosaicking artifacts as a digital fingerprint, we are proposing a new feature measuring the presence of demosaicking artifacts even at the smallest 2 x 2 block level by interpreting the local absence of CFA artifacts as an evidence of tampering, the proposed scheme provides as output a forgery map indicating the probability of each block to be trustworthy.

The fine-grained localization of tampered regions using CFA artifacts is the main contribution of this work, since in previous approaches either the area to be investigated has to be manually selected, or automatic block processing obtains poor detection performance when forced to reveal CFA artifacts at a fine-grained scale.

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