

Wireless Vehicular Accident Detection and Reporting System

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Abstract: In this paper, we suggest a method to intelligently detect an accident at any place and any time and report the same to the nearby 'service provider'. The service provider arranges for the necessary help. Accident Detection and Reporting System (ADRS) which can be placed in any vehicle uses a sensor to detect the accident. The sensor output is monitored and processed by the PIC16F877A microcontroller. The microcontroller takes decision on the traffic accident based on the input from the sensors. The RF transmitter module which is interfaced with the microcontroller will transmit the accident information to the nearby Emergency Service Provider (ESP). This information is received by the RF receiver module at the 'service provider' control room in the locality. The RF transceiver module used has a range up to 100 meters under ideal conditions. The service provider can use this information to arrange for ambulance and also inform police and hospital. We used low cost RF modules, a microcontroller by Microchip, LCD module and an accelerometer. This system can be installed at accident prone areas to detect and report the same. MPLAB IDE and Proteus software are used to simulate part of the system. ADRS also implements an intelligent Accident Detection and Reporting Algorithm (ADRA) for the purpose.

Keywords—microcontroller, RF transmitter, RF receiver, service provider

I. INTRODUCTION

In today's world, everything has become very fast and speed has become the other name for life. To add to this the auto manufacturers are coming up with faster cars and bikes every day. Nowadays as the number of vehicles increased, the roads have become crowded and the frequency of road accidents has increased manifolds. As a result the number of deaths increased because of not providing emergency Services at the right time. So as to provide emergency services at the site of accident we propose an Accident Detection and Reporting System (ADRS) which can report to the nearby Emergency Service Provider (ESP) about the site of accident. This is achieved through a wireless interface. ADRS which we have proposed is economical and can be a one-time installment in the vehicle. The ADRS provides the ESP with the information regarding the location of accident. The ESP arranges for emergency services from the nearby hospital or police and thus immediate attention is given to the people met with accident. This way the number of deaths can be reduced. The rest of

the paper is organized as follows – Motivation, Problem definition, Related Work, Hardware implementation, Working, Experimental Results, Future work, Conclusion, Acknowledgement and Reference. Related Work compares our system with the existing ones.

Hardware Implementation describes about the project hardware design and setup. Future Work includes the various scopes in which the system can be improved.

II. MOTIVATION

Although different governmental and non-governmental organizations all round the world carry out workshops and other training programs to make people aware of careless driving, yet this whole process has not been very successful till date. For example some threatening statistics of road accidents that took place in India as per [9] show that the emergency services are not being provided at the proper time. The statistics included that the road accidents last year caused death of more than 130,000 and it clearly indicates that it is set to jump to 150,000 by 2015. India has just 1% of the world's vehicles, but accounts for 10% of world's total accidents. Mortality rate per 10,000 vehicles is 14 (less than two for developed countries). [10] Shows that the situations in other countries are also similar. [4] Also shows the various ways of accident fatalities. Having known about such threatening statistics, we aimed at implementing a system which could give immediate information to a service provider about the accident occurrence, by which the service provider can arrange for immediate safety measures. This helps the humanity by a great deal as human life is very crucial.

III. PROBLEM DEFINITION

An emergency service by hospitals or police is not provided at the place of accident at required time. This causes death to those people whose life could have been saved if proper help were provided at the right time. This is because these emergency services are not being informed about the accident at the proper time. The ADRS proposed can intelligently inform the service provider the site of accident through a Wireless interface. Thus immediate medical care and help is reached out to the people without any delay. Thus the accident mortality rates shown above can be reduced and above all it protects the life of people which is the most important factor.

IV. RELATED WORK

Conventional vehicular sensor systems for accident detection, such as OnStar and system discussed in [5] notify emergency responders immediately by utilizing in-vehicle sensors, such as accelerometers and airbag deployment monitors to detect car accidents. Our system too makes use of the inbuilt vehicle sensors to detect an accident. But the interfacing part with the service provider is done in a simple and cost effective manner. [1] Describes about a smart phone based accident detection system. Its complexity increases as the vehicle has to possess a smart phone whereas our system just employs a transmitter in addition to inbuilt features of the car. Also the availability of proper range (network connection) for the smart phone is again a serious issue. An inter link is described in [1] that can be made by their system to the emergency responders for locating the position of accident. But Google map does not give proper details of where exactly the accident has taken place especially in rural areas. A method to detect accidents and report the same using acoustics method is described in [2]. It compares the acoustic received during accident and compares it with the acoustic database. But in [2], although similar acoustics of previous accidents take place, there is no guarantee that an accident has taken place. It might intimate the ESP with false information. [3] Shows an accident reporting system which can be implemented only at intersections. The limitation of our ADRS is that the installment of repeated receivers on the road at a very short interval.

V. HARDWARE IMPLEMENTATION

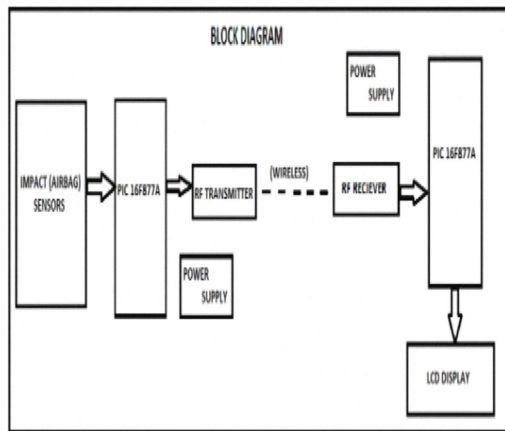


Fig.1 ADRS System Block Diagram

A. Sensor Module

If an accident happens, the impact sensor produces signals by which a flag bit in the microcontroller is set and the microcontroller comes to know that an accident has taken place. The sensors used to detect the impact are the accelerometer sensors ADXL 335 from Analog Devices. It is a small, thin, low power, complete 3 axis 3g accelerometers as shown in [7]. It can measure the static acceleration of gravity in tilt sensing applications, as well as dynamic

acceleration resulting from motion, shock or vibration. We can select the bandwidth of the accelerometer using the Cx, Cy, Cz capacitors at the Xout, Yout, Zout pins. Bandwidth ranges from 0.5Hz to 1600Hz for the X and Y axes and a range of 0.5 to 550Hz for the Z axes.

B. Wireless Module

The transmitter module used is TWS 434A RF transmitter, transmits serial data modulated at 433.92 MHz. [8] shows that it is a 4-pin module and can operate on input voltage ranging from 2-12 volts DC power supply. The serial data it is intended to transmit is fed as input to PIN-2. It modulates the serial data to a specific frequency and transmits the serial data through the PIN-4. There will be a specific RF receiver to receive the serial data. The range of RF transceivers being used was 100 meters under ideal conditions. [8] Shows that receivers can receive serial data modulated to 433.92 MHz. It is an 8-pin module and can operate on input voltage ranging from 4.5 to 5.5 volts DC power supply. An antenna at PIN-8 receives the serial data and demodulates it and gives the output from PIN-3. The encoder and decoder IC's which we have used are HT-12E and HT-12D manufactured by Holtek semiconductors. These IC's use Manchester encoding routine to encode the parallel input data from the microcontroller to the serial data which can be fed as input to the RF transmitter. This Manchester Encoding routine can be implemented in the PIC microcontroller if we wish to reduce the power consumption by not using the encoder IC itself. Thus the RF transmitter transmits the encoded data at 433.92 MHz. This data will be received by the RF receiver and fed as input to the decoder IC which decodes the serial data into parallel data and feeds as input to the microcontroller. Else the RF receiver's output can be directly given to the PIC to reduce the power consumption. From the PIC it can be interfaced to the computer.

C. Data transfer Module

All encoders use a common word format. They all pack the bits of information in the same number and position in the transmission sequence. Many advanced encoders provide Manchester encoding for RF modulation and transmission. Manchester encoding is shown in Fig. 2 and the format of one word being used for transmission is shown in Fig. 3. The flowcharts of the functioning of HT-12E encoder IC and HT-12D decoder IC is shown in Fig.4 and Fig.5 respectively.

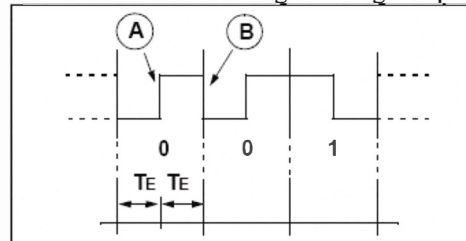


Fig.2 Manchester Encoding

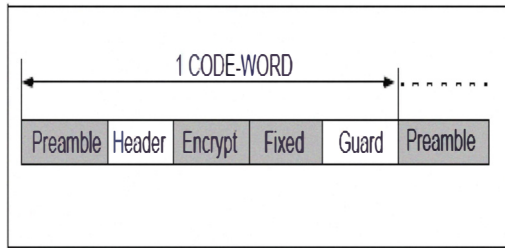


Fig. 3 Format of one Code Word

• HT12E

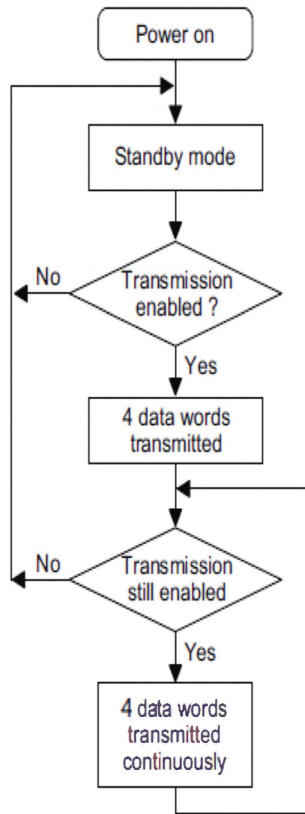


Fig. 4 Flowchart of HT 12E

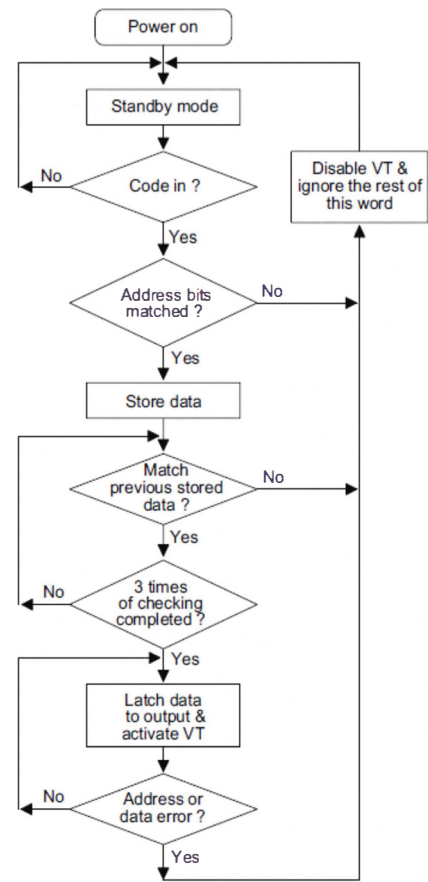


Fig. 5 Flowchart of HT 12 D

VI. WORKING

A. Accident Detection and Reporting Algorithm (ADRA)

The flow chart of the ADRA is shown in Fig 6. The output of the accelerometers is fed as input to an amplifier circuit. This amplifier circuit gives a digital output which sets some flag bits of the microcontroller as soon as a crash is detected. The analog to digital conversion module of the microcontroller is used here as the output from the accelerometer is analog in nature and is to be converted to digital form for the transmitter network to function. The microcontroller will be in sleep mode generally to save power. The microcontroller is programmed in such a way that as soon as the flag bits are set it comes out of the sleep mode and the RF transmitter will be switched on. This ensures that less power is being consumed. The microcontroller and the RF transmitter can be interfaced by using a specific encoder and decoder IC's.

The first RF receiver on the road appends its own address to the data received. Thus a data with two parts is being received by the master receiver. The first part is the

emergency signal and the second part gives the location of the car i.e. the place of accident. Thus the position of accident is known to the ESP.

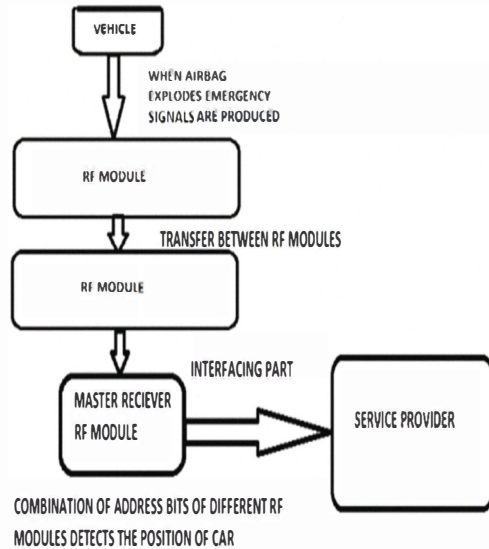


Fig.6 Procedure

B. System Setup

The lab work conducted as part of the project includes the setting up of the RF transmitter receiver on the breadboard as shown in Fig.7, interfacing the microcontroller with the LCD display to ensure that the data is received properly and testing with accelerometers for the detection of accidents.

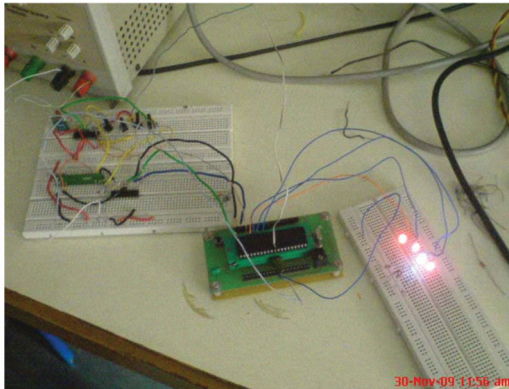


Fig.7 Setup of the ADRS at lab

VII. EXPERIMENTAL RESULTS

The transmitter voltage has a range of 2 to 12 volts. The transmitter voltage was varied and the different ranges of reception obtained were plotted. TABLE 1 shows the different set of voltages used and the corresponding ranges of reception obtained. It was observed that the maximum range was obtained when the transmitter voltage was kept at

12 V. Fig.8 shows the simulation diagram done in Proteus of the interfacing part done using PIC 16F877A and the 16*2 character generator LCD.

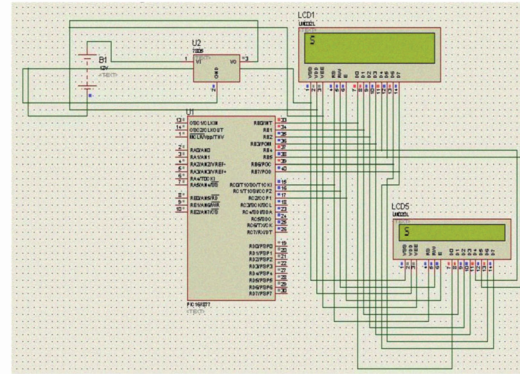


Fig.8 PIC-LCD interface in Proteus

Transmitter Voltage in Volts (V)	Reception Range in meters (m)
2.5	24
4	37
6	52
8	68
10	79
12	103

TABLE 1

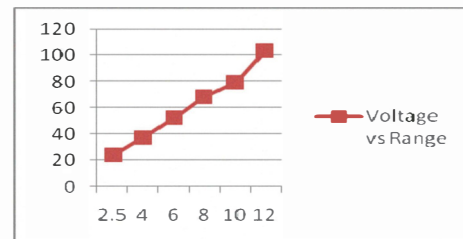


Fig.9 Transmission Voltage vs Reception Range

VIII. FUTURE WORK

This system can be implemented using Zigbee with a higher wireless range which is based on IEEE 802.15.4 specification for Wireless Personal area networks (WPAN).[6] shows that Zigbee is a recently developed wireless technology used in many commercial and research applications. It has become a very attractive wireless connectivity solution due to its open standard, low cost and low power characteristics in comparison with other wireless technologies such as Bluetooth and Wifi. As the wireless range is increased, the number of RF modules being used now can be reduced. In the experimental studies conducted for the system, we interfaced the receiver part to a LCD display. As an expansion for this we can interface it to a computers database which has got the car information. This

makes use of the USART module in the PIC 16F877A microcontroller.

IX. CONCLUSION

The ADRS can be set up in accident prone areas which include many busy roads such as national highways and can be used to inform the service provider about the site of accident. This setup intelligently transmits signals when an accident occurs and according to the received signal the place of accident can be known. This system can be made realistic by making some tie up with car companies and during the manufacture the transmitter module can be set up within it. Even the old cars can be given an option of setting it. It is preferable to have this setup in the vehicles as human life can be saved as immediate reporting is done as accident is detected.

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