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An Efficient Accident Rescue System using Lora

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Abstract: ***The road fatalities in India are increasing exponentially. These road fatalities have high impact on any country. The life of the injured person can be saved by providing the medical assistance. The traditional methods mainly concentrate on the transmission of the messages using the cellular network. The methodology of this project is to identify the location of the accident prone area and send that coordinates to the nearest medical help centers. The communication takes place between the rider and the system with the help of the Bluetooth device. GPS device is very well-known for the identification of the current location. The coordinates of the accident prone area will be extracted using GPS. The latitude and longitude coordinates of different hospitals will be stored in the database. The coordinates of the accident prone area and the coordinates of hospitals in the database can be mapped and the distance between them can be calculated. The coordinates of the nearest hospitals can be recognized and the communication can be established with that hospital.***

Keywords: ***GPS device, Bluetooth device, cellular network location, accident prone area.***

I. INTRODUCTION

The automobile industry plays a very vital role in human life [1]. Our life is completely dependent on the automobile industry. In our country more than 1, 50,000 people are killed in accidents in a year [2]. It is very difficult to protect a life of a person when he is met with an accident at the place where he cannot receive any help. In India 1 person dies for every four minutes due to accident. The road safety is a major issue in India. Many lives are lost due to road accidents. According to one survey conducted by the World Health Organization one lakh people died immediately at the location of the accident in 2013. The road fatality factor of any country can be reduced by contacting the nearest medical centres [3]. The mechanism present in this paper concentrates mainly on the message transmission to the nearest help centres [4]- [9].

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GPS (Global Positioning System) is a device which is used for the location tracking.

This device identifies the location through satellite communication. It takes the inputs at least from 3-4 satellites and identifies the locations. The device uses the triangulation method to identify the locations and then the distance calculation is very easy.

Bluetooth module also part of this system. Bluetooth device is used to for short distance communication. Traditional accident system is not concerned about the state of the driver. This proposal is takes the input from the driver. The input from the driver is the base for the further actions. The device uses radio frequency of 2.45 GHz for the communication. The conventional systems use GSM for the message transmission [10]- [12]. This paper presents our research work on implementation of LORA technology in the detection of accident and ensuring the driver's safety. This system uses LORA technology for transmitting the coordinates of the accident prone area to the nearest hospitals, so that the immediate help can be sent by that hospital to the area where the accident has taken place. LORA is a device based on an exclusive spread spectrum modulation technique developed by Semtech. Lora Module is an integration of Chirp Spread Spectrum and Forward Error Correction. The operating frequency of Lora Devices is between 137MHz to 1020 MHz .As a result, the devices can operate in both licensed and also in license free bands. Lora follows star topology. The star topology is a topology in which n-number of s are connected to a single server. Based on the server availability it responds to the client. The Lora module proposed in this system is LORASX1278 Ra-02 which operates at 433MHz. The main purpose of this paper is to propose a methodology that can solve the present problem.

II. LITERATURE SURVEY

A lot of research has been done in the field of accident detection and recovery. Md. Syedul Amin et al proposed a technic based on the speed of the vehicle [13]. This classical system utilizes the potential of GPS and accelerometer to monitor the location and speed of the vehicle. When the downward acceleration is more than a threshold value then it concludes that the vehicle is met with an accident. The system uses the GSM module to convey the location of the accident to the nearest help centres [14] –[18]. The second phase of the system is composed of GPS and GSM modules to send the location of the accident prone area to the nearest medical centres. The major drawback of this technique is that the methodology is not concerned about the state of the driver. There is no necessity that the retardation takes place only after the accident occurs.

Naji Taaib Said Al Wadhahi et al has proposed a solution to reduce the number of deaths caused due to the accidents. This proposal is completely based on the working of IR sensors. The methodology proposed by this system contains two phases. The first phase is all about the detection of accident and the second phase concentrates on the prevention of an accident.

The first phase of the system contains IR sensors to alert the driver whenever the distance between the two vehicles is less than a threshold value. The proposed technique cannot be applied in the areas with heavy traffic congestion. Venkata Krishna Kota et al came with the solution to the problem. The solution is to integrate the data of all the sensors used by the system. The mechanism suggests that the accident can be detected with the help of sensors. The methodology also uses the potential of the wearable sensors. The health condition of the driver can be determined with the help of the wearable sensors. When the rider is met with an accident his health condition can be determined. The accuracy of the wearable sensors is very important for the examination of health conditions. The system proposed in this paper uses Lora technology for transmitting the coordinates of accident prone area to the nearest hospitals [19]- [21].

III. DESIGN METHODOLOGY

The main aim of this project is to save the driver's life when an accident occurs. Bluetooth 5.0 is a device which is used for shorter communication. When a car is met with the accident a message is sent from the system to the driver's registered mobile number. This system waits for the time interval of forty five seconds. The system decides whether to send the location of the accident vehicle to the nearby hospitals and police station is based on the driver's response.

4.1) **Methodology to find the nearest Hospitals**

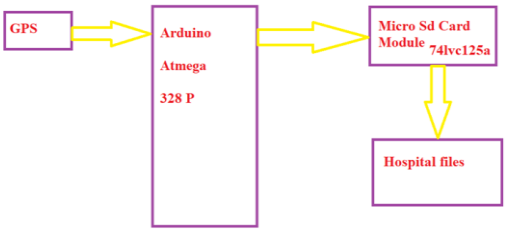

Fig 4.1 Hardware prototype to find the medical centres

The architecture shown in the figure 4.1 specifies the methodology to find the latitude and longitude coordinates of the nearest hospitals. The location identified using GPS is the input to the Arduino Atmega 328P. The coordinates stored in the Micro SD Card module are compared with coordinates extracted by the GPS. The below formula is based on the longitude and latitude coordinates of that particular location:

The coordinates of the minimum distance is stored and the locations extracted by the GPS are sent to the identified coordinates. Lat1 is the latitude value of the GPS coordinate and Lat2 is the latitude value of the hospitals stored in the database. Lon1 is the longitude value of the GPS coordinate and lon2 is the longitude value of the hospitals stored in the database

IV. PROPOSED SYSTEM

The block diagram shown in the Figure 4.2.1 describes the methodology used in this proposal. The location of the vehicle which met with an accident is identified using GPS module. In this model we are using Neo-6m GPS module. When the accident takes place a communication is initiated by the system to the contact number of the driver. The response time is calculated. The further task is to get the coordinates of the location and send them to the nearest hospital and police station. When the communication is initiated the driver is intimated with the help of buzzer Alarm. The coordinates of the location are sent using LORA gateway. The Lora module used in this project is LORA SX-1278. The coordinates of the hospitals are stored in a separate database.

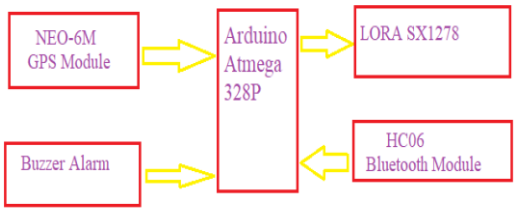

Fig 4.2.1 Block diagram of the Proposed System

Micro-sd card module (74lvc125a) is used to store the coordinates of the nearest hospitals. The protocol used by this system is spi (serial peripheral interface).the embedded world is based on the processors and integrated circuits. In order to establish the communication between the processors and integrated circuits, a common communication protocol has to be shared. The proposed system follows serial peripheral interface (spi) protocol. There are three ways in communication:

Simplex: in simplex model the data traversal takes place only in one direction. It is either in the direction of transmitter to receiver or in the direction of receiver to transmitter half-duplex: in half-duplex mode of communication information is passed in one direction at a time. The data transmission takes place in the direction of transmittal to reception and also in the direction of reception to transmittal but traversing in both directions is not possible at the same time. Full-duplex: in full-duplex mechanism the data traversal takes place in both the directions. The data traversal takes place in the direction of transmitter and receiver and also in the direction of receiver to transmitter simultaneously. The SPI protocol follows full-duplex mechanism. As a result the data can be transmitted from master to slave and slave to master at the same time. It is a synchronous serial protocol. This protocol functions on master-slave protocol. This protocol ideally suits to the stream data application transmission. Synchronous transmission means 1 byte of data is displaced at 1 timer pulse. The entire system is synchronized with the timer. Both the timers at the transmitter and receiver operate at same frequency. Synchronous transmittals take very less time for displacement. The timer frequency of the arduino is 16 mhz and all the peripherals attached to arduino may not work at the same timer frequency.

In the master slave protocol the master is the microcontroller and the slave is peripherals. The main disadvantage of this protocol is that when number of devices is attached to the microcontroller increase then the complexity of the circuit increases.

The number of pins need for the master depends upon the number slaves connected to that device. The total number of pins need in spi communication is: 3+a. Here the a is the number of apparatuses connected to one particular master. There are 4 modes in the spi communication protocol. The modes are as follows: The table shown in the figure 4.2.2 describes the 4 modes of SPI communication protocol. When polarity of the timer is 0 and the phase of the timer is 0 then the Master sends the data at the rising edge.

SPI Mode	Clock Polarity	Clock Edge/Phase	
	CPOL/CKP	CPHA	NCPHA/CKE
0	0	0	1
1	0	1	0
2	1	0	1
3	1	1	0

Figure 4.2.2- Modes of SPI communication protocol

When the phase is 1 then the Master receives the data at the falling edge of the timer. When the polarity of the timer is 0 and the phase of the timer is 1 then the data is sampled at the rising edge and data is shifted on rising edge of the clock. In mode 2 the data is sampled on the falling edge of the clock pulse and shifted out on the rising edge of the clock pulse. In mode 3 the data is sampled at the rising edge and is shifted out on the falling edge of the clock pulse. The timing diagrams of SPI communication protocol are shown in the Figure 4.2.3.

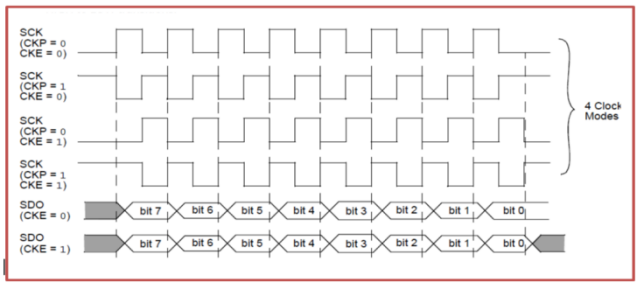

Figure 4.2.3 Timing diagrams of SPI communication protocol

4.3) Components

1)HC-06 Bluetooth Module: The Bluetooth accessory is used for the shorter distance communiqué. It is the RF communication with flash memory, Bluetooth base band controller, RS232 host interface and a radio appliance. Bluetooth is a wireless approach of transmittal that works at 2.45 GHz. In our project we are using Bluetooth to govern the situation of rider after an accident occurs. Whenever the accident is detected a dummy message is sent to the person's identification number. When the rider responds to it within forty five seconds of delay which means that the rider is in conscious state and can help himself. If there is no response form the rider the system assumes that the person is unconscious and needs immediate medical help. Bluetooth sends the signal to the controller to get into action.

2) LORA SX 1278 Module: The frequency range of LORA SX1278 is 137 MHz to 525 MHz The modern Lora module provides a wide spectrum that helps to achieve the long range communication. It reduces the noise interference. Modulation is the technique using which we provide the strength to the signal so that the modulating signal can transmit over long ranges. The modulation is the process in which the carrier wave varies with the spontaneous values of the transmitted signal.

3) Neo-6 GPS appliance: The GPS module is used for the identification of location. This module is equipped with EEPROM for the data backup. In this proposal GPS is used for the identification of location where accident has taken place. The operating voltage of this device is 3.3V. The GPS device can be configured from 4800 baud rate to 115200 baud rates. The 9600 baud rate is the default baud rate.

4) Micro SD Card Appliance (74LVC125A): The Micro SD Card follows the SPI protocol. SPI means for Serial Peripheral Interface. This protocol was invented in Motorola. This appliance follows full-duplex mechanism. As a result data can be transmitted in both the directions. The data can be transmitted from Master to slave as well as from Salve to Master at the same time. The appliance 74LVC125A is used as a database that contains the coordinates of the hospital.

5) Arduino Atmega 328P: The ATmega328 is a 8-bit microcontroller which was designed and implemented by AVR. It has an altered Harvard design 8-bit RISC processor. The Arduino Atmega 328P is used as the heart of the proposed system. The processing of the inputs and the further actions take place in this microcontroller.

V. RESULTS

Results of GPS

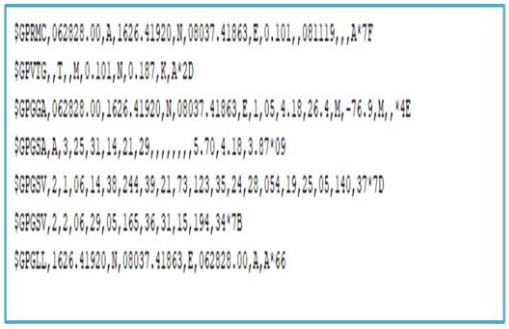

Figure 5.1: Location of Accident Prone Area

Figure 5.1 describes the results of the GPS when it is interfaced with Arduino Uno. The $GPGGA stands for GGA protocol header. 062828 is the time at which the GPS device was interfaced with the Arduino Uno. The value next to the time was the latitude coordinates of the location that is followed by the direction. The value of the longitude coordinates of location is 08037 is followed by the direction. N stands for north and E stands for East. 05 stand for the number of satellites used by the GPS device for the location reference.

The minimum distance hospital coordinates

```
The minimum distance is:
0.05
The latitude is:
16.48
The Longitude is:
80.62
```

Figure 5.2: Coordinates of Nearest Hospital

Figure 5.2 describes the output when Arduino is connected to Database to get the coordinates of the nearest hospitals. The transmission output of Lora is described in the 5.3 figure when it is interfaced with Arduino Uno. Figure 5.4 describes the outputs of the receiver module. RSSI indicates the strength of the received signal. The signal strength is very high when the RSSI value is closer to 0. SNR is the ratio of the received signal and the unwanted signals that get integrated in the Transmission medium. The value of the SNR should be near to the +10db at receiver end for the perfection.

Lora Transmitter Output

```
The minimum distance is:
0.05
The latitude is:
16.48
The Longitude is:
80.62
Initializing ... success!
Sending packet ...  success!
Datarate:        975.66 bps
Sending packet ...  success!
Datarate:        975.67 bps
Sending packet ...  success!
Datarate:        975.66 bps
Sending packet ...  success!
Datarate:        975.67 bps
Sending packet ...  success!
Datarate:        975.66 bps
Sending packet ...  success!
Datarate:        975.65 bps
Sending packet ...  success!
Datarate:        975.67 bps
Sending packet ...  success!
Datarate:        975.66 bps
```

Figure 5.3: Coordinates of the location sent to nearest Hospital

Lora Receiver Output

```
Waiting for incoming transmission ... timeout!
Waiting for incoming transmission ... timeout!
Waiting for incoming transmission ... success!
Data:                The Accidental Location is 16.4398255... 80.4301555
RSSI:                -59.00 dBm
SNR:                 12.25 dB
Frequency error:     -891.29 Hz
Waiting for incoming transmission ... timeout!
Waiting for incoming transmission ... timeout!
Waiting for incoming transmission ... success!
Data:                The Accidental Location is 16.4398255... 80.4301555
RSSI:                -60.00 dBm
SNR:                 11.25 dB
Frequency error:     -895.48 Hz
Waiting for incoming transmission ... timeout!
Waiting for incoming transmission ...
```

Figure 5.4: **Coordinates of the location received at the hospital.**

VI. CONCLUSION

The main objective of this project is to send the medical help to the accident prone area without any human interference. The current system makes use of the latest technology. System is considered to be reliable and accurate from the experiments carried out and observations done. The results obtained are consistent and work in different environments.

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