International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 3 Mar 2022, pp: 64-71 www.ijaem.net ISSN: 2395-5252

Implementation of Intelligent Road Safety and Vehicle Crash Preclusion System Using Iot

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Submitted: 01-03-2022 Revised: 07-03-2022 Accepted: 10-03-2022

ABSTRACT: In recent years, the number of road accidents occurring in and around the country has become increased, it is critical to pay attention to this issue. The primary notion in this work is to instantly convey information about an accident to a nearby hospital. The GPS Module is used to track the location.In addition, a reset button is provided; if the driver presses the reset switch within a short period of time after a minor accident, the information will not be communicated. The second approach is focused with informing the motorist in regions where accidents are likely to occur. The third concept is focused with establishing vehicle communication in assuring road safety. The main objective of this paper is to implement a low cost intelligent road safety and accident preclusion system using IoT.

KEYWORDS: IoT, Accident, Road safety, PIC Microcontroller, Communication.

I. INTRODUCTION

The number of traffic accidents has climbed dramatically around the world in recent years. Every year, around 1.3 million people's lives are shortened as a result of a traffic accident. Non-fatal injuries affect between 20 and 50 million more people, with many of them resulting in disability as a consequence of their injury. The majority of countries lose 3% of their GDP due to road accidents. Pedestrians, cyclists, and motorcyclists account for more than half of all road traffic fatalities. Despite having over 60% of the world's vehicles, low- and middle-income countries account for 93 percent of all road deaths [1-4]. For children and young adults aged 5 to 29, road traffic injuries are the greatest cause of death. Accidents are aired on TV channels and social media almost every day. Road accidents can occur for a variety of causes. Ignoring traffic signals, over speeding, drunken driving, driver distractions, and failure to use safety equipment such as seat belts and helmets are the factors that contribute to road accidents.

Looking at the current system, it appears that following an accident, one must phone the nearest hospital to notify them. This is normally a time-consuming procedure. If a third person does not make a call right away, and there is no one to relay the information to a nearby hospital, serious consequences may result [5-6]. Most individuals will not stop their automobiles on highways, especially national highways, to inform a hospital if they witness an accident, as humanity is failing. The next issue is that most drivers ignore or disregard the warning signs such as radar speed boards, danger zones, and other signs that are placed along the roadside to caution drivers. As a result, our country is experiencing a significant increase in the number of road accidents, with the death rate increasing day by day [7, 8].

II. METHODOLOGY

This paper focuses on three concepts: IoT-based communication, driver alerting about distinct zones, and vehicle-to-vehicle communication (V2V). The block diagram of vehicle unit is shown in Figure 1. IoT-based communication entails automatically relaying accident information to a local hospital.This information, along with the location, will be transmitted.PIC Microcontroller (PIC 16F877A), IoT module, GPS module,

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Vibration sensor module, Buzzer, Step down transformer (0-12V), Bridge rectifier, Voltage regulator, Capacitors, and LCD module are essential hardware components for this design.When an accident occurs, the vibration sensor (Accident sensor) detects the vibration and sends a signal to the PIC Microcontroller.As pre-programmed, the PIC Microcontroller performs the appropriate operation.In the event of a minor collision, the driver can push the reset button to prevent the information from being sent to a local hospital and to display the word "Mild Accident" on the LCD panel.A time limit of 10 seconds is set for this, although this can be altered by the programmer.In the event of a serious accident, once the time limit has expired, the information, along with the location, will be forwarded to a nearby hospital.

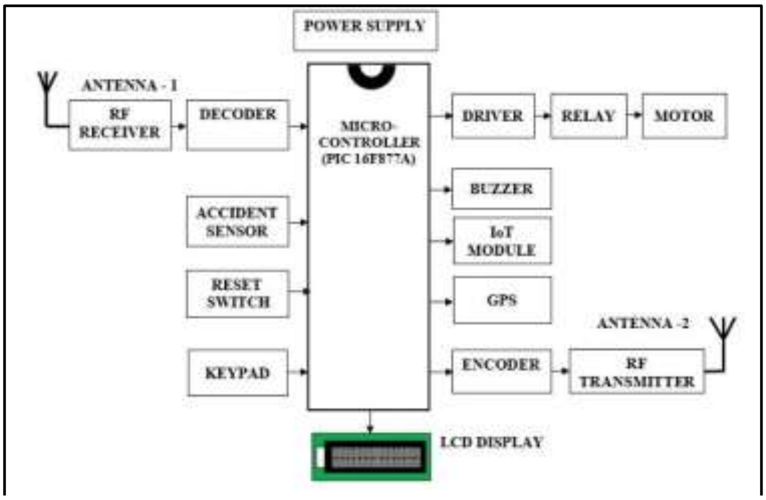

Figure 1. Block diagram of Vehicle Unit – 1

The second approach is to alert the driver if they are driving in an area that is prone to accidents. Generally, vehicle speeds must be reduced in certain regions, such as danger zones, areas with speed limit signs, hilly terrain, and so on.PIC Microcontroller, RF transmitter, RF receiver, 12V Brushless DC motor, Relays, Voltage regulator, and LCD display are essential hardware components for this approach.A signal is sent through the RF transmitter when the Data transmitting switch and Enable switch are pressed simultaneously.The RF receiver will receive this signal, which will then be transmitted to the PIC Microcontroller. The PIC Microcontroller will send the signal to lowering the voltage rating to 8 volts, the speed will be reduced (Initially running at 12V rating). The block diagram of zone unit is shown in Figure 2.

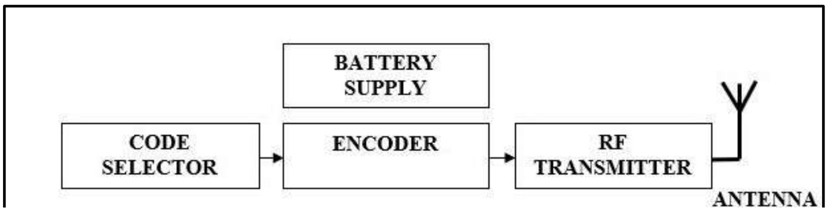

Figure 2. Block diagram of Zone Unit

The third concept entails establishing communication among the vehicles.RF transmitters and receivers can be used to implement this principle.When the driver needs to convey information to another car nearby, he or she must touch a keypad button.The keypad's options can include things like emergency, overload, and so on.After pressing the button, a RF transmitter sends a signal to a nearby vehicle.This signal will be acquired by an RF receiver, which will then pass it to the PIC Microcontrollerand a message is displayed on the LCD module as a result.Figure 3 shows the block diagram of vehicle-to-vehicle communication.

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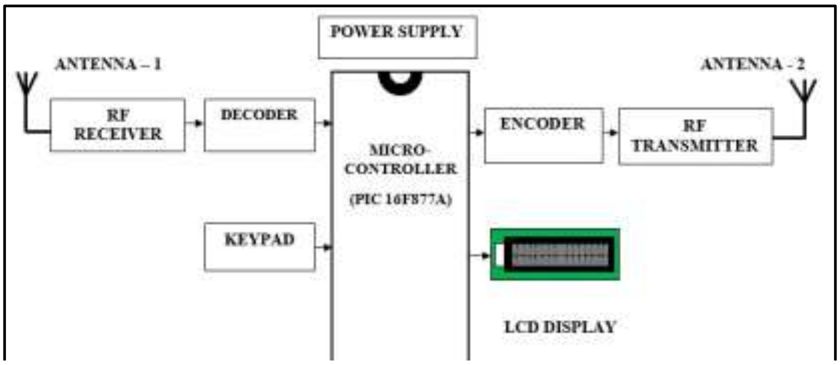

Figure 3. Block diagram for Vehicle-to-Vehicle Communication (V2V)

III. FRAMEWORK IMPLEMENTATION

i) IoT- BASED COMMUNICATION:

This concept is focused with automatically transmitting information about an accident to hospitals through IoT so that an instant rescue can be carried out. Frame work implementation of vehicle unit – 1 is shown in Figure 4. When an accident occurs, the accident sensor (vibration sensor) detects the vibration. The PIC Microcontroller (PIC 16F877A) receives the sensed vibration.Because the PIC Microcontroller is pre-programmed, it will respond to the signal by activating the buzzer and sounding the alert.According to the instruction sent to the microcontroller, the alarm sound lasts for a specific amount of time. There are two types of accidents: minor accidents and major accidents.

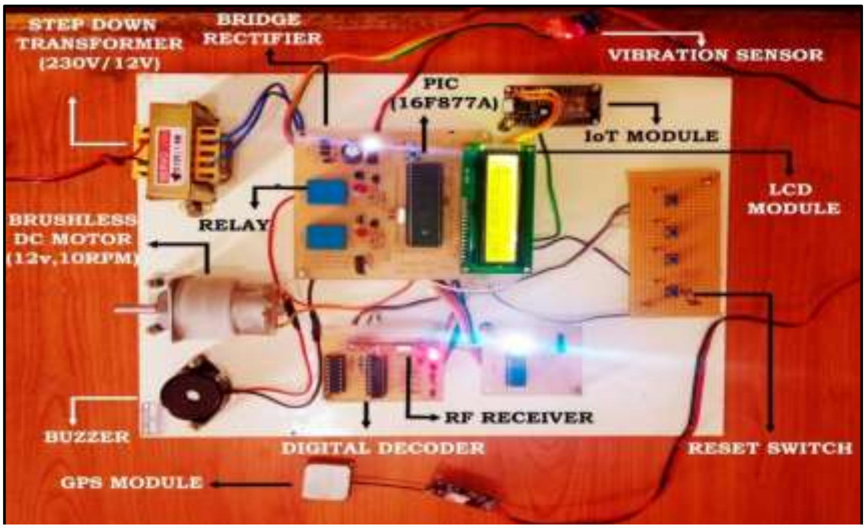

Figure 4. Framework Implementation of Vehicle Unit – 1

In the event of a small collision, the driver can push the reset button to prevent accident data from being sent to hospitals.Once the time limit has been exceeded in the event of a major accident, information about the accident will be forwarded to the hospitals.

Once the alarm sound has silenced, the microcontroller will send an immediate message to the hospitals through IoT, along with the location.The location will be tracked using GPS, and the information will be sent to the hospitals along with it via IoT.

ii) ZONE UNIT:

Framework Implementation of Zone Unitis shown in Figure 5. Using an RF transmitter (433MHz) and an RF receiver(433MHz), this concept alerts the vehicle to traffic lights, road signs, speed limit boards, and other relevant information.Wherever it is needed, RF transmitters are put along the roadside.Typically, traffic road signs, speed limit boards, danger zones, and other such items.When a vehicle reaches an accident-prone region, a signal is transmitted through an RF Transmitter controlled by a microcontroller.The received signal will be transferred to the digital

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decoder, which will turn it into bits that the PIC Microcontroller can read.The motorist will be notified whenever a signal violating the speed limit is received.The LCD Module is used to display the alert notification.

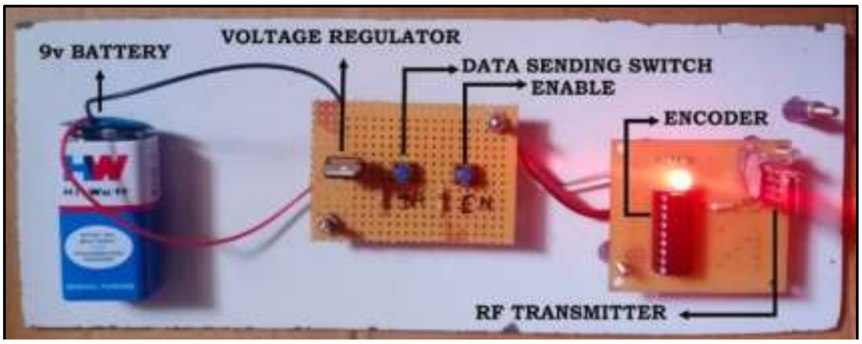

Figure 5. Framework Implementation of Zone Unit

iii) VEHICLE TO VEHICLE COMMUNICATION:

This notion is concerned with establishing vehicle communication in order to improve road safety. Figure 6 shows the framework implementation of vehicle unit – 2. When a driver wants to communicate information to a nearby vehicle, he or she must press a button for that information.The PIC (16F877A) will send a signal to a digital encoder after pushing a button, which will turn a large number of inputs into a single output.

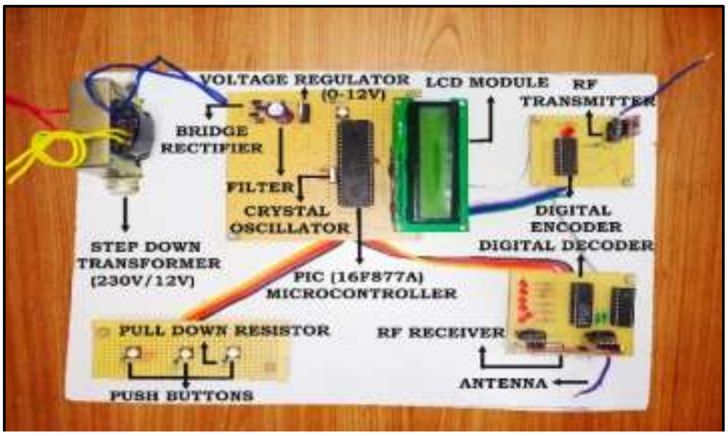

Figure 6. Framework Implementation of Vehicle Unit – 2

This signal will now be transmitted as a radio frequency signal to a neighbouring vehicle using an RF Transmitter (433MHz).This signal will be received by an RF receiver and then decoded by a digital decoder.This decoded signal will be transferred to the PIC (16F877A) Microcontroller, which will send a signal, resulting in the display of a message.

IV. MEASUREMENT AND MONITORING

(i) VEHICLE UNIT – 1:

In the first concept, IoT is used to send data to a neighboring hospital.GPS is used to track the location, which is then shared with a neighbouring hospital via IoT.In order to keep track of the accidents, the 'Cayenne' software is utilized.A smartphone can also be used to monitor the output.After an accident, the vibration sensor will initially detect the vibration in the measurement procedure.

Following that, a signal will be sent to the PIC Microcontroller (PIC 16F877A).The GPS-tracked location will be relayed over the IoT. Monitoring screen of vehicle unit – 1 is shown in Figure 7.

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Figure7. Monitoring Screen of Vehicle Unit – 1

On the monitoring screen, there are three columns.The first column is the accident column 'ACC,' which displays '0' when there has been no accident in the region, and '1' when there has been an accident in the area.

When an accident occurs, the second column is called the latitude column, which represents the location's latitude.When an accident occurs, the third column is the longitude column, which displays the longitude of the place.

(ii) ZONE UNIT:

In the second concept, anytime a vehicle reaches a certain region where a speed limit is required, an RF transmitter is installed to send information to incoming vehicles, which is then received by an RF receiver.This signal is given to the PIC Microcontroller, which subsequently performs the operation specified in the program. The motor starts out with a 12v rating, but once the signal from the RF Transmitter is received, the motor switches to an 8v rating. Relays are utilized for switching in this instance.

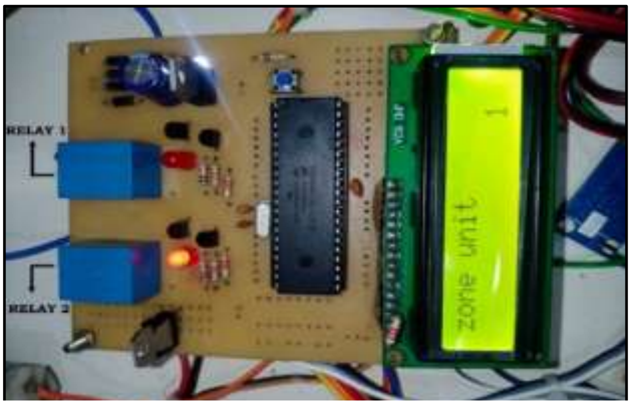

Figure 8. Output of Zone Unit

The output of zone unit is shown in Figure 8. The 'RELAY 1' will be in the 'ON' position at first, while the 'RELAY 2' will be in the 'OFF' position. The motor is powered by 12 volts in this state. When you push the 'ENABLE' and 'DATA SENDING SWITCH' buttons at the same time, 'RELAY 1' will turn off and 'RELAY 2' will turn on. The motor will run under 8V throughout the final stage. 'ENABLE' is pressed to revert to the previous stage.

(iii) VEHICLE UNIT – 2:

The third concept involves establishing communication between drivers in order to promote road safety. When a motorist wants to overtake another vehicle in an emergency, he or she can press the 'EMERGENCY' button to alert the other driver.

Following that, the PIC (16F877A) Microcontroller will send a signal which is encoded by a 'Digital Encoder' and transmitted by an RF Transmitter. This signal will be received by the vehicle via an RF Receiver that will be placed in front of it. The word 'EMERGENCY' will appear on the screen is shown in Figure 9.

Figure 9. Image Displaying a Message 'EMERGENCY'

The 'HEAVY LOAD' button should be pressed when a driver wants to provide information about a vehicle carrying a heavy load. According to the program of PIC microcontroller, a signal will be encoded and transmitted using a 'RF Transmitter.' This signal will be received by the vehicle via an RF Receiver that will be placed in front of it. Figure 10 shows the warning message 'HEAVY LOAD'.

Figure 10. Image Displaying a Message 'HEAVY LOAD'

When a driver wants to tell others of a vehicle breakdown, he or she must press the 'VEHICLE BREAKDOWN' button. This PIC microcontroller signal will be encoded and transmitted using a 'RF Transmitter.' This signal will be received by the vehicle via an RF Receiver that will be placed in front of it. The message 'VEHICLE BREAKDOWN' will appear on the screen is shown in Figure 11.

Figure 11. Image Displaying a Message 'VEHICLE BREAKDOWN'

V. RESULTS AND DISCUSSION

Figure.12 depicts the number of accidents that happened from mid-September to mid-November. From the middle of September to the first week of October, there is an increase in the number of accidents. From the first week of September through the middle of November, there is a consistent drop in the number of accidents.

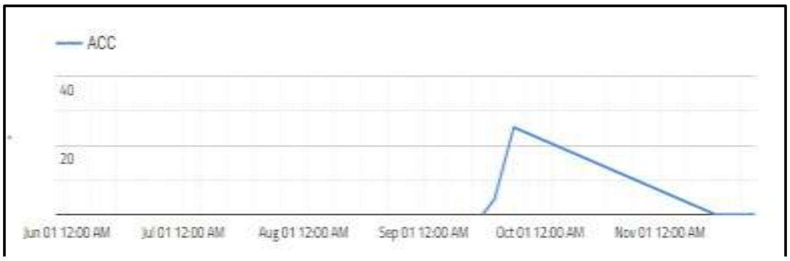

Figure 12. Monthly graph showing number of accidents occurred

Figure 13 reveals different latitude values in which accidents have occurred. Only the latitude readings from the middle of September to the middle of November are shown here. The latitude value varies depending on the location.

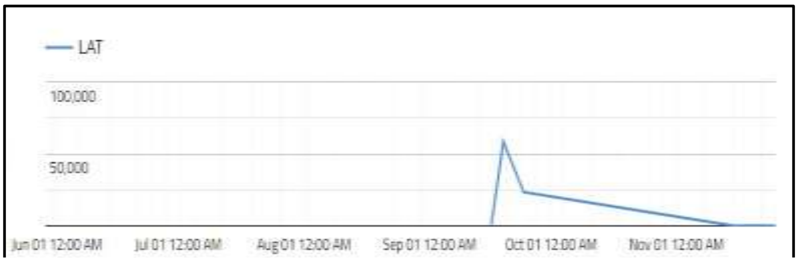

Figure 13. Latitudes of different locations – Monthly graph

Figure 14 shows the various longitude values where incidents have happened. Longitude readings are only given from the middle of September to the middle of November. The longitude value varies depending on the location.

Figure 14. Longitudes of different locations – Monthly graph

VI. CONCLUSION

This work is a low-cost road safety and accident prevention system that primarily focuses on three things. The first is using IoT to automatically relay information about an accident to a local hospital. The second concept is to warn the motorist of danger zones, such as high-traffic areas, accident-prone locations, and hilly places. The third notion is concerned with improving driver communication in order to improve road safety. Thousands of lives will be saved as a result of this work, and the number of accidents will be reduced.

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