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Accident detection, avoidance and vehicle safety using IoT and vehicular network

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ABSTRACT

The increase in the population of cities and the number of vehicles leads to increase in congestion on roads and accidents. The lack of quick medical service on road accidents is the major cause of death. In such situation, an automatic accident detection can help to save the loss of life. Due to increase in number of cars there is also an increase in number of accidents on the roads. In this paper, we have designed a proto type for automatic accident detection and Avoidance system using IOT and Vehicle Area Network. The system is able to avoid accident using distance measuring sensors and also detect accidents if they occur using sensors. In case of an accident the location is sent to the hospitals and the nearby vehicle using VANET. The Avoidance sensor will first try to avoid the accident by slowing down the vehicle whenever a nearby obstacle is detected, every if after that an accident is occurred the shock sensors will detect it. The Vehicle will be connected to each other through a server and will communicate with each other, after an accident the hospitals present in that particular Area and the cars present in that area will be informed with the location acquired from GPS. There will also be an alcohol sensor that will detect if the driver has consumed alcohol and lock the car if detected.

Keywords— *IoT, GPS, VANET*

1. INTRODUCTION

World Health Organization (WHO) report presents the current state of global road safety. It states that the road traffic death rate around the globe is 1.24 million per year, which is still high and unacceptable. This risk of dying as a road accident is three times greater in low-income countries than high-income countries, where the considerable disparity exists between countries in the same region. These accidents can be reduced by applying appropriate precautions and safety measurements. Half of the fatalities are due to lack of quick medical aid on the accident locations. WHO is working for the post-crash care, which includes emergency room based injury surveillance system, emergency access telephone numbers, emergency medicine training. Apart from these efforts, automobile manufacturing companies are producing advance vehicles that provide safety and comfort to the customers. In regard to safety and management, the research community and industries considering the concept of use of wireless communication technologies in vehicles since 1980s. In last few years, a number of research and development projects have been launched, which have several goals to achieve e.g., improving traffic management, road safety, security, navigation system, environmental friendly usage etc., with the help of Vehicular Networks and its combination with Wireless Sensor Networks (WSNs), Internet of Things (IoT). The growth in development is also because of the low cost of IEEE 802.11 technologies, and the attractive features and the potential use in the development of safety, informative, and environmentally friendly applications in vehicles manufacturing companies. Although cellular networks have provided several voice and infotainment services to the customers even in vehicular environments, there are certain direct communications in Vehicle-to-Vehicle (V2V) or Vehicle-to-Infrastructure (V2I), where these networks have high latency and are not well suited. However, Vehicular Networks offers minimal latency in sending hazard warnings, alerts and information messages in V2V and V2I communications. One of the reasons of death on road accidents is the absence of quick medical care. Hence, it is needed to develop certain applications that can help in such scenarios. A number of researchers are working on such applications, which can help for the post-accidents care.

2. LITERATURE SURVEY

Kiran Sawant et al. developed a Raspberry Pi based accident detection Syr accident detection. There were piezoelectric sensors that were used to detect the accident and the microcontroller will detect it, then the GPS was used to acquire the location in longitude and latitude. The latitudes and longitude position of particular vehicle was sent via the GSM module. The Static IP for the Emergency server needs to be saved in the EEPROM of the microcontroller. Whenever an accident has occurred the position is detected and a

message has been sent to the pre-saved static IP address [1].

Mrs Manasi Patil et al. proposed a better traffic management system using Raspberry Pi and RFID. The vehicle has a Rpi fixed on it which has sensors connected to it that are the shock sensor and the temperature sensors. The sensors are fixed to a threshold value at first, whenever an accident is detected the location is acquired via a GPS module and sent through the GSM module. The GPS module which is also interfaced with the controller also sends the location of the vehicle. When the location is received by the Ambulance there needs to a clear route that needs to be provided to the ambulance. The ambulance has a controller ARM which is interfaced with the RFID tag sends Codes to the RFID reader. When the Ambulance reaches the signal there is an RFID reader present on the Signal that read the Tag that is present on the Ambulance and detected the Ambulance and clears the path for the Ambulance turning the lane green and the other lanes red. [2].

V. Sagar Reddy et al. developed an accelerometer-based System for driver safety. The system has the advantage of tracking or identifying vehicles location just by sending an SMS or email to the authorized person. The system is designed by using Raspberry Pi (ARM11) for fast access to the accelerometer for event detection. Is there any event is occurs the message sent to the authorized person so they can take immediate action to save the lives and reduce the damages. Images captured by the camera on the vehicle are emailed to the concerned person (for example the owner of the vehicle) along with the type of accident and the time of the accident. [3].

Sri Krishna Chaitanya Varma et al., Proposed an automatic accident system using 89c52 and GPS. When the system is switched on, LED is ON indicating that power is supplied to the circuit. The IR sensor will be used to sense any obstacle and generate an interrupt for the microcontroller. The GPS will read the location after the accident is occurred and give it back to the controller. This information is sent to a mobile number as a message. This message is received using GSM modem present in the circuit. The message gives the information of longitude and latitude values. Using these values the position of the vehicle can be estimated [4].

Apurva Mane et al Described a System for Vehicle accident detection and alarm system, Key feature includes real-time location tracking using GPS, angle to the monitoring station and to the user/owners mobile that should help them to get medical help if an accident or the theft occurs. Also, the user/owner has an option the receive the live location. Whenever an accident occurs MEMS and vibration sensor detects and sends the signals to the microcontroller, by using GPS particular locations where an accident has occurred is found, then GSM sends message to authorized members. [5].

3. PROPOSED METHODOLOGY

The architecture diagram is basically divided into 2 parts the sensor node and the base node.

3.1 Sensor Node

The sensor node will consist of controller and sensors. There will be sensors for accident detection, sensor for Alcohol detection and a GPS module. The sensor node will also have a wireless device that will be used to connect the sensor node to the base node. The Controller that we will be using is the Arduino Uno board which is microcontroller based board that has an ATmega328 on it. The Network device that we will be using is the Wi-Fi Module. The GPS module will be us acquire the location in longitude and latitude

3.2 Base station

All the sensor nodes will be connected to the base station via a wireless device. The Base station has the most computational power it will process and collect the data that is collected from the sensor nodes. All the Sensor nodes will be connected to it will exchange data when an accident is detected at the sensor node side.

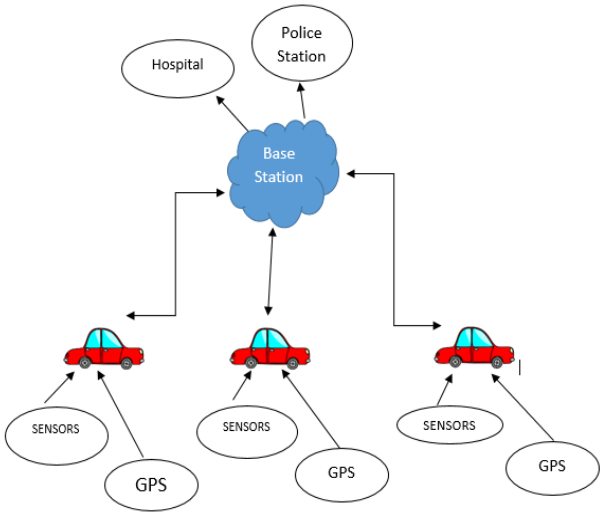

Fig. 1: System architecture

(a) Raspberry Pi: At the base node there is Raspberry. The Latest Raspberry Pi 3 Model B Original quad-core 1.2GHz 64Bit SoC and onboard Wi-Fi and Bluetooth is the latest product in Robu.in among raspberry pi family. The Latest Raspberry Pi 3 Model B

Original is a third generation product which maintains the same popular board format as other raspberry pi modules, but it has faster 1.2GHz 64Bit SoC, and onboard Wi-Fi and Bluetooth.

(b) Arduino Uno: Arduino Uno is microcontroller based board which has a atmega328p on it, some of its features are that it has 14 digital IO pins, 6analog inputs, 1 UART port, 1 I2C and 1 SPI Port. Arduino Uno is a easy to use and easy to program board. It is widely used in IoT projects all over the world. In our project it will be used at the Sensor node to take the input from the sensor and give it to send it to the Base Node.

(c) GPS: The GPS module will be used to detect the location in the form of latitude and longitude which will be connected to the sensor node and will be used when there is an emergency situation.

(d) Network device: The network device will be used to connect the sensor node and the base node. WIFI Module will be used to connect the sensor node to the base node so As to form the network between the vehicles.

(e) Shock and accident avoidance: Vibration sensor or shock sensor will be used to detect the accident at the sensor node and distance measurement sensor will be used that is the ultrasonic sensor will be used for accident avoidance.

(f) Alcohol sensor: Alcohol sensor will be used to detect the Alcohol on the Driving side and will inform the Microcontroller whenever alcohol is above a certain threshold value. MQ 6 Sensor will be used as Alcohol sensor.

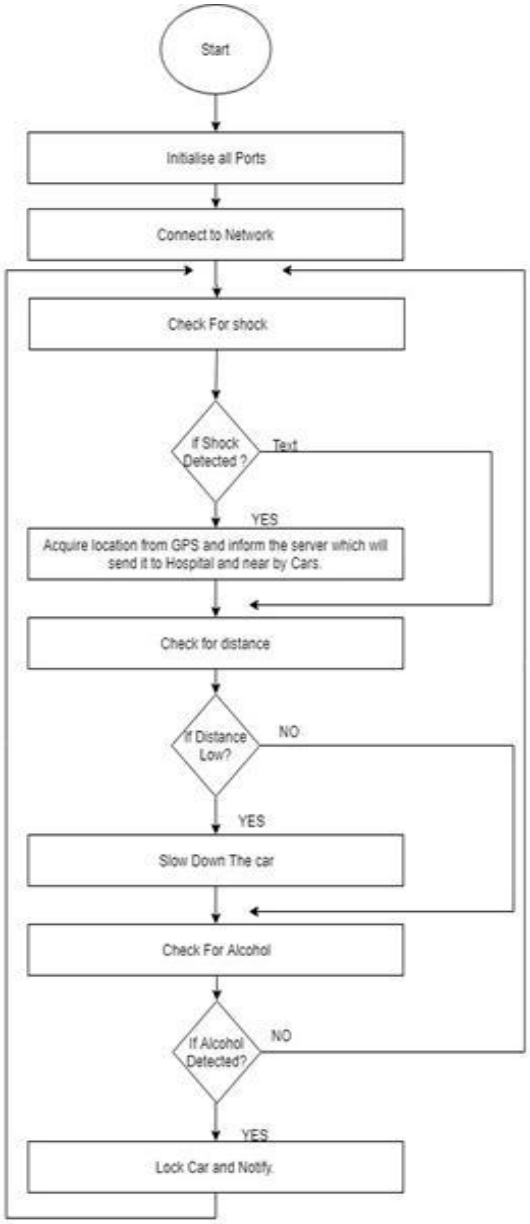

Fig. 2: Flow chart

4. RESULT AND DISCUSSION

Our system will be using Sensors that will be present on the car that are vibration sensor, Alcohol sensor and distance measurement sensor. All the sensor will be connected to RPI that is out BASE NODE which will use WIFI as the Wireless Communication medium. The communication will happened using MQTT Protocol between the BASE NODE and Sensor Node. The Car module

will also consist of GPS which will Acquire Location data and will send it over the Wireless medium to the Base mode. Data base will be maintained using MySQL on the base node and will be used to send the notification's to the particular people.

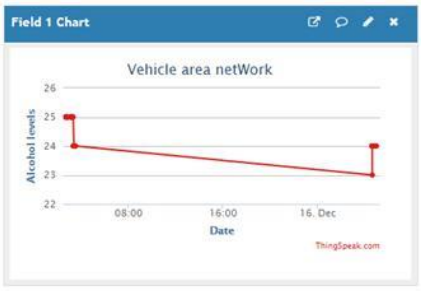

Fig. 3: Alcohol level graph

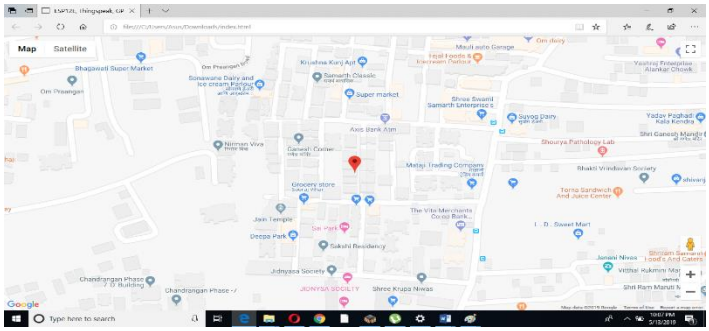

Fig. 4: Location tracking graph

Fig. 5: Results

Fig. 6: Alcohol detection

5. CONCLUSION

This paper is based on road accident detection and avoidance system using IOT and Vehicular Area Network. These technique consist of accident avoidance using distance measurement sensor and accident detection using shock sensors. Also generate emergency situation and acquire location using GPS module and send it to the hospitals and vehicles con-nected to the server. Also have established vehicle to vehicle communication. This will help Solve many traffic related problems using accident detection and

traffic management systems

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