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Accident Alert Using ZIGBEE and GPS

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Abstract— The Internet of Things is a network of physical objects embedded with electronics, software, sensors and network connectivity that enable these objects to collect and exchange data. Currently, when an accident occurs, either the victim or the witness has to inform the local law enforcement and call the ambulance for help. This manual process causes a lot of delay in providing assistance to the injured person(s). To reduce this delay, we propose an automated system that sends an alert message to the law enforcement in the locality of the accident and also to the ambulance, as soon as the accident occurs, so that help may be provided as soon as possible. For automating this process, we make use of the vibration sensor in the car and ZigBee for transmission of information. The vibration sensor is activated when the accident occurs which, simultaneously activates the PIC, which contains the information regarding the vehicle, and the GPS, which, obtains the location of the accident. This information is loaded into the ZigBee transmitter, which transmits it to the ZigBee transceiver from where it is sent to the server via a LAN (Land Area Network) connection. The server then searches the database for emergency contact numbers pertaining to that location. An SMS gateway is then used to send the alert message to those numbers. The outcome of this system is the automatic and immediate alert to the local law enforcement and ambulance about the accident.
Keywords— PIC, GPS, zigbee, alert, vibration sensor, SMS gateway, emergency

I. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity—that enables these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Currently, when an accident occurs, either the victim or the witness has to inform the law enforcement in the locality of the accident and call the ambulance by himself or herself. This process is very time consuming and there is a huge delay for help to arrive. There are additional problems for accidents that occur at nights or in remote areas with very less traffic, where there would not be any witnesses and the victim may be seriously injured. In such situations, it is extremely difficult to get help on time or any help at all. Therefore, it would be of great assistance to automatically send an emergency alert message to the ambulance and local law enforcement as soon as an accident has occurred.

To provide this facility, we make use of the in-built vibration sensor in the vehicle and a ZigBee module for communication. When an accident occurs, the vibration sensor is triggered. The vibration sensor in turn activates the PIC and the GPS that are additionally provided in the vehicle. The PIC contains the information regarding the vehicle. The GPS, when activated, obtains the position of the car as latitudinal and longitudinal coordinates with cardinal directions. These particulars are loaded into the ZigBee transmitter present in the vehicle. The ZigBee transmitter then transmits this information to the ZigBee transceiver using ultrasonic signals. The main advantage of using ZigBee for the transmission of information regarding the accident is that ZigBees may transmit even in remote areas and do not require any GSM network for transmission of the data.

The ZigBee transceiver sends the received information to the server via a LAN (Land Area Network) connection. The server, upon receipt of this information, uses the latitude and longitude coordinates to search the database for emergency numbers pertaining to that location or area. An SMS Gateway is then employed to automatically send an emergency alert message, containing the details of the accident, to those numbers. Therefore, the local law enforcement and the ambulance service providers would be alerted immediately when an accident occurs without any human intervention, even if the accident occurs in remote areas.

A. Confidentiality

The data received by the server is stored in a secure database and cannot be accessed by unauthorized personnel. The emergency alert message is sent only to the emergency contacts listed in the database, thus the information regarding the accident is not

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publicized.

B. Verifiability

The emergency alert message is sent only to the emergency contact numbers, pertaining to that location, stored in the database by the SMS gateway. The message does not reach unnecessary persons. This can be verified by checking the list of contacts registered for that location.

II. IOT(INTERNET OF THINGS)

The Internet of Things may be a hot topic in the industry but it's not a new concept. In the early 2000's, Kevin Ashton was laying the groundwork for what would become the Internet of Things (IoT) at MIT's AutoID lab. Ashton was one of the pioneers who conceived this notion as he searched for ways that Proctor & Gamble could improve its business by linking RFID information to the Internet. The concept was simple but powerful. If all objects in daily life were equipped with identifiers and wireless connectivity, these objects could be communicate with each other and be managed by computers

At the time, this vision required major technology improvements. After all, how would we connect everything on the planet? What type of wireless communications could be built into devices? What changes would need to be made to the existing Internet infrastructure to support billions of new devices communicating? What would power these devices? What must be developed to make the solutions cost effective? There were more questions than answers to the IoT concepts in 1999.Today, many of these obstacles have been solved. The size and cost of wireless radios has dropped tremendously. IPv6 allows us to assign a communications address to billions of devices. Electronics companies are building Wi-Fi and cellular wireless connectivity into a wide range of devices. ABI Research estimates over five billion wireless chips will ship in 2013. Mobile data coverage has improved significantly with many networks offering broadband speeds. While not perfect, battery technology has improved and solar recharging has been built into numerous devices. There will be billions of objects connecting to the network with the next several years. For example, Cisco's Internet of Things Group (IOTG) predicts there will be over 50 billion connected devices by 2020.

III. OBJECTIVE

The objective of our project is to automatically identify the position of the vehicle when the accident occurs and immediately send an alert message to the emergency contact numbers pertaining to the location of the accident without any manual interference.

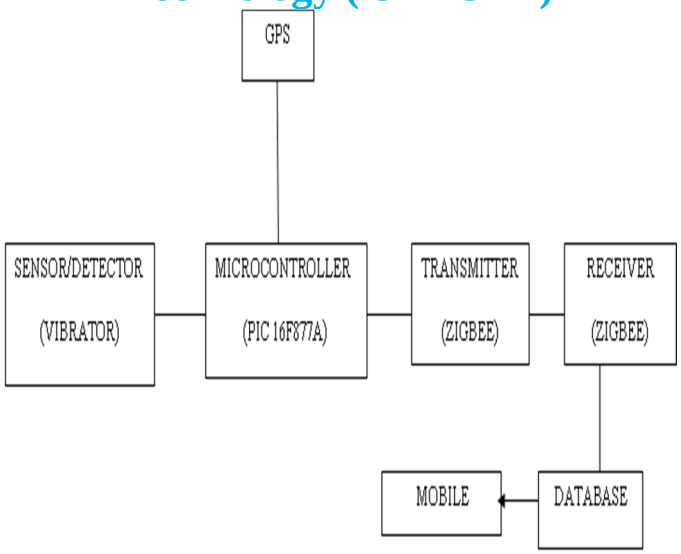
A. Existing System

In the existing system, when an accident occurs, either the victim or the witness has to inform the local law enforcement and call for an ambulance manually, hence there is a huge delay before help could arrive. If the location of the accident is remote or if the accident occurs during late hours of the day, there may be no witnesses and the victim may be seriously injured and unable to call for help.

B. Proposed System

In the proposed system, when an accident occurs, the in-built vibration sensor is triggered which, in turn activates the PIC and the GPS. The PIC contains information regarding the vehicle. The GPS, when activated, obtains the position of the car in latitude and longitude format. These particulars are loaded into the ZigBee transmitter which transmits this information to the ZigBee transceiver that sends the information to the server which employs an SMS gateway to send an alert message to the emergency numbers pertaining to the location of the accident by searching the database.

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System Architecture for Accident Alert Using ZIGBEE and GPS

IV. SYSTEM DESIGN

A. *System Architecture*

The system architecture establishes the basic structure of the system, defining the essential core design features and elements that provide the framework. The systems architect provides the architects view of the users vision. Fig. shows the system architecture for the vehicle section module. A power supply of 5V is provided to the Peripheral Interface Controller (PIC). The GPS and the PIC transmit information to the ZigBee transmitter.

V. SYSTEM IMPLEMENTATION

A. *Vibration Detection*

The detection of vibration is the first phase of the system. When an accident occurs, the vibration sensor detects the vibration caused by the impact. If the frequency of vibration is high, then the vibration sensor activates the GPS and ZigBee, otherwise, the sensor goes back to dormant mode.

B. *GPS Initiation*

The vibration sensor initiates the GPS of the vehicle that met with the accident. The GPS obtains the exact location, in the form of latitudinal and longitudinal coordinates with the cardinal directions, of the car and transmits it to the ZigBee transceiver.

C. *ZigBee Activation*

When the vibration sensor detects the vibration caused by the accident, it activates the ZigBee transmitter, which receives information regarding the vehicle from the PIC and the loaction (latitude and longitude) from the GPS.

D. *SMS Alert to Emergency Number*

This is the final phase of the project, where the Server receives all the information. Once the server receives the information, it will search the database, using the location provided, for emergency numbers pertaining to that location. An SMS gateway is used to send an alert message to those emergency numbers.

E. *Data Transmission*

When all the information is loaded into the zigbee, then zigbee is ready to transmit the data. The information is transferred from the zigbee transmitter to the zigbee transceiver through ultrasonic signals. The ZigBee transceiver then sends this information to the server via a LAN (Land Area Network) connection.

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VI. CONCLUSION

Thus we have implemented the automated accident alert system using the Global Positioning System and ZigBee. Here we are using ZigBee for shorter distance transmissions. But ZigBees are helpful for transmitting the accident information even from remote areas therefore making it a better option than GSM, which does not get proper network coverage in remote areas.

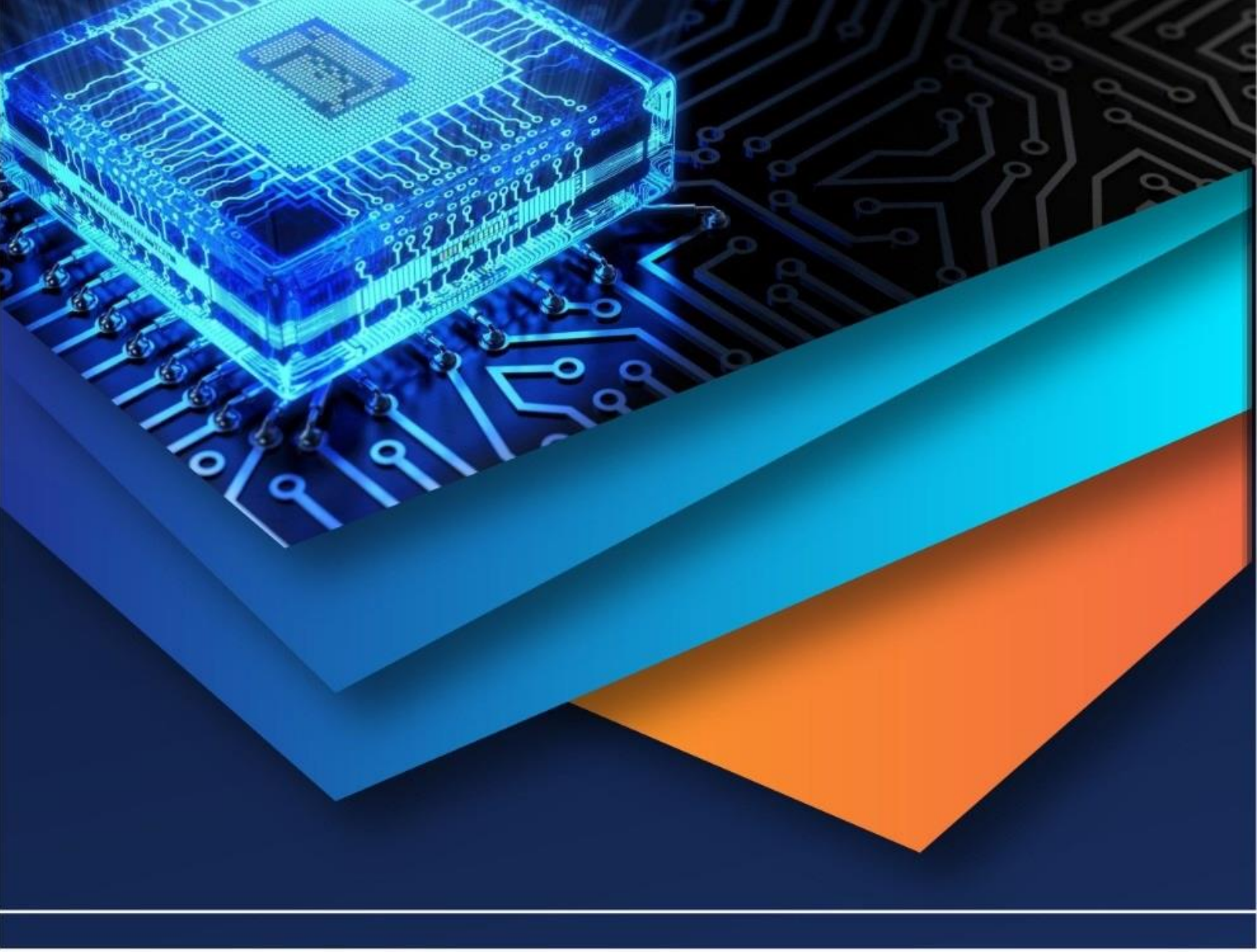
VII. FUTURE ENHANCEMENT

In the future, we may enhance this project by finding the level of damage, number of persons in the vehicle and extent of injuries. The vibration sensor may be programmed to send the level of damage. By installing a camera inside the vehicle, it may be possible to find the number of people in the vehicle and visually view the extent of injuries of the victims. Also, detection of hit and run vehicles may be made possible by using an encapsulation technique to encapsulate the data of both the vehicles, involved in the accident, into a packet before being sent to the ZigBee transceiver, to help make the investigation of the police much easier. Future enhancements in technology may make it possible to replace the ZigBee with newer long-range communication systems.

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