ACCIDENT DETECTION AND ALERT GENERATION USING RASPBERRY PI

ABSTRACT

We all are well aware of the fact that since the days of early men humans have gained remarkable development in each and every aspect for making his lives easier. One of the main concerns of the modern world is about safety and accessibility. As the usage of vehicles increases drastically, the possibility of accidents also increases. Some of the reasons for road accidents are high speed driving, drunk and drive diversion of minds over stress or due to use of electronic gadgets while driving. We have proposed an Accident detection system which is IoT (Internet of things), is one of the most growing technologies in IT industries and is used to decrease the burden of human beings. With the help of IoT we are creating a solution for the accident Over-speeding or driving in excess of prescribed speed limits. Drunken driving or driving under the influence of drugs. Over loading of vehicles. Use of mobile phones or ear phones while driving/crossing the road. Violation of road signs, signals, traffic lights and road safety rules or many a time due to their ignorance. System and method for preventing car accidents in which GSM ranging signals relating to a host car's position on a roadway on a surface of the earth are received on a first com munication link from a network of satellites and GSM auxiliary range correction signals for correcting propagation delay errors in the GSM ranging signals are received on a second communication link from a station or satellite. The host circle's position on a roadway on a surface of the earth is determined from the GSM, XYZ sensor, and accurate map database signals with centi-meter accuracy and communicated to other car owner. The car receives position information from other cars and determines whether any other car from which position information is received represents a collision threat to the host car based on the position of the other car relative to the roadway and the host car. If so, a warning or car control signal response to control the car motion is generated to prevent a collision with the other car. Accidents on the road are increasing day by day. Due to overpopulation and increased vehicles on the road, safety on the road has become an essentialelement. To reduce the number of accidents, accident detection and alert generation systems are being developed. These systems aim to detect accidents and generate alerts to the appropriate authorities. In this project, we propose an accident detection and alert generation system using Rasp berry Pi.Raspberry Pi is a low-cost, credit-card sized computer that can be used for a wide range of applications. It is an ideal platform for developing an accident detection and alert generation system.The proposed system uses a combination of sensors, such as GPS, ac iv celerometer and camera, to detect accidents. The GPS sensor is used to track the location of the vehicle, while the accelerometer is used to detect sudden changes in speed or direc tion, which can indicate an accident. The camera is used to capture images and videos of the accident, which can be used for later analysis.Once an accident is detected, the system generates an alert to the appropriate authorities, such as the police or emergency services. The alert can be sent through various channels, such as SMS, email or through an app.In addition to generating alerts, the system can also provide real-time updates to the vehicle owner or the emergency contact person. This can include information such as the location of the accident, the severity of the damage and the status of the injured persons.The proposed system provides a cost-effective and efficient way to detect accidents and generate alerts. It can be integrated into existing vehicles or can be used as an independent system. The system can be used to improve road safety and reduce the number of accidents on the road. Due

to overpopulation and increased vehicles on the road, safety on the road has become an essentialelement. To reduce the number of accidents, accident detection and alert generation systems are being developed. These systems aim to detect accidents and generate alerts to the appropriate authorities.

KEYWORDS: Accelerometer, Accident detection, Robot, Obstacle avoidance, data logger.

INTRODUCTION

Each day in the newspapers or in news the mankind read about thousands of people dying in road casualties not because of improper medical facilities or non-availability of efficient medications but just because the families of the people did not get timely informed. Isn't it sad? that just because of delayed communication, a number of people are dying every day in the world. To overcome this delayed communication a number of accident detection, notification and vehicle tracking systems have been developed in the recent years. Some of the systems proved to be of great use but still lack somewhere. This system aims to review some of these designed and proposed systems for Accident detection, notification and vehicle tracking. These systems if practically interfaced and implemented in vehicles can help saving lives and that too by informing the families of the people indulged in road casualty or by contacting the nearest hospital and by sharing the exact co-ordinates of the location where accident has taken place. Based on the identification of the potential pseudo-accident, with respect to the distance between vehicle A and vehicle B; Approaching vehicle A from the rear, an XYZ Stability sensor,Ultrasonic Sensor, a GSM, future implementation improvements using a camera, and Buzzer, LED. GSM transceiver and a camera in Raspberry Pi. Initially, a centralized server has been set up with adequate medical information of people for easier retrieval in case of accidents.

This system is configured with an auto-alert module to send the necessary information in case of an accident. In this we are using image processing to detect the accident using raspberry pi and send location through message.In the recent years various vehicle tracking, accident detection and notification systems have been developed, these all systems are based on different technologies, makes use different controllers and sensors to control the functioning of the system and sense the value of the parameter on which the functioning is based upon, or uses different communication protocols to establish the communication. Over the years the technology has advanced and so have these systems.The strong demand for vehicles has resulted in greater traffic congestion and road accidents. Demand primary road accidents occur due to driver recklessness in cities, but accidents often occur outside of cities owing to intoxicated driving.

Not only can driving while inebriated result in fatalities, but so does driving while not wearing a seat belt. As a result, the public's life is in grave danger. The reason for this is that our country lacks the greatest emergency facilities. This study introduces an automated alarm system that provides the most detailed information about the accident. This message has been delivered to the emergency server, which will notify the ambulance and police station closest to the area, allowing vital lives to be saved.The "vibration sensor" is the most important component of this system. If an accident happens, it is identified, and an alarm message is sent to the appropriate numbers. The vibration sensor detects the occurrence of an accident and sends a command to the Raspberry Pi module, which sends an alarm message to the emergency server.Inertial and GSM model acquisition systems are commonly used in various applications such as mobile robotics, tracking systems, and remote monitoring. Raspberry Pi is apopular platform for developing these systems due to its affordability, flexibility, and open-source nature

To enhance the functionality of the inertial and GSM model acquisition system, a buzzer can be added to provide audible notifications. This can be helpful for alertingthe user of important events, such as system startup, sensor readings, and status updates. Overall, adding a buzzer to the inertial and GSM model acquisition system can provide a simple and effective way to obtain audible notifications from the system. This can be useful for a variety of applications, including remote monitoring of environmental conditions, tracking of vehicles and assets, and mobile robotic systems. The Raspberry Pi is a popular single-board computer that can be used for various applications including data acquisition. In this project, we will be using the RaspberryPi to acquire data from inertial and GSM models while using a buzzer to provide sound feedback.

An accident detection system with inertial and GSM models and a buzzer can be an effective way to detect accidents and alert passengers and emergency services. By using the sensors to monitor motion patterns, the system can detect accidents and trigger alerts, while the GSM module can contact emergency services or a designated contact. Additionally, the buzzer can provide an audible alert to passengers and drivers.

COMPONENTS DETAILS:

1.1 Raspberry Pi 4B

A Raspberry Pi can be used for a wide range of applications. Making your Raspberry Pi into a retro arcade machine, using it as a web server, or using it as the brain for a robot, security system, IoT device, or dedicated Android device are all popular uses. Raspberry Pi 4 Model B is one of the recent Raspberry Pi single-board computers. In this blog, you will see Raspberry pi 4 specifications Pin Diagram and Description. You can do all kinds of basic tasks using this computer what you need one monitor, keyboard and mouse. you can play low graphics games, stream 4k video connecting on two displays, all your office work, and many more. This small computer is designed for learning purposes. It was made for those who can't afford expensive computer hardware but still want to learn. The performance of this small computer is similar to entry-level x86 based pc systems. Raspberry Pi 4 : Pi has a more powerful quad-core Cortex-A72 64-bit CPU running at 1.5GHz and Broadcom VideoCore VI GPU running at 0.5GHz. It can handle 4k videos, H.265 encoding 2 HDMI outputs. It has a fully functional Gigabit Ethernet interface and USB 3.0 port. Raspberry Pi is a series of single-board computers developed in the United Kingdom by the Raspberry Pi Foundation. The first model was released in February 2012 and since then, several models and variations have been released. These small and affordable computers are designed to promote the teaching of basic computer science in schools and developing countries. Raspberry Pi boards have relatively low power consumption and can run on various operating systems, including Linux, Windows, and various versions of the Unix operating system. They can be used for basic computing tasks such as browsing the internet, word processing, and playing multimedia content, as well as for more complex projects such as building robots, controlling home automation systems, and creating arcade game consoles.The Raspberry Pi boards are also popular among hobbyists and makers due to their flexibility, low cost, and ease of use.

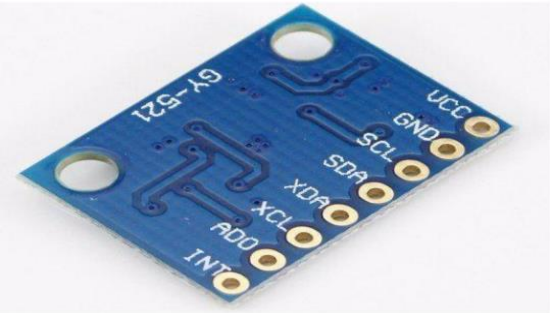
1.2 GSM Module

A GSM modem or GSM module is a device that uses GSM mobile telephone technology to provide a wireless data link to a network. GSM modems are used in mobile telephones and other equipment that communicates with mobile telephone networks. They use SIMs to identify their device to the network.A GSM module or module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM system. The modem (modulator-demodulator) is a critical part here.A GSM modem can be a dedicated modem device with a serial, USB, or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.The GSM module is de signed to enable wireless communication for radiation monitoring instrument intended for continuous data monitoring and emergency alert.GSM Module Wireless MODEMs are the MODEM devices that generate, transmit or decode data from a cellular network, for estab lishing communication between the cellular network and the computer. These are manufac tured for specific cellular network (GSM/UMTS/CDMA) or specific cellular data standard (GSM/UMTS/GPRS/EDGE/HSDPA) or technology (GPS/SIM). Wireless MODEMs like other MODEM devices use serial communication to interface with and need Hayes com patible AT commands for communication with the computer (any microprocessor or mi crocontroller system). It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.

1.3 XYZ Stability Sensor

The GY-521 module is a breakout board for the MPU-6050 MEMS (Microelectromechanical systems) that features a 3-axis gyroscope, a 3-axis accelerometer, a digital motion processor (DMP), and a temperature sensor. The digital motion processor can be used to process complex algorithms directly on the board. Usually, the DMP processes algorithms that turn the raw values from the sensors into stable position data. This tutorial gives only a brief introduction to the GY-521/MPU-6050. In particular, it is shown how to retrieve the raw sensor values. The sensor values are retrieved by using the I2C serial data bus, which requires only two wires (SCL and SDA). * The MPU-6050 sensor contains accelerometer and gyro in a single chip. * The module captures the x, y, and z channel at the same time. * The sensor uses the I2C-bus to interface with the Arduino. * GY-521 modules has a voltage regulator. * Some GY-521 modules have the wrong capacitor (or a bad capacitor) and that results into a high noise level. A stability sensor is a device used to measure the stability of an object or system. It detects the movement or vibration of the object and provides information about the degree of sta bility or instability. Stability sensors are used in various applications such as automotive, aerospace, and machinery to ensure the safe operation of the system.In automotive appli cations, stability sensors are used to measure the lateral and longitudinal acceleration of a vehicle andto detect any deviation from the intended trajectory. This information is then used by the vehicle's stability control system to adjust braking and steering to keep the vehicle stable and prevent accidents.In

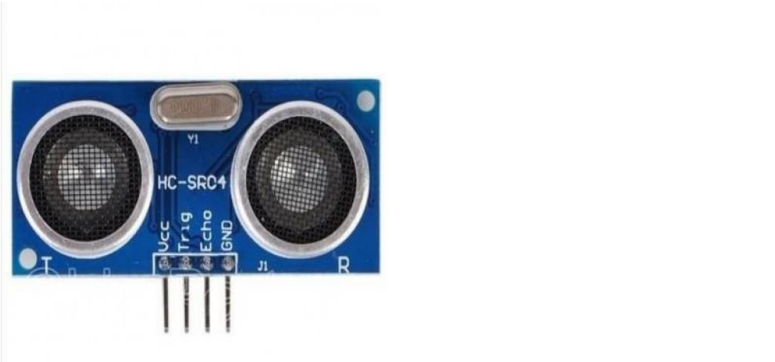
aerospace applications, stability sensors are used to measure the stability of aircraft during flight. These sensors detect any deviation from the intended flight path and provide information to the pilot or the flight control system to makenecessary adjustments to maintain stability.In machinery and equipment, stability sensors are used to detect any vibrations or movements that could cause instability or damage to the equipment.



1.4 Ultrasonic Sensor

Ultrasonic sensors are electronic devices that calculate the target's distance by emission of ultrasonic sound waves and convert those waves into electrical signals. The speed of emit ted ultrasonic waves traveling speed is faster than the audible sound.There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component.Ultrasonic sensor working principle is either similar to sonar or radar which evaluates the target/object attributes by understanding the received echoes from sound/radio waves correspondingly. These sensors produce high-frequency sound waves and analyze the echo which is received from the sensor. The sensors measure the time in terval between transmitted and received echoes so that the distance to the target is known. the specifications of an ultrasonic sensor helps in understanding the reliable approximations of distance measurements. An ultrasonic sensor is an electronic sensor that sends sound waves at high frequencies(typically in the range of 20kHz to 200kHz) andlistens for the echoes that bounce back. The sensor can then determine the distance to an object based on the time it takes for the sound waves to bounce back and the speed of sound in the medium they are travel ing through (usually air). Ultrasonicsensors are commonly used for object detection and distance measurements in a variety of applications, including robotics, automation, and au tomotive sensors. They are often preferred over other sensors like infrared sensors as they can be used in any lighting condition, are not affected by color or reflectivity of the object and can provide accurate measurements even at longer distances. However, they do have limitations such as being affected by temperature, wind, and air currents, which can affect the accuracy of the measurements.An ultrasonic sensor is a device that uses sound waves with frequency higher than the human audible range to detect objects or measure distances. The sensor consistsof a transmitter and a receiver. The transmitter emits a high frequency sound wave, which travels through the air and bounces off of an object. The sound wave is then detected by the receiver, which calculates the time it took for the wave to bounceback to the sensor. This time measurement is then used to calculate the distance between the sensor and the object. Ultrasonic sensors can be used in a variety of applications including robotics, distance mea surement, level

sensing, and presence detection. They are commonly used in parking sensors, industrial automation, and healthcare devices. One common example of an ultrasonic sen sor application is in a car's parking assist system. The sensor is placed on the bumper of the car and measures the distance between the car and an object behind it. The sensor then sends a signal to a display in the car to indicate how far away the object is.Overall, ultrasonic sensors provide a safe and accurate way to measure distance and detect objects in a variety of applications.An ultrasonic sensor is a type of sensor that uses high frequency sound waves to detect objects and measure distances



1.5 MPU 6050

The MPU 6050 is a 6-axis accelerometer and gyroscope sensor module that is commonly used in electronics projects and applications. It includes a MEMS (Micro-Electro-Mechanical Sys tem) accelerometer and gyroscope, as well as an onboard temperature sensor. The MPU 6050 module allows users to measure acceleration, angular velocity, and motion in three dimensions.The MPU 6050module communicates using the I2C (Inter-Integrated Circuit) protocol and can be interfaced with various microcontrollers such as Arduino, Raspberry Pi, and others. It can be used in various applications including motion sensing, robotics, navigation, gaming, and more.The MPU 6050 module is known for its high accuracy and stability, making it a popular choice for many projects. It also includes a built-in Digital Motion Processor (DMP) which reduces the load on the main processor and provides accu rate sensor fusion data.The module is compact in size and easy to use, making it a great choice for beginners and hobbyists looking to experiment with motion sensing applications. Additionally, there are many libraries and code examples available online to help users get started with the MPU 6050 module. The MPU-6050 is a popular 6-axis accelerometer and gyroscope module that can measurelinear and angular motion. It uses MEMS technology tomeasure changes in acceleration and rotation, and provides digital output through its I2C communication interface. The MPU 6050 is commonly used in applications such as drones, robotics, and gaming controllers to provide motion sensing capabilities. It includes a built-intemperature sensor that allows for accurate temperature compensation of its measurements. The module is small in size, easy to use, and relatively low cost, making it a popular choice for motion sensing projects. In addition, it supports advanced features such as motion detection and interrupts, and can be configured to provide various output data rates and ranges. The MPU 6050 has a digital interface that allows it to communicate with microcontrollers, such as Arduino and Raspberry Pi. It operates on low power and has a range of configurable options including sample rates, filter settings, and sensitivity levels. Overall, the MPU 6050 is a highly reliable and effective motion tracking device that is widely used in the indus try.The MPU 6050 is an electronic sensor that combines a accelerometer and gyroscope in one chip. It is widely used in electronic devices for motion sensingand orientation

track ing. The MPU 6050 is capable of measuring acceleration along three axes and rotation rate along three axes. This makes it an ideal sensor for applications such as gaming, robotics, drones and other motion sensing devices. The sensor uses I2C communication protocol for interfacing with microcontrollers and has a built-in digital motion processor (DMP) that can perform complex calculations and filtering algorithms for sensor fusion. The DMP can provide accurate orientation tracking without the need for additional processing on the mi crocontroller. The MPU 6050 is also capable of detecting motion gestures such as shaking, picking up and tilting, which makes it ideal for user interface applications. The small size and low power consumption of the MPU 6050 makes it easy to integrate into portable and wearable devices.

1.6 Buzzer

A buzzer or beeper is an audio signaling device,which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications. There are two types of buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval. A buzzer is an electronic device used to produce a sound or a tone. It consists of a elec tromechanical component or an electronic circuit that producesan audible tone or sound when an electric current is applied to it. A buzzer can be used in various applications such as in security systems, doorbells, alarms, game shows, and so on. It can either be a standalone deviceor integrated into a larger electronic system. There are different types of buzzers available in the market, including electromechanical (mechanical buzzer), piezoelec tric, magnetic, and electro-acoustic buzzers. Each type of buzzer has its own advantages and disadvantages and can be used for different applications.

A buzzer is an electrical device that produces a low-pitched buzzing or humming sound when activated. Buzzer is usually a type of electromagnetic device that utilizes a coil that when powered with an electric current, creates a magnetic field that causes a vibrating reed or diaphragm to produce the sound. Buzzers are commonly used as alarms or indicators in various types of electronic

equipment and systems, suc has well as in games and toys. They can also serve as signal alerts in industrial settings, such as to indicating the start or stop of a specific process or to warn of a potential hazard. Buzzers come in different shapes and sizes, from small, low-profile ones used in handheld devices to larger, more powerful ones that can produce louder and more distinct sounds.

They may also be categorized into different types based on the way they are activated, such as push-button, ambient-light, or vibration-activated buzzers.

METHODOLOGY

Start

Run the Program

Ultra-Sonic will calculate the distance

Check for the distance <50

If distance <50

On the buzzer

On the LED

Else

Off the buzzer

Off the LED

Check MPU 6050 value

Check for Acc value

If Amp>5 then:

Get the current location

Ready also to send sms

Create sms and send

Accident detected msg with location

Else

Off the gps & gsm

Stop.

RESULTS

The partial results of this project have been obtained thanks to the development of the prototype ADAS system consisting of an IoT (Xbee) module for communication, a GPS for location, an inertial sensor for statistical data and a camera to measure the distances of the cars in the back. The first data collection was carried out in the city of Tunja with a predetermined route to be able to compare the data generated by the google maps and the data generated by the GPS device, additionally the data from the inertial sensor will be taken and all of these were sent to a remote base via the Xbee PRO S3B. In this scenario, the buzzer can be used to provide feedback or alerts based on the measured data. For example, the buzzer can be programmed to sound when a certain movement threshold is reached, or when the device detects a change in location.Overall, the combination of inertial and GSM data acquisition with a buzzer can enable a wide range of applications, such as tracking and monitoring systems for individuals or assets, or for use in industrial settings to detect and respond to changes in machinery or equipment.

CONCLUSION

A system to detect an event of accident has been developed. The proposed system deals with accident alerting and detection. It reads the exact latitude and longitude of the vehi cle involved in the accident and sends this information to driver.Raspberry Pi 4B helps in transferring the message to different devices in the system. In IMU Accelerometer monitors the accident happening direction and gyroscope is used to determine rollover of the vehicle. The information is transferred to the driver through GPS NEO-6M module.Using GPS, the location can be sent to base station

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