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RESEARCH ARTICLE

IOT BASED ACCIDENT DETECTION DEVICE

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ABSTRACT

Road traffic injuries (RTI) are worldwide health and constitute an oversized majority of the deaths caused by all injuries. Every year the lives of approximately 1.35 million people are died as a result of a road traffic crash. Between 20 to 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. we are introducing the automated alert device for vehicle accidents. The proposed system detects the accident and sends the data in less time to emergency services like 108 in India. This can be unacceptably high when put next with international standards. An intelligent system for accident detection using a microcontroller like Arduino. When an accident occurs accident detection device detects an accident and communicates with the GPS module and acquires the placement of the accident spot and can send that location to their relations and emergency services. After an accident, if the rider is safe then he/she can send the message that "No need to worry, I'm safe" by pushing the protection switch. For that, we'd like to speak with a microcontroller like Arduino by using the Arduino IDE platform.

INTRODUCTION

Nowadays, the high demand of automobiles has also increased traffic hazards and road accidents. According to the report that is issued by the "Transport Research Wings", there were 4,97,686 accidents reported in one country in 2011, whereas, the number of people who died due to lack of an appropriate plan of action was 1,42,485. This is because lack of emergency service reaches the time [Bilal Khalid Dar, 2018]. In such critical situations, technology can play a vital role. We made one device using the Internet of Things (IoT) technology. In this device, we use SIM 808 module which includes GSM and GPS so that we can easily detect the location of the accident and send message to the nearest emergency service, police and relatives and also second module is MPU 6050 it includes Gyroscope and Accelerometer so that we defined the accident by seeing the angles in X-angles, Y-angles, and Z-angles [Varsha Goud, 2012]. If Accident occurs but a person meets with no more damage then we also put the Fall button if the person have no more damage then he/she kindly pushes the button so that it directly gives the message to the emergency services, police, and relatives that I am Fine. Here is our project demo video https://www.youtube.com/ watch?v= WBDt_fqWimo and yes you can find the whole module with the running project in Github https://github.c om/ Parth Sabhadiya/IOT-BASED-ACCIDENT-PRONE-DEVICE.

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In this Research paper, we defined that it how it works and sends message according to it. In Second section we include components description, third section include accident detection device implementation, fourth section conclude our project research.

Components description MPU6050 (Gyroscope and accelerometer)

Fig. 1. Shows MPU6050, gyroscope and accelerometer sensor which is used to detect an accident.

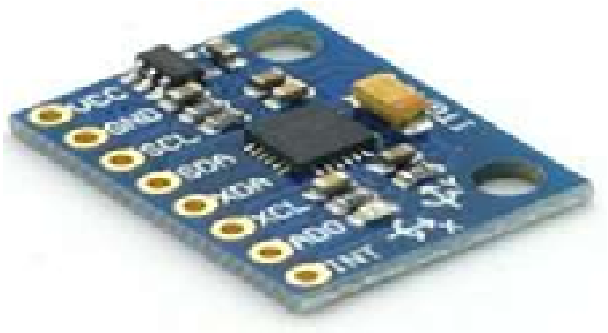

Fig. 1. MPU6050

MPU6050 pin description
INT: Interrupt digital output pin.
AD0: I2C Slave Address LSB pin.

This is 0th bit in 7-bit slave address of device. If connected to VCC then it is read as logic one and slave address changes.

XCL: Auxiliary Serial Clock pin.
This pin is used to connect other I2C interface enabled sensors SCL pin to MPU-6050.
XDA: Auxiliary Serial Data pin.
This pin is used to connect other I2C interface enabled sensors SDA pin to MPU-6050.
SCL: Serial Clock pin.
Connect this pin to microcontrollers SCL pin.
SDA: Serial Data pin.
Connect this pin to microcontrollers SDA pin.
GND: Ground pin.
Connect this pin to ground connection.
VCC: Power supply pin.
Connect this pin to +5V DC supply.

There are many types of micro-electro-mechanical Systems (MEMS) gyroscopes that differ in their internal structure. They are similar in the fact that their work is based on the use of Carioles' force. In each of them, there is a working body, making reciprocating movements.

Here, rotation takes place the substrate on which this body is located, then the Carioles' force, which is directed perpendicular to the axis of rotation and the direction of motion of the body. Also, it will begin to act on it. Fig. 2 demonstrates illustration for the understanding of the principle of this force [Fedorov et al., 2015].

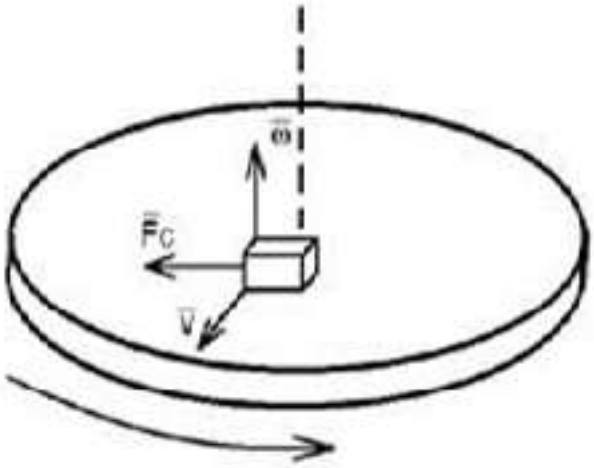

Fig. 2. The mechanism of the Coriolis force

$\overline{\omega}$ = The vector of angular velocity
$\overline{v}$ = The vector of linear velocity
Fc = The Carioles' force

Technical characteristics of the module

- 3-axis gyroscope.
- 3-axis accelerometer.
- Thermal sensor.
- Power supply 2.375V-3.46V.
- FIFO-buffer of 1024 bytes.
- User-programmable digital filters for the gyroscope, accelerometer and thermal sensor.
- I2C interface for writing and reading device registers, operating at a frequency of up to 400 kHz.

GSM Module

Fig. 3. GSM/GPRS Module (SIM900) (Bharavi, 2017)

GSM/GPRS Modules are commonly used communication modules in embedded systems. A GSM GPRS Module is used to enable communication between a microcontroller and the GSM / GPSR Network. GSM stands for Global System for Mobile Communication and GPRS stands for General Packet Radio Service. GSM/GPRS Modules allow microcontrollers to have a wireless communication with other devices and instruments. Such wireless connectivity of microcontroller opens up to wide range of applications like Home Automation, Home Security Systems, Disaster Management, Medical Assistance, Vehicle Tracking, Online Banking, E – Commerce etc.

Using GSM/GPRS Module, we can do the following tasks

- Make, receive or reject voice calls
- Send, receive or delete SMS messages in the SIM Card
- Add, read and search the contacts in the SIM Card
- Send and receive data to / from the GSM/GPRS Network through GPRS

Example

- AT+CMGF=1

Sets the GSM Module in Text Mode

- AT+CMGS=\"+XXYYYYYYYYYY\"

enter country code in XX and Mobile number to whom you want to send SMS over YYYYYYYYYY

Arduino UNO

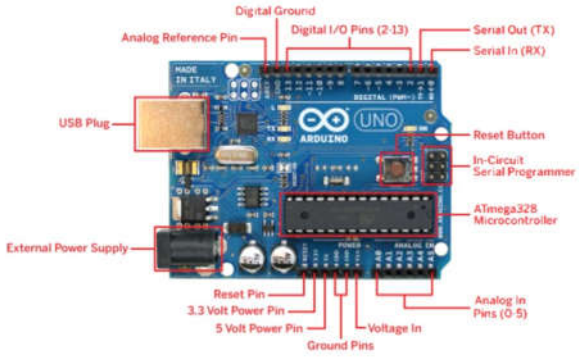

Fig. 4. Arduino UNO [6]

Fig. 4. Arduino Uno is a microcontroller board, used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. It has 6 analog inputs, 14 digital input/output pins (of which 6 can be used as PWM outputs), a power jack, a 16 MHz ceramic resonator, a USB connection an ICSP header and a reset button. It possesses everything is needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Technical specifications of Arduino Uno

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

B.16×2 LCD Display: This is a basic 16 characters by 2 lines Alphanumeric display. Black text on Green background. It uses the common HD44780 parallel interface chips. Interface code to use this display is freely available.

You will need Minimum 6 general input/output pins to interface to the given screen. It includes LED backlight, and it works in 4bit and 8bit Mode.

Features of 16×2 display

- 16 Characters x 2 Lines
- Green Backlight
- HD44780 Equivalent LCD Controller/driver Built-In
- Standard Type
- Works with almost any Microcontroller
- 4-bit or 8-bit MPU Interface
- 5x7 Dot Matrix Character + Cursor

Accident Detection Device Implementation

Problem occurs during an accident: How soon will the authorities receive a call for help after an injury road accident? In urban Missouri 70% of the calls were received in less than five minutes. But in rural Missouri only 34% of the calls came in that quickly.

These figures are based on a merge of police and emergency medical services accident data in which the earlier of the two notifications is selected as the time of first call. Fig. 5 shows parameters for not getting treatment after an accident (Harold Brodsky, 1991).

Fig. 5. Problems after an accident

Tools and technologies to be used to solve this problem

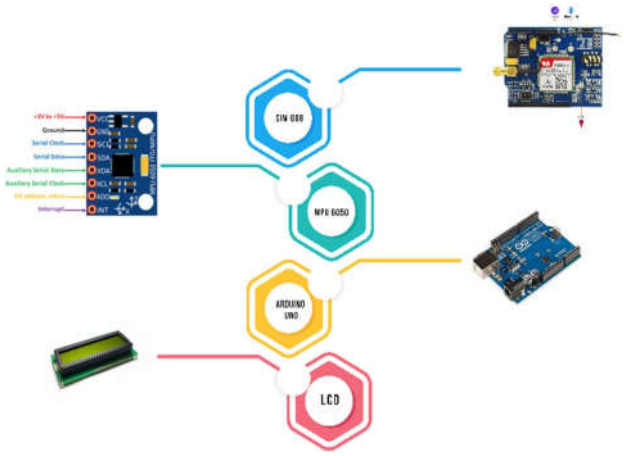

Fig. 6. Tools used in ADD

(GSM Module, MPU6050, Arduino UNO, LCD Display)

Process flow of ADD

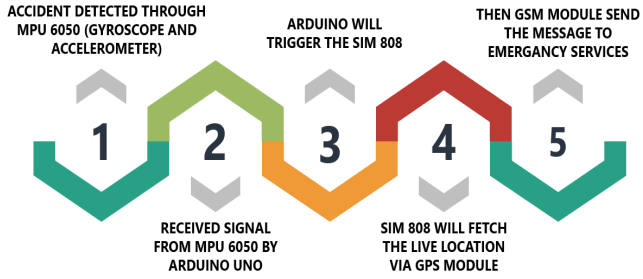

Fig. 7. Process flow of ADD

First, and foremost thing that we are going to do is to interface MPU6050 sensor which includes gyroscope and accelerometer. Gyroscope calculates the angular velocity and accelerometer calculates the linear acceleration. By combining both the readings, we examine the threshold value which detects the accident and MPU6050 sends the signal to Arduino. Then Arduino triggers the SIM808 module. SIM808 comprises GPS and GSM modules. The GPS tracks longitude and latitude which helps to get live location with a google map link and GSM sends the message to central control room like emergency services. Thus, the delay can be avoided and the victim can be taken to the hospital as soon as possible.

Circuit diagram of ADD

First, Here, Fig. 8 shows the Printed Circuit Board (PCB) design of ADD. On the left side of fig. x LCD is being placed. After that buzzer and push-button than Arduino, MPU6050, GSM module. All components of ADD are already describe with their functions. This PCB design is design in DipTrace software.

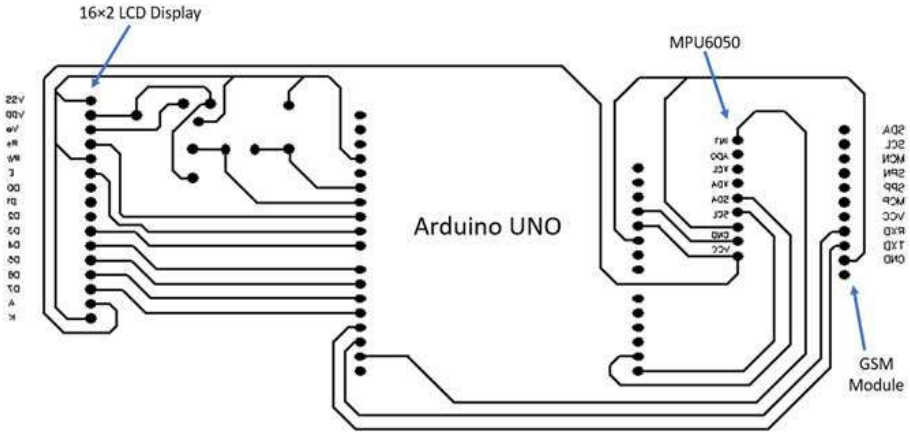

Fig. 8. Circuit diagram of ADD

Conclusion

In this paper, we made a device that detects accidents through the SIM 808, MPU 6050 and Arduino. Our main purpose for this device is to inform the nearest emergency service about the accident so that we can save the people at a time, this device's accuracy is 100%. In future, we can add this device to the camera so that using Machine learning we can detect the accident and send message directly to nearest emergency service also this device has some limitation also like if the network not available in ruler area then it can't send the message but in future, we make a solution for it.

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