Vehicle Tracking And Accident Detection Using IoT

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Abstract: **With the advent of modern technology has made our life simple, comfortable luxurious compared to the previous years. Now a day's people are more habituated to vehicles for travelling purpose because of its ease and time consumption. Thus there is 31increase in usage of vehicles leading to increase in traffic causing many people to die due to road accidents. This paper is about a system that prevents the accident of vehicles which gives more likely to lower the accidents takes place daily on roads and at the same time if any accident occurs the system will locate the vehicles location and informs to local emergency authorities automatically helps to take immediate and appropriate actions. This system is based on Arduino developed with Global Positioning System (GPS) to identify the vehicle's location and Global System for Mobile Communication (GSM) technologies.**

A motion sensor gyroscope with 3-axis gyroscope and 3-axis accelerometer is used that measures the vehicles velocity and tilting position when the vehicle hits by something. When the vehicle velocity is more than the defined maximum for the particular location a warning will be given automatically and if any accident occurs the geographical coordinates of place are located by GPS and sends an SMS to the authorities nearby.

Keywords: **GPS; GSM;**

I. INTRODUCTION

With the advent of modern technology has made our life simple, comfortable luxurious compared to the previous years. Nowadays people are more habituated to vehicles for travelling purpose because of its ease and time consumption. Thus there is increase in usage of vehicles leading to increase in traffic causing many people to die due to road accident. As per Indian road safety reports in 2013 alone over1,37,000 people died in accident which is more than that are diedin a war. As 2016 report given by the National Bureau Of Crime Records states were 496,762lanes, railways and rail course crossing-related auto collisions in 2015. Out of these, road impacts spoke to 464,674 accidents 148,707 are related to traffic deaths in India [1]. The majority of fatalities were happened in Uttar Pradesh, Maharashtra, and Tamil Nadu, and together they spoke to about33% of supreme Indian traffic fatalities in 2015[2]. Balanced for 182.45 million vehicles and its 1.31billion peoples, India uncovered a fender bender pace of about 0.8 per 1000 vehicles in 2015 stood out from 0.9 per 1000 vehicles in 2012, and an 11.35 loss rate for each 100,000 people in 2015.

The statistics of road accidents in India from 2005 to 2017 are given on Table below. While the absolute numbers for road accident, fatal accident and injury are on the decline, the ratios pertaining to fatal accidents and accident severity have been consistently increasing, every year [3]. Road accidents cost India 3-5% of gross domestic product every year if India could improve its roads and city planning, train its drivers better, and enforce traffic laws properly, an India spend analysis shows.

India's young, productive population, aged 18-45 years, is involved in 70% of road accidents, according to data from Road Accidents in India 2018, a report published by the Ministry of Road Transport and Highways. Over a period of 24 years from 2014 to 2038, if India could halve the deaths and injuries due to road traffic, its GDP could increase by 7%, a 2018 World Bank report said. In 2018, India had 467,044 reported road accidents, an increase of 0.5% from 464,910 in2017, according to the road ministry's data. India has 1% of the world's vehicles but accounts for 6% of the world's road traffic accidents, according to data from a 2018 World Health Organization report. As many as 73% of all deaths due to road traffic accidents in 2018 in the South and South-East Asia region happened in India, the report said.

Road accidents are one of the 12 most common causes of deaths in India, the ninth most common cause of premature deaths, and the 10th most common reason for disability, according to the 2017 WHO Global Health Estimates.

In 2018, of all road deaths, the most were of those riding two-wheelers (36%), followed by pedestrians (15%), ministry data shows.

Speeding and drink driving

The two most frequent causes of road deaths are speeding and drunk driving, followed by a lack of lane discipline (driving on the wrong side), jumping the red light and the use of a mobile phone while driving, data shows.

Over speeding is the most common cause of deaths on roads in India, with 64% of road deaths because of speeding. Sixty per cent of the accidents in India occur on highways, mostly because of speeding, said Piyush Tewari from Save a Life Foundation.

The most deaths due to speeding were in Rajasthan (9,618 deaths), followed by TamilNadu (9,224 deaths) and Karnataka (8,714 deaths).The fine for speeding has increased from Rs 500 to Rs 5,000 since September, 2019 [8]under the new Motor Vehicles Act of 2019. In addition, drivers could also be imprisoned for three months for speed racing – an illegal race – if it is their first offence, and for a period of one year if it is the second offence, according to the law.

The current speed limit in the country is 80 km per hour on a 4-lane highway. However, the WHO has recommended that if we reduce the speed limit to about 55-57 km per hour, we could save around 30%-37% lives, said Patanjali Nayyar, regional advisor for the WHO.

II. IMPLEMENTATION PROCESS

If the value of velocity and tilting exceeds the defined maximum value then an SMS to the concern authorities will sent through Arduino with real time geographical coordinates. This will be shown on LCD display and a buzzer sound is given as warning to inside people. The system model is shown in below figure.

GSM is a second-generation (2G) standard employing time-division multiple-Access (TDMA) spectrum-sharing, issued by the European Telecommunications Standards Institute(ETSI).

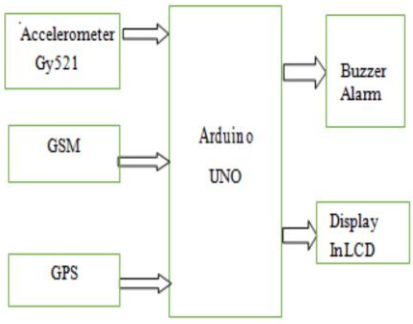

Fig. 1 Architecture of Accident Detection and Vehicle Tracking.

The GSM standard does not include the 3G Universal Mobile Telecommunications System (UMTS) code division multiple access (CDMA) technology nor the 4G LTE orthogonal frequency-division multiple access (OFDMA) technology standards issued by the 3GPP. GSM, for the first time, set a common standard for Europe for wireless networks. It was also adopted by many countries outside Europe.

GPS: The design of GPS is based partly on similar ground-based radio-navigation systems. Precise navigation would enable United States ballistic missile submarines to get an accurate fix of their positions before they launched their SLBMs. The USAF, with two thirds of the nuclear triad, also had requirements for a more accurate and reliable navigation system.

Buzzers: Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Electromechanical

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

Mechanical

A joy buzzer is an example of a purely mechanical buzzer and they require drivers. Other examples of them are doorbells.

Piezoelectric

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. Interior of readymade loudspeaker, showing a piezoelectric disk-beeper with 3 electrodes including one feedback-electrode the central, small electrode joined with red wire in this photo, and an oscillator to self -drive the buzzer.

III. SYSTEM DESIGN

The system design totally based on Microcontroller Arduino. Here the Arduino acts as a main controlling unit. As we continuously monitor the data will received by Arduino from sensors and GPS it first decodes, fetches and will execute its operation finally. Here the simulation circuit of system design is shown below. we can see Arduino as main controlling unit in this connected with Global Positioning System (GPS),Global System for Mobile Communication (GSM), LCD Display Buzzer, Gyroscope.

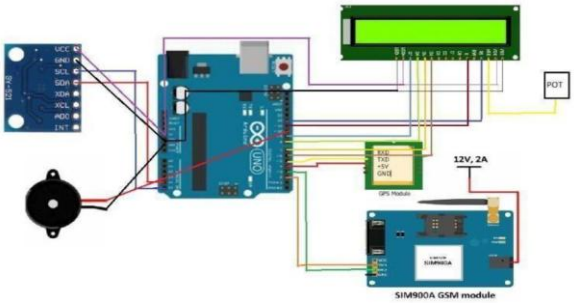

Fig 2. Simulated Circuit Design

ARDUINO UNO: The Arduino Uno Board consists of a microcontroller chip that was made to house the ATmega328 chip. The chip is an elite performance. Low power 8-piece miniaturized scale controller that has 23 programmable I/O lines, 32K bytes of glimmer memory (of which 0.5KB is as of now utilized for the Boot loader), 1k bytes of EEPROM and 2k bytes of RAM. The Arduino UNO board has capability of transmitting receiving with 6 simple info pins, 14 advanced I/O pins out of which 6 of them can be likewise or be utilized for PWM yields, as a power jack, or as a USB port, or as an ICSP header, or as a reset catch, a little LED associated with advanced stick 13, and a 16MHz precious stone oscillator.

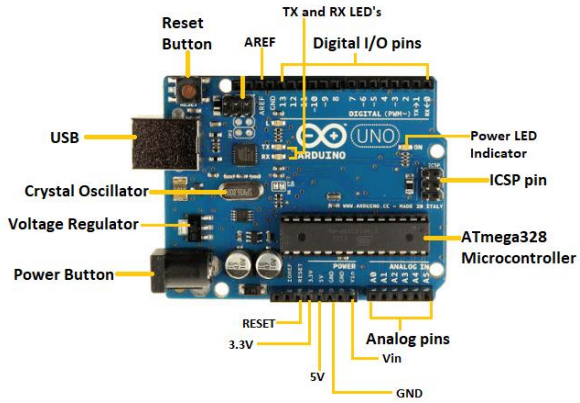

Fig 3. Image of the Arduino UNO board and components are labelled

The basic functioning of the standard Arduino microcontroller board. Use the Arduino Integration development environment used for loading, compiling, sketching and downloading the programs.

Items	Features/Ratings
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage(recommended)	7-12V
Input Voltage(limits)	6-20V
Digital I/O pins	14
Analog Input pins	6
DC current per I/O pin	40mA
DC current for 3.3v pin	50mA
Clock Speed	16MHz
Flash Memory	32Kbits
SRAM	2Kbits

Table 1. Features of Arduino

GYROSCOPE AND ACCELEROMETER(MPU-6050):It belongs to a family of motion sensors having 3-axis of both Gyroscope and Accelerometer on the same side of the silicon die are the highest performance sensors in the market having less noise and more stability. The 3-axis Gyroscope measures the tilting value of the vehicle. If the vehicle strikes anything there will be a change in its stable values x, y, z-axis respectively. This change tells an accident has occurred. Now To prevent the accident the velocity must be taken into consideration and we know that from formulaV=u+at Where a is said to acceleration (m/s2), t is considered as time (seconds), u is initial velocity (m/s) and velocity v(m/s).

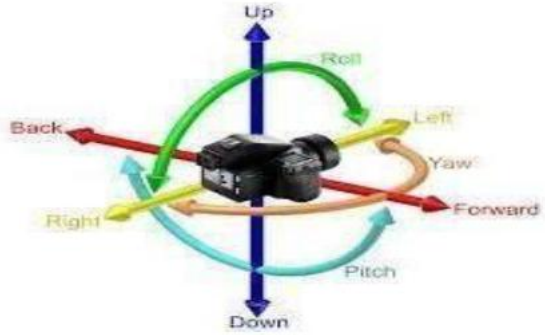

Fig 4. 6-axis directions of gyroscope

Working: At the point when your gadget turns a specific way, the gyro sensors sense the movement on the drive arm. At the point when the gyro pivots, the Coriolis power will follow up on the drive arm to deliver a vertical vibration. This triggers the stationary part to twist making the detecting arm distinguish movement. The precise speed is accordingly dictated by the development of detecting arms. It is then changed over and transmitted as an electric sign.

GPS-Module:

GPS modules highlight significant progressions in signal following for applications working in poor sign conditions. With their higher affectability, execution and quicker startup times, the Condor GPS modules empower framework integrators to effortlessly include Global Positioning System (GPS) ability to a cell phone with a negligible effect on its size or battery life at an exceptionally practical cost. The GPS module incorporates modules with various structure components and interface choice.

Fig. 5 GPS Module

In this, a Global Positioning System is used to locate the values of geographical coordinates of the vehicle in terms of latitudes and longitudes when the values of both velocity and titling are above predefined values

GSM-Module:

The main purpose of GSM is for long distance communication and is used in devices like mobile phones. It transmits and receives data over GPRS. In this projectSIM900A GSM module is used for sending SMS alert. When the velocity will exceed the maximum value for the given location coordinates or when the sensor tilted implies that an accident occurred, GSM will send SMS to some selected numbers. The SMS received by the cell phone consists of location coordinates and the speed of the vehicle.

Fig 6. SMS sent from the GSM module

GSM module is utilized to set up interchanges between an implanted framework and the GSM cell arrange. The GSM works at various frequencies around the world. Recurrence groups of 900Mhz and 1800 MHz are normally utilized in Europe, Asia, Oceania, and the Middle East, while the United States utilizes 950 Mhz and 1850 Mhz. A GSM module empowers the inserted framework to send and get instant messages, send information on the General Packet Radio Service (GPRS Modem) system, and make or get voice calls.

Fig. 7 GSM Module

Same as with a standard mobile, the GSM module need an initiated SIM card to work.

LCD(16*2):

LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of5×8 Pixel Dots. A Single character with all its Pixels is shown in the below picture.

IV. HARDWARE IMPLEMENTATION

The implemented hardware circuit is shown in Fig. 6. I2C protocol is used to connect the IMU sensor and LCD display. SIM900A GSM Module and GPS Module are connected via serial communication with Arduino UNO. For powering the GPS and GSM modules we used a 12v and 2A power supply. Output result it will be displayed on LCD with real time geographical coordinates and velocity.

Fig. 8 Implemented Hardware Circuit

As the predefined velocity of the area is fixed, if the vehicle crosses the predefined velocity in that area then warning will be displayed on LCD. If the vehicle is slowed down to less than defined maximum, the warning indications will be off automatically.

Fig. 9 Location displaying w.r.t GPS

The velocity ranges for different roads with latitudes and longitudes are shown. While testing in Road1 and Road2 the vehicle has not crossed the predefined speed limit. So there will be no warning in this case. Testing the hardware if the vehicle is travelling in

road 3 with 50 m/s but the predefined value is less than that of the value. As it exceeds the limit a warning will be displayed on the LCD with buzzer telling to slow down and an immediate SMS will be send to the owner or to whomever monitoring the vehicle status. Again if the vehicle is slowed down to less than defined maximum, the warning indications will be off automatically.

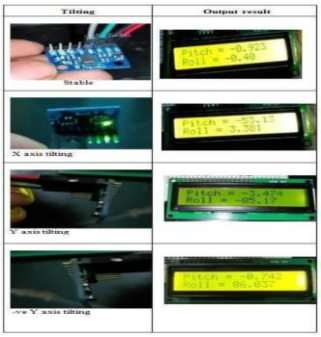

Fig. 10 Output corresponding to tilt of the vehicle

The output result in showing the tilt of Gyroscope (IMU sensor). If the vehicle exceeds the limit of the axis predefined then a SMS will be send to the nearby.

CONCLUSION

This paper offers a system that will save the life of many people on roads due to over speed of vehicle. The proposed Arduino based system using GPS and GSM technology was developed and tested successfully to track the exact location of a moving or stationary vehicle in real time. The device was successfully implemented and tested with real time GPS coordinates, and giving the warnings but the main drawback for this system is that the velocity is not detected automatically; it is needed to be predefined. The framework will guarantee wellbeing and security of vehicle, driver, and travellers and furthermore gives better assistance. The framework is practical answer for clients. In future, further research can be done to improve the calculation for this framework and make the framework completely worked for mishap avoidance. The framework can be additionally upgraded by utilizing camera to get the continuous perspective on the vehicle, which would be increasingly advantageous for the client to follow the vehicle and furthermore to recognize the individuals/vehicle which is answerable for the mishap.

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