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Advanced bike safety and security system

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ABSTRACT

India has one of the highest rates of motorcycle injuries. 40% of those killed and injured on Indian roads are motorcyclists. Speed is one of the basic reasons for vehicle accident. Many lives could have been saved if emergency service could get accident information and reach in time. This project analyses the capability of a MPU6050 Gyro sensor to monitor lean angle of a vehicle and detect accident basing on monitored speed, lean angle and send accident location to an emergency contact and to a nearby hospitals and police station. The abnormal condition of speed and gyro sensor will activate the GPS module when accident occurs. GPS will send the coordinates that it receives from the satellite on a real time basis of the vehicle via GSM module to ambulance and family members. This will help to reach the rescue service in time and save the valuable human life. And also the vehicle tracking system will send you the location to your mobile phone along with the Google map coordinate. You can request the location at any time & view the location on Google Maps installed on your mobile phone.

Keywords: *Gyro Sensor, GSM, GPS, Lean angle, Vehicle tracking*

1. INTRODUCTION

The development of a transportation system has been the generative power for human beings to have the highest civilization above creatures in the earth. Automobile has a great importance in our daily life. We utilize it to go to our work place, keep in touch with our friends and family, and deliver our goods. But it can also bring disaster to us and even can kill us through accidents. Speed is one of the most important and basic risk factors in driving. It not only affects the severity of a crash, but also increases risk of being involved in a crash. Despite many efforts taken by different governmental and non-governmental organizations all around the world by various programs to aware against careless driving, yet accidents are taking place every now and then. However, many lives could have been saved if the emergency service could get the crash information in time.

1.1 Accidents

India has one of the highest rates of motorcycle injuries. According to the latest data released by the National Crime Records Bureau NCRB, speeding and dangerous driving were the biggest reasons for road fatalities. Over-speeding accounted for about 1.7 lakh crashes and nearly 49,000 deaths. Road casualty statistics show that 40% of collisions occur in the hours of darkness. The idea of developing this project comes from social responsibility towards the society. This project aims for fall prevention and safety of bike rider. Earlier studies indicate that there exist road accidents and the number of occurrences has been increasing over time especially in developing world. Over time governments had to come up with more and more traffic rules and measures to mitigate the increasing rate of accidents but with little success. People escape from minor scrapes if lucky. A very unfortunate thing if they get involved in a life-threatening accident leaving the victims emotionally and financially drained.

Road Accidents can be categorized in the following ways:
i) High-speed collisions:
High-speed collisions can leave a devastating blow to the people involved in the crash. About 30 % of the fatal crashes are from

high-speed collision. Most of these collisions happen at a curved road and at night time.
ii) Collision against stationary object, for example collision against mountains, buildings, trees and solid concrete.

Table 1.1 Accidents Occurred from 2012 to 2015

YEARS	NO. OF ACCIDENTS	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED
2012	4,84,704	1,19,860	5,23,193
2013	4,86,384	1,25,660	5,15.458
2014	4,99,628	1,34,513	5,27,512
2015	4,97,686	1,42,485	5,11,394

2. LITERATURE SURVEY

[1] This paper is implemented to detect bike accidents using MPU6050 (gyro sensor and accelerometer), SIM808 (GPS+GPRS+GSM), Raspberry Pi 3 Model B and Arduino Uno. They placed the proposed system on the surface of the bike. If an accident occurs, the sensors will trigger and send a message containing the number and location of the biker to the nearest hospitals, police stations and registered family members

[2] In this paper they use 2 types of sensors, Accelerometer and Gyroscope sensors which are generally the basic features of a smartphone. They adopt a Machine Learning-based movement identification process with an Artificial Neural Network ANN algorithm. ANN will do what movements it does based on the data obtained from the Accelerometer and Gyroscope sensor values.

[3] In this paper a system is proposed to control the speed of the motorcycle by using gyro sensor and ultrasonic sensor. When the gyro sensor value exceeds the threshold limit then the speed of the vehicle is reduced, this prevents from having major accidents and the Ultrasonic sensor used here detects the distance between the obstacle and the motorcycle and stops the vehicle, if it is too close to the obstacle. This prevents the accidents occurring during night times at highways or city outskirts due to poorly illuminated roads.

[4] In this paper Stabilizing plays a major role to help in avoiding the majority of an accident in two-wheelers. Gyroscope thus helps to develop the counteracting forces against the tilting force. The safety aspects of the vehicle are increased by incorporating a gyroscope mechanism in the two-wheeler. The torque generated by the gyroscope must be equal to the imbalance torque acting on the vehicle for the dynamic stabilization of the vehicle. The main principle is about generating the counteracting torque to help stabilize the tilting vehicle.

[5] In this paper Stabilization of a two wheeled vehicle plays a vital role in the complex transportation system. Gyroscopes can deliver a major contribution towards stabilization of two wheeler vehicle. It has been speculated that gyroscopically stabilized vehicles would have higher safety with respect to normal two wheelers. The dynamic stabilization of a two-wheeled vehicle requires that a torque acting on the vehicle naturally be neutralized by a torque produced within the vehicle by a gyroscope.

[6] Vehicle and Fuel theft cases are increasing day by day all over the world. So, Vehicle Security system plays an important role nowadays. When under attack, these systems can only immobilize the engine and sound a loud alarm. Alerting owner by SMS about the theft attempt, allowing user to control the system remotely by SMS.

3. EXISTING SYSTEM

In the existing system they have used two different microcontrollers. Arduino Microcontroller, Raspberry Pi3, MPU6050 Gyro and Accelerometer Sensor, SIM800A GSM Module, personal computer (pc) and serial port (COM) port are used to perform the vehicle accident detection. Arduino processes the data from MPU6050 and Raspberry PI determines whether to send the message or not.

They have imported serial library function and saved all the data from Arduino IDE. If the connection is true, 'connected' message will be printed in the terminal. Then the coding part enters a loop. In this loop, the data of Arduino IDE will be saved in a variable 'data'. After that a method will be called to get the data (value of the angle) from Arduino. Then it will check if the axis is above 45 degree or not. If yes, the Raspberry PI gives a command to Arduino to send a signal to SIM808.

4. PROPOSED SYSTEM

The gyro, accelerometer sensor and speed sensor which measures the abnormal values of both bike's lean angle and speed value of the bike. It sends the exact accident location acquired from the GPS to the emergency contacts through GSM module. The 3-axis accelerometer gives the G-forces along x, y and z axis. The direction in which crash happens produces a drastic variation in G-forces along that axis remarkably along x- and y-axis. Howbeit, the rotation angles viz. roll, pitch and yaw along the x, y and z axis are computed from 3- axis gyroscope.

For analysing the rollover of vehicle roll and pitch angles are sufficient as yaw isn't affected by the rollover. The values combined from accelerometer and gyroscope provides an efficient way of determining the occurrence of accident instead of using a single sensor. When the location request by user is sent to the number at the modem, the system automatically sends a return reply to that mobile indicating the position of the vehicle in terms of latitude and longitude.

4.1 Block Diagram

The MPU6050 Gyro and Accelerometer sensor have been interfaced through Serial Data (SDA) and Serial Clock (SCL) lines with the Microcontroller. SIM800C GSM module and NEO-6M GPS module have been interfaced through Receiver (RX) and Transmitter (TX) lines with the Microcontroller. LM393 Speed sensor and Metal sensor have been interfaced through I2C lines with the Microcontroller. Power supply has been provided for Microcontroller and GSM module, 5V DC and 12V DC respectively.

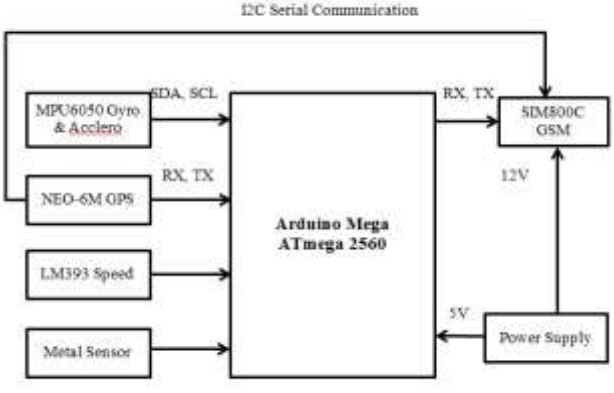

Fig 4.1: Block diagram

4.2 Modes of operation

The Microcontroller will be operating in two modes:

1. Accident detection Mode
2. Finding Location mode

In accident detection mode gyro, accelerometer sensor and speed sensor which measures the abnormal values of both bike's lean angle and speed value of the bike. It sends the exact accident location acquired from the GPS to the emergency contacts through GSM module. In finding location mode the user can send a message request to know the current location of the vehicle.

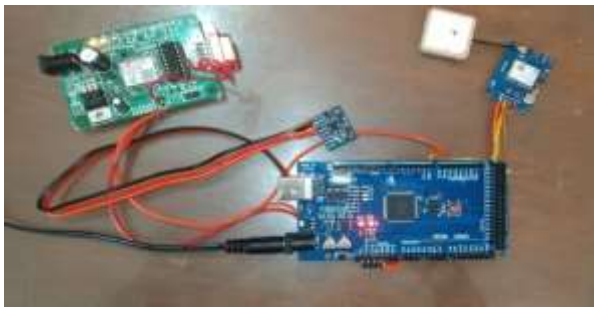

Fig 4.2 components of Proposed System

4.3 Gyro and Accelerometer

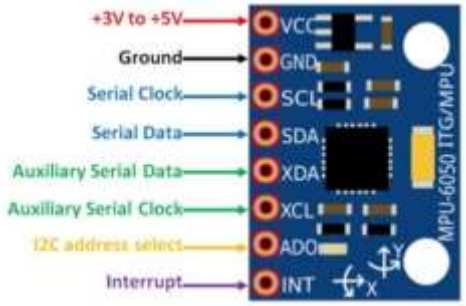

Fig 4.3 MPU6050 Pinout

A gyro sensor, angular rate sensor or angular velocity sensor is a device that can sense angular velocity. Gyro sensors can sense rotational motion and changes in orientation and therefore augment motion. This motion produces a potential difference from which angular velocity is sensed. The angular velocity is converted into an electrical signal output. It is used to sense the amount of angular velocity produced, which is the motion itself. It is also to sense the angular velocity produced by the movement of the sensor itself. Angles are detected by a CPU. Thus, the moved angle is fed to and reflected in an application. Examples are car navigation systems, video game controllers and mobile phones.

3-axis angular rate sensor able to provide unprecedented stability at zero rate level and sensitivity over temperature and time. It includes a sensing element and an IC interface capable of providing the measured angular rate to the external world through a standard SPI digital interface. An I2Ccompatible interface is also available. The sensing element is manufactured using a dedicated micro-machining process developed by STMicroelectronics to produce inertial sensors and actuators on silicon wafers.

The IC interface is manufactured using a CMOS process that allows a high level of integration to design a dedicated circuit which is trimmed to better match the sensing element characteristics.

The gyro sensor has a full scale of ±245 dps and is capable of measuring rates with a user- selectable bandwidth. The gyro sensor is available in a plastic land grid array (LGA) package and can operate within a temperature range of -40 °C to +85 °C.

4.4 GSM SIM800C

Fig 4.4 SIM800C GSM module

GSM (Global System for Mobile Communications, is a standard set developed by the European Telecommunications Standards Institute ETSI to describe protocols for second generation 2G digital cellular networks used by mobile phones. General packet radio service GPRS is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications GSM where protocols means set of invisible computer rules that govern how an internet document gets transmitted to your screen and 2G is short for second-generation wireless telephone technology and provides advantages like to provide the services such as text messages, picture messages and MMS multimedia messages. In simple language, GSM is primarily used to carry your voice on cell phone networks that uses that type of technology.

4.5 NEO-6M GPS

Fig 4.5 NEO-6M GPS

Global Positioning System was developed by the United States' Department of Defence. It uses between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current location, time and velocity. The GPS satellites are maintained by the United States Air Force.

NEO-6M GPS module, a very popular, cost effective, high-performance GPS module with a ceramic patch antenna, an on board memory chip shown in figure 5.6 and a backup battery that can be conveniently integrated with a broad range of microcontrollers.

4.6 Working

The system is a microcontroller based which is interfaced with the MPU6050 sensor consisting of accelerometer and gyroscope

along with Global System for Mobile Communication (GSM) and Global Positioning System (GPS). The key component behind detecting the collisions is the accelerometer and gyroscope. Thus, the values combined from accelerometer, gyroscope and speed sensor provides an efficient way of determining the occurrence of accident instead of using a single sensor. The different phases of the proposed system with manifestation on data acquisition and filtration.

4.7 Software

The Arduino ATmega 2560 Microcontroller is programmed using Arduino Integrated Development Environment. The Embedded C is used as Programming language. The Microcontroller is programmed using Arduino IDE

5. CONCLUSION AND RESULT

The hardware of advanced bike safety and security was implemented successfully. In accident detection mode MPU6050 gyro, accelerometer sensor and speed sensor which measures the abnormal values of both bike's lean angle and speed value of the bike. It sends the exact accident location acquired from the GPS to the emergency contacts through GSM module. In finding location mode the user can send a message request to know the current location of the vehicle.

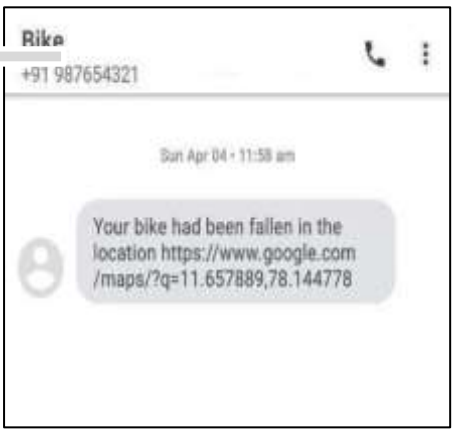

Fig 5.1 Emergency Message

If the bike has fallen down, It sends the exact accident location or bike fallen location acquired from the GPS to the owner through GSM module. If the owner responds by sending a "SAFE" message or pressing the reset button, further message will not be sent to the emergency contact. If he fails an additional message would have been sent to the emergency contact with the accident location as shown in figure 5.1.

Fig 5.2 Location Message

If the bike had been theft, or the owner of the bike wants to know the location, the owner has to request in by sending a request message "Location". The GSM module in the bike sends the exact location of the bike acquired from the GPS to the requested number through GSM module as shown in Fig 5.2.

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