ISSN (O) 2321-2004, ISSN (P) 2321-5526

IJIREEICE

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Vol. 9, Issue 12, December 2021

DOI: 10.17148/IJIREEICE.2021.91212

Smart Driving System using Alcohol Sensor

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Abstract: The advancement of the new technologies in the field of automotive electronics has brought abundant changes in day to day life of every human being. The driver assistance system are meant to support driver with driving process in order to avoid accidents which enable various users to be better informed and makes safer, more coordinated and smarter use of transport network. The current work says about one such system which uses Alcohol Sensor, Bio-Metric Sensor, and GPS module driving by various applications.

Keywords: Alcohol Sensor, Bio-Metric Sensor and GPS module, Arduino Pro Mini

I. INTRODUCTION

Road accidents have become more common in nowadays. The reasons for this are the extreme road traffic and the relatively greater freedom given to the drivers for movement. Road accidents are an outcome of the interplay of various factors, some of which are the length of road network, vehicle population, alcohol consumption, human population and adherence/enforcement of road safety regulations etc. Road accident causes injuries, fatalities, disabilities and hospitalization with severe socio economic costs across the country. Consequently, road safety has become an issue of concern both at national and international level.

Accidents and deaths caused due to "Intake of alcohol/drugs" within the category of drivers fault accounted for 4.2 per cent (16,298 out of 3, 86,481 accidents) and 6.4 per cent (6,755 out of 1,06,021 deaths) respectively. However, taking into account the total road accidents and total road accident killings, the share of intake of alcohol/drugs comes to 3.3 per cent (16,298 out of 5, 01,423 accidents) and 4.6 per cent (6,755 out of 1, 46,133 deaths) respectively.

1.1 Objective:

The Prevention of road accidents is a very important aspect and is being ensured by strict laws, by technical and police controls, on-going training for drivers and, if needed by imposing legal and administrative penalties for those responsible.

To prevent issues like drunk driving, unaware of the usual crowded areas like school, market, hospitals and other public places, we in our project have come up with a system that takes account of these things and slows down the vehicle.

The aim of our project is to build a secured and reliable system for identification of information provided by GPS data of specialised places like Schools, Hospitals and other crowded areas like market etc. to prevent over speeding and reckless driving by the driver.

Drunk driving has become another issue for accidents. Alcohol detector in the vehicles is implemented for safety of people sitting inside the vehicles.

1.2 Methodology:

The main aim of our system is to take coordinates from the GPS module compare it with the stored data and then control the motor to control acceleration of the device.

1.3 Alcohol Detection and Control of Ignition:

Once the Vehicle is turned on the Arduino Pro-Mini Checks for the content of Alcohol (say) using Breath for a particular threshold range using an MQ3 sensor. It also consists of two amplifiers and a potentiometer. Out of two one acts as a comparator and other as buffer with unity gain. The potentiometer is used to set the concentration consumed by the driver. This value is fed to voltage divider circuit which in turn on crossing the threshold drives the relay off connected to pin 6 of Pro-Mini and hence the ignition is stopped.

1.4 GPS Based Control Mechanism:

The U-Blox Neo6m GPS module is used to receive GPS coordinates from satellite. The GPS coordinates of places like school, hospitals, market etc. where the vehicle should not cross a particular speed limit is stored in Microcontroller (Arduino Pro-Mini 328) connected to pin 2 and 3. The Arduino checks for the GPS Coordinates continuously and once

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Electrical, Electronics, Instrumentation and Control Engineering

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the vehicle goes in the specified range the speed of the vehicle is controlled by driving a DC gear motor of 100 RPM connected via L293D IC to pins 7 and 8 of Arduino to limit acceleration.

1.5 Bio Metric

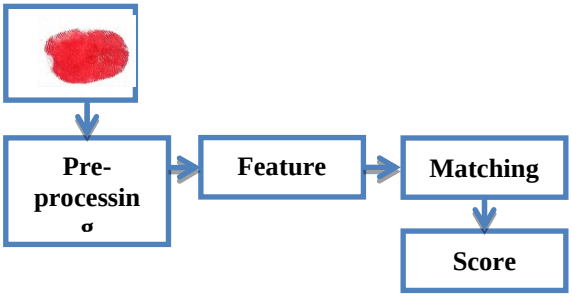

Fig 1.1 Block diagram of fingerprint enrol & scanning process

The main modules of fingerprint verification systems are:

- Fingerprint sensing: In which the fingerprint of an individual is acquired by a fingerprint scanner to produce a raw digital representation
- Preprocessing: In which the input fingerprint is enhanced and adapted to simplify the task of feature extraction.
- Feature extraction: In which the fingerprint is further processed to generate discriminative properties, also called feature vectors and
- Matching: In which the feature vector of the input fingerprint is compared against one or more existing templates. The templates of approved users of the biometric system, also called clients, are usually stored in a database. Clients can claim an identity and their fingerprints can be checked against stored fingerprints.

II. SYSTEM DESIGN

The main objective of the present work is to avoid accidents and prevent the driver to vehicle after consumption of alcohol. The Fig. 1.2 shows the block diagram of proposed project. The block diagram mainly consists of 3 parts they are: i. Alcohol Sensor ii. Bio-Metric Sensor iii. GPS module. To interface all these main parts we use Arduino pro-mini kit.

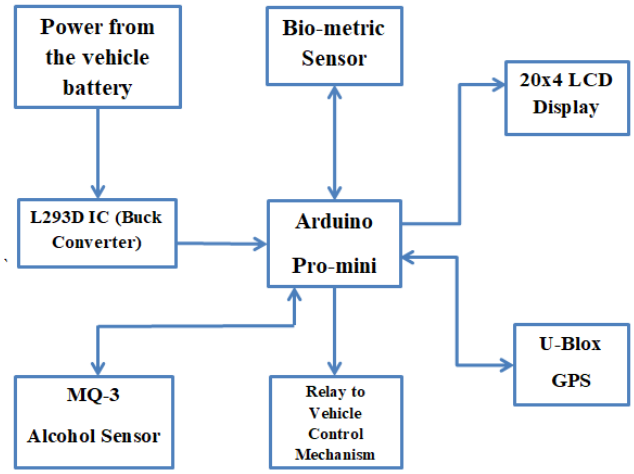

Fig 2.1 Block diagram for the proposed work.

Firstly, the Arduino pro-mini kit is powered by the vehicle battery. Then, the LCD display asks us to scan the finger print on to the bio-metric sensor, we need to scan our registered finger print on the bio-metric sensor by which we access or ignite the engine. Then the LCD displays the note: "Checking the alcohol content", then the MQ-3 alcohol sensor senses the alcohol content, if there is no alcohol content then we can ignite the vehicle without any objection and drive safely, if the alcohol content is present then the ignition gets locked. Thus we need to scan the registered finger on to the bio-metric sensor to unlock the ignition.

Secondly, to limit the speed at densely populated areas like school, hospital, colleges etc, where the speed needs to be in a particular limit, we use GPS sensor to locate the particular places and automatically slow down the vehicle to predefined value. We use specially designed mechanism to limit the speed to pre-set value.

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So by this we avoid drunken drive and also we limit the speed of the vehicle to a particular limit, which helps in avoiding the accidents and have a safe and sound travel.

III. HARDWARE DESCRIPTION

3.1 Arduino Pro Mini

The Arduino Pro Mini board (fig: 3.1) was developed for applications and installations where space is premium and projects are made as permanent set ups. Small, available in 3.3 V and 5 V versions, the board is powered by ATmega328

Fig 3.1 Arduino Pro Mini

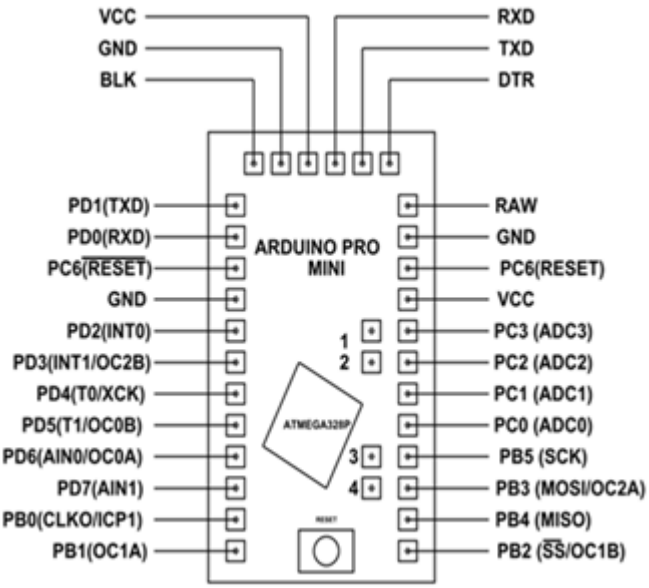

Fig 3.2Arduino Pro-mini Pin Description

Arduino Pro Mini is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable or Spark fun breakout board to provide USB power and communication to the board. The Arduino Pro Mini is intended for semi-permanent installation in objects or exhibitions. The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires. The pin layout is compatible with the Arduino Mini. There are two version of the Pro Mini. One runs at 3.3V and 8 MHz, the other at 5V and 16 MHz's. We use the 3.3 V at 8 MHz range. Technical specifications of Arduino pro mini is given in table no.2

Microcontroller	Atmega328p – 8 BIT AVR controller
Operating Voltage	5V and 3.3V

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Raw Voltage input	5V to 12V
Maximum current through each I/O pin	40Ma
Maximum total current drawn from chip	200mA
Flash Memory	32Kbytes
EEPROM	1Kbyte
Internal RAM	2Kbytes
Clock Frequency	3.3V --- 8Mhz, 5V --- 16Mhz
Operating Temperature	-40ºC to +105ºC

Table1: Technical Specifications of Arduino Pro Mini

3.2 Alcohol Sensor (MQ-3)

The MQ3 gas sensor (fig 3.3) is alcohol sensor which is used to detect the alcohol concentration on your breath. This sensor provides an analog resistive output based on alcohol concentration. When the alcohol gas exist, the sensor's conductivity gets higher along with the gas concentration rising. It is suitable for various applications of detecting alcohol at different concentration. It is widely used in domestic alcohol gas alarm, industrial alcohol gas alarm and portable alcohol detecter.

Fig 3.3Practical MQ3 Sensor

Features of MQ3 Sensor

•High sensitivity to alcohol and small sensitivity to Benzene.
•Fast response and High sensitivity.
• Stable and long life.
•Simple drive circuit.
•Portable alcohol detector.

Technical Data of MQ3 Sensor

•Concentration: 0.05 mg/L ~ 10 mg/L Alcohol
• OperatingVoltage: 5V
•Current Consumption: 150 mA
•Operation Temperature: -10 to 70 Centigrade

3.3Fingerprint based biometric authentication:

An accurate personal identification has become very essential in today's world. With the rapid changes in electronics and information technology, people are becoming connected with the electronic devices in the automatic modern universe. As an output, the ability to achieve highly precise, automatic and reliable personal identification has become more tough and demanding. A broad variety of systems needs a reliable personal authentication scheme to either confirm or discover the identity of individuals requesting their services.

The motive of such scheme is to ensure the rendered services are acquired by a legal user and not another user. Examples of these systems comprise computer laps, mobile phones.

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Fig 3.4 Bio-metric Module

The advantages of this conventional personal identification are,
i) They are very straightforward
ii) They are also easily combined with different systems with a cheap cost.
However, in this point of view are not based on any a single personal identification that causes a number of snags like tokens are lost and it is stolen or unremembered. So, they are unable to satisfy the authentic and optimal security need to our electronically interconnected information body. The disclosure of biometric sensors with the real algorithm has addressed the problems that invasion conventional verification. Fingerprint enrolment and authentication process is shown in Fig 3.4.

3.4 U-Blox Neo-6 GPS Module

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. The 50- channel u-blox 6 positioning engine boasts a Time-To-First-Fix (TTFF) of under 1 second. The dedicated acquisition engine, with 2 million correlators, is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses jamming sources and mitigates multipath effects, giving NEO-6 GPS receivers excellent navigation performance even in the most challenging environment.

Fig 3.5 U-Blox Neo-6 GPS Module

3.5 L293D IC (Buck Converter):

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.
L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.
Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

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And other components required for the hardware design include LCD Display, Limit switch and DC motor.

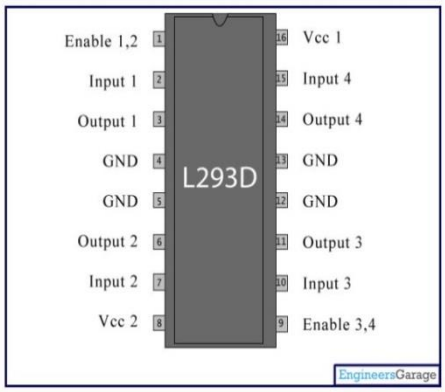

Fig 3.6 L293D Pin Diagram

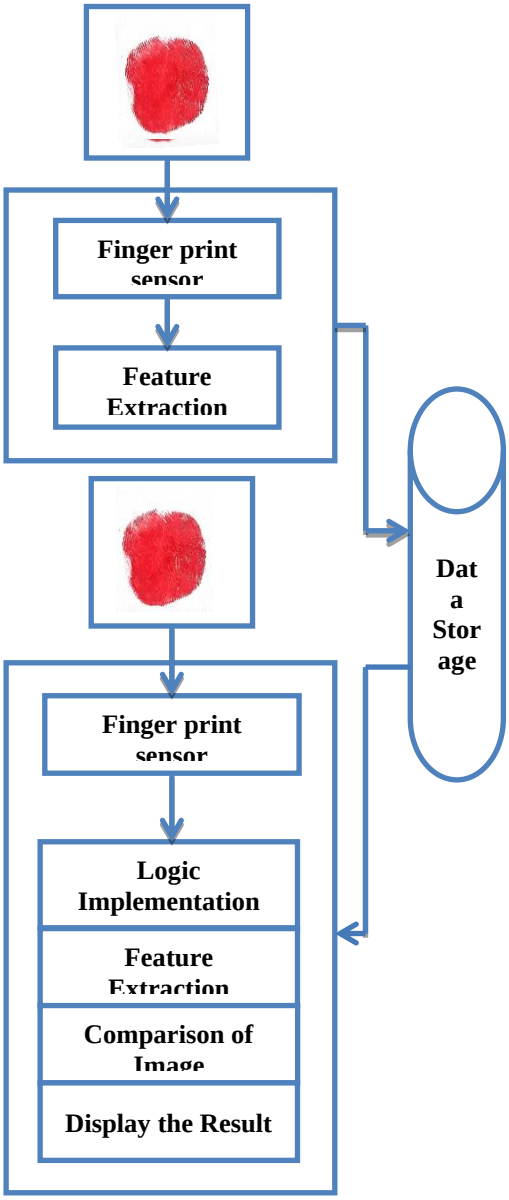

Fig 3.7 Fingerprint enrollment and authentication process

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3.6 Flowchart for execution of proposed work

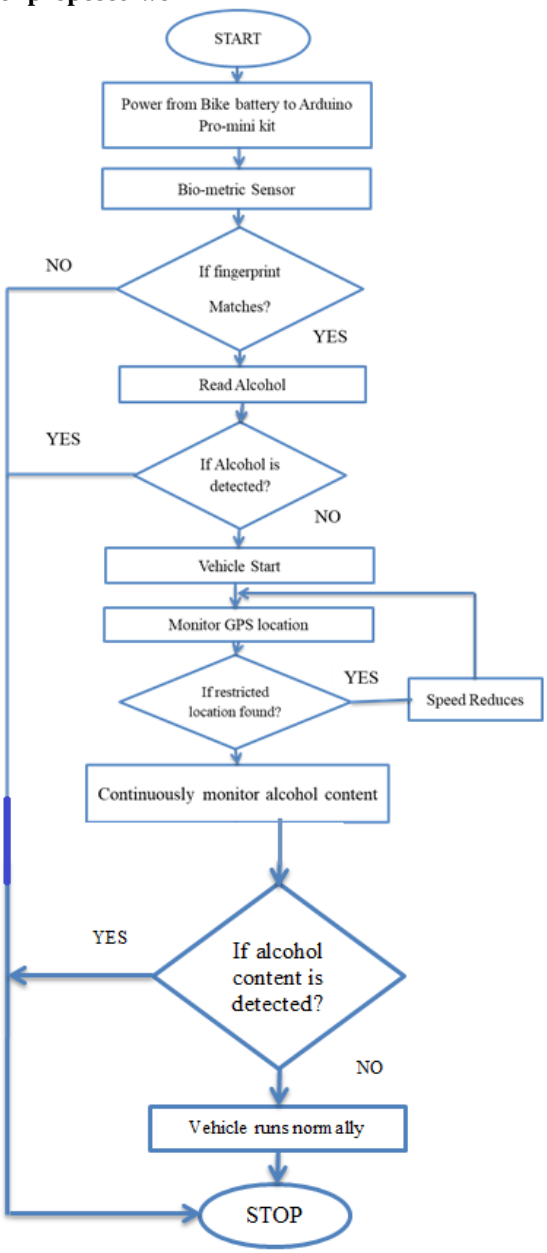

Fig3.8Flowchart of Complete Process

Once the Vehicle is turned on the Arduino Pro-Mini Checks for the content of Alcohol (say) using breath for a particular threshold range using an MQ3 sensor. This value is fed to voltage divider circuit which in turn on crossing the threshold drives the relay off connected to pin 6 of Pro-Mini and hence the ignition is stopped. A broad variety of systems needs a reliable personal authentication scheme to either confirm or discover the identity of individuals requesting their services. The motive of such scheme is to ensure the rendered services are acquired by a legal user and not another user. The U-Blox Neo-6 GPS module is used to receive GPS coordinates from satellite. The GPS coordinates of places like school, hospitals, market etc. where the vehicle should not cross a particular speed limit is stored in Microcontroller (Arduino Pro-Mini 328) connected to pin 2 and 3. The Arduino checks for the GPS Coordinates continuously and once the vehicle goes in the specified range the speed of the vehicle is controlled by driving a DC gear motor of 100 RPM connected via L293D IC to pins 7 and 8 of Arduino to limit acceleration.All three applications are installed to vehicle and tested for their operation; all the three applications were running successfully.

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IV. MECHANISM INVOLVED IN THE INSTALLATION OF SPEED GOVERNING SYSTEM

The main part in proposed work is the mechanism involved to control the Throttle of the vehicle. This is a mechanical part consisting of various components viz. Plates, Nut and Bolt, Rods and DC gear motor. The main function of this mechanism is to limit the speed of the vehicle by controlling the air-fuel supply. It does the required work effectively and it is very low on cost and can easily be made. The complete working of this mechanism is discussed.

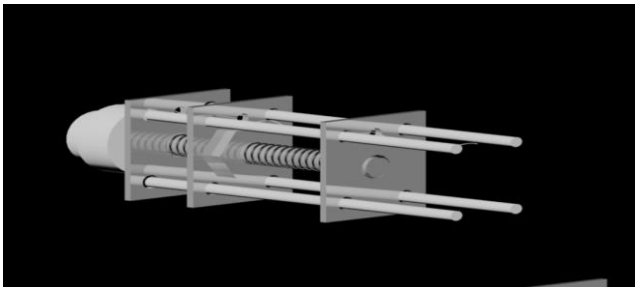

Fig 4.1 Mechanism of Speed Governing System

This mechanism (mechanical part) is the heart of this project. It has a DC motor coupled with a bolt as shown in the figure, so that the rotation of the motor causes the bolt to rotate. The mechanism has three plates one of which is mounted (fixed) on the threaded extension of the motor, the other plate (named as primary plate) has got hole at its centre big enough to avoid the contact with bolt, it has also got the nut coupled with its alignment at the centre, so that when the bolt rotates, the plate with the help of nut tends to gain linear motion if its rotary motion is constrained. Hence to constrain the rotary motion of primary plate, another similar plate is used and holes are drilled at the corners of all the plates, so that four steel rods are inserted in those holes to make the plates aligned and constrain the rotary motion of the primary plate. The reason for restricting the rotary motion of the primary plate will be discussed later. Another hole is drilled at the top of each plate for the passage of the accelerator wire.

Initially it was decided that a part of accelerator wire insulation will be cut off and a lock nut will be placed at one point on the wire and it will be treated as reference. When the accelerator is rotated at full throttle, the lock nut along with wire will move from point 1 to point 2. The primary plate will be at point 2. The movement of the lock nut in the wire will take place between these two points. When the signal is detected, the mechanism gets activated to restrict the accelerator to move up to particular point (point 2 shifted) at which the speed is considered maximum in that particular area. To restrict the motion of the accelerator wire, on signal detection the motor rotates along with the bolt and consequently leading to the movement of primary plate. The plate just does the work of shifting this point 2 such that the throttle cannot be opened fully and rather the plate will allow the wire to move only up to certain distance at which the maximum desired speed is met. This happens because the lock nut placed on the wire cannot pass through the hole and therefore it gets locked.

The idea stated above faced a serious issue of its robustness and to overcome this alternative design was opted. The alternative design has got an extra wire on the accelerator side (on one side of the mechanism) and the original accelerator wire on the other side. Both the wires are made to meet between the plates and are joined with the help of a lock nut. This joint of the wires will act as a lock nut itself as was in the previous ideology. The rest goes the same without compromising the stability and robustness of the mechanism.

Fig 4.2 Practical implementation of Speed Governing Mechanism on two wheeler vehicle

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V. RESULTS AND DISCUSSION

In the present work the MQ-3 alcohol sensor is used to detect alcohol content (of the rider one who is riding the two wheeler) and it is been implemented and tested successfully on the vehicle. A permanent marker is used for testing purpose during project demo and the alcohol content present in the marker was successfully detected by alcohol sensor and vehicle did not start as programmed. The test results are as follows.

If alcohol not detected	Vehicle starts
If alcohol detected	Vehicle does not start

Bio-metric module which is used to enrol & scan the fingerprint of the authorised person. This Bio-metric module helps to gain private access & provides complete security for the vehicle. Here in this project UG LAND INDIA R305 Optical fingerprint module is used as a bio-metric sensor which is used to gain access to ignition system of the vehicle and same is been implemented and tested on the vehicle. The Bio-metric sensor was working fine. The test results are as follows.

If Bio-metric is Authenticated	Vehicle starts
If Bio-metric is not Authenticated	Vehicle does not start

GPS sensor is used to track the GPS co-ordinates according the speed restricted areas like school, college, etc. Here in this project U-blox Neo-6 GPS module is used to track the longitude and latitude co-ordinates. As per the program data vehicle automatically limits the speed to set value (say 20kmph) in the speed restricted areas. The U-blox Neo-6 GPS module is been successfully implemented and tested on the vehicle. The test results are as follows.

If Vehicle enters into Pre-set GPS Co-ordinates as per program	Vehicle speed will be reduced to pre-set value (say 20kmph)
If Vehicle is out of Pre-set GPS Co-ordinates as per program	No restriction for speed control of vehicle, Vehicle runs normally

All three applications are installed together on a two wheeler and tested for their operation; all the three applications were running successfully.

VI. CONCLUSION

The three features have been addressed in this project. The major reason for accidents is drunk and drive, which can be prevented by using alcohol detectors. In this project MQ-3 alcohol sensor has been used for detecting the alcohol content from the rider(one who is riding the two wheeler) and the same is installed and tested successfully on the vehicle, which helps to provide safety to the rider as well as vehicle. The security of the vehicle in public places is another major concern; Security can be provided by using bio-metric sensor for authentic usage of the vehicle. In this project UG LAND INDIA R305 Optical fingerprint module has been used. The same has been installed and tested on the vehicle successfully. Reckless driving in crowded areas like Schools, Hospitals, Courts etc., can be prevented by limiting the speed of the vehicle automatically by different means. In this project U-blox Neo-6 GPS module for automatic speed governing has been used and the same is been installed and tested on the vehicle by setting the GPS co-ordinates of restricted areas of the city. All the above mentioned features have been programmed in Arduino pro-mini kit using Arduino IDE software, which controls all the features (parameters like sensing alcohol content, scanning fingerprint image and sensing GPS co-ordinates). All the three features of the project have been installed together and tested on the vehicle and they were working successfully.

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ISSN (O) 2321-2004, ISSN (P) 2321-5526

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