TRIBHUWAN UNIVERSITY

INSTITUTE OF ENGINEERING

THAPATHALI CAMPUS

A Minor Project Report

On

Alcohol Detector with Vehicle Controlling and GPS Detection

Submitted By:

Dipesh Lamichhane (31265)

Prabin K. Shrestha (31271)

Shishir Pantha (31283)

Shreekar Tiwari (31284)

Submitted To:

DEPARTMENT OF ELECTRONICS AND COMPUTER ENGINEERING

THAPATHALI CAMPUS

KATHMANDU, NEPAL

November, 2018

TRIBHUWAN UNIVERSITY

INSTITUTE OF ENGINEERING

THAPATHALI CAMPUS

A Minor Project Report

On

Alcohol Detector with Vehicle Controlling and GPS Detection

Submitted By:

Dipesh Lamichhane (31265)

Prabin K. Shrestha (31271)

Shishir Pantha (31283)

Shreekar Tiwari (31284)

Submitted To:

Department of Electronics and Computer Engineering
Thapathali Campus
Kathmandu, Nepal

In partial fulfillment for the award of the Bachelor's Degree in Electronics and Communication Engineering.

Under the Supervision of

Umesh Kant Ghimire

November, 2018

DECLARATION

We hereby declare that the report of the project entitled **"Alcohol Detector with Vehicle Controlling and GPS Detection"** which is being submitted to the **Department of Electronics and Computer Engineering, IOE, Thapathali Campus**, in the partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in **Electronics and Communication Engineering**, is a bonafide report of the work carried out by us. The materials contained in this report have not been submitted to any University or Institution for the award of any degree and we are the only author of this complete work and no sources other than the listed here have been used in this work.

Dipesh Lamichhane (072/BEX/318) _____

Prabin K. Shrestha (072.BEX/326) _____

Shishir Pantha (072/BEX/339) _____

Shreekar Tiwari (072/BEX/340) _____

Date: November, 2018

CERTIFICATE OF APPROVAL

The undersigned certify that they have read and recommended to the **Department of Electronics and Computer Engineering, IOE, Thapathali Campus**, a minor project work entitled "**Alcohol Detector with Vehicle Controlling and GPS Detection**" submitted by **Dipesh Lamichhane, Prabin K. Shrestha, Shishir Pantha** and **Shreekar Tiwari** in partial fulfillment for the award of Bachelor's Degree in Electronics and Communication Engineering. The Project was carried out under special supervision and within the time frame prescribed by the syllabus.

We found the students to be hardworking, skilled and ready to undertake any related work to their field of study and hence we recommend the award of partial fulfillment of Bachelor's degree of Electronics and Communication Engineering.

_____

Project Supervisor

Umesh Kant Ghimire

Department of Electronics and Computer Engineering, Thapathali Campus

_____

External Examiner

Department of Electronics and Computer Engineering, Pulchowk Campus

_____

Project Coordinator

Saroj Shakya

Department of Electronics and Computer Engineering, Thapathali Campus

_____

Er. Kiran Chandra Dahal

Head of the Department,

Department of Electronics and Computer Engineering, Thapathali Campus

November, 2018

COPYRIGHT

ACKNOWLEDGEMENT

It is a pleasure to remind the fine people in the Department of Electronics and Computer Engineering of Thapathali Campus, IOE for their sincere guidance that we students received to perform our projects successfully. First, we would like to thank the Head of our Department for providing this platform to explore our knowledge and skills practically and providing us with necessary help and support.

Second, we would like to thank our project coordinator for providing us with various ideas and enhancements possible for uplifting of the project. Thirdly, we would like to thank our teachers for providing their knowledge and expertise on our project and helping us with feasibility study.

Similarly, we would like to express our gratitude towards our seniors who restlessly helped us upon our call regarding project aids and tips. We would also like to thank the Department of Electronics and Computer for providing us necessary study materials, technical support and financial support.

Special thanks also goes to all the colleagues, who have been assisting in the project directly as well as indirectly by reviewing and suggesting the improvements. Lastly, we would like to thank our family members for supporting us to make this project successful.

Dipesh Lamichhane (072/BEX/318)

Prabin Kumar Shrestha (072/BEX/326)

Shishir Pantha (072/BEX/339)

Shreekar Tiwari (072/BEX/340)

ABSTRACT

Drunk driving is one of the most prominent causes of road accidents. The number, though greatly reduced over the years due to tireless effort of the government, has not gone down to zero. Despite traffic police centered at various check points solely for testing Breath Alcohol Content (BrAC) of the drivers, the number of drunk driving cases still persist to an extent that the government cannot afford to consider it a solved problem. Hence, we propose to build an alcohol sensor that can help reduce the number of cases of drunk driving.

In this project, we propose to prepare a device that does not allow the driver to start engine of the vehicle if s/he is not found "sober" enough. Also, the device sends co-ordinates to the concerned authorities/people along with a message. We expect the device can successfully reduce the road accidents caused due to drunk driving.

TABLE OF CONTENTS

DECLARATION ..... **i**

CERTIFICATE OF APPROVAL ..... **ii**

COPYRIGHT ..... **iii**

ACKNOWLEDGEMENT ..... **iv**

ABSTRACT ..... **v**

List of Figures ..... **viii**

List of Abbreviations ..... **ix**

1. INTRODUCTION **1**

1.1 Background Introduction 1

1.2 Motivation 1

1.3 Problem Definition 2

1.4 Objective 3

1.5 Scope and Applications 3

1.6 Report Organization 3

2. LITERATURE REVIEW **5**

2.1 Gas Sensor 5

2.2 Alcohol Sensor 5

2.3 Common Sources of Error 6

2.4 Minimizing the Errors 6

3. REQUIREMENT ANALYSIS **7**

3.1 Hardware Requirements 7

3.2 Software Requirements 7

3.3 Feasibility Study 7

4. SYSTEM ARCHITECTURE AND METHODOLOGY **8**

4.1 System Block Diagram 8

4.1.1 Actuation of Detector 8

4.1.2 SMS Delivery 9
4.2 Data Flow Diagram 9
5. IMPLEMENTATION DETAILS 10
5.1 Hardware Components 10
5.1.1 AVR ATMEGA32 Microcontroller 10
5.1.2 MQ-3 Alcohol Sensor 11
5.1.3 16x2 LCD Display 11
5.1.4 Neo-6m GPS Module 12
5.1.5 SIM800A GSM Module 12
5.1.6 L293D Motor Driver IC/L293D Motor Driver Module 13
5.1.7 7805 IC 13
5.2 Implementation 14
6. RESULTS AND ANALYSIS 15
7. CONCLUSION AND FUTURE ENHANCEMENTS 16
7.1 Conclusion 16
7.2 Limitations 16
7.3 Future Enhancements 16
8. APPENDICES 17
Appendix A: Circuit Diagram 17
REFERENCES 18

List of Figures

Figure 1: System Block Diagram....8

Figure 2: Data Flow Diagram....9

Figure 3: ATMEGA32 Pin Configuration....10

Figure 4: MQ-3 Gas Sensor....11

Figure 5: 16x2 LCD Display....11

Figure 6: Neo-6m GPS Module....12

Figure 7: L293D Pin Configuration....13

Figure 8: 7805 Pin Out Diagram....13

Figure 9: Breadboard placement in prototype....15

Figure 10: Circuit Diagram....17

List of Abbreviations

AC	Alternating Current
ADC	Analog to Digital Converter
ASF	Atmel Software Framework
BAC	Blood Alcohol Content
BrAC	Breath Alcohol Content
CMOS	Complementary Metal Oxide Semiconductor
DC	Digital Current
EEPROM	Electrically Erasable Programmable Read Only Memory
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile
I2C	Inter-IC
IDE	Integrated Development Environment
IR	Infrared
LCD	Liquid Crystal Display
MCU	Micro Controller Unit
MIPS	Million Instructions per Second
RISC	Reduced Instruction Set Computing
SMT	Surface Mount Technology
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
TTL	Transistor-Transistor Logic
USART	Universal Synchronous/Asynchronous Receiver/Transmitter

1. INTRODUCTION

1.1 Background Introduction

Drunk driving continues to be a serious road safety problem. People break the rules and feel excited to drink and drive although driving under the influence of the alcohol has been illegalized in almost every country. Lots of news about accidents because of drunk driving are reported almost every day. Consumption of alcohol causes drivers to drive recklessly causing many accidental deaths on the roads. Drunk driving is a major reason of accidents in most countries in the world. Keeping this in mind a system needed to be designed which fails the attempt of the drunken driver to initiate the engine thus, preventing any risk of accidents. The main intention of this system is to avoid the accidents which normally happen due to the drunkenness of driver. This system detects the drunkenness of a driver and prevents them from driving, thus providing a type of security or safety mechanism to driver and save lives. The system designed can be used as a breath analyzer as well as to sense the alcohol molecules in the range.

The system that we implement aims at reducing the road accidents due to drunk driving. The system detects the presence of alcohol in the vehicle and immediately locks the engine of the vehicle. At the same time an SMS along with the location of the vehicle is send to a pre-selected contact. Hence the system reduces the quantum of road accidents and fatalities due to drunk driving in the future.

1.2 Motivation

Every day traffic police are stationed at various points in the streets of Kathmandu Valley to check the BrAC of a driver. However, there are plenty of cases where the drivers manage to find “escape routes” to get away from the impending fines and punishment. Also, there are reported cases of bribery every now and then and some drunk drivers even brawling with the policemen, the current method of reducing drunk driving is both unreliable and dangerous. Hence, we proposed to devise an in-built mechanism that takes care of all the “loop-holes” of the previous methodology.

Also, with road accidents prevalent in the country due to various reasons, the mechanism can be altered to reduce the accidents that can be caused due to various reasons. It can also be modified to protect a vehicle from burglary.

There may be various altercations to the mechanism we have deployed in this project, but the main motive is always to prevent road accidents.

1.3 Problem Definition

Alcoholic beverages are enjoyed all over the world. Although controlled consumption may do no harm as is made out, any amount of intake while driving could lead to varying extents of road accidents which may even be fatal. Drinking and driving is one of the main causes of road crashes worldwide. In high-income countries about 20% of fatally injured drivers have excess alcohol in their blood, while in some low- and middle-income countries these figures may be up to 69%.

In Nepal, the situation is a bit better, but not well off. Of the 27000 road accidents that have taken place over the last 6 years, 962 have been attributed to drunk driving. Sure enough, the number does not sound alarmingly high, but the fact remains that despite the government's effort to bring the number of road accidents down to zero, the target has not been achieved. The numbers are not as per desired by the authorities because there are certain loop holes in the procedure of testing BrAC of the driver, which clearly signifies the need of an upgrade in the system.

The problem with current methods are:

- Traffic Police are placed in few "checkpoints" only, which happen to be around main streets. So, the drivers are presented with the opportunity to sneak through small streets where traffic police are not present.
- There have been few cases of bribing the Police Officers.
- There is no technology to track the vehicle in case the driver manages to escape from the police.

The proposed project can help reduce these problems considerably, as:

- When a driver enters his vehicle, the sensor in the vehicle will check his "sobriety", and if found drunk, the vehicle would not start.
- The tracking system enables us to track down the vehicle using GPS.
- The number of officers to be allocated for BrAC testing can be greatly reduced, which ca give provide with some economic reprieve, and at the same time, the problem of bribery can be nullified altogether.

1.4 Objective

To prepare an alcohol sensor that can reduce the number of road accidents due to drunk driving through the use of GSM and GPS.

1.5 Scope and Applications

- **Saves lives:** There are many accidents in which a driver loses his life under the influence of the alcohol. This project devises a system that prevents drunk driving from happening.
- **Reduces the number of accidents:** The aim of this system is to reduce the number of accidents which are basically due to alcohol consumption during driving.
- **Helpful for Police:** Every vehicle cannot be checked by police manually, thus the purposed system is helpful for checking of the drunk drivers.

1.6 Report Organization

This report consists of the detailed study, processes involved; project requirements, project architecture, problems faced, applied solutions and screenshots related to project completion. This report begins with the basic introductory section where we discuss about the background status and problems related in our research field. Then, the same introductory part covers the objectives of our project and its possible applications and scope in our society. The next section involves literature review that covers problem definition and current measures for overcoming them. We have also discussed the possible limitations of such steps taken in the same section as well as its status in the developed societies.

The following section then involves a brief overview on requirement analysis for the project where we have discussed about the various software and language frameworks involved in our project development process. The feasibility study carried out for this project is also covered up in the very section. The following section consisting of block diagrams and Dataflow diagrams discusses about the system architecture and processes involved in our prototype.

Then the report is focused towards the implementation details involving various unit processes involved in the system development. We discuss here about how each unit processes were accomplished stating the software, hardware and language used in the process. Moving towards the later part of the project, we have involved output and problem analysis. In this portion, we have discussed about the problems we faced before we actually ended up with final product. Then, in conclusion, the limitations of the system and possible enhancements for the project are covered up to conclude this report. The appendices involve the screenshots from our project development and output. The references section involves the sources from which we obtained materials for the completion of our work.

2. LITERATURE REVIEW

An alcohol sensor is basically a gas sensor, which is used to measure the amount of alcohol excreted through breath. If the content of alcohol exceeds the permissible level, the system gives off a signal, like buzzer or change in colour of the solution in which the breath is passed onto. Through the years, alcohol sensors have developed into one of the most important road safety tools and there are only a few things that can match the level of effectiveness of alcohol sensors in maintaining road safety today.

2.1 Gas Sensor

A gas sensor is a device that is used to measure the content of a specified gas in the air. While the first use of the gas sensor dates back to 1815, it wasn't until 1926 that the gas sensor first found its application in the current form when Dr. Oliver Johnson developed Catalytic Combustion Sensor for Standard Oil Company, California, to test the contents of the gases present in a sample. However, gas sensors were most popular for security purposes as they would ring alarm as soon as the contents of combustible gases would exceed the safety level. Today though, they have found their application in various sectors.

2.2 Alcohol Sensor

Alcohol Sensor is also a gas sensor and can detect alcohol content in the breath. Attempts to measure the alcohol contents in breath were made as far back as 1874 by Francis E. Antie and in 1927 William Duncly McNally invented a Breathalyzer in which a chemical solution would change colour if an alcoholic breath passed through it. In the same year, a man was first testified in a court in Marlborough, England to have been "50%" drunk when Dr. Gorsky, a police surgeon concluded that the bladder inflated with the person's breath was found to contain 1.5 ml ethanol. 1931 saw the use of Alcohol Sensors in road safety purposes, called Drunk-o-meter for the first time, when Rolla Neil Harger of Indiana University School of Medicine, devised a chemical sensor which contained acidified potassium permanganate, which upon being treated with alcoholic products would change colour. In 1954, Robert Frank Borkenstein used photochemical methods to detect alcohol, which gave the birth to the brand-name Breathalyzer. Since then, alcohol sensors have gone on to save millions of lives by signaling the authorities that the driver is drunk enough to risk an accident.

2.3 Common Sources of Error

- Most sensors use Silicon Oxide sensors which are prone to contamination and can lead to inaccurate results.
- Substances which are like alcohol in the molecular level as ethanal, may also give off the signal.
- Diabetic patients have hundred to thousand times more acetone level in their breath and the tests taken to such people can give misleading results
- Residual Mouth Alcohol can also give off inaccurate results
- Various interfering substances like Radio frequency interference can occur.

2.4 Minimizing the Errors

- Silicon Oxide diodes can be changed from time to time for accurate results.
- The results can be verified by checking BAC (Blood Alcohol Content) of a person.

3. REQUIREMENT ANALYSIS

3.1 Hardware Requirements

a. AVR Microcontroller (ATMEGA32)

b. 16x2 LCD Display

c. SIM800A GSM Module

d. Neo-6m GPS Module

e. Alcohol Sensor

f. L293D Motor Driver IC

g. 7805 IC

3.2 Software Requirements

a. WinAVR

3.3 Feasibility Study

We carried out the feasibility analysis of our project and found out that the total cost of the project was within the initial value of our approximation. While detecting alcohol in the driver's breath may have served the purpose of preventing road accidents, but going a step further to inform the owner about the whereabouts of the vehicle made this project a little costlier than what we projected at one stage during the course of our project. Since we opted to design a real model of the vehicle, we did not require the Proteus Software for the simulation purpose as well.

As for the complexity, despite a large number of jumper wires connecting as much as six different components, the overall design was not as complex as what may be perceived from the outset. The interfacing of the microcontroller and other components was more laborious than mentally challenging, as each component needed proper care and attention while connecting to other components. However, the lack of reliable devices made the project far more difficult than what should have been.

4. SYSTEM ARCHITECTURE AND METHODOLOGY

4.1 System Block Diagram

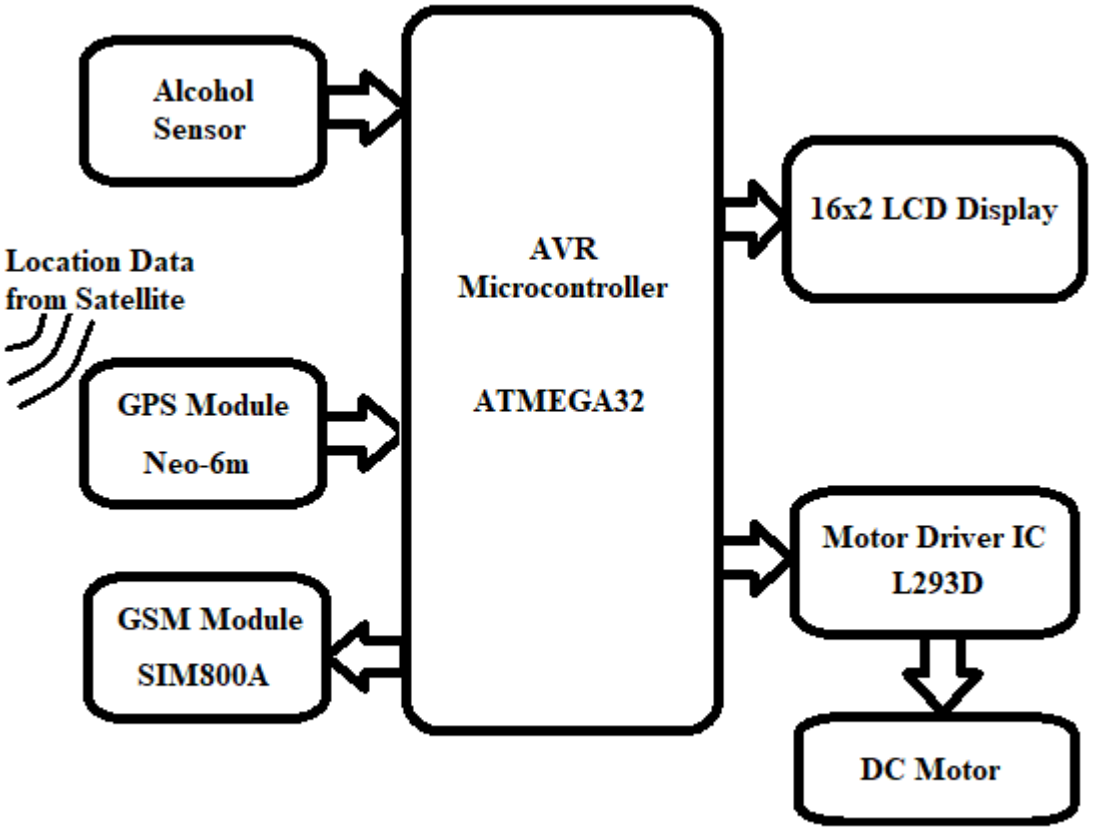


Figure 1: System Block Diagram

The basic functioning of the alcohol detector with Vehicle Controlling and GPS tracking can be described with:

4.1.1 Actuation of Detector

The detector is actuated on switching on the vehicle with the help of a push button. This would actuate the working circuit and make the entire unit in a vigilant mode. Alcohol detection is performed in real time by the alcohol sensor to the microcontroller. Thus there is never a situation when the system is in a shadow or a sleep state.

In the GPS based drunk and drive detection project, the system generates a figurative alarm once a level of alcohol is measured. At the same time engine locking is done with the help of the driver IC.

4.1.2 SMS Delivery

The microcontroller reads data from the GPS unit which gives the position of the vehicle and sends SMS to the hand held mobile phone with the help of GSM modem. User can click on the link in the received SMS to ensure easy location and possible further action.

4.2 Data Flow Diagram

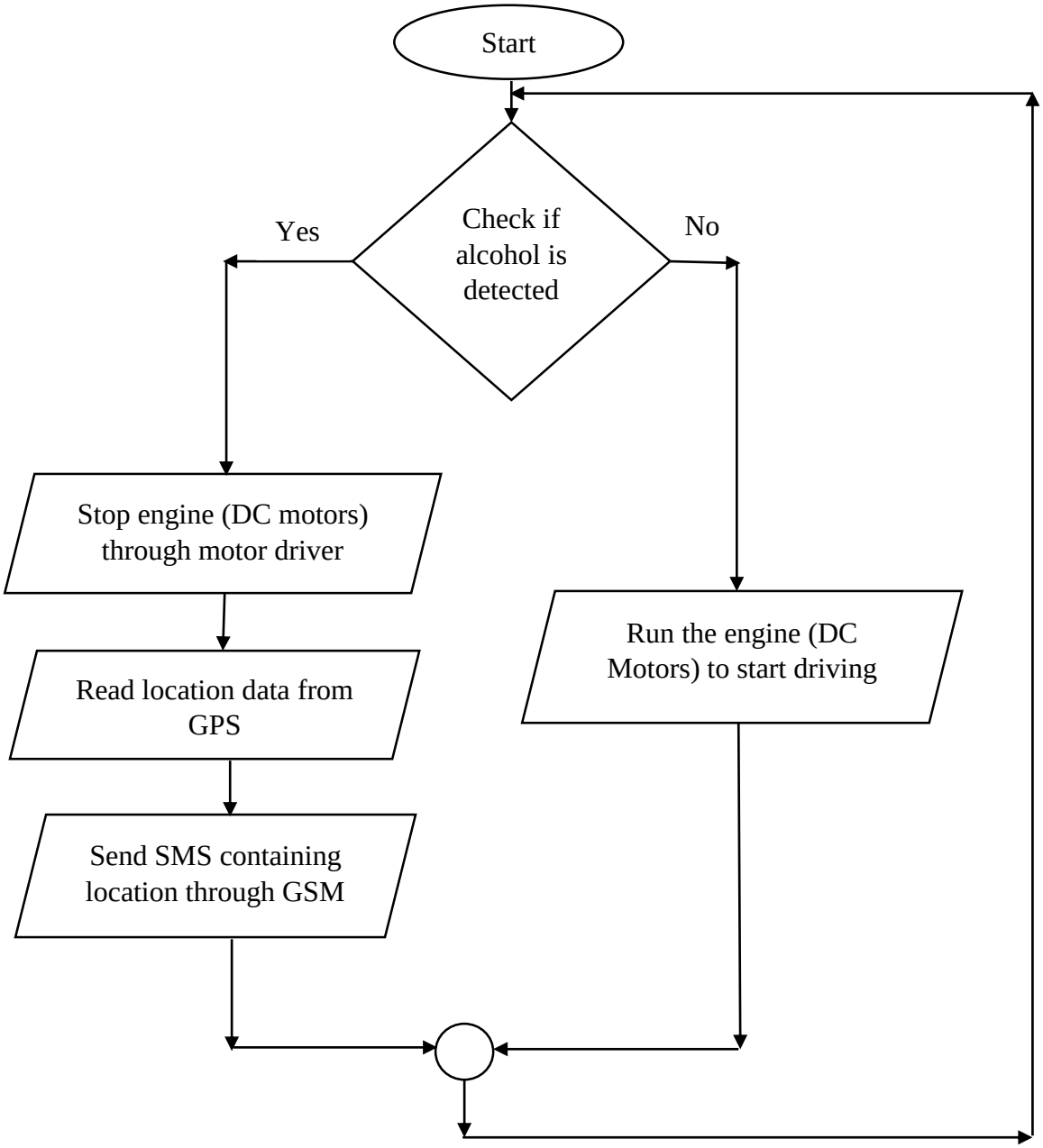


Figure 2: Data Flow Diagram

5. IMPLEMENTATION DETAILS

5.1 Hardware Components

5.1.1 AVR ATMEGA32 Microcontroller

ATmega32 is a high-performance low power microchip AVR RISC-based microcontroller. It combines 32KB ISP flash m0emory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 54/69 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for boundary-scan and on-chip debugging/programming, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a universal serial interface (USI) with start condition detector, an 8-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, SPI serial port, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

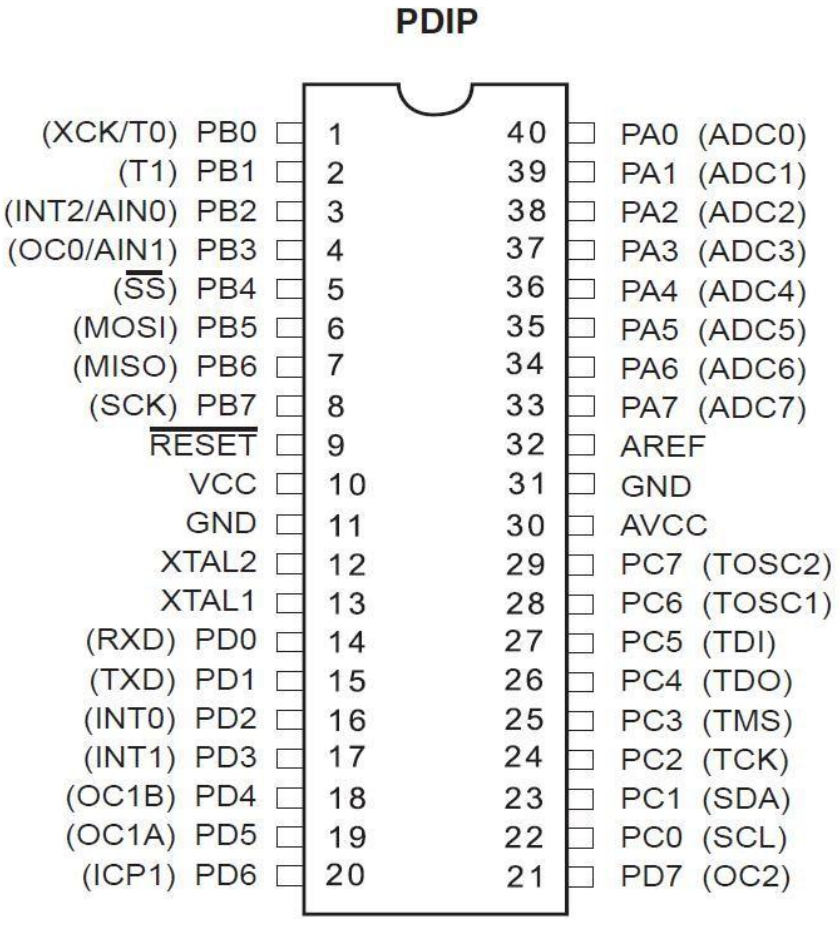


Figure 3: ATMEGA32 Pin Configuration

5.1.2 MQ-3 Alcohol Sensor

It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. Its conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs.

Figure 4: MQ-3 Gas Sensor

5.1.3 16x2 LCD Display

The LCD display is used to display two rows of characters and each row contain 16 characters. It is a high-speed I2C interface and including LCD with negative blue type is a white case with low background.

Figure 5: 16x2 LCD Display

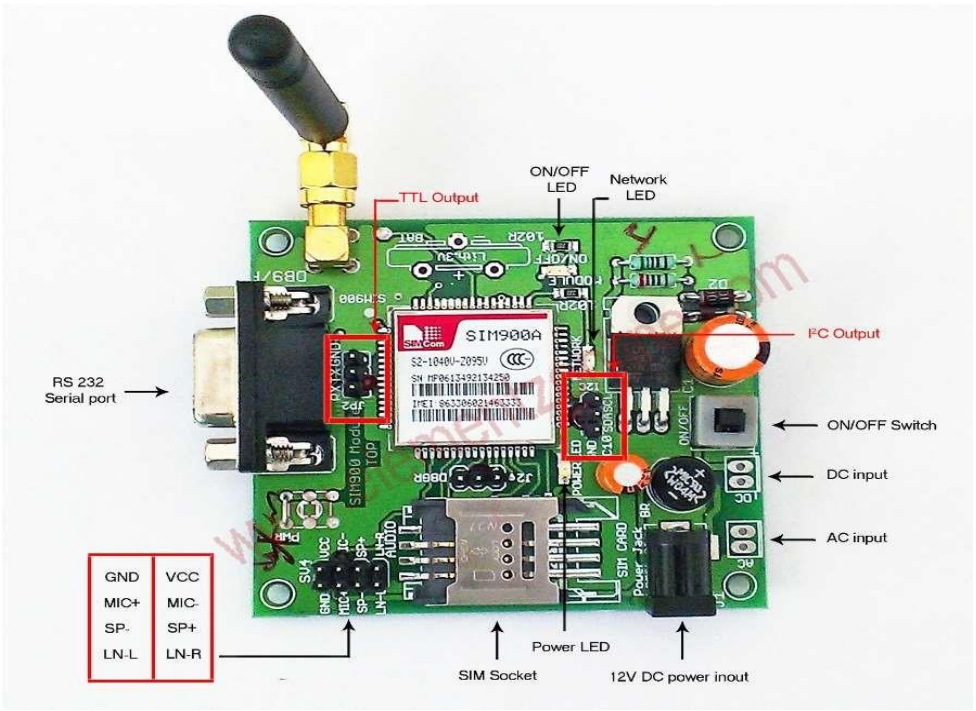
5.1.4 Neo-6m GPS Module

The Neo-6m GPS module has an external antenna and built-in EEPROM. It has an RS232 TTL interface. The power supply for this module may be 3V to 5V and default baud rate of 9600 bps. It works with standard NMEA sentences

Figure 6: Neo-6m GPS Module

5.1.5 SIM800A GSM Module

The SIM800A is a complete Dual-band GSM/GPRS solution in a SMT module. It features an Industry Standard Interface (ISI), the SIM800A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.



With a tiny configuration of 24mm x 24mm x 3 mm and weight of 3.4 g, SIM800A can fit almost all the space requirements in applications, especially for slim and compact demand of design working on supply voltage range of 5V. It has low power consumption of 1.5mA which is sleep mode and operation temperature of -40 0 C to +85 0 C.

5.1.6 L293D Motor Driver IC/L293D Motor Driver Module

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. In a single L293D chip there are two H-Bridge circuit inside the IC which can rotate two dc motor independently.

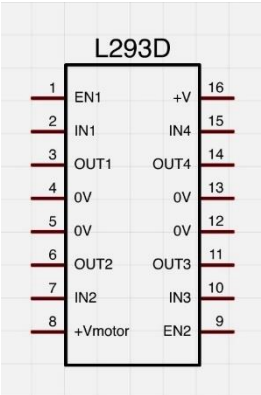


Figure 7: L293D Pin Configuration

5.1.7 7805 IC

A voltage regulator IC maintains the output voltage at a constant. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuation, is a popular voltage regulator integrated circuit. The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

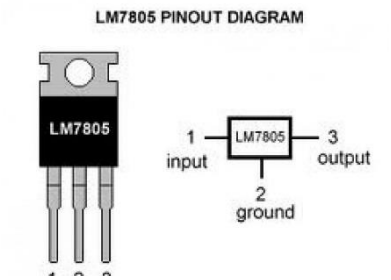


Figure 8: 7805 Pin Out Diagram

5.2 Implementation

The ATMEGA32 AVR microcontroller is programmed with the necessary details as per the requirement of the implementation. The 16x2 LCD is connected to port B of the microcontroller. The Neo-6m GPS module and the SIM800A GSM modules are connected to the Rx and Tx terminals of the ATMEGA32 microcontroller, to receive or send data as required. The L293D motor driver module is interfaced to Port A of the ATMEGA32 microcontroller to function as needed.

6. RESULTS AND ANALYSIS

After connecting the components and programming the microcontroller, the circuit system was supplied with 9V through battery. Initially, when no alcohol is detected by the alcohol sensor, the DC motor rotates, and thus, rotating the wheel of the vehicle model. As a deodorant product was sprayed onto the sensor, the vehicle came to rest instantly. A message was sent to a designated number, containing the information regarding the drunken state of the driver, along with a link containing the GPS location of the vehicle. The step by step progress of the overall process was also displayed on the LCD screen.

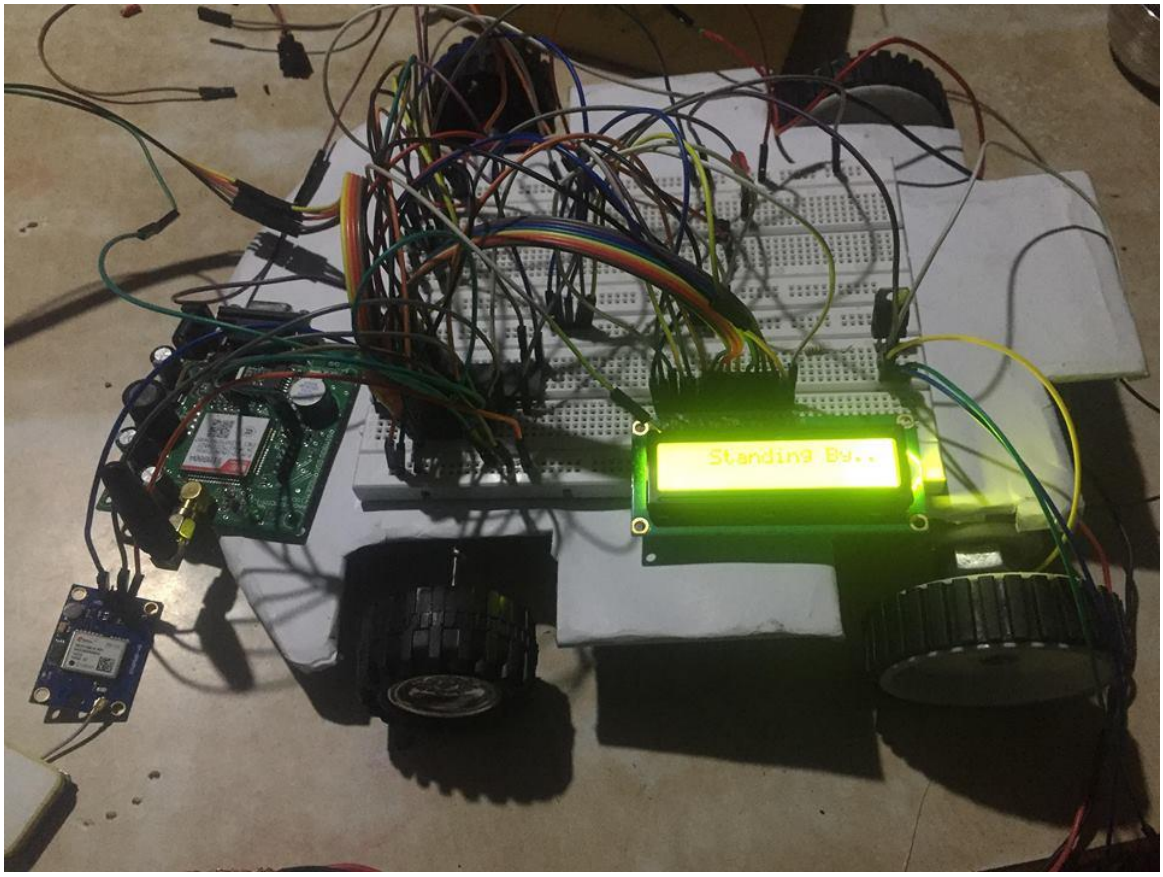


Figure 9: Breadboard placement in prototype

7. CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

The motor was turned off when the alcohol was detected, while at other times the motor was turned on. As all the results were concurred with the desired output, the project can thus be concluded to have been successfully accomplished.

7.2 Limitations

Despite the successful accomplishment of the project, we encountered some difficulties, which are enlisted as follows:

- The unreliability of the MQ3 alcohol sensor, which it is notorious for, hindered the progress of the project.
- The GPS device is difficult to work with, especially when inside a building.
- It also takes some time before the transmitting speed of the GPS matches to the speed of the processor.

7.3 Future Enhancements

The proposed device is simple in its prototype but the exciting in terms of prospect and possibilities. These can be listed as:

- The GPS technology embedded in the mechanism can help track a vehicle if it is stolen.
- Besides the sobriety of the driver, we can set various eligibility criteria for the engine of the vehicle to start. For example, if the vehicle exceeds a threshold value of weight, the engine will automatically turn off. This has the potential to prevent the highway accidents in Nepal that regularly take place due to the vehicles carrying more men than prescribed.
- We can also prevent burglary of the vehicle from unauthorized owner, if an owner recognizing device like voice recognizer, or eye scanner is used.

8. APPENDICES

Appendix A: Circuit Diagram

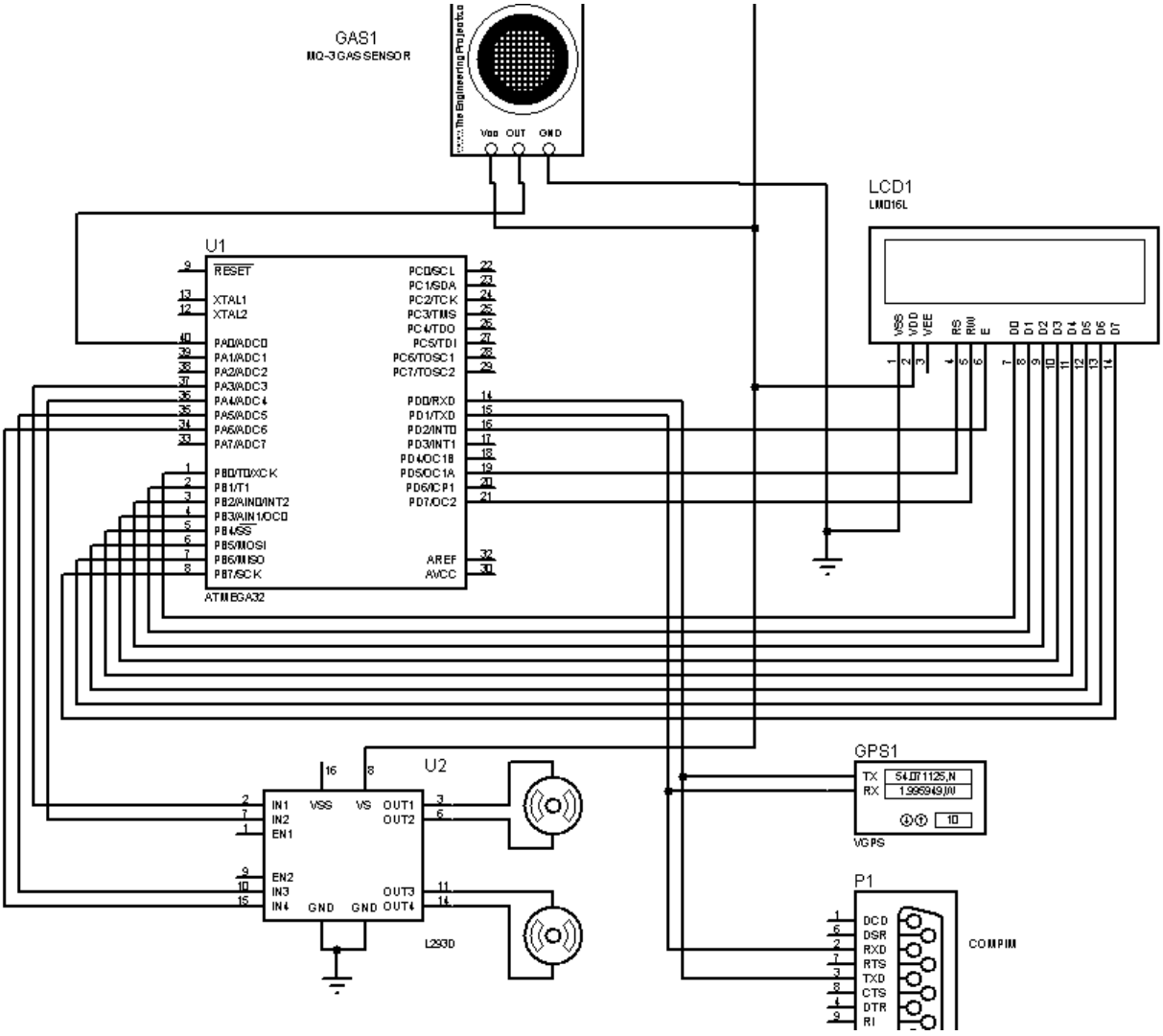


Figure 10: Circuit Diagram

References

[1] "Random Nerd Tutorials," [Online]. Available: https://randomnerdtutorials.com/guide-to-neo-6m-gps-module-with-arduino/.

[2] "Explore Embedded," [Online]. Available: http://exploreembedded.com/wiki/Serial_UART_Interface_with_AVR.

[3] R. Mondal, "RONRobotics," [Online]. Available: https://www.rakeshmondal.info/L293D-Motor-Driver.

[4] P. Hood-Daniel, "Newbiehack.com," [Online]. Available: https://www.newbiehack.com/MicrocontrollerTutorial.aspx.

[5] "AVRFreaks," [Online]. Available: https://www.avrfreaks.net/.

[6] "Electronic Wings," [Online]. Available: https://www.electronicwings.com/avr-atmega/sim900a-gsm-module-interfacing-with-atmega1632-.

[7] T. G. Frank Vahid, Embedded System Design, John Wiley and Sons, 2008.