JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

FABRICATION OF SMART HELMET FOR SECURE DRIVING USING IoT

[1]Sourav Bhattacherjee, [2]Ankur Barai, [3]Kumud Ranjan Mallick, [4]Sayak Patra, [5]Soumyajit Mondal

[*1] (CEng.-India) , Faculty of Department of Mechanical Engineering, [234](UG Students) of Mechanical Engineering, [5](UG Student) of Computer Science Engineering, Sanaka Educational Trust Group of Institutions, Durgapur, West Bengal, India-713212.

I. ABSTRACT

According to the present scenario in India, almost 35% of the street mishaps are brought about by bikes. The first foundations for the fatalities are because of tanked driving, rash driving, and sluggishness because of lengthy drive. The point is to construct a fascinating shrewd cap that shields us from mishaps and demonstrates the clumsy region. A shrewd cap is a sort of defensive headgear utilized by the rider which makes bike driving more secure than previously. This helmet's primary function is to protect the rider. This can be carried out by utilizing progressed highlights like liquor recognition, mishap ID, area following, use as a hands free gadget, fall discovery. Because of this, it is both a smart helmet and a feature of a smart bike. It is necessary to wear the cap, without which the start switch can't turn ON. An NRF240L Module can be utilized as remote connection for correspondence among transmitter and collector. In the event that the rider is plastered the start gets consequently locked, and makes an impression on the enrolled number with his ongoing area. In the event of a mishap it will make an impression on enlisted portable number without us of any Gsm Gps modules. This collaborative endeavor towards reestablishing the concept of advanced safety system of rider's Protective Cap as multidisciplinary work will carry significant focus for developing more user friendly aspects of products as future scope of research work.

Keywords: Advanced Protective Helmet, Rider Safety using IoT, Mechatronics based sensors.

II. Introduction

It's undeniably true that youthful age lean towards bikes and cruiser compared to four wheelers. A review demonstrates that over 80% of the riders try not to wear protective cap with practically no particular explanation. Any collision involving a vehicle on the road is considered a traffic accident. Bike mishaps are expanding step by step and lead to loss of many lives. In numerous mishaps that happen around us, there is an enormous death toll. As indicated by an overview, around "8500" individuals kick the bucket on streets each year that happen because of bike mishaps. Violation of traffic laws and a lack of experience or focus can lead to serious accidents. As a result, the motivation for developing our project stems from our obligation to society to assist in minimizing the number of accidents that occur. There are different purposes behind mishaps, for example, not having sufficient capacity to drive, inadequate bikes, rash driving, "driving drunk", and so on. However, the fundamental explanation was the shortfall of head protector on that individual which prompts quick demise because of cerebrum harm. Thusly, there must ought to be an office to limit the delayed consequences of these mishaps. Anyway the fundamental objective of our work is to make it compulsory for the rider to wear a protective cap during the ride in the interim giving answers for other significant issues for mishaps. Hence, this feeling of moral obligation towards society, established the groundwork for our "Shrewd Cap" project. The three main goals of the smart helmet are beneficial to our day-to-day lives. From the outset and premier one is the start of the bike won't begin except if and until we wear a

protective cap and no liquor is distinguished. Besides alcoholic driving is preposterous when wore a shrewd protective cap. In the event that the rider is alcoholic, the bike won't start. Third application is mishap recognition. In the event that an individual meets with a mishap and nobody is there to help him, or when he is in a far off regions, in such circumstances we can illuminate his relatives and medical clinic with assistance of this savvy protective cap utilizing innovation. Different advances are currently accessible for bike rider wellbeing. Remote correspondence between bike to cap and versatile application is created which persistently speak with one another.

III. METHODOLOGY

It is now referenced that the venture is partitioned into two units in particular head protector and bike. In cap unit, likewise called the transmitter unit, the power detecting resistor is put on inside upper piece of the cap where really head will contact with sensor surface. Also, liquor sensor is put on before rider's mouth with the goal that it can detect without any problem. Sun powered chargers are mounted on upper side of head protector which is in direct daylight. What's more, the battery and customary circuits were fixed inside the cap. Auxiliary regulator and RF transmitter circuit were likewise positioned inside the cap. Recieving wire is situated external the cap. The collector unit is put in the bike. The RF beneficiary acknowledges every one of the information from the cap (i.e transmitter) unit. Contingent upon the circumstances, if valid, the start starts and bike moves. The GSM can constantly send the area data of the bike. On the off chance that
any mishap happens, the vibration sensor gets enacted and sends the area data to the enrolled portable number. The recipient unit is set in the bike. The RF recipient acknowledges every one of the information from the head protector (i.e transmitter) unit. Contingent upon the circumstances, if valid, the start starts and bike moves. The GSM can persistently send the area data of the bike. Assuming any mishap happens, the vibration sensor gets enacted and sends the area data to the enrolled versatile number.

The initial step of undertaking is it instates all the port and subsequent stage is mishap identification utilizing accelerometer. On the off chance that No mishap happens, it will go to third step. Third step is paying attention to RF module persistently for Information and deciphers information utilizing if conditions. Fourth step is to check climate head protector is wear or not. On the off chance that Head protector isn't wore then show Message "Kindly wear the cap" will be shown. Subsequent stage is to actually take a look at the state of plastered, in the event that rider is tanked, show message "You are Smashed" and send the message to put away number with area, and request the secret phrase. In the event that secret key is right, bike will begin. In the event that mishap is identified in 6th step, it will quit all that and communicate something specific with location.A brilliant cap is planned utilizing Arduino with transmitter In the event that liquor fixation is available in human breath, it shows the message on LCD and it sends the SMS to enlist no. with their ongoing area. On the off chance that mishap happens and bike falls, it shows the message on LCD and sends a SMS to the enlisted numbered with the ongoing geological area.

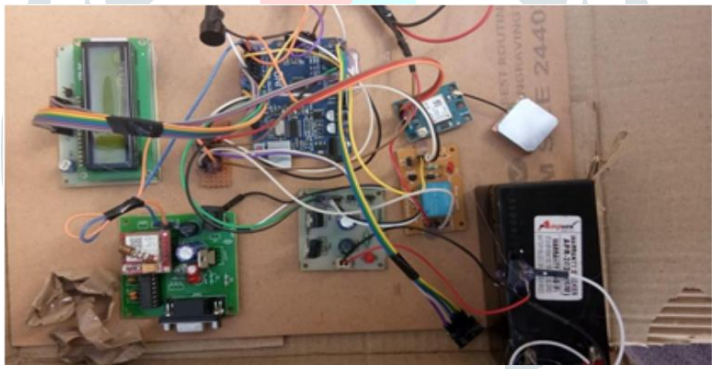


Fig : Hardware Components

we use installed sensors - gas Sensor, mems sensor. The accelerometer estimates the adjustment of slant, in X Y and Z axes separately, and sends the information to a server by means of a web-based application programming connection point (Programming interface). The breath analyzer detects how much liquor present in the breath of an individual wearing the cap and reports on the off chance that it is past as far as possible. This can assist with advancing mishap identification in the future when enough information is assembled to give solid exactness. This will guarantee the all encompassing wellbeing of the rider consistently. This undertaking presents an alarm of the mishap discovery strategies by utilizing savvy head protector location.

IV. SYSTEM REVIEW

4.1 Hardware Components Used

Sl. no.	Components list	Quantity
1)	Arduino Uno	2 pcs
2)	NRF24l01 module	2 pcs
3)	Helmet for Demo	1
4)	1 Sg90s Servo motor	1 pc
5)	MQ-03 Sensor	1 pc
5)	HC -05 Bluetooth Module	1 pc
5)	MPU6050	1 pc
6)	Male to female, Male to Male, Female to Female Connecting wire	50 pcs
7)	Soldering Flux	1 pc
8)	Glue stick	15 pcs.
9)	Switch and sun board	1 pc
10)	Connecting Wire (5 m)	1 pc
11)	Bo Motor and Wheels	1 pc
12)	Arduino Cable	1 pc
13)	18650 3.7 v Batteries	2 pcs
14)	TP4056 module	1 pc
15)	Pulse sensor	1 pc

4.2 Hardware details

4.2.1 Arduino Uno

Fig : Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins(of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller;

Automatic(Software) Reset: Rather than requiring a physical press of the reset button before an upload, the Arduino Mega2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor.

USB Overcurrent Protection : The Arduino Mega2560 has a resettable polyfuse that safeguards your PC's USB ports from shorts and overcurrent.

4.2.2 : NRF24L01 Module

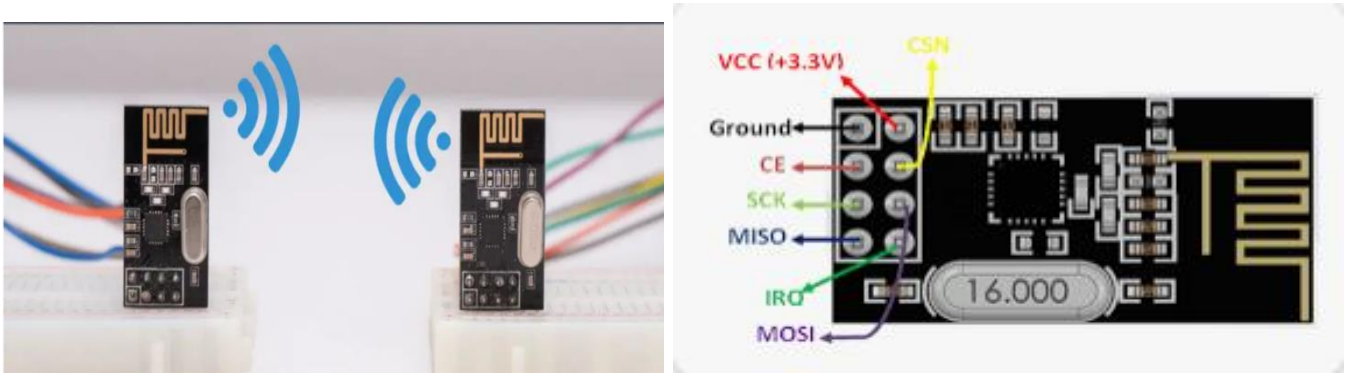


Fig : NRF24L01

The nRF24L01 module is exceptionally well known decision for remote correspondence while utilizing Arduino. The nRF24L01 is a solitary chip 2.4GHz handset with an implanted baseband convention motor (Improved ShockBurst™), intended for ultra low power remote applications. The nRF24L01 is intended for activity in the overall ISM recurrence band at 2.400 - 2.4835GHz. A MCU (microcontroller) and not very many outside latent parts are expected to plan a radio framework with the nRF24L01.

4.2.3 MQ- 3 Alcohol Sensor

MQ-3 Gas Sensor

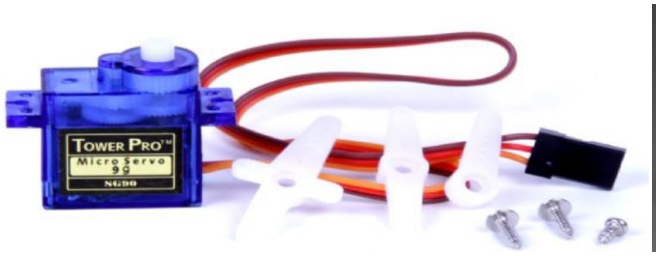
MQ-3 module is appropriate for identifying Liquor, Benzine, CH4, Hexane, LPG, CO. Touchy material of MQ-3 gas sensor is SnO2, which with lower conductivity in clean air. At the point when the objective liquor gas exist, the sensor's conductivity is more higher alongside the gas fixation rising. MQ-3 gas sensor has high sensitity to Liquor, and has great protection from upset of gas, smoke and fume. This sensor gives a simple resistive result in light of liquor fixation. At the point when the liquor gas exist, the sensor's conductivity gets higher alongside the gas fixation rising.

There is an obstruction across An and B inside the sensor which changes on location of liquor. More the liquor, the lower the opposition. The liquor is estimated by estimating this opposition. The sensor and burden resistor structure a voltage divider, and the lower the sensor obstruction, the higher the voltage perusing will be.

4.2.4 18650mAp Battery and Charger

The 18650 battery is a Li-ion battery named after its 18mm × 65mm cylindrical size (diameter × height). The 18650 battery specification includes its properties like the voltage, capacity, charge-discharge cycle, output current, output voltage and so on.

.4.2.5 Sg 90 Servo Motors



A **servo motor** is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision.

Interfacing Servo Motors with Microcontrollers:

Interacting leisure activity Servo engines like s90 servo engine with MCU is extremely simple. Servos have three wires emerging from them. Out of which two will be utilized for Supply (positive and negative) and one will be utilized for the sign that will be sent from the MCU. A MG995 Metal Stuff Servo Engine which is generally regularly utilized for RC vehicles humanoid bots and so on. The variety coding of your servo engine could contrast subsequently check for individual datasheet.

Controlling Servo Motor:

All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU. Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns.

4.2.6 ADXL 345 accelerometer

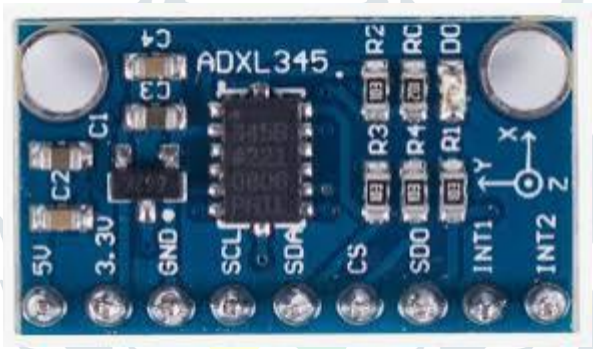


Fig : ADXL 345 accelerometer

The ADXL345 is a low-power, 3-axis MEMS accelerometer modules with both I2C and SPI interfaces. The Adafruit Breakout boards for these modules feature on-board 3.3v voltage regulation and level shifting which makes them simple to interface with 5v microcontrollers such as the Arduino. ADXL345 measures static acceleration due to gravity as well as dynamic acceleration resulting from motion or shock.

4.2.7 HC- 05 Bluetooth module

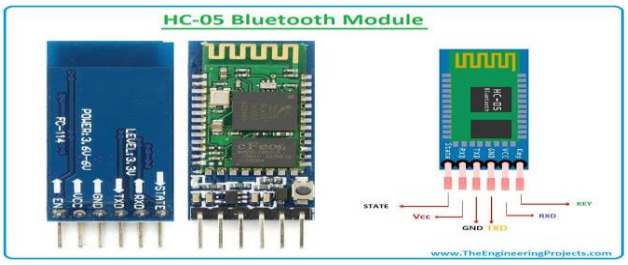


Fig : HC- 05 Bluetooth module

HC-05 module is a simple to utilize Bluetooth SPP(Serial Port Convention) module, intended for straightforward remote sequential association arrangement. The HC-05 Bluetooth Module can be utilized in an Expert or Slave setup, making it an extraordinary answer for remote correspondence. This sequential port bluetooth module is completely qualified Bluetooth V2.0+EDR(Enhanced Information Rate)3Mbps Regulation with complete 2.4 GHz radio handset and baseband. It utilizes CSR Bluecore 04-External single chip Bluetooth framework with CMOS innovation and with AFH(Adaptive Recurrence Jumping Component).

Button Switch: This is utilized to switch the module into AT order mode.to empower AT order mode, press the button switch for a second.With the assistance of AT commands, the client can change the boundaries of this module however just when the module isn't matched with some other BT device.If the module is associated with some other bluetooth gadget, it begins to speak with that gadget and neglects to work in AT order mode.

4.2.8. BO motors

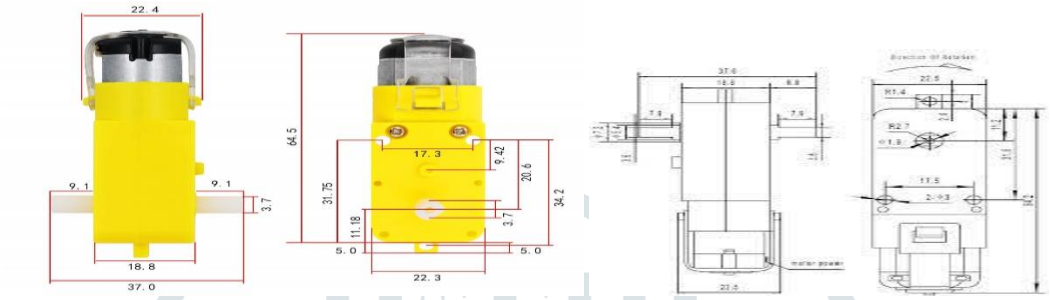


Figure :150Rpm Bo Motor

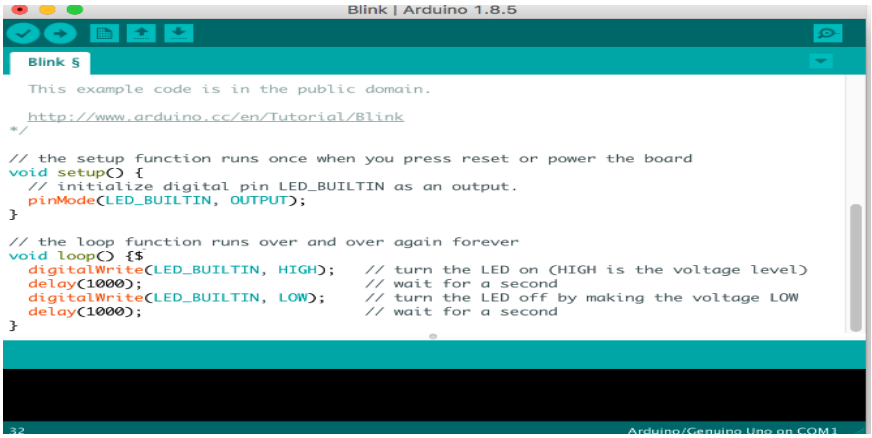
The BO Series 2 150RPM DC Motor Plastic Gear Motor – BO series straight motor gives good torque and rpm at lower operating voltages, which is the biggest advantage of these motors.

4.2.9. Pulse sensor

Pulse Sensor- Working

The working of the Beat/Heart beat sensor is extremely straightforward. The sensor has different sides, on one side the Drove is set alongside a surrounding light sensor and on the opposite side we have some hardware. This hardware is liable for the intensification and commotion wiping out work. The Drove on the front side of the sensor is set over a vein in our human body. This can either be at the tip of your finger or you ear tips, yet it ought to be put directly on top of a vein.

.3.0 Aurdino Programming



The programming of an Arduino Mega 2560 should be possible with the assistance of an IDE (Arduino Programming), and it upholds C-programming language. Here the sketch is the code in the product which is scorched inside the product and afterward moved to the Arduino board utilizing a USB link.

An Arduino super board incorporates a boot loader which takes out an outside burner use to consume the program code into the Arduino board. Here, the correspondence of the boot loader should be possible utilizing a STK500 convention.

Steps for installation:

Download & install the Arduino environment (IDE)

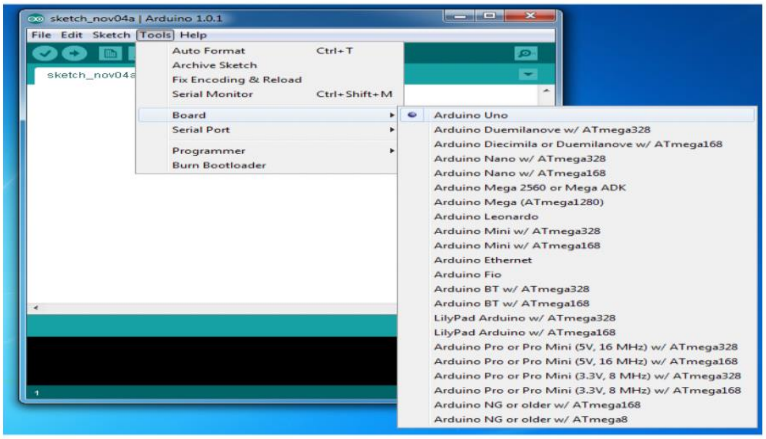
2. Launch the Arduino IDE

3. If needed, install the drivers

4. Connect the board to your computer via the USB cable

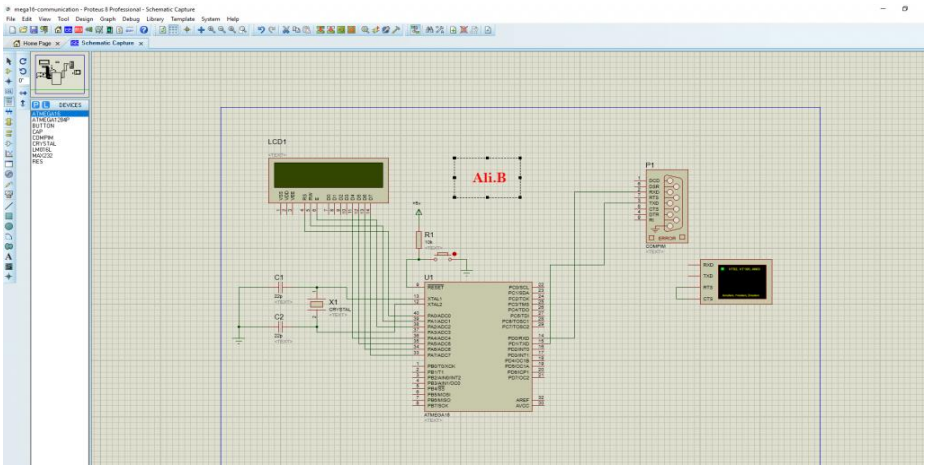
5. Select your board

Next, make sure the software is ready up for your particular Arduino board. Go to the “Tools” computer menu from the menu bar. Select the “Board” option and another menu will appear, where you'll select your Arduino model from the list.



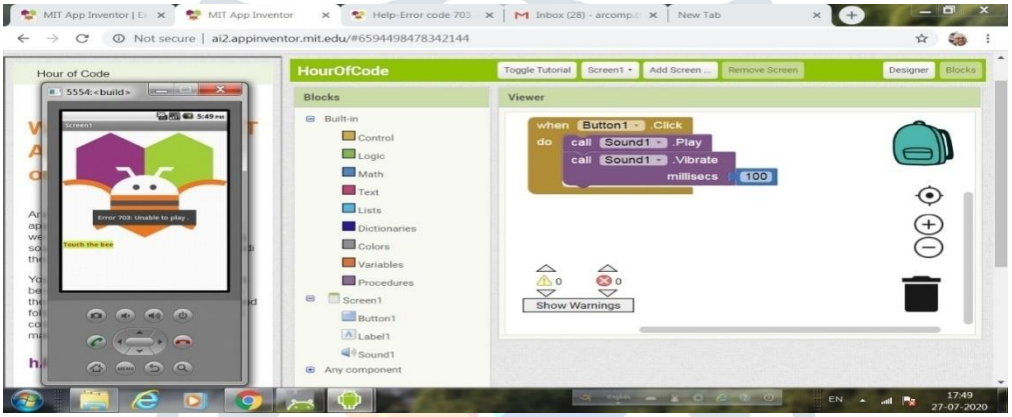
After a few seconds, you will get this screen, with the message "Done uploading."

4.3.1 Proteus 8 Professional



Proteus 8 Professional is software which can be used to draw schematics, PCB layout, code and even simulate the schematic. We can simulate your work and be more efficient in completing the task at hand.

4.3.2 MIT App Inventor



Hence, to make app development easier MIT provides us with the MIT app inventor. This is a platform that makes app development easy for anyone who knows to code or not.

4.3.3 Circuit Diagrams:

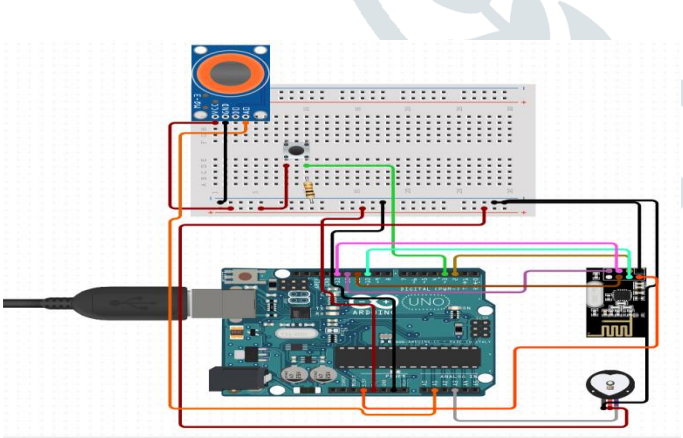


Fig : Tx Circuit Diagram

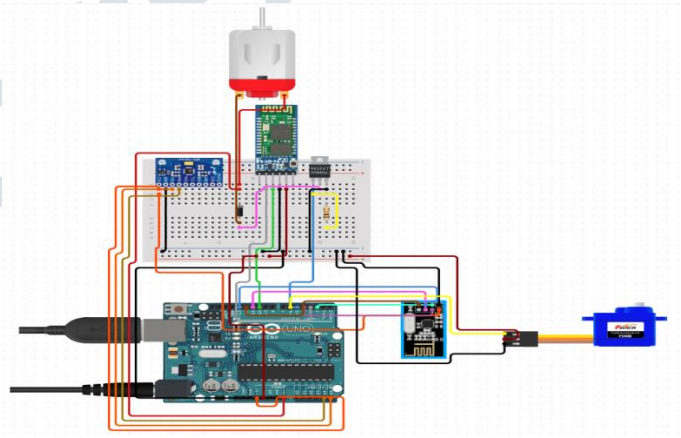
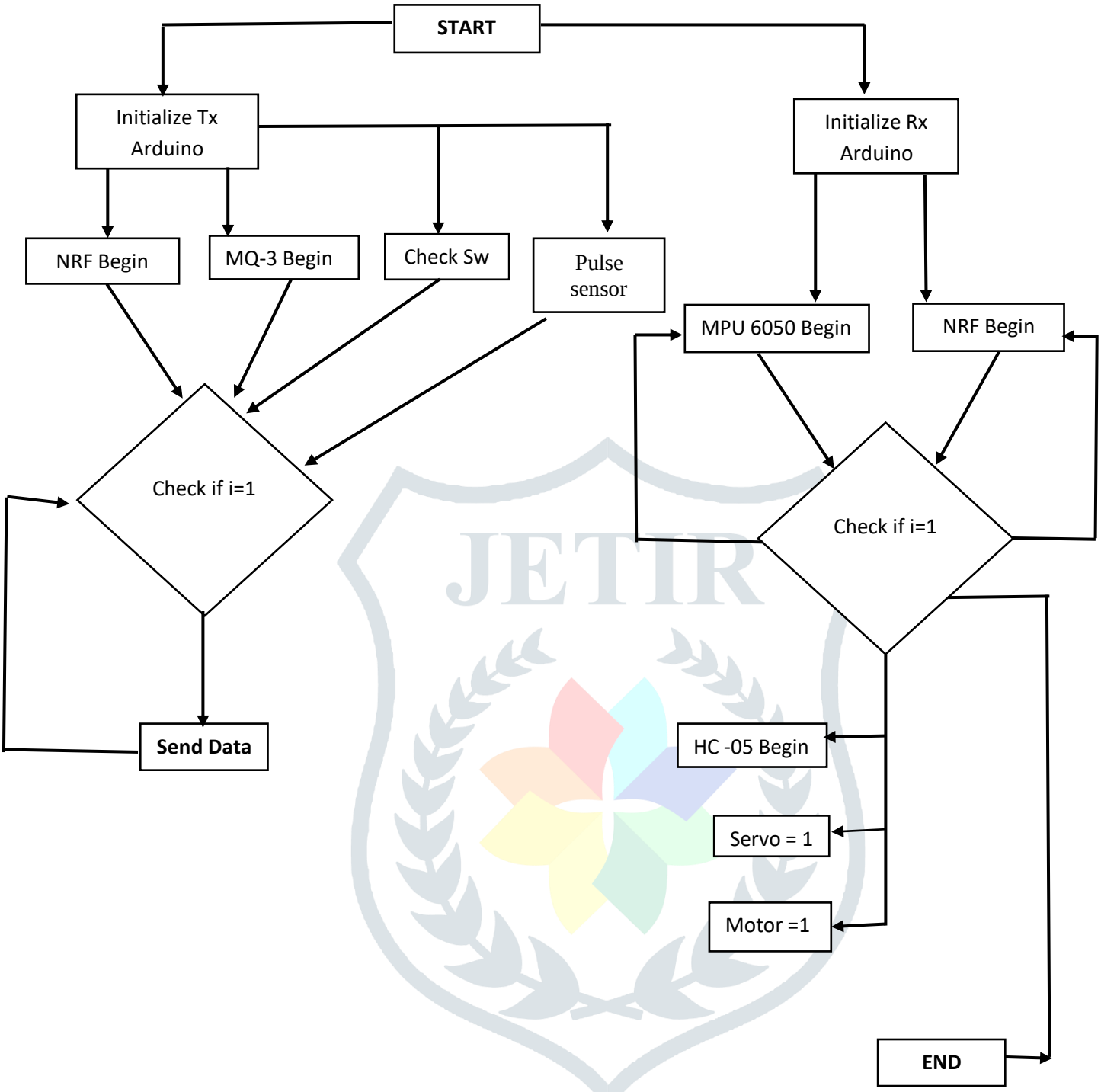


Fig : Rx Circuit Diagram

V. HARDWARE BLOCK DIAGRAM :



HARDWARE WORKING

In this venture we have utilized two independently working Circuits with remote correspondence through NRF24L01 modules. In the transmission end we have utilized liquor sensor alongside a touch sensor. At the getting division we have used Gyro sensor, Dc engine, HC 05, servo engine.
The working of all components are as per the following.

Feature 1) Anti-theft function:: - We frequently go over circumstance when somebody or different purposes our bike. For that, we have fostered our versatile application which will convey message and after that no one but rider can gain admittance to embed bike key.

Feature 2) Pre Liquor Detection: - It is noticed individuals will in general polish off liquor and begin a bike. So in that particular situation the communicated liquor sensor will get liquor follows and won't give admittance to rider to embed his key. In the end he will not have the option to begin his bike. Furthermore, area of the rider will be shipped off his relatives alongside his ongoing heartbeat rate.

Feature 3) Post Liquor Detection: - On the off chance that a rider polishes off Liquor while riding his bike and this is distinguished by the liquor sensor then the bike will stop gradually and keep away from biker to ride his bike been drunken.And area of the rider will be shipped off his relatives alongside his ongoing heartbeat rate.

Feature 4) Helmet Detection: - It is many times noticed individuals don't wear head protectors while riding bike. In that condition rider will not approach embed his keys in bike keyhole and on the off chance that he eliminates cap while riding, bike will stop automatically.And area of the rider will be shipped off his relatives alongside his ongoing heartbeat rate

Feature 5) Accident Identification: - in the event of any mishap which is distinguished by the gyro sensor which is communicated in bike module. There will be an alarm signal created which will send current area of the rider with his relatives data them about mishap and location.And area of the rider will be shipped off his relatives alongside his ongoing heartbeat rate.

HARDWARE PICTORIALS:

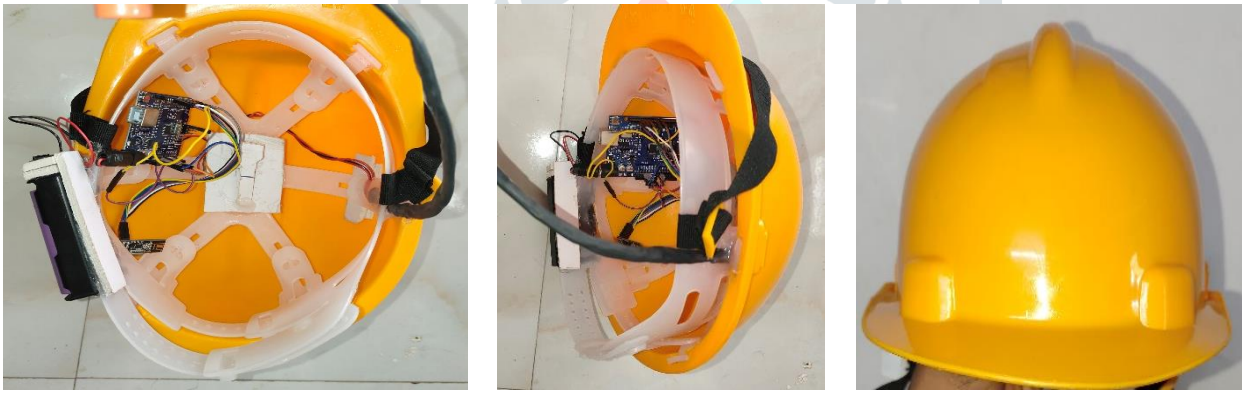
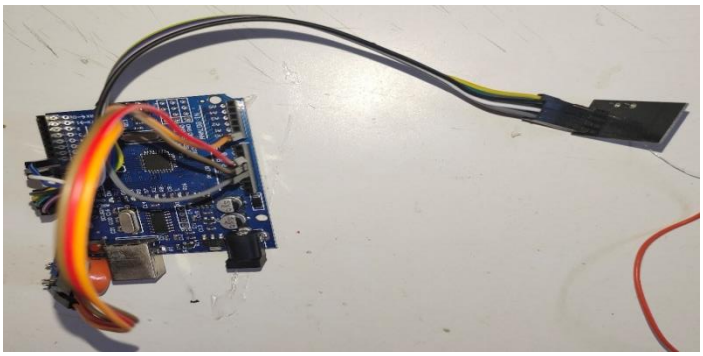


Fig (a): Proposed prototype for Smart Helmet



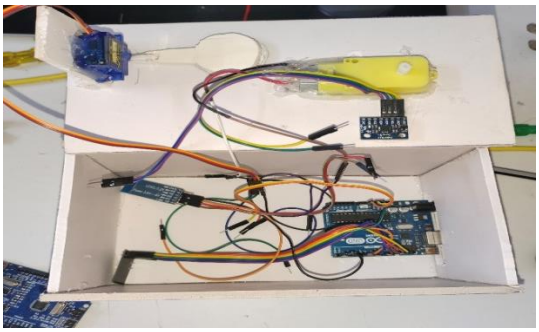
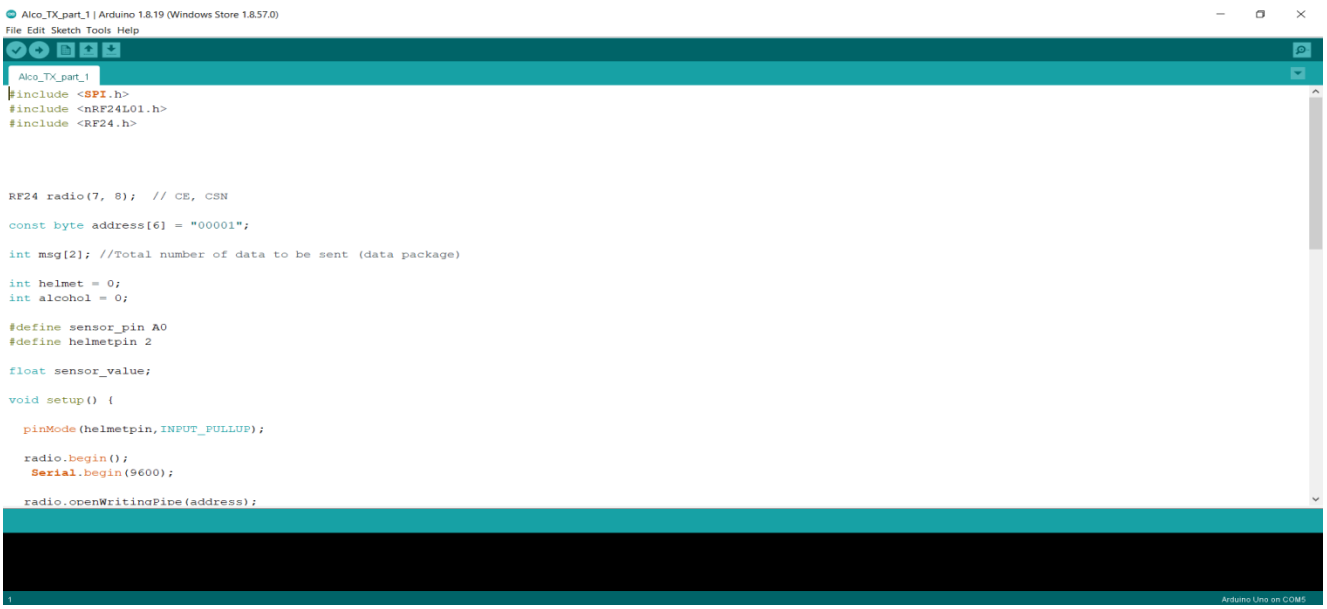


Fig (b): Components of Proposed prototype for Smart Helmet

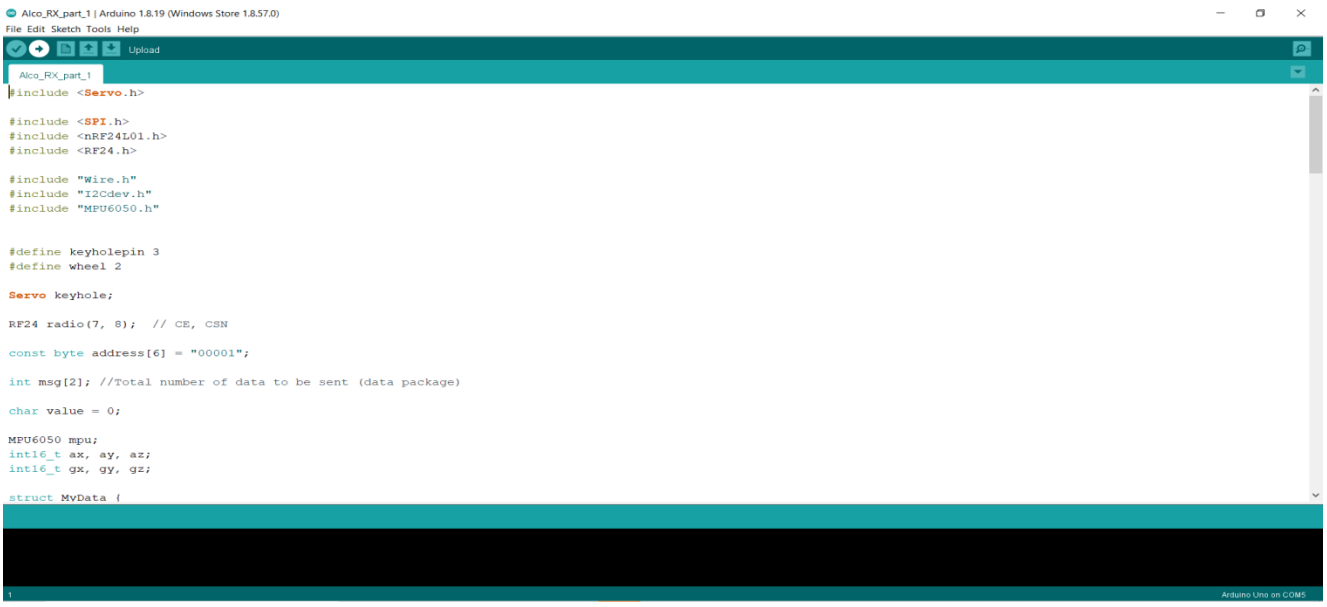
VI. SOFTWARE PICTORIALS:

Tx Arduino programming

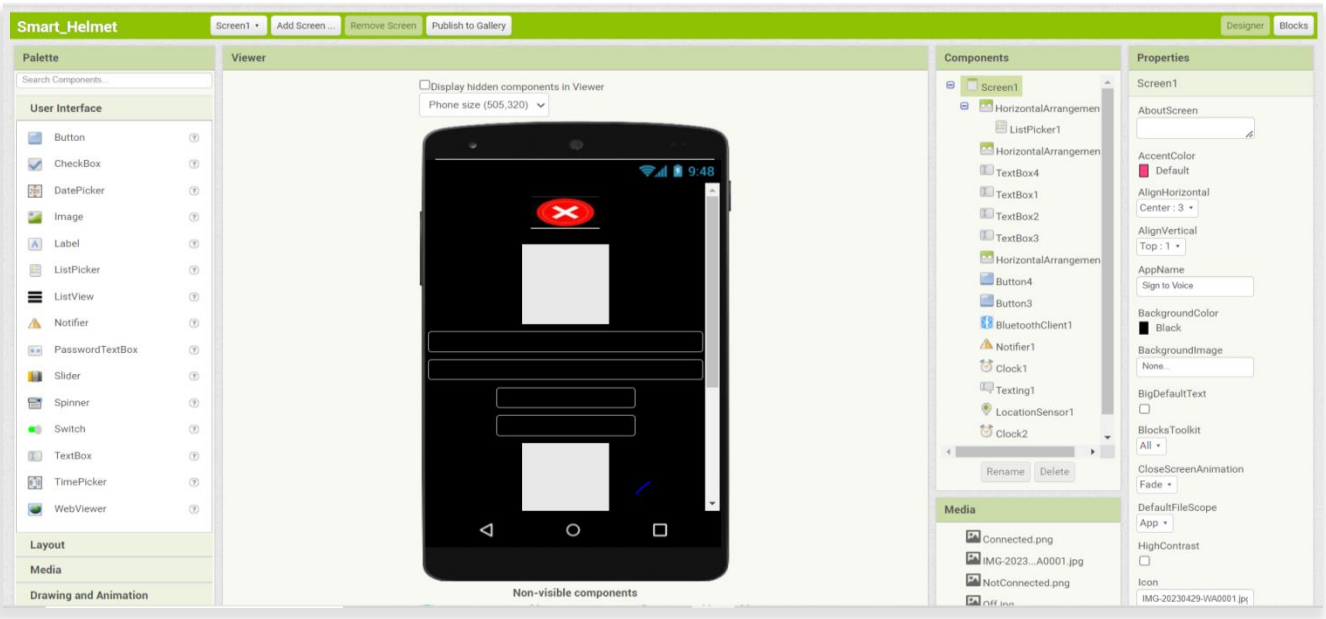


```
Alco_TX_part_1 | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help
Alco_TX_part_1
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>


RF24 radio(7, 8);  // CE, CSN

const byte address[6] = "00001";

int msg[2]; //Total number of data to be sent (data package)

int helmet = 0;
int alcohol = 0;

#define sensor_pin A0
#define helmetpin 2

float sensor_value;

void setup() {

  pinMode(helmetpin,INPUT_PULLUP);

  radio.begin();
   Serial.begin(9600);

  radio.openWritingPipe(address);
1
Arduino Uno on COM5
```

Rx Arduino Programming



VII. MOBILE APPLICATION PICTORIALS :



VIII. RESULT & DISCUSSION:

The proposed smart helmet includes three main modes namely Pre-Start mode, Running Mode followed by Sudden-Obstruction mode. These three different modes of operations are designed using suitable sensors using conception of mechatronics & Internet of Thinking and tested in the real time ambience.

In these modes, the controller will check whether the user has placed the helmet properly on his head and tie the belt of it, whether any alcohol consumption is detected at pre-driving status as well as running mode, whether anybody is trying to steal the bike & finally in accident mode, it will check whether it faces any severe obstruction as like accident or not. If all these conditions are satisfied, then the controller sends signals to relay to ignite the engine. Even if any one of the above-mentioned conditions are not satisfied, relay will not be activated. Hence the engine would not be ignited or send alert signal to convenient destination as default preset receiver.

In running mode, a sensor will be monitoring the angle of inclination of the motor bike. The ignition of the engine will be terminated when the bike is tilted above 70 degrees and which would be considered as an accident. 70 degrees here is a default set value. It can be customised to 60 or 90 degrees depending on owner requirement. It can also be turned off if the user wants to travel to high

inclination route path without getting unexpected accident warning. The proposed model is built and tested in a motorbike and found to work effectively. The modes of operations and emergency messages will be displayed in the Liquid Crystal Display (LCD) screen which can be fitted in the dashboard of the motorbike.

IX. CONCLUSION:

The smart helmet is fabricated and checked for real time application. All the modes of operations incorporated in the prototype namely Pre-Start mode, Running Mode and Sudden-Obstruction (Accident) modes are practically tested and found to act up to the mark. Wearing a helmet, zero tolerance of alcohol in body through detection are mandatory without which the bike will not start followed by anti-theft facility during Pre-Start mode;. While riding the bike, mechantronics sensors will be continuously active and monitor the rider, and bike as well. In case if the sensors & pulse-detector encounters an angle greater than 70 degrees, the ignition will be off and will not be ignited and a message will be sent to the emergency number. This emergency number should be default set in the mobile device. Apart from that, the used Circuit is very basic and effectively implementable, task can be executed in bikes no sweat activities .

Future research scope of this project includes refabricating the proposed model using high end IoT micro-processor or controllers like raspberry pi or high version Arduino and communicating in vehicle-to-vehicle). The self-detection of errors in the vehicle and reflected those significant errors in the display to inform the victim, encirculating with the warning cum action messages are some advanced features which are currently under progression.

X. ACKNOWLEDGEMENT:

We would like to thank to **Mr. Prasun Roy Chowdhury**, HOD-in-charge (**Mech. Engg**) for his extreme endeavour and our Honourable **Director of SETGOI-Prof. Dr. Saikat Chatterjee**, for his continuous support from different aspects and guidance in completing this project review-study on the topic-"Fabrication Of Smart Helmet For Secure Driving Using Iot". It was a great learning experience.

We would like to give special thank to **Dr.Sankar Mukherjee** (HOD-**Comp. Sci. Engg**.) for his earnest cooperation & approval towards this collaborative work-plan being succeed & also take the opportunity to express our gratitude to rest of our group members Saikat Layek, Ashis Neogi, Milan Salui & Sandip Chattaraj for their restless effort. The project review analysis would not have been successful without their cooperation and inputs.

XI. REFERENCES:

[1] Road accidents in India [online] 2007 June 25. Available from: URL: http://www.easydriveforum.com/f44-share-yourroad-experience/road-accidents-in-india834.html

[2] Articles base directory [online] 2011 Feb. 16 Available from: URL: http://www.dwworld.de/dw/article/0,,5519345,00.html

[3] Article from The Hindu [online] 2011 Feb. 10 Available from: URL:http://www.hindu.com/2011/02/10/stories/2011021063740500.htm

[4] Yue –Cheng Wu, Yun-qing Xia &, Zhegiang, Multichannel reflective PPG earpiece sensor with passive motion cancellation? Biomedical Circuits &System, IEEE, 2007, PP 235-241.

[5] Drunk Drivers Beware Of Saab Device, http://www.buzzle.com/articles/drunkdrivers-beware-saab-device.html]

[6] Nissan to drink drive–proof its vehicles, September 2006, [http://www.nissanglobal.com/EN/NEWS/2007/_STORY/070723-01]

[7] Drunken driving protection system International Journal of Scientific & Engineering Research Volume 2, Issue 12, December-2011 1 ISSN 2229-5518

[8] Alcohol sensor and Automatic control system for bike, Volume 2, Issue ICRAET12, May 2012, ISSN Online: 2277-2677.

[9] http://itp.nyu.edu/~ejp291/sensor_workshop/arduino.html

[10] https://www.arduino.cc/en/Tutorial/ADXL3xx

[11] http://www.rakeshmondal.info/IR-Infrared-Sensor-Interface-lcd-Arduino-uno

[17] https://www.youtube.com/watch?v=9UEcT5GxdBk

[18] http://www.pcb.com/TestMeasurement/Accelerometers