Innovative Vehicle Support System

(Military Convoys)

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Project Title: **Innovative Vehicle Support System (Military Convoys)**

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Abstract: Mil convoy is the basic entity of move .The same is subjected to vulnerability/threats. Hostile attacks and natural hazard on move can be a serious issue at all times and maintaining communication with rear (Control rooms/command echelons) is very much needed as they require real time info as soon as possible and specially convoys location and their present condition . Similarly when a convoy going on certain mission , there it might encounter ambush or any eventuality, Instead troops engage in a fight, they try to info rear HQ for their loc. Theme is that both system (Veh) and soldier should assist to pass back info as soon and as earliest as possible

Real time info needs to be transmitted back to the HQs or to the control rooms (displayed onto the live coverage screen), or in the form of emergency text message, determining the intensity of damage incurred to that vehicle.

Furthermore accidents prevention within convoy is also necessary, the driver must be fully attentive while driving the vehicle , even the slightest mistake on part of driver negligence can prove fatal . Vehicle must also assist driver regarding accident prediction in advance ,so that it alerts the vehicle driver or the second seater regarding probable happening in advance .

.

ENDORSEMENT OF CORRECTNESS AND APPROVAL

It is affirmed that data presented in this thesis "**Innovative Vehicle Support System (Military Convoys)**" carried out by 1) Maj Shehryar Tariq 2) Maj Samar Abbas Khan 3) Capt Waleed Bin Waheed 4) Capt Hamza Bahar , under the direction of **Asst Prof Aimen Aakif** in partial fulfillment of our degree of Bachelor of Telecommunication Engineering is correct and approved. The plagiarism is 17% (Complete document) and the report is attached at the end of thesis

Affirmed By

_____

Asst Prof Aimen Aakif

Project Supervisor

Military College of Signals, NUST

DECLARATION

We herewith declare that none of the content and the variety of work bestowed during this thesis has been submitted in support of another award of qualification or degree either during this course or any place else

DEDICATION

This proposal is devoted in thanks to ALLAH ALMIGHTY our Creator who always blessed us with wisdom, knowledge and understanding then to our parents for their direction and their never-ending support. Then to our Faculty for their guidance and supervision. Without their help and supervision this project would not have been made possible.

ACKNOWLEDGEMENT

The accomplishment of this project would not have been possible without the contribution of different people the names of which cannot be reckoned with. Their assistances are sincerely respected and thankfully recognized. We would like to thank following:

- To Allah Almighty who is the most Powerful, Merciful, and everything is in His obedience.
- Asst Prof Aimen Aakif for her support and guidance during the entire project.
- To all relatives and friends.

CONTENTS

FIGURES

ABBREVIATIONS

HQ	**Headquarter**
INFO	**Information**
MIL	**Military**
IN-COORP	**Incorporated**
OS	**Operating System**
GSM	**Global System for Mobile**
RPI	**Raspberry Pi**
LCD	**Liquid Crystal Display**
HDMI	**High Definition Multimedia Interface**
USB	**Universal Service Bus**
VEH	**Vehicle**
EQPT	**Equipment**
LOS	**Line Of Sight**
FREQ	**Frequency**
NEC	**Necessary**

CHAPTER 1

1.1 INTRODUCTION

Driving vehicles in a convoy is a routine practice in any military. Driving while maintaining a proper discipline and keeping the rear HQ in clear picture about the location is always demanding/ challenging which can be dangerous at times. The tendency of drivers to relax or to fall asleep while driving cannot be ruled out. Especially when someone goes beyond the speed limit on any road, he puts the lives of other people in danger, leaving a very thin bracket of reaction time for himself to react to any eventuality. If that little bracket of the reaction time is materialized, whereby vehicle also assists in giving that opportunity window to react in advance before it is too late.

FIGURE 1: ACCIDENT MILTIARY CONVOY

1.2 PROJECT OVERVIEW

We have selected "**Innovative Vehicle Support System (Military Convoys)**" as our project. Project envisages on the design of such a support system,

which pass back real time video transmission, and other various attributes to update our rear HQs regarding any eventuality with their last location, so that assistance of any sort can be provided to them as soon as possible . In addition to that mentioned above, accident prevention is also incorporated in the project, where the vehicle will assist the driver or the second seater regarding any future eventuality that can happen.

FIGURE 2: CONTROL ROOM REAL TIME INFO

1.3 PROBLEM STATEMENT

1. As such, no state of the Art system is avail as far as our mil is concerned.
2. Passing back timely and speedy info as soon as possible is pivotal.
3. Various equipment are avail like radio to pass back , but no equipment is avail to pass information auto in any eventuality
4. Devising ways / floating a logical implementation of this idea will assist our, mil think tanks to incorporate this cheap Hardware into their convoys with respective modifications so that instead of buying

expensive equipment for this purpose, one can resort to indigenous production.

1.4 APPROACH

We had multiple option to undergo this project

1. Use Arduino as our main operating system.

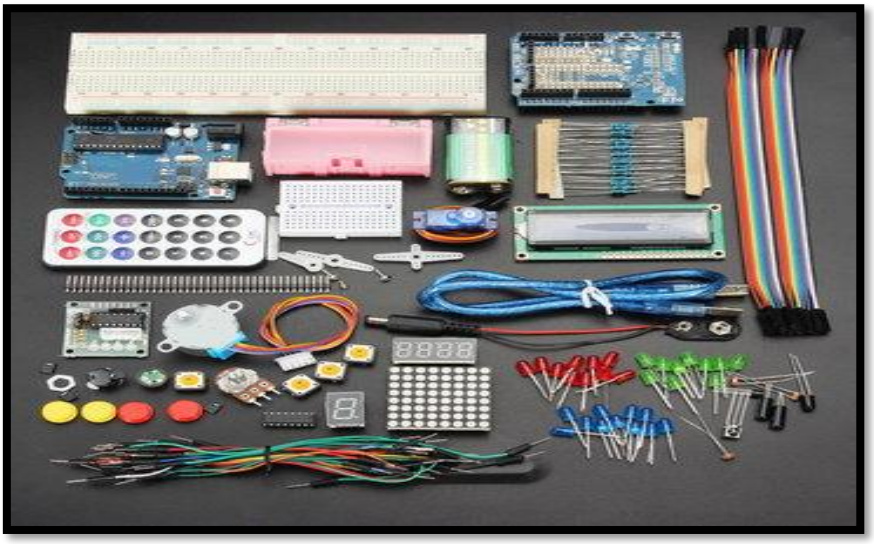

FIGURE 3: AURDUINO KIT

2. Micro controller could be in-coorp to some extent .

FIGURE 4: MICROCONTROLLER KIT

3. Use Raspberry Pie as our main operating system.

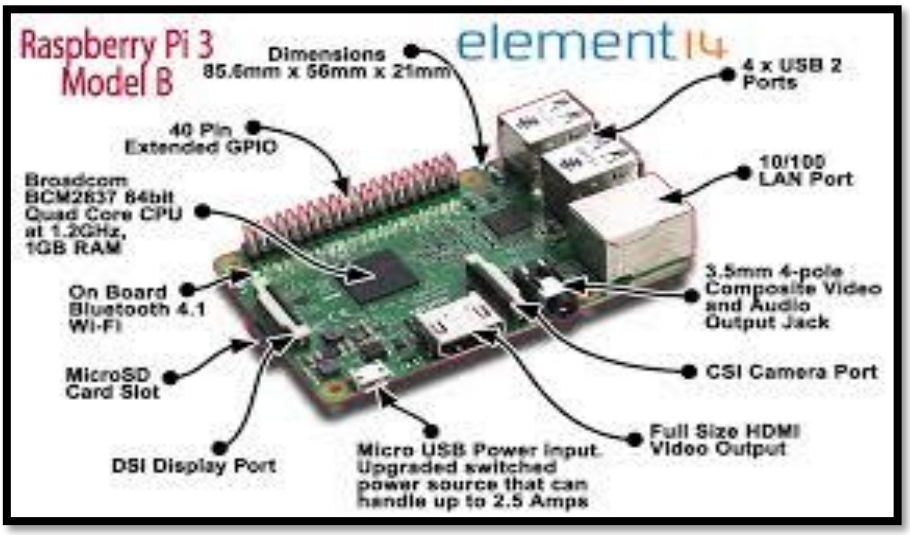

FIGURE 5: RASPBERRY PIE 3B

1.5 OBJECTIVES

Our objective is to design a cheap prototype system, which will be capable of :

1. Passing Real time, Live Coverage to Control Room.
2. Accidental Info to the control room via OS .
3. Accidental Info to the control room via GSM

4. Accident Prevention
5. GPS Location to Control room

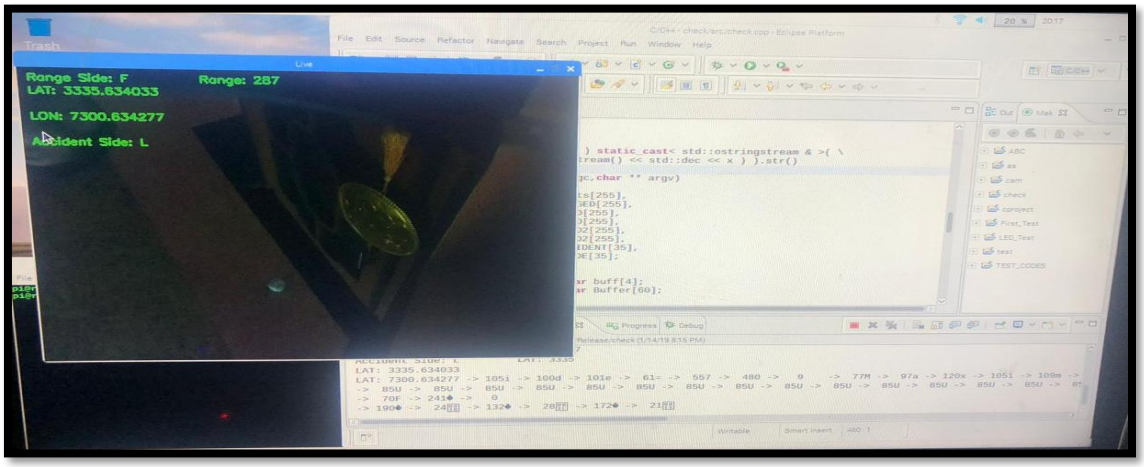

FIGURE 6: CONTROL ROOM WITH IMPLEMENTION

1.6 LIMITATIONS

This project had its limitations.

1. First, we had to go through the literature to find the suitable OS
2. Then we had to find the right hardware for the right job
3. Although we initially proposed to work on Arduino as OS, but later resorted to raspberry pie as suggested by the faculty members.
4. Raspberry pie was a total new OS.
5. No background knowledge about its functionality and working.
6. Consulted multiple papers online to understand this new OS.
7. Frequent errors needs to be addressed.
8. Hardware implementation was very difficult, because a lot of hardware was added in our project.
9. Project Cost was too much.

CHAPTER 2

2.1 BACKGROUND STUDY

The area of research in the field of Live coverage/vehicle support is fast paced and is rapidly growing at a much faster pace. Since the last couple of years, a lot of exploration has been made in this field. The problem is that how we implement this model in our country which is quite new to this kind of Ideas, mainly because of lack of technology and awareness in these aspects. This Prototype model will act as a way forward to implement these kind of models/technology, indigenously made at a much cheaper cost and more durable with requisite R&D in this area .

2.2 LITERATURE REVIEW

Our area of concern was to study and review literature about various components, which will act as a stair to the accomplishment of our tasks. Various kind of literatures are avail in the form of research papers. Finding something very accurate from these papers, which can fit our idea was very difficult, so we resort to pick the ideas from different papers and combine all of them that fits our need /requirement. Fol are the list of papers which helped us through the complete time frame

1. We wanted to implement live video coverage in our project via Raspberry Pie, which was a total new concept/OS for us, so we read it

and get the fair idea as to what are the ways and methods we can accomplish that. [1]

2. Similarly our Raspberry Pie had to communicate with other OS , our other OS was Arduino and few components we fitted on other car which communicate/pass info to Arduino and later send all the transmitted info to Raspberry pie .So we studied the data , Arduino processes and consolidate within itself , so that on later stages we can use that to make our data communicate with Raspberry Pie. [2]

3. Info/ data Arduino processes and consolidate needs to be studied deliberately. Arduino and Raspberry Pie normally don't communicate well once they are connected directly because of the difference in the information/Data bytes they need to understand what they both are talking about .So this paper helped us a bit regarding data processing of Arduino. [3]

4. Few of the accidental information's need to be displayed in the control room via Raspberry Pie . So we studied this paper to understand how Raspberry Pie react to these sensors and consolidate the info/data once it receives it .so that later we can in-coop it in our model with a fair understanding of the data processing. [4]

5. Once the life video has been made on raspberry pie , how to send it back to the control room wirelessly , so we had to study certain papers to fulfil our task to get the fair idea , as to what kind of component can be best suited for our requirements. [5]

6. Now problem arises as we had to make two different vehicles with different OS to communicate with each other , so we resorted to this

paper which helped us ,as how to use 433 MHZ RF TX , RX optimally and send and receive information at a considerable distance with less delay in terms of processing and travel time. [6]

2.3 DELIVERABLES

Our aim is to design a model which work as a whole in which One Car is fitted with Raspberry Pie OS and other car is fitted with Arduino OS , they both are communicating independently and sending data to each other on wireless link using 433 MHZ ,TX,RX link , process that information on Raspberry Pie and after proper consolidation of that info at Raspberry Pie it displays at the rear control room at a considerable distance from that place via again a wireless link using 5.8 GHZ Video TX , RX .

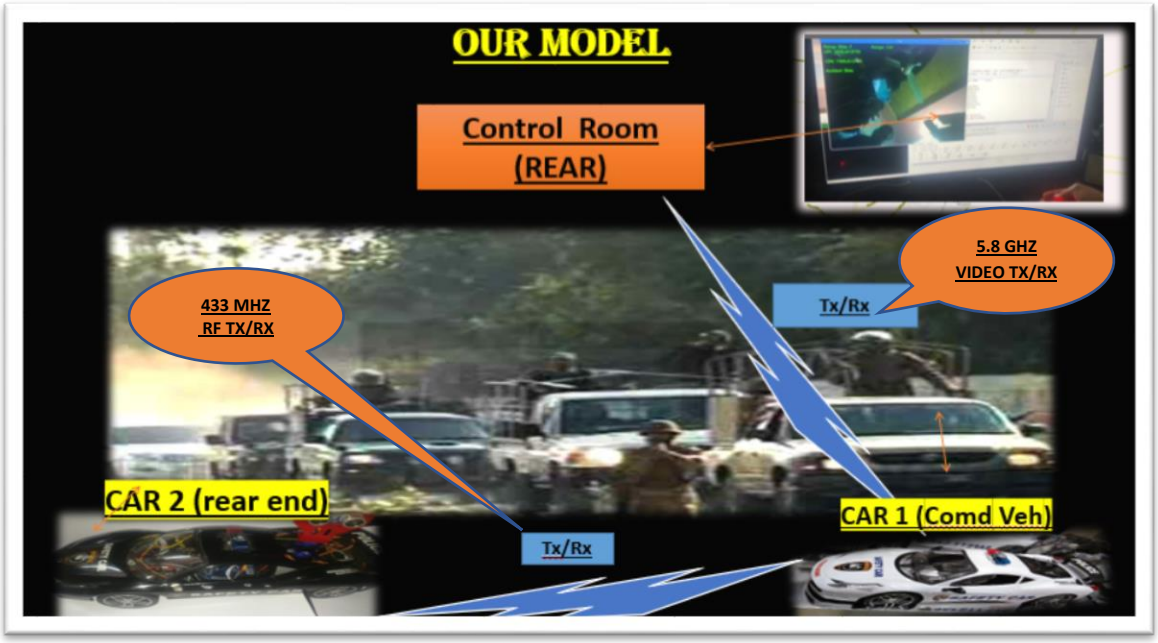

FIGURE 7: DELIVERABLES

CHAPTER 3

3.1 DETAILED DESIGN

Our design comprised of

- Two Cars with different OS
- Control room, which displays the condition of the vehicles.
- Mobile application interface

1. **Car 1** actually comprised of a Raspberry pie 3b+ as our OS and all these components are attached with this OS. This car is connected to the other car via HC-12 RF TX/RX which receives the info/data from the Car 2 and processes it. 5.8 GHZ Video TX is also attached with the Raspberry pie to send all the attributes along with the live coverage to the control room where it is displayed.

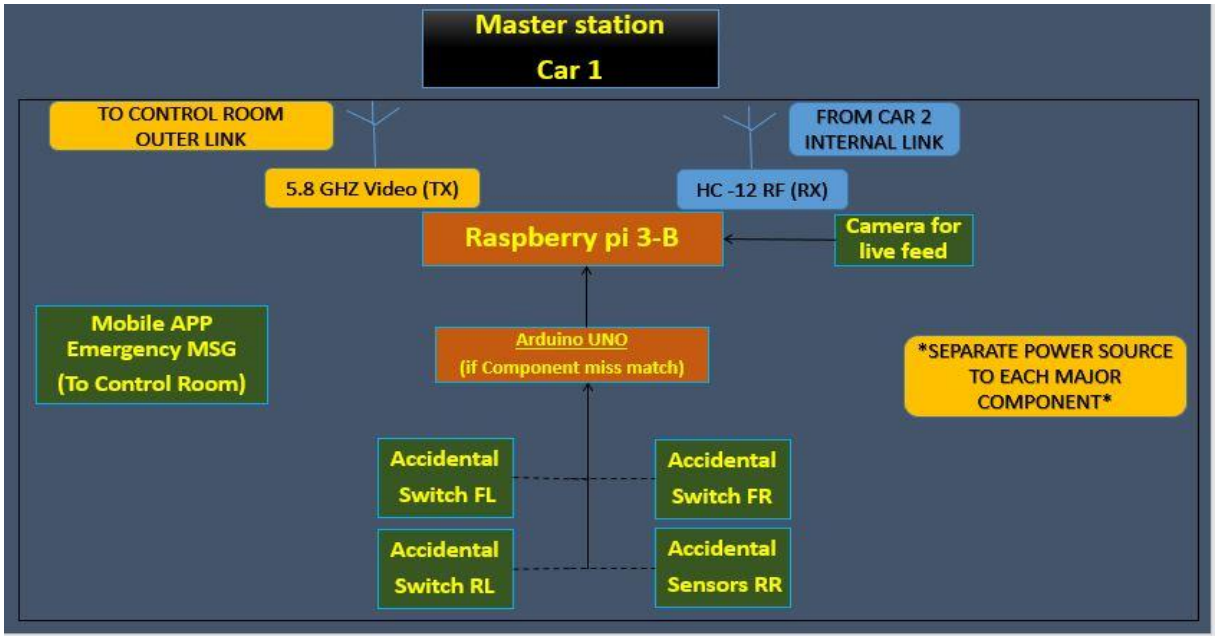

FIGURE 8: Car 1 MODEL

The same is implemented by using protius as shown below in the figure

CAR 1 (PROTIUS DESIGN)

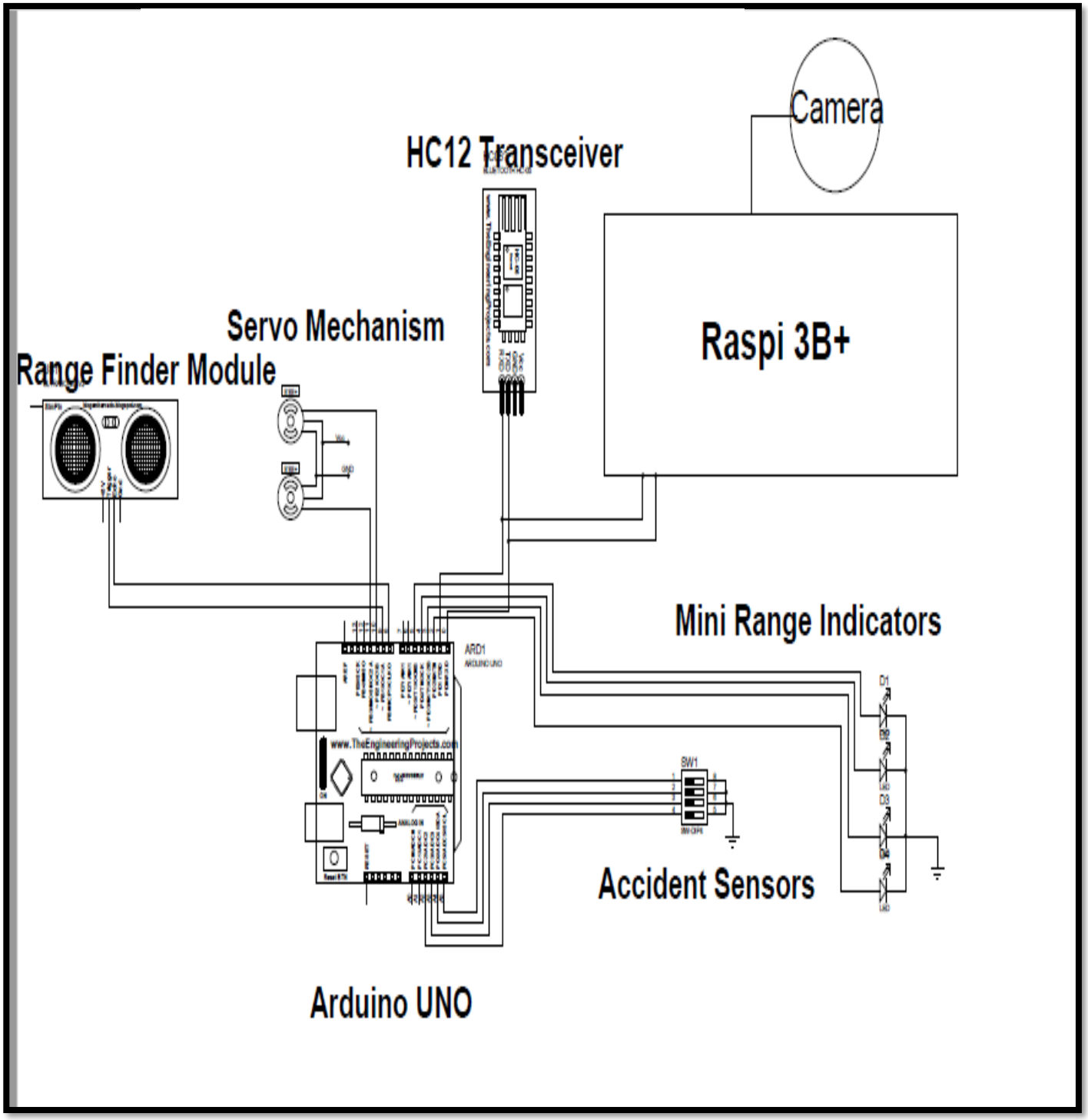

FIGURE 8(a): Car 1 MODEL

2. **Car 2** on the other hand have Arduino 2560 as our OS. It is attached with all other components which are necessary to fulfill our required tasks, like Accidental sensors give the input to Arduino where it processes this info and forwards it to the Raspberry Pie via HC-12 TX ,where it got further processing and later displayed at the control room wirelessly. Similarly our Range finder ultrasonic sensor get the minimum distance info and forwards it to the raspberry pie via Arduino 2560 , but also displays at the Car 2 in LED form , which will assist the driver to predict future accident happening /low distance side. Furthermore the Bluetooth module is connected to the mobile application and passing the accidental info via GSM at the back end, along with the live data that is shared via RF Tx and later displayed at the control room. It's 2 alternate ways for Redundancy.

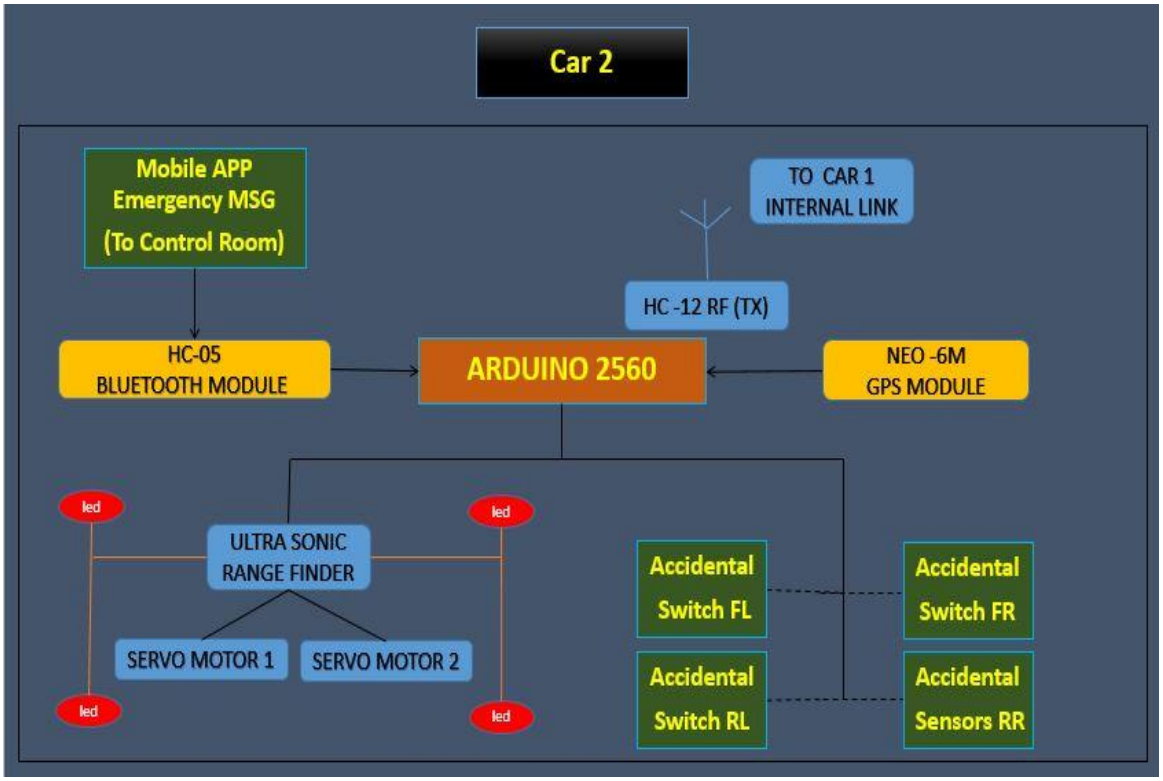

FIGURE 9: Car 2 MODEL

The same is implemented by using protius as shown below in the figure

CAR 2 (PROTIUS DESIGN)

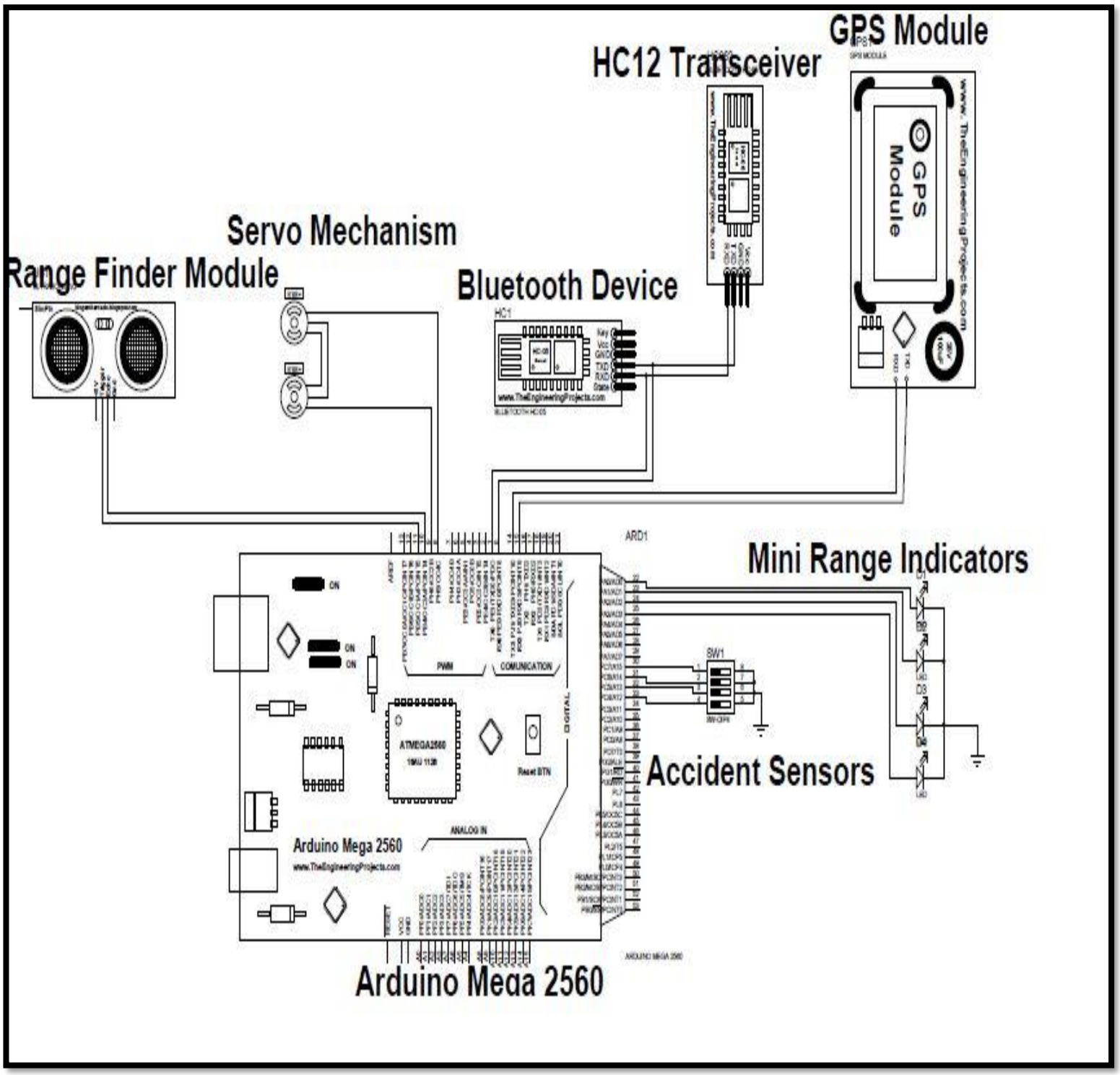

FIGURE 9(a): Car 2 MODEL

3. **Control Room** similarly is present at the rear end, for the demonstration purpose, it is displaying the info of these two Cars at the rear end

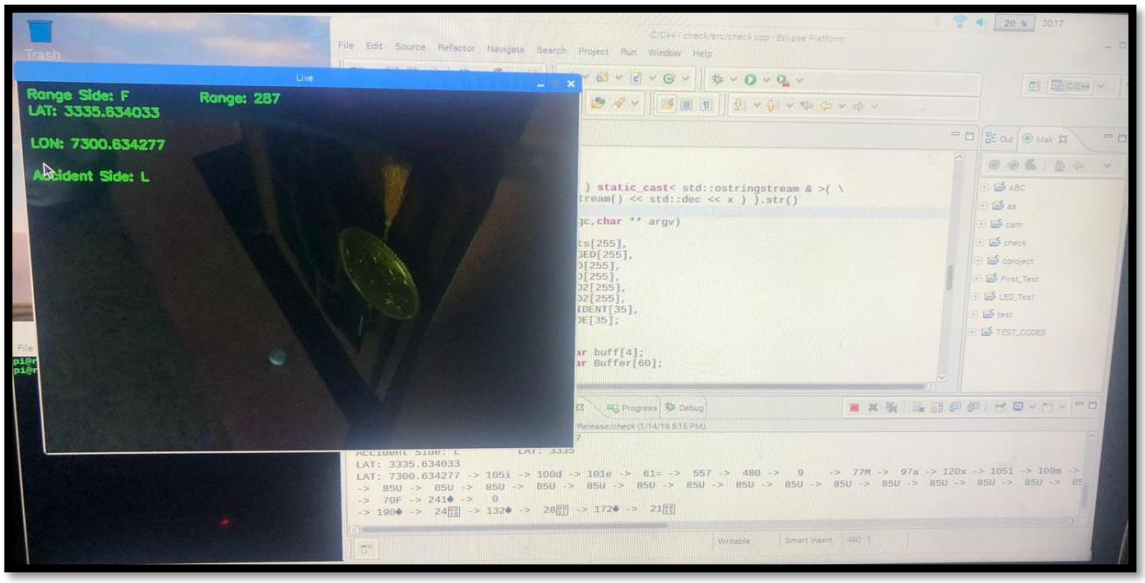

FIGURE 10: CONTROL ROOM (REAR END)

4. **Mobile app** is also in-coop in the project. The app is connected to the 2 at the rear end is also sending the accidental info at the rear end I,e control room . The app works by connecting to the Car 2 via Bluetooth module and is placed with the Car1. When there is an accident with our Car it automatically sends the message via GSM, to the control room mobile no , the message includes the message that XYZ size got hit and this is the link of last location which was recorded via GPS Module placed at Car 2, that this eventuality has happened at such and such place . So what happened is that a redundancy has happened via alternate link that this event has had happened .using the info taken from

Arduino at Car 2 and processes it and sent it to control room . Specimen of the mobile app and messages with location is shown below

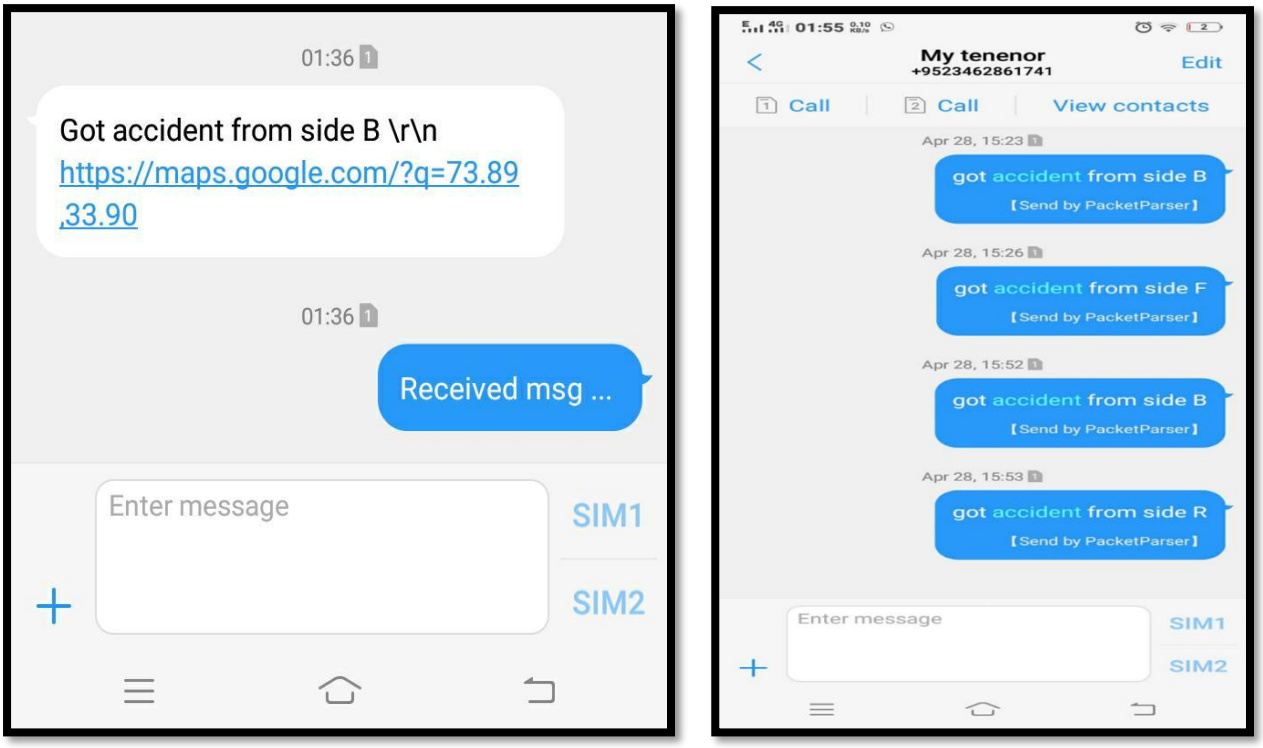

FIGURE 11: CONTROL ROOM (MESSAGE DISPLAY)

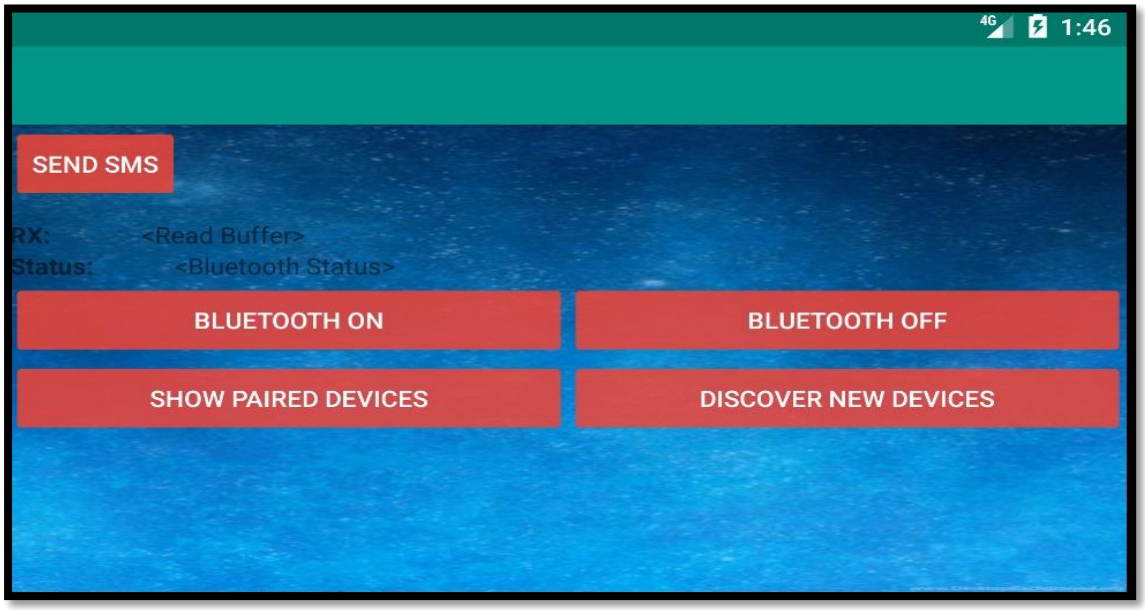

FIGURE 12: APPLICATION INTERFACE

3.2 MODULE DESCRIPTION

Multiple modules are in-coop in our project. Systematically will explain their functionality and technical specification. Their detail are as follows

3.2.1 RASPBERRY PI 3B+

Raspberry Pi is like a wonder for students, hobbyists and the professionals who want to learn and try to renovate their ideas into reality. [7] Moreover, it is its easy interfacing with the devices that are essential for our project. It has 4 USB ports which can be used to attach a mouse, Keyboard, Camera or any other devise that has a USB connector for interfacing. It also have audio and video jacks through which we can attach an audio device or a television or other video devices. New High definition LCDs and TVs have HDMI interfaces which is also not an issue for Raspberry Pi board as it also has an HDMI output interface from where we can connect it with HD televisions or LCDs.

The Raspberry Pi model 3 B+ Specs

1. **CPU**: 1.4GHz 64-bit quad-core ARM Cortex-A53 CPU
2. **RAM**: 1GB LPDDR2 SDRAM
3. **WIFI**: Dual-band 802.11ac wireless LAN (2.4GHz and 5GHz) and Bluetooth 4.2
4. **Ethernet**: Gigabit Ethernet over USB 2.0 (max 300 Mbps). Power-over-Ethernet support (with separate PoE HAT). Improved PXE network and USB mass-storage booting.
5. **Video**: Yes – Video Core IV 3D. Full-size HDMI

6. **Audio**: Yes
7. **USB 2.0**: 4 ports
8. **GPIO**: 40-pin
9. **Power**: 5V/2.5A DC power input
10. **Operating system support**: Linux and Unix

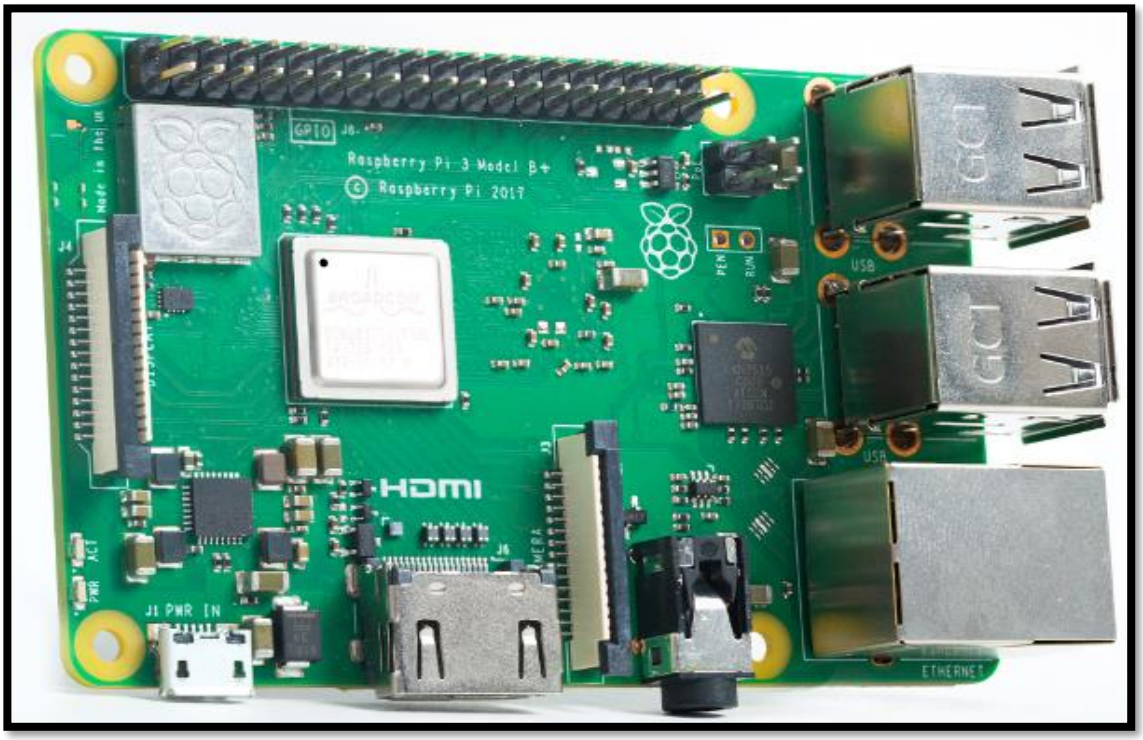

FIGURE 13: RASPBERRY PIE 3B+ MODEL

3.2.2 Arduino Mega 2560

A microcontroller panel grounded on ATmega2560 is known as **Arduino Mega 2560**. [8] It is equipped with 54 digital I/O pins, 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB assembly, a power jack, and a reset button. It generally supports a micro controller because it has everything that is to be needed to support it, like we connect it with the computer via

USB port and it gets power via AC to DC convertor or battery bank. Supports student usage and help him in performing multiple projects and various kinds

The Arduino Mega 2560 Specs

1.	**Operating Voltage**	5V
2.	**Input Voltage (recommended)**	7-12V
3.	**Input Voltage (limit)**	6-20V
4.	**Digital I/O Pins**	54
5.	**Analog Input Pins**	16
6.	**DC Current per I/O Pin**	20 mA
7.	**DC Current for 3.3V Pin**	50 mA
8.	**Flash Memory**	256 Kbps
9.	**SRAM**	8 KB
10.	**Clock Speed**	16 MHz
11.	**Length**	101.52 mm
12.	**Width**	53.3 mm
13.	**Weight**	37 g

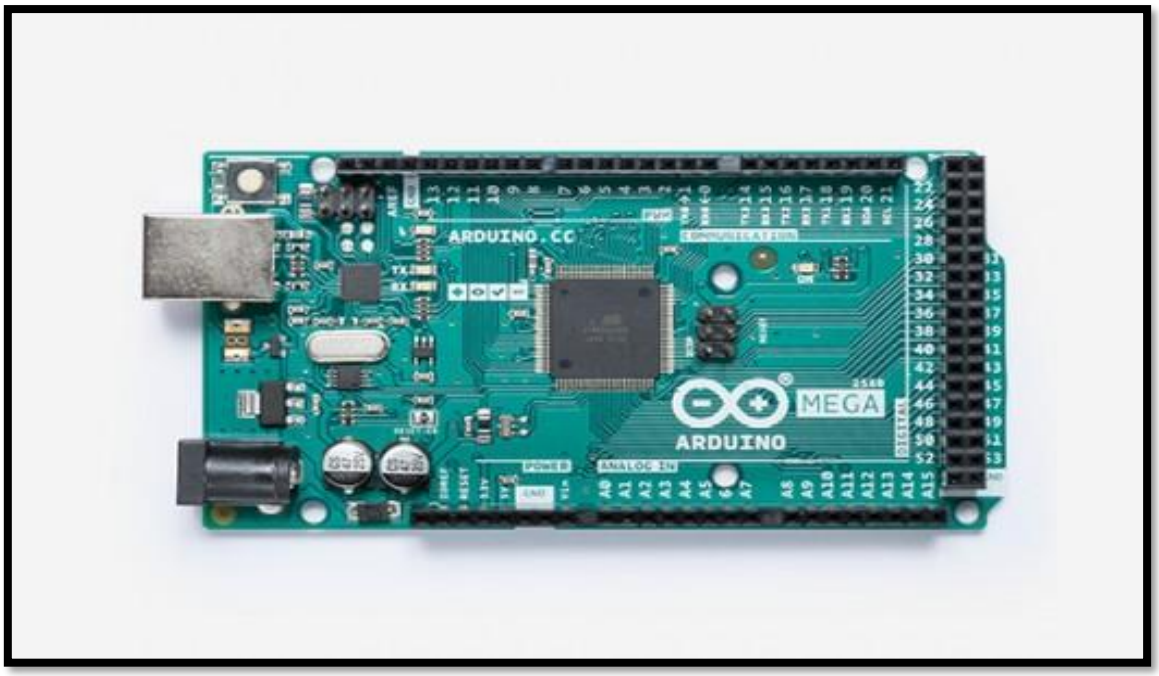

FIGURE 14 : ARDUINO MEGA 2560

3.2.3 Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). [] It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

"Uno" means one in Italian. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform

The Arduino UNO Specs

1.	**Microcontroller**	ATmega328P
2.	**Operating Voltage**	5V
3.	**Input Voltage (recommended)**	7-12V
4.	**Input Voltage (limit)**	6-20V
5.	**Digital I/O Pins**	14
6.	**PWM Digital I/O Pins**	6
7.	**Analog Input Pins**	6
8.	**DC Current per I/O Pin**	20 mA
9.	**DC Current for 3.3V Pin**	50 mA
10.	**SRAM**	2 KB
11.	**Clock Speed**	16 MHz
12.	**Length**	68.6 mm
13.	**Width**	53.4 mm
14.	**Weight**	25 g

FIGURE 15 : ARDUINO UNO

3.2.4 HC-SR04 ULTRASONIC RANGE SENSORS

The HC-SR04 Ultrasonic Range finder is such a module that that is quite simple to use. The sound mainly consists of oscillating waves from side to side a medium with the pitch being firm by the adjacency of those waves to each other, mainly known as frequency.[10]

There are few spectrum that are audible to human ear, identified as the “Acoustic” range. Ultrasonic sensors are calculated to sense object proximity or range using ultrasound reflection, similar to radar, to calculate the time it takes to return ultrasound waves between the sensor and a solid object. As ultrasound waves are used because they are inaudible to human ear and work fine at relatively short ranges.

An ultrasonic sensor contains one or more than one ultrasonic transmitters ultimately speakers, a receiver, and a control circuit. The transmitters radiate a high frequency ultrasonic sound, which returns from a hard body ,whose surface is reflective in nature .

There is a sensor which receives the reflected waves and gets hold of it and process it, which calculates the approximate time difference between transmitted and received wave. So in this manner the time difference is calculated and because of that the distance is calculated as well which is of use to our project .

Hc-Sr04 Ultrasonic Range Sensors Specs

1.	Power Supply:	+5V DC
2.	Effectual Angle:	<15°
3.	Ranging Distance:	2cm – 400 cm/1" - 13ft
4.	Measuring Angle:	30 degree
5.	Trigger Input Pulse width:	10uS
6.	Dimension:	45mm x 20mm x 15mm

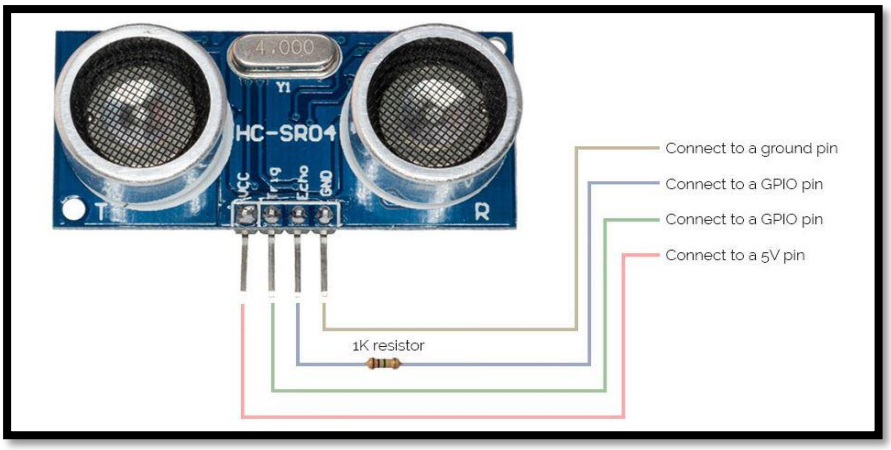

FIGURE 16 : HC-SR04 ULTRASONIC RANGE SENSORS

3.2.5 SG09 SERVO MOTOR

It is handy device with high output power and durable performance. Servo traverse roughly 180 degrees and works like the devices but smaller as compared to other devices which are comparatively bigger in size. [11] We have used multiple codes as we have two servos in our project; they both are working in harmony with each other. It is decent for those students who want to implement some kind of project and need physical movement because of that. It has 3 horns and generally fits at small places.

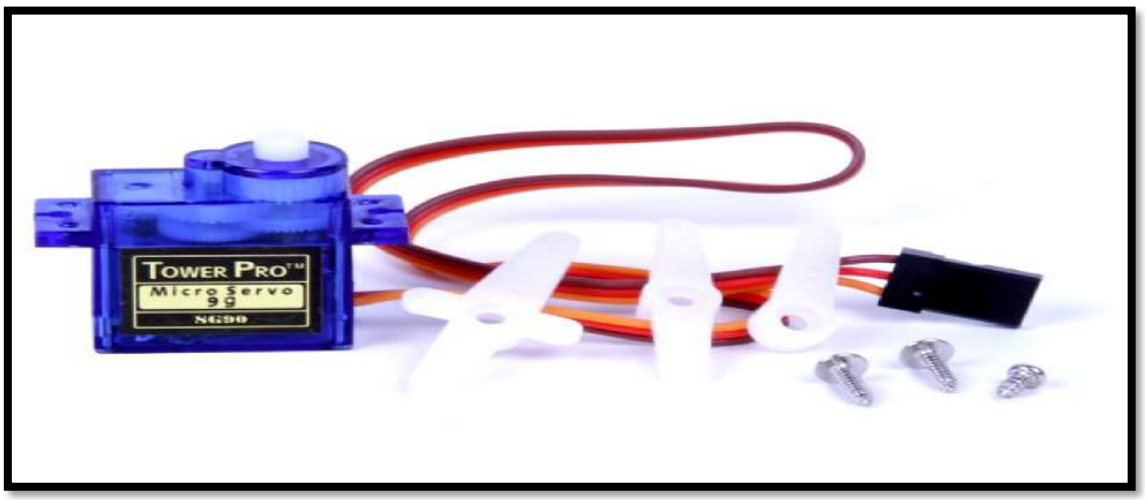

FIGURE 17: SERVO MOTOR

3.2.6 RASPBERRY PI CAMERA V2

The Raspberry Pi Camera Hardware is an emerging OS in market which is quite superior to the other OS avail in market. [12] The category one model that was released earlier (2013) ,was 5 mega pixel and later another model of 8-megapixel category camera was released in 2016. We preferred latest model camera that is compatible with raspberry Pi, so we have chosen model v2. The resolution is good for the prototype model and further for the demonstration purpose.

Raspberry Pi Camera V2 Specs

1.	**Weight**	3g
2.	**Still resolution**	8 Megapixels
3.	**Video modes**	1080p30, 720p60 and 640 × 480p60/90
4.	**Straight field of view**	62.2 degrees
5.	**Upright field of view**	48.8 degrees

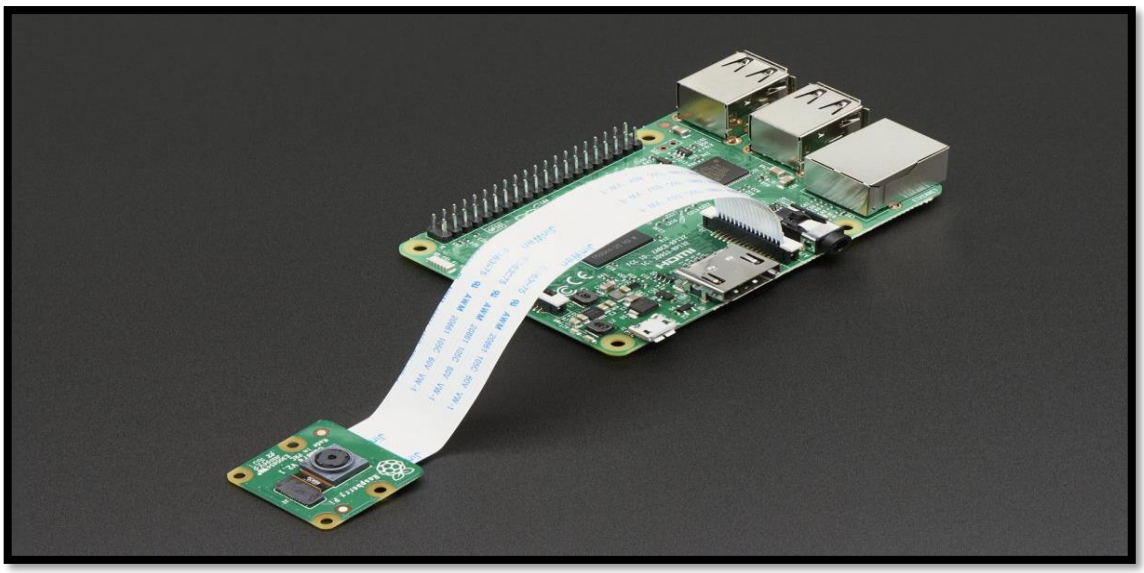

FIGURE 18: RASPBERRY PIE CAMERA V2

3.2.7 HC-05 BLUETOOTH MODULE

The module, which we used, could be powered from 3.6 to 6 volts, because it comes on escape board, which has a voltage regulator. [13] However, voltage level of the logic pin is mainly 3.3 V. Therefore, the line between the Arduino TX (Transmit Pin, which has 5V output) and the Bluetooth module RX (Receive Pin, which supports only 3.3V) which is to be coupled through a voltage divider because it will not harm the module . When we want to power up the module the key pin which is there is to be grounded to enter into the command mode, If this pin is not hooked up it will by default make way to data mode. As soon as the module is given power the we generally get the device name at the Bluetooth interface of the mobile phones named by HC-05" then can be connected to it by using a password if it asks as 1234 , otherwise it will be connected directly .

HC-05 Tech Specs

1. Serial Bluetooth module for Arduino and other microcontrollers
2. Operating Voltage: 4V to 6V (Typically +5V)
3. Operating Current: 30mA
4. Range: <100m
5. Follows IEEE 802.15.1 standardized protocol
6. Uses Freq-Hopping Spread spectrum (FHSS)
7. Can operate in Master, Slave or Master/Slave mode
8. Can be easily interfaced with Laptop or Mobile phones with Bluetooth
9. Indicates the status of Module

a) Flash once in 2 sec: Shifted to Command Mode

b) Repeated Flashing: Connection not made (Data Mode)

c) Flash twice in 1 sec: connection has been made (Data Mode)

Applications

1. It usually connects two Arduino or any other breed of OS like Raspberry Pie with Arduino
2. Interconnect Cell phones , Touch books and Desktop PCs ,tabs
3. Information Logging
4. End user applications
6. Home Computerization
7. Veh Connectivity with ease

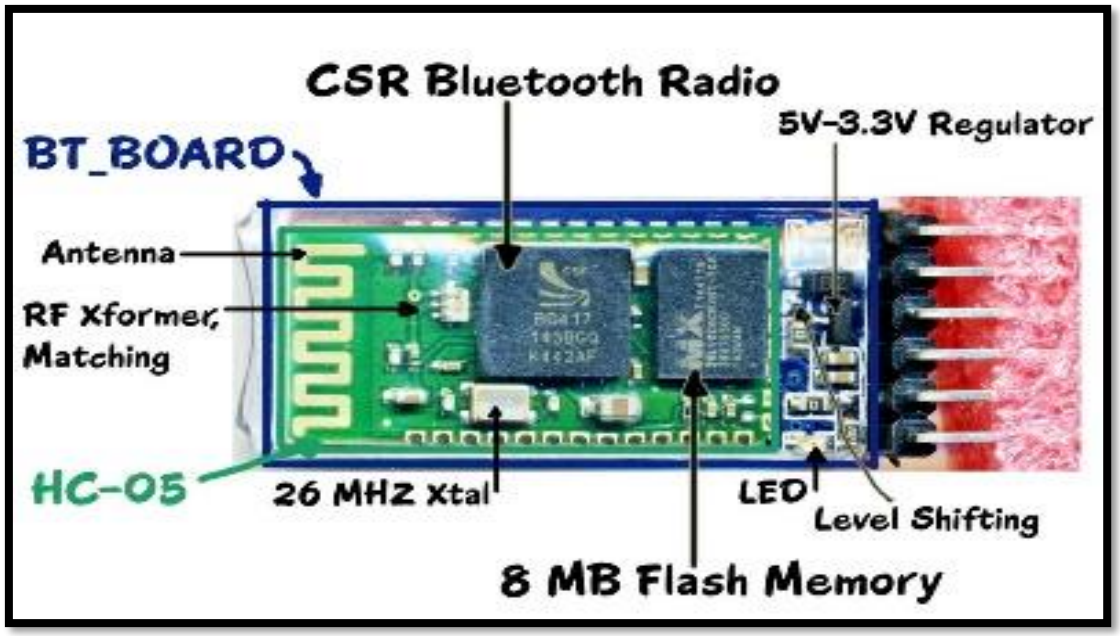

FIGURE 19: HC-05 BLUETOOTH MODULE

3.2.7 HC-12 TRANSCEIVER

The HC-12 is device which interconnects two OS and works on the principle of Half duplex, which usually have 100 channels operating at freq range of 433 MHZ to 473 MHZ range. [14] It is proficient enough to communicate at the range of 1 km to 2 km in the open and works on the principle of LOS. We used this module HC-12 to create a wireless link between two modules and pass the info required to be sent in due course of time. We tried multiple Tx/Rx avail at cheap rates, but they were not durable, caused us a lot of trouble, because they while sending the data, add certain amount of garbage values, and then forwards the data to the other device. Later we discovered that these transceivers are much better, reliable and durable which would help us in flawless data exchange

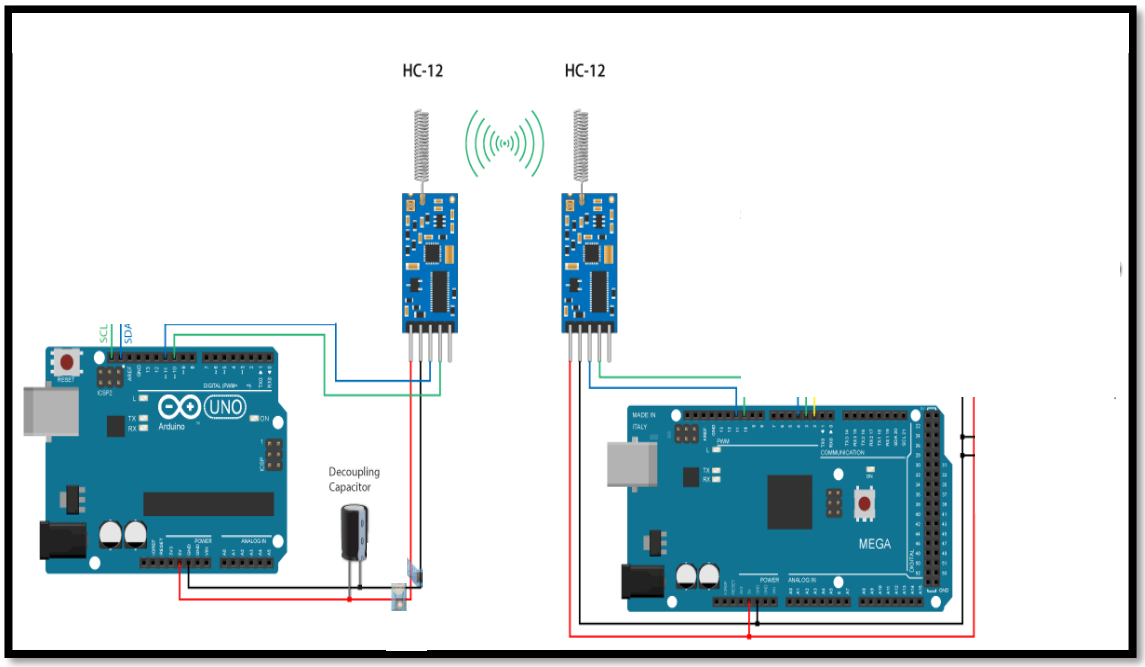

FIGURE 20: HC-12 TRANSMITTER / RECEIVER

3.2.9 NEO 6M –GPS MODULE

This GPS Module which is displayed below. Comes with an peripheral antenna, and is without header pins. So, they are to be patched manually with the module.[15] We purchased two of the modules of this specs , because they are not manufactured here , they are more susceptible to fault . Same happened with us , one of the module got faulty because of unknown reason . Other one is also sensitive to interference, like thick walls of the room, which hamper signal reaching the module. Once this GPS got connected then the link will likely to be made for a considerable amount of time.

FIGURE 21: NEO 6M GPS MODULE

- Equipped with peripheral antenna and incorporated EEPROM.
- Interface: RS232 TTL
- Power supply: 3V to 5V

3.2.10 5.8 GHZ 200 mA VIDEO TRANSMITTER/RECIEVER

The TS832 generally operates at 600 mW and works on 5.8GHz freq.[16] This LOS equipment/module is very user friendly and it is mainly just plug and play. We have in-coop it in our Raspberry Pie OS and it transmits the data at a considerable range with good quality video. The range which it normally functions is upto 5 km LOS , but we have tested it at 1 km range. It is handy and easily be carried/installed at changing environment.

Similarly RC832 Receiver is also quite handy and easily be carried and installed at control room. It has two buttons which are there to change they channels and freq band. Multiple quality LOS equipment are used but this we have tested is among the best which not only fulfilled our requirement but also caters for our future requirements.

FIGURE 22: 5.8 GHZ 600 mW VIDEO TX/RX

3.2.11 MISC MODULES

Misc modules include

1. 2 x Toy Cars
2. Misc push switches (3 x Category With respect to Size)
3. Battery banks
4. 12 v battery for 5.8 GHZ Video Tx
5. 12 v Adaptor for 5.8 GHZ Video Rx
6. Audio video Cable

CHAPTER 4

4.1 ISSUES FACED

Our design comprised of two veh with different OS and a control room, which we had to implement, the issues we faced are of extreme nature which needed a deliberate analysis and execution .We started one by one and addressed issues accordingly. The issues we faced are as follows

1. Raspberry pie 3B

   - New OS to work on
   - No background knowledge/MCS
   - Rasp windows install

     - Memory card class 10 was required.
     - Initially windows install using 8 GB card , crashed less space
     - 16 GB card requirement
     - Library install was a big issue to be looked after ,took us a lot of time
     - Eclipse installer was the interface on which the programming was done.

FIGURE 23: MEMORY CARD CLASS 10

2. Arduino UNO

Connecting Raspberry pie with Arduino to check compatibility via wired link (comm established by sending dummy packets) Arduino used 2 bytes architecture and Raspberry pie uses 4 Byte architecture. Which caused a lot of problem and was an unidentified issue.

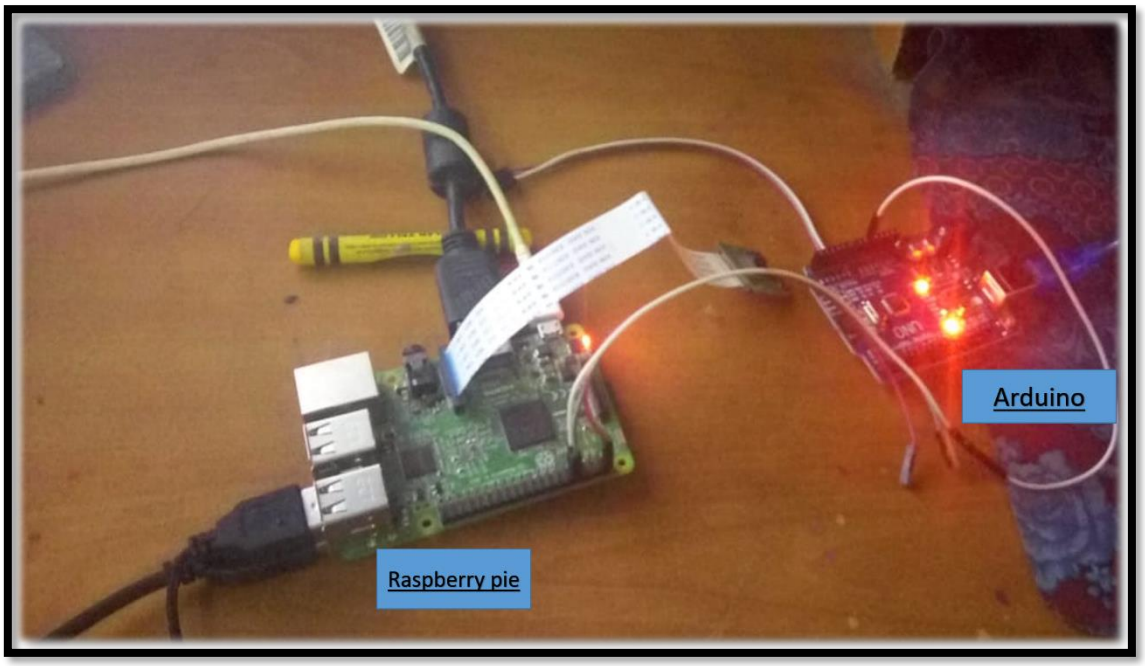

FIGURE 24: RASPBERRY PIE & ARDUINO INTERFACE

3. GPS

- GPS module , replaced 2 , purchased better one due to signal fluctuation
- Limitation of GPS , not connected inside buildings , better sig strength on roof tops
- Have checked its connectivity outside working fine but was un identified before.
- GPS incorporated in Arduino , packet is sent to raspberry pie where it processed and further send to control room in the display .
- Information and codes need to be verified and separated and addressed accordingly.

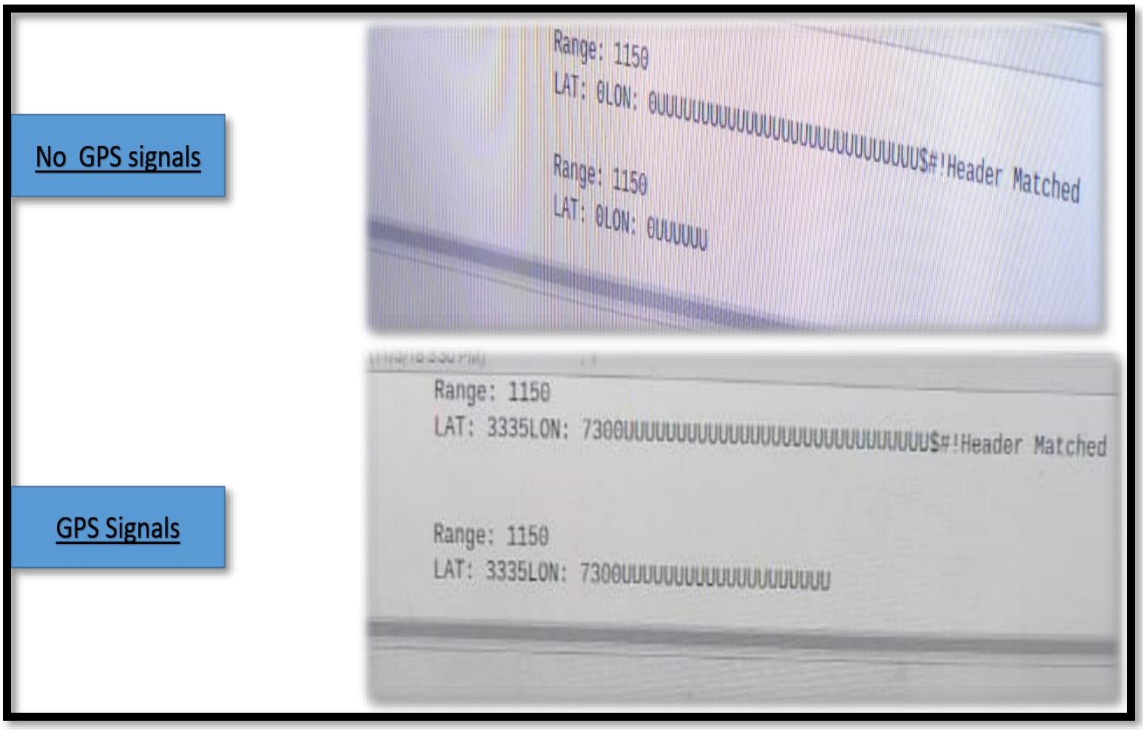

FIGURE 25: GPS HEADER MATCH, DSPLAYING INFO

4. Servo motors

- 2 x servo motors incorporated
- Separate code written for both
- Each servo motor can rotate at an angle of 180 degree in two steps each
- Similarly other motor alao traverse at 180 degree to 360 degree so that makes complete 360 degree that was needed for further in-coop of range finder .
- Range finder is mounted on it and gets the compete 360 turn
- Each giving 180 degree movement

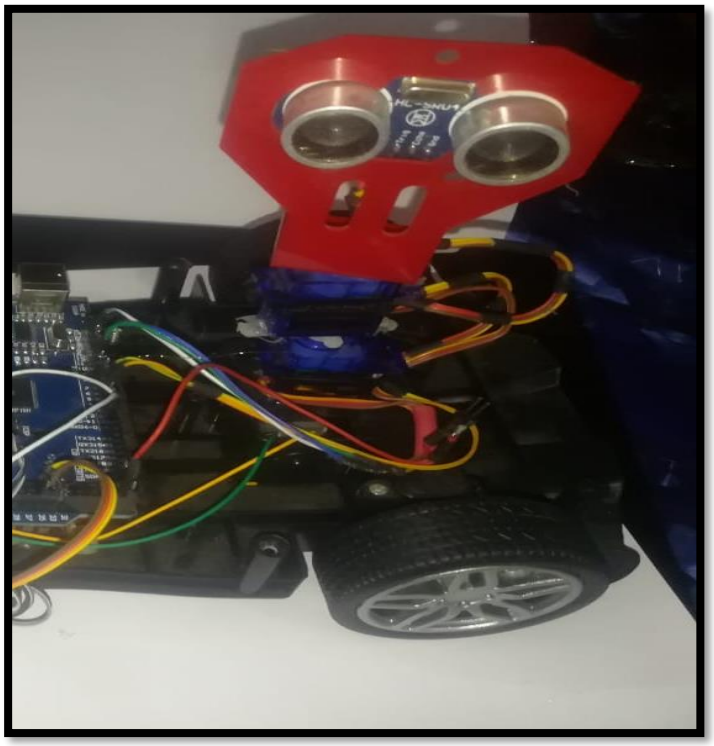

FIGURE 26: TWO SERVO MOTORS PLACED ON TOP OF OTHER

5. Arduino UNO issue

- Initially until now we used Arduino UNO as our OS
- Issue incurred at the end when we wanted to incorporate sensors , spare slots were not avail
- All wires were permanently attached /plugged in
- So we got stuck up!!!
- New Arduino incorporate that fits our requirement
- Shift to Arduino 2560
- Additional 4 ports / interrupt pins as compared to simple Arduino

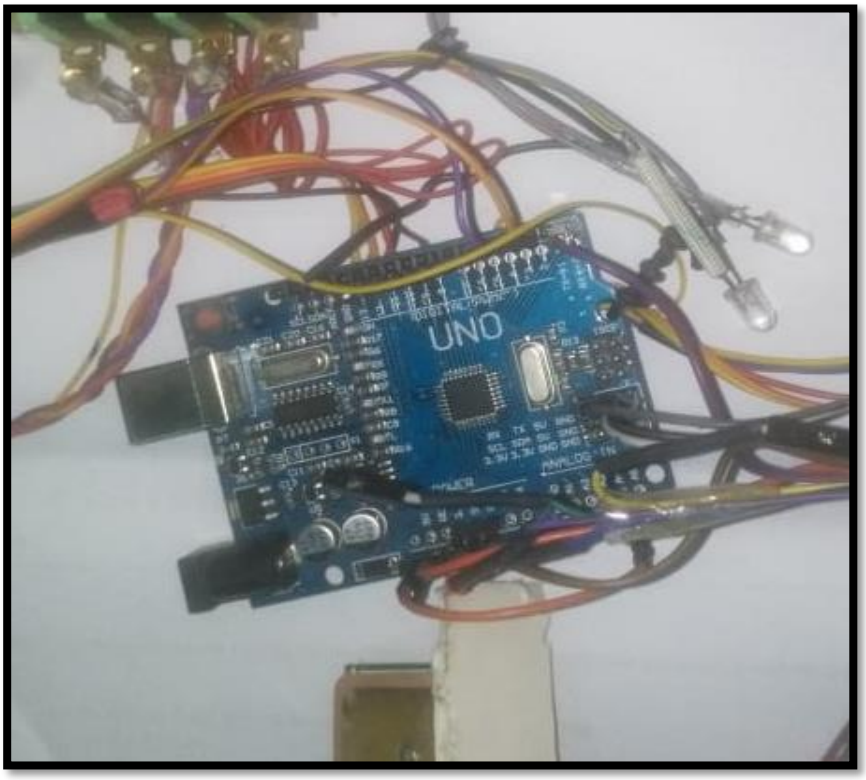

FIGURE 27: ARDUINO COMPLETE PATCHING BRFORE REPLACING

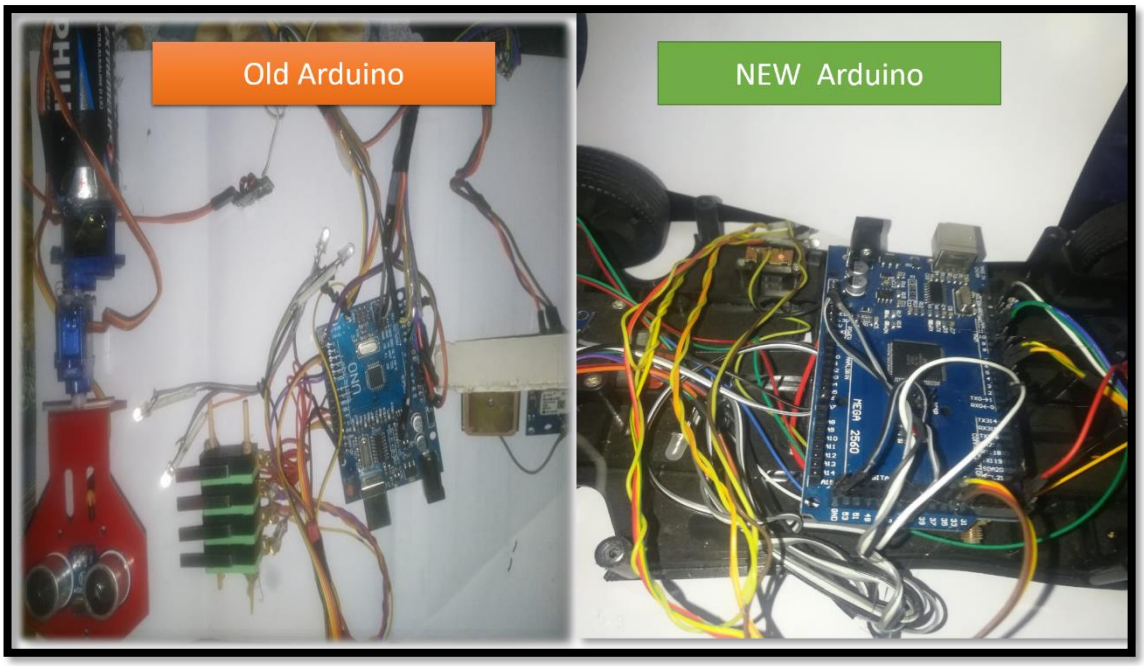

FIGURE 28: BOTH ARDUINO IMPLEMENTATION

6. Switches Issues

- The switch we were using previously was misfit in the system.
- No major issue with that but were not appropriate to fit that due to nature of the cars.

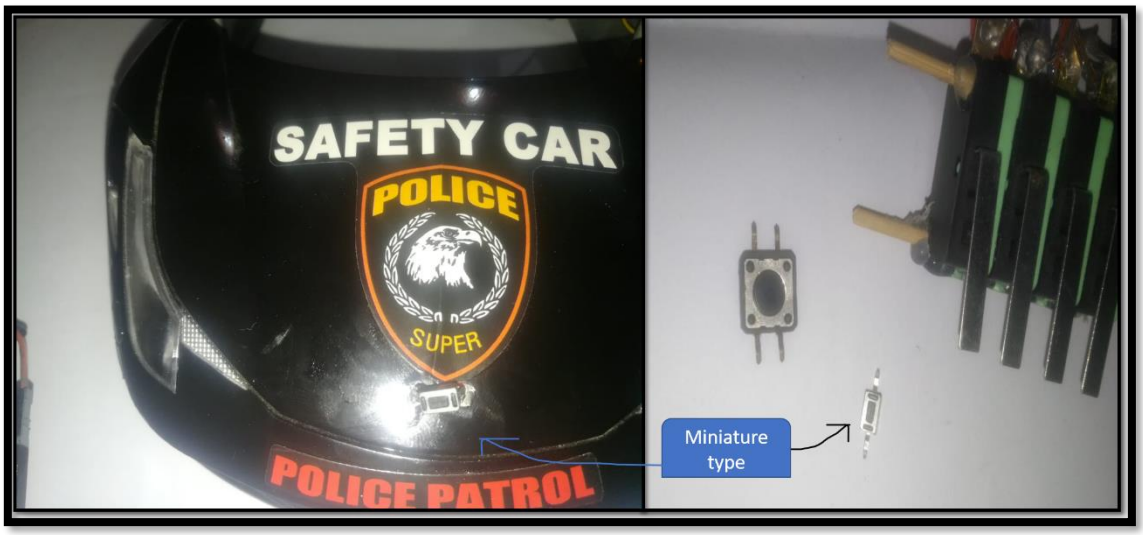

FIGURE 29: SWITCHES CATEGORY

7. Video Transmitter Issue

- Due to budget constraints we were reluctant in using video transmitter.
- Fortunately we managed to buy this video transmitter receiver.
- All the nec data management is done.
- Video at a distance of 5 km can easily be transmitted on this video transmitter and receiver LOS equipment.
- Unfortunately there is unidentified issue with this transmitter and receiver.
- It works for some time randomly and then stays un connected, the issue was not identified as it was Chinese eqpt and after repeated test and trial but couldn't find the reason of this issue, so resorted to a more suitable video transmitter.
- New Tx /Rx purchased to fulfil our requirement

FIGURE 30: COMPARISION VIDEO TX / RX

8. RF Tx/Rx

- Initially we implemented 433 MHZ RF Tx / Rx which we not high quality but were fulfilling our requirements.
- The issue involved with those were that they were not reliable so we had faulty data tx.
- Delays in data transmission.
- Frequent packet loss.
- Ultimately we had to purchase new ones which were programmable and named as HC-12 RF Tx/Rx with around 1.8 km range.

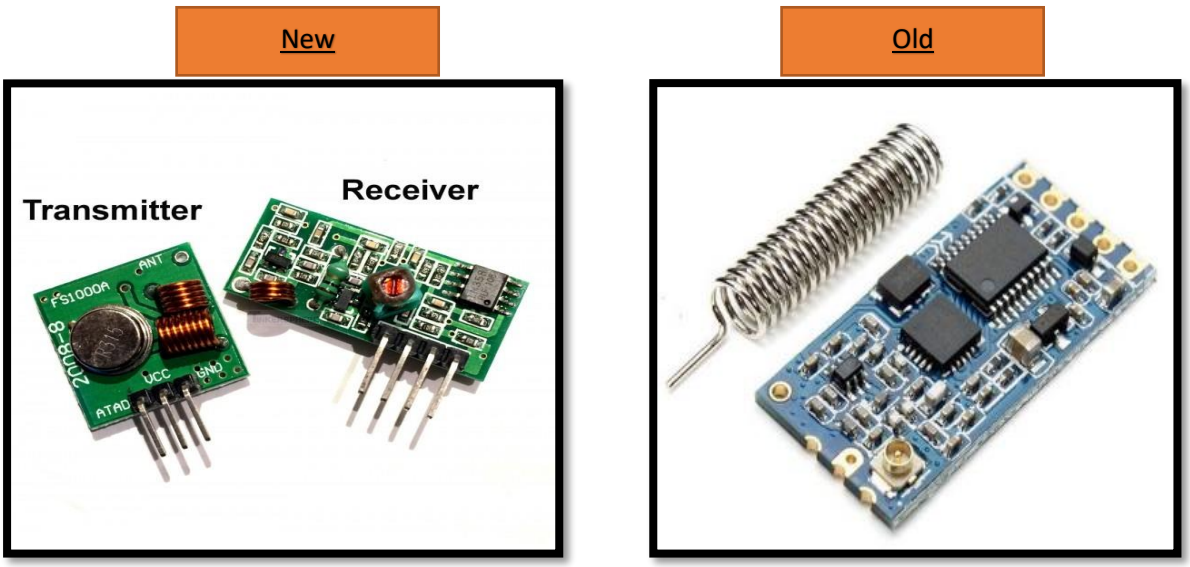

FIGURE 31: COMPARISION RF TX / RX

4.2 BUDGET OVERVIEW

Roughly we went though a lot of expenditure . The detail is as follows

Raspberry Pie	**8000**
Arduino UNO	**950**
Arduino 2560	**1400**
Rasp Camera	**2800**
Video TX /RX (Faulty)	**7000**
Video TX /RX NEW	**8000**
Dummy Adhoc Vehs	**6000**
Switches Old	**1000**
Switches New	**1500**
Servo Motors	**1500**
2x GPS Module	**5000**
Bluetooth module	**1000**
RF TX /RX (Faulty)	**1000**
RF TX /RX (New)	**2000**
Misc btys extra	**1000**
Range finder	**750**
TOTAL	**48,900**

FURTHER RESEARCH

This chapter will mainly focus on the suggestions and ideas given as input during the work done on the project. These ideas show how to expand the project into more practical innovations for real life control of vehicles and enhanced monitoring at control room if incorporated with improved framework structure.

1. This project can be modified for purely military use by incorporating MBNR/ SDR.
2. This framework can be introduced commercially in the market for cars, cabs and rescue/ ambulances by making few changes.
3. This project with minor modifications can be used by police/ anti-car lifting cells to overcome the cases of car theft and to track prisoner vehicles carrying prisoners from prison to court and vice versa.
4. For commercial, rescue and police use, existing commercial 3G or 4G can be incorporated for transmission of real time information (location and cameras feed) to the control room.
5. Range finder can be traded with long range laser sensors.
6. Raspberry pi camera and other cameras (if) incorporated can be supplanted with night vision camera.
7. For mil operating in sensitive areas where movement is independent of light during night, ultrasonic sensors and night vision cameras can be incorporated to ease the movement during night/ low light.
8. Automatic alert scheme be devised for neighboring vehicles in case they cross the minimum defined inter vehicle distance.

CONCLUSION

We have selected “**Innovative Vehicle Support System (Military Convoys)**” as our project. Project envisages on the design of such a support system, which pass back real time video transmission, and other various attributes to update our rear HQs regarding any eventuality with their last location, so that assistance of any sort can be provided to them as soon as possible. In addition to that mentioned above, accident prevention is also incorporated in the project, where the vehicle will assist the driver or the second seater regarding any future eventuality that can happen. If this project dully materialized with little amendments and best suited components or the right job, this project will act as a way forward for live streaming of info/video between various command echelons.

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