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Autonomous Car Parking System

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Abstract – As the number of cars is increasing it is leading to a number of problems such as the area is becoming more congested leading to the immense traffic on road and even lesser space for parking the vehicles. Hence emerges the main problem which includes finding space for parking or manoeuvring the car in the parking space which becomes very difficult because of the congestion. The Parking alert system will make sure that no other vehicle comes and parks in vicinity to the car in a way that it becomes difficult for the driver to get in the car or it gets difficult for the driver to manoeuvre the vehicle later out of the parking space. We aim to create the system that turns on as the vehicles gets parked and alerts the driver of the other vehicle to park at a distance in order to give the vehicle passage for manoeuvring. In the system a microcontroller will be installed along with four ultrasonic sensors on all four sides of the vehicle and an alarm that acts as an actuator. The system actuates only when a certain condition arises which are coded according to the algorithm used in the microcontroller.

Keywords: **Autonomous System, Parking Alert, Arduino, Ultrasonic Sensor, Actuators, Sensors.**

I. INTRODUCTION

Considering the rate at which the population is increasing rapidly and the increase in rate of growth of car owners everywhere, the space on road is decreasing and number of vehicles is increasing. Especially in countries like India, China and other populated countries, parking spaces are stuffed with vehicles which make it very difficult for the drivers to get their vehicles out of the parking space. The main problem includes finding space for parking or manoeuvring the car in the parking space which becomes a very difficult task because of the congestion. The Parking alert system will help the driver to manoeuvre even if he/she has cars surrounding their own car. So, in this situations like these when other vehicles parking in vicinity to your parked vehicle becomes an issue for you, an alert system comes for a rescue as it can be managed by performing different cases in which the alert system can acknowledge the minimum distance at which any other car should be parked.

The system can be of great help for not only the beginners but also the experts as sometimes in case of emergency the vehicle may get stuck and find it hard to drive through the congestion in parking hence in such situations, the alert system will help by informing the other

car driver about the range and alerting him to maintain a certain distance from the vehicle as well as not to block the vehicle from all directions.

The range of each side of the vehicle is defined as the minimum distance that any side of the vehicle should have so that the car can be easily manoeuvred or even the driver can easily get in and come out of the car if two cars are parked together. The ranges vary by every side, as the algorithm designed is defined in way such that the vehicle has enough space left with it to easily manoeuvre.

Below given graph shows the increasing number of vehicles per 1000 people with the increasing years.

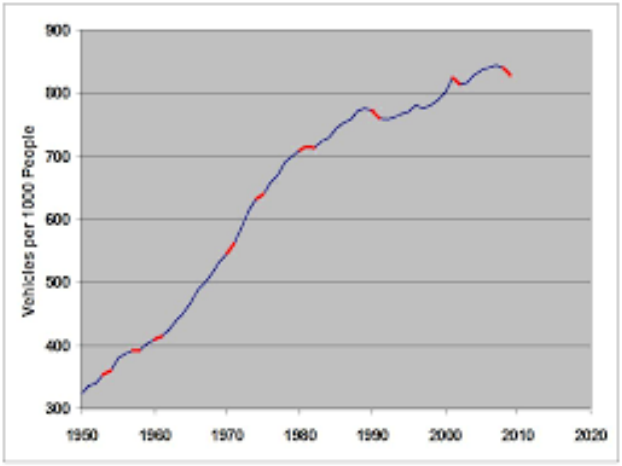

Fig 1. Year V/s Vehicles per 1000 people

The aim is to make a cheaper system which is suitably provides results that are helpful for the user in order to maximize the output.

II. About Idea

As the congestion is increasing day by day because of the large number of vehicles compared to the number of land present so it sometimes creates problems including the difficulty for the driver to get out of the car when another car is parked close leading to making it difficult for the driver to drive off the car out of the parking space. The research enlightens the unsatisfactory experience of the drivers which the system will resolve by performing various algorithms. In populated areas, urban or rural, it is very common to see vehicles parked compactly, blocking other parked vehicles and making it difficult for the drivers to drive off.

Plan towards completing the aim:

• Using a microcontroller embedded with four ultrasound sensors which can be used for the calculation of distance between the sides of the car and the nearby vehicle or any other obstacle.

• If the recorded value is less than the range provided to the microcontroller then it will lead to actuate the alarm through the actuator.

Also, the alarm will alert the driver of other car to park the car at a distance that does not block the vehicle or make it difficult for the driver to manoeuvre.

III. FUNCTIONAL REQUIREMENTS

The main aim was to make the design more durable and more user-friendly in such a way that they can get the required output at all the times.

The designed system should provide the following services:

- It should alert the driver of other parking vehicle through an alarm.
- Provide easy manoeuvring to the driver.

Take care of the vehicle's all sides in order to make sure there is always ample space in vicinity to the vehicle.

V. SOFTWARE AND HARDWARE SELECTION

SOFTWARE: Arduino

The microcontroller that we used in our system is ARDUINO-UNO because of its compatibility with all the system with its ease of availability.

Reason for Choosing Arduino:

- Arduino software can be easily used by beginners as it becomes easy to code in the microcontroller. It also provides a a lot of opportunities to the advanced coders of Arduino. It runs on Mac, Windows, and Linux. It is used by scholars and teachers for building the projects.
- Arduino are inexpensive leading it to be user- friendly as even the student can buy it and perform the experiments on it.

- It can be used on any platform whether it is Macintosh OSX, Windows or Linux which makes it a cross platform.
- It is an open source software for providing the programmers with the extensibility to code in language such as C++.

HARDWARE: Ultrasonic Sensor (HC-SR04)

The hardware plays a very important role in parking alert system as most the main aim of the system is accomplished by the hardware. The hardware involves four ultrasonic sensors with an arduino uno. The HC-SR04 uses sonar to determine distance to an object. It provides the distance analysis from the object which is done accurately and precisely. Its analysis is not affected by any component such a sunlight or darkness.

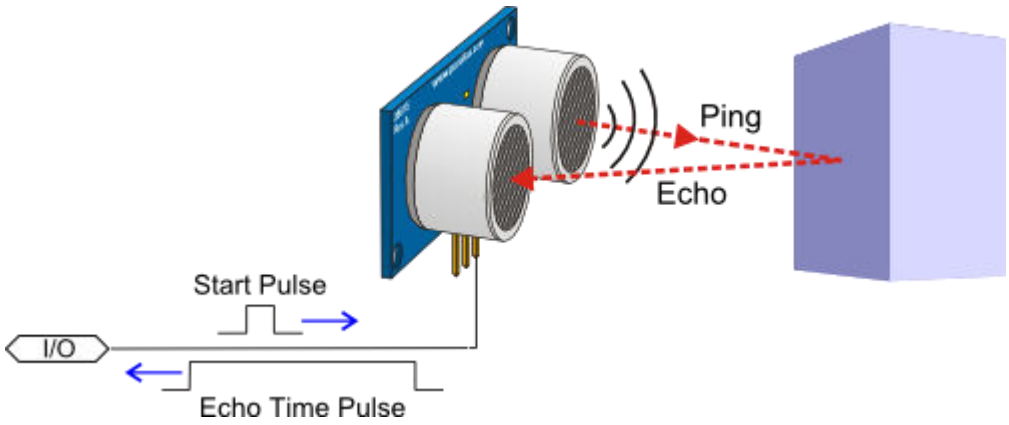

Fig 2. Ultrasonic sensor working

MICROCONTROLLER: Arduino UNO

Arduino has a common IDE which is very easy to use and can be used by the beginners. The main purpose behind of using Arduino is its portability along with its open source existence.

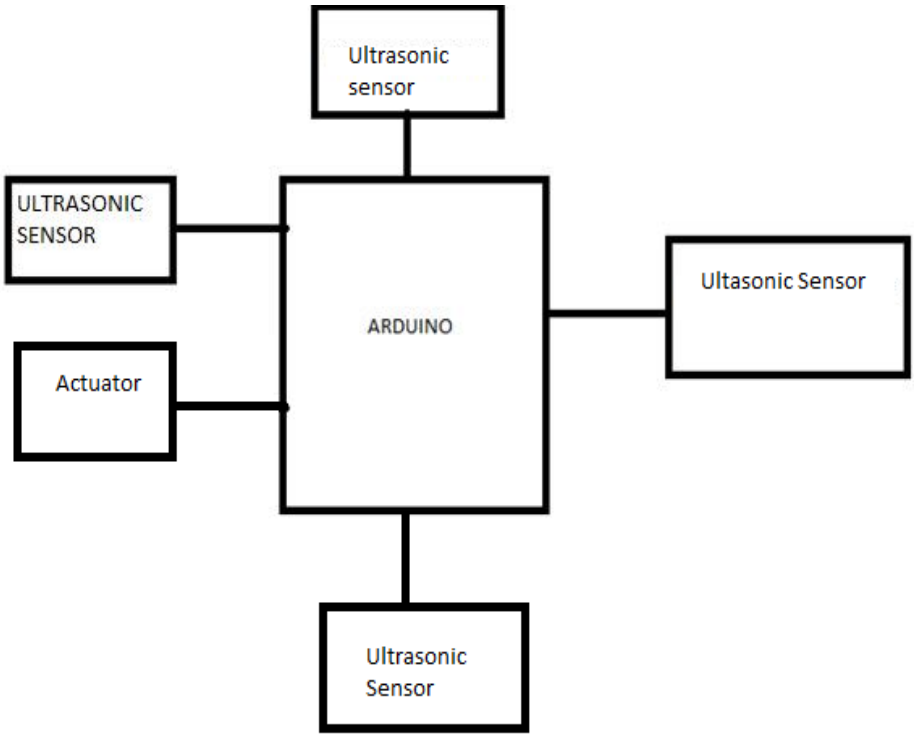

Fig 3: Block Diagram of the system

VI. IMPLEMENTATION

The system consists of four ultrasonic sensors and one actuator. It consists of its own battery but the system starts when the vibration in the car is zero that is the car is off till a given particular time. This is to make sure that vehicle is actually parked and not waiting in a jam or traffic lights. The role of ultrasonic sensor is to calculate the distance between the two cars if the distance for the left and the right side is less than the $3/4^{th}$ width of the car door then it will lead to the actuation of the alarm so as to alert the other vehicle's driver. Hence, first as the vibration of the vehicle stops the system turns itself on and the ultrasonic sensors start to measure distance of the vehicles and obstacles in the vicinity and compare them with the range values of each sides and act according the algorithm has been coded.

Below image shows the positioning of the ultrasonic sensors and the arduino board in the vehicle.

Fig 4. Model Setup of arduino and the sensor in the vehicle

VII. FEASIBILITY

The system that we aim to build is an autonomous system that does not need to be connected with the internal system of the vehicle and only needs to be incorporated in the vehicle so as to any vehicle can have our system in it and effective to use it. We aim to design a COTS which can be embedded inside the vehicle and is ready to use.

VIII. ALGORITHM

1. If the vibration is equal to 0 till the 5 second then the system is initialised and along with that initialises the variables on the four side to calculate the distance using the ultrasonic sensor.

int dist1, dist2, dist3, dist4;

int range1, range2, range3, range4;

(all the above values of range1, range2, range3 and range4 are pre-defined according to the vehicle)

Range1 is sub divided into two parts:

Range1_a and range1_b where range1_a is the distance that any other vehicle must be parked at the driver's side of the vehicle if the vehicle already has a blocking from any two more sides, whereas the range1_b is the distance where any other vehicle can be parked in order that the driver can enter the vehicle easily.

2. Calculating the distance between the car and the obstacle when the engine is off and various cases are formed.

2.1. First, let us consider that there is no vehicle in the front of the car as well as no other obstacle is present in front.

In this case, the sensor2, i.e., in front of the vehicle gives us no obstacle reading, hence a vehicle can easily be driven off. Only case that can create problem in this scenario will be if any other vehicle is parked so close to the car such that the door of the driver's side cannot be opened and hence it will be tough for the driver to get in the vehicle.

If *(dist1<range1_b):* alarm is actuated

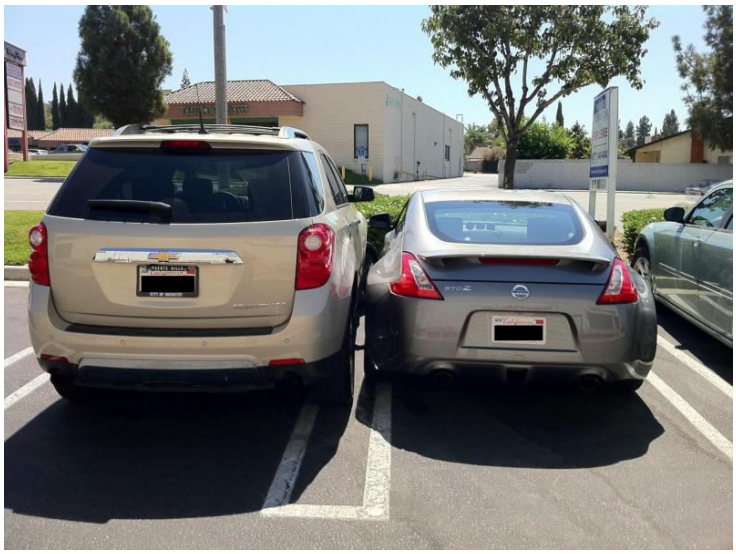

Fig 5. Car parked in vicinity to the driver's side

2.2. Second, if there is an obstacle right in front of the vehicle than no other car or vehicle can be parked right behind the vehicle even if the sides are not blocked, as it will not be possible than to manoeuvre for the driver if both front and the back are blocked.

If *(dist2<range2 && dist4<range4):* alarm is actuated

Fig 6. Car parked right in front of the vehicle

2.3. Thirdly, the car can have obstacles on either sides and in front, in such cases no other parking can be allowed behind the car, and the range of the space that has to be kept behind the vehicle is equivalent to the length of the vehicle.

If *((dist2<range2 &&(dist1<range1_a || dist3 <range 3) && (dist4<length_vehicle))*: alarm is actuated

Fig 7. Car having its all sides blocked due to parking

2.4. Fourthly, even if the front and back has no obstacles, but too close parking of any other on either sides will not allow any easy passage to drive off from the parking.

If *(dist1<range1 && dist2<range2):* alarm is actuated.

Fig 8. Car with blocked passage at sides

IX. TESTING

The Testing of the system will be done by installing the system in a four wheeler vehicle and then recording the values. System testing is performed on the entire system in the context of a Functional Requirement Specification(s) (FRS) and/or a System Requirement Specification (SRS). System testing tests not only the design, but also the behaviour and even the believed expectations of the customer. It is also intended to test up to and beyond the bounds defined in the software/hardware requirements specification(s). System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of black-box testing, and as such, should require no knowledge of the inner design of the code or logic.

Also, we have tested the given hardware system on the Swift Dzire vehicle. Below, are the details of the vehicle's length and other measurements:

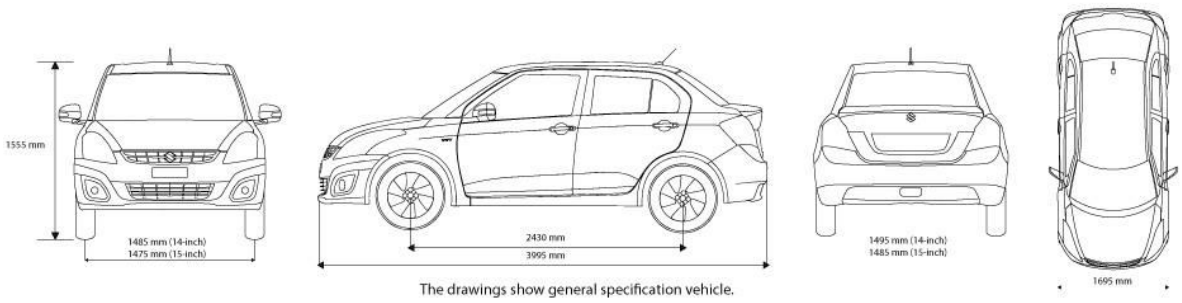

Fig 9. All related measurements of the Swift Dzire

For testing we coded the designed algorithm onto an arduino microcontroller and below given are the code snippets from the arduino code:

1. Defining and declaring all required variables such as the vehicle length as well as door length along with the ranges defined for all the four ultrasonic sensors.

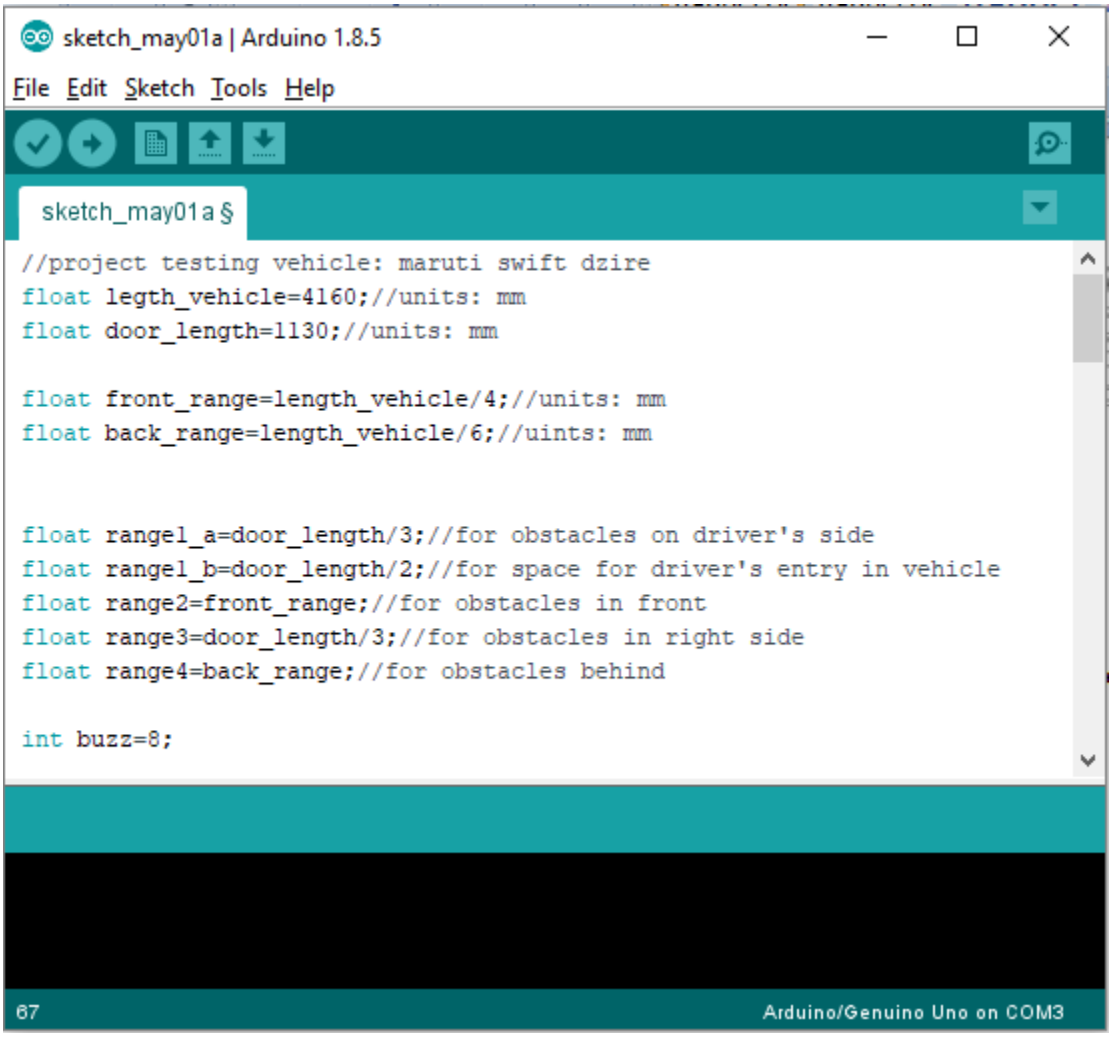

Fig 10. Declaring variables and constants

2. In the setup area of the arduino code, we define the positioning of the pins of all the ultrasonic sensors and the buzzer on the arduino uno board.

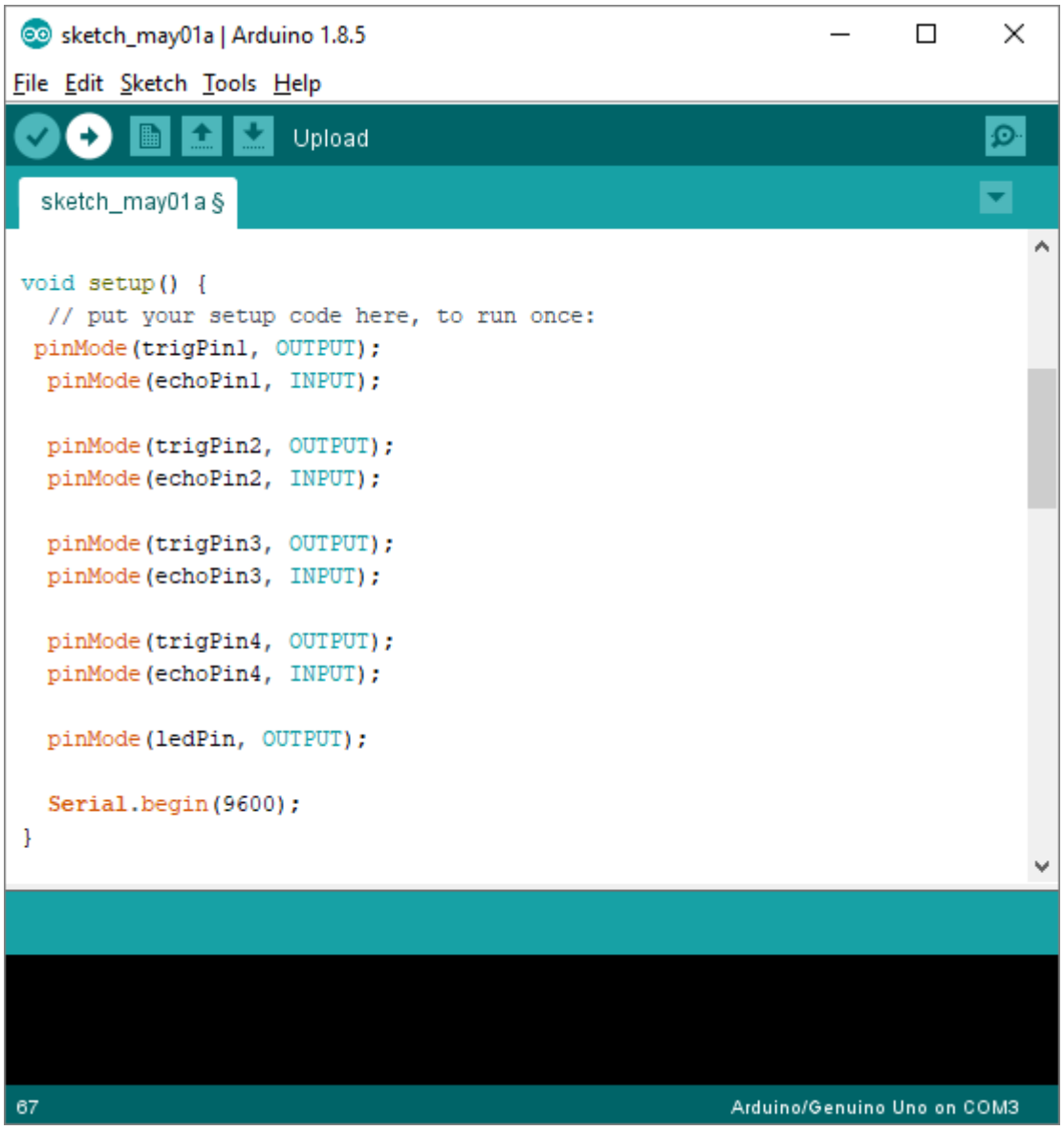

Fig 11. Setup() clock of arduino code

3. Further, in the loop section:

3.1. First, we code to find the distance measured by each ultrasonic sensor, so as to further use it in the given code.

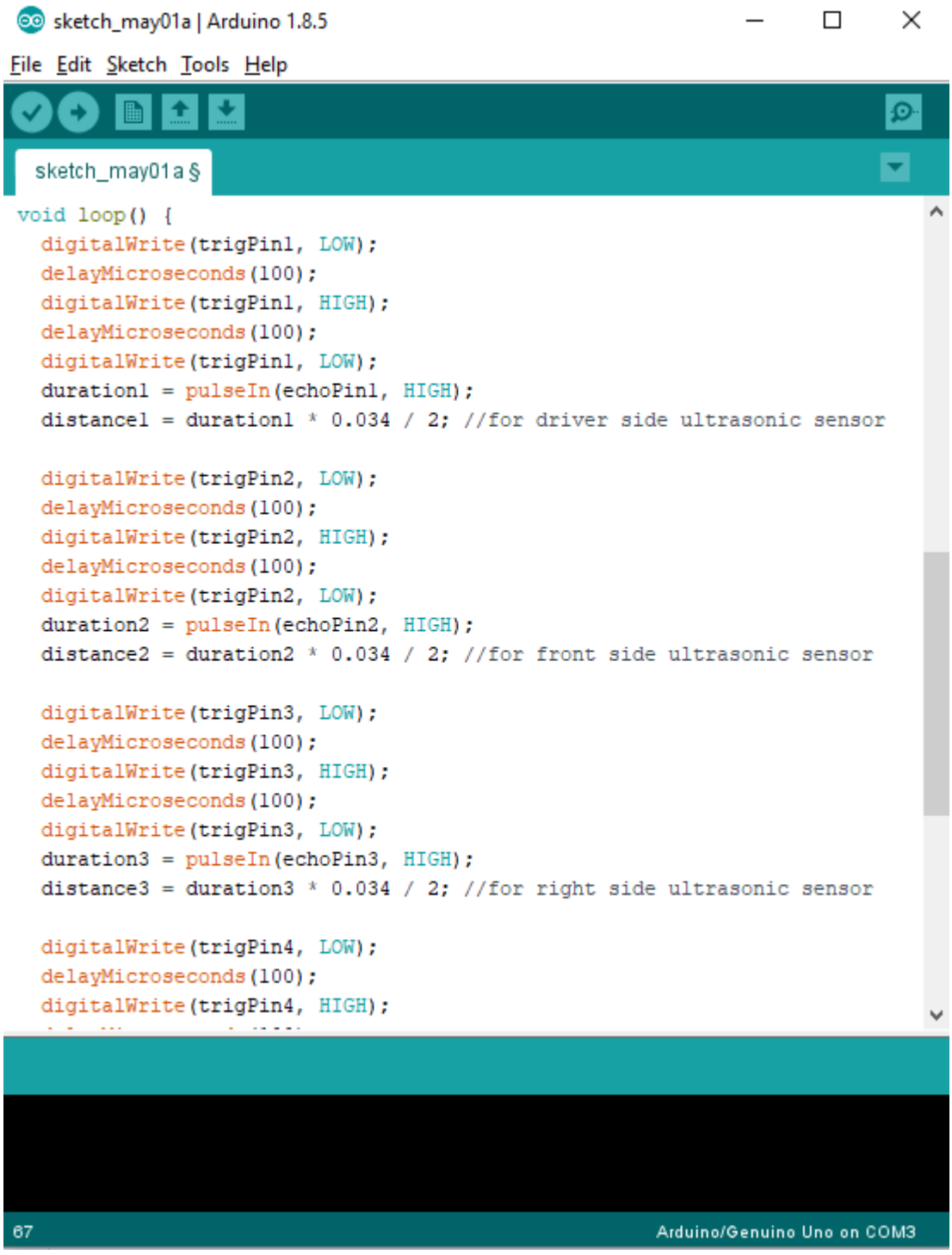

Fig 12. Loop() section of the arduino code

3.2.Now, finally we use the above vaues as measured by the ultrasonic sensors and use it to actuate the alarm whenever required as given in the algorithm.

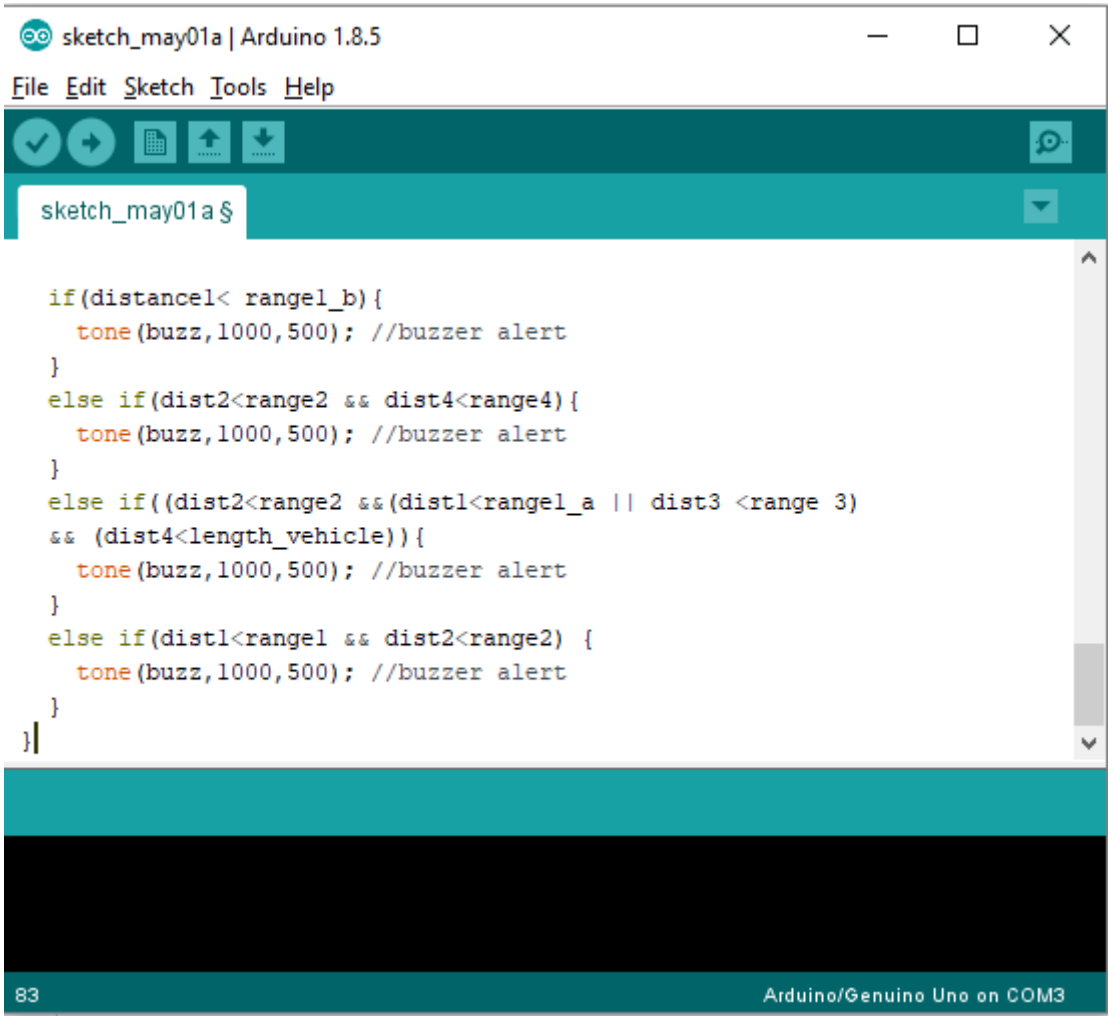

Fig 13. Algorithm implementsation

X. CONCLUSION AND FUTURE SCOPE

The system as one will help in alerting the driver of the other vehicle to park the vehicle at a distance greater than the range defined in the algorithm keeping in mind the required distance for safe passage and manoeuvring of the car so that it is convenient for both drivers to drive off the parking area. Also, sometimes it leads to the unnecessary arguments which will be eliminated once the other driver has an idea about the range of the car near which he is parking.

The system has been tested, taking care of testing all the modules to all their functional requirements. Such autonomous parking alert system hold a great importance in today's world where roads are panting up with vehicles and it is getting really difficult for the drivers to park their vehicles in the crowded areas. The system helps to maintain a certain distance between two

vehicles such that both can have easy passage to manoeuvre and drive off their vehicles from the parking area.

REFERENCES

[1] IOP Science. [Online]. Available: http://iopscience.iop.org/article/10.1088/1755-1315/88/1/012031/pdf
[2] "Deep Drive: 2007 Lexus LS". Consumer Guide. Retrieved 2010-02-02
[3] Ford Motor Company (2008). "See It, Hear It, Feel It: Ford Seeks Most Effective Driver Warnings for Active Safety Technology. Increased warnings indicate potentially hazardous lane changes". Gale, Cengage Learning/Free Library. Retrieved August 11, 2013. .

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