Intelligent Braking System with Cruise Control

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Abstract- India is among the fastest developing nations in the world and its population and number of vehicles on the road are increasing exponentially. Reports suggest that India is among the top nations having maximum number of road accidents. This paper proposes a safety system for vehicles in order to reduce the chances of collision, hence reducing number of road traffic accidents.

Most of the safety systems already present in vehicles like ABS (Anti-Lock Braking System) require human intervention or Airbags, which work post collision. The intelligent braking system suggested in this paper is an automatic continuous monitoring system, which works without any human intervention and eliminate any chances of collision at the same time. This system is also an improvement over the cruise control system present in some vehicles.

As we brainstormed to find solutions to develop this system, we came up with two main parameters, which need to be calculated. First being the distance between vehicles, which is found using the reliable and precise ultrasonic sensors and second the relative speed between two vehicles, which is found using the millimeter wave Doppler sensor. These two parameters are then fed to an algorithm, which controls the brakes and engine speed of the vehicle to avoid collision.

The proposed collision avoidance system also comes with a feature of cruise control where in the driver can set a speed at which he/she wants to cruise. The Intelligent braking system monitors the traffic ahead and works seamlessly with the cruise control. This system is very capable of completely reducing the number of accidents on road making the Indian roads a safer place to drive.

Keywords- Ultrasonic sensor, Doppler sensor, Collision avoidance system, Cruise Control, Vehicle safety system.

I. INTRODUCTION

India is among the fastest developing nations in the world and its population is clearly among the highest in the world. With such a great population in this date, there are more number of vehicles on the roads than ever. A 2015 report by the Ministry of road transport & highways, Gov. of India [7] stated that there were 4 lakh to 5 lakh road accidents taking place every year during 2005-2015 [7] also there were around 1 lakh people dying because of road accidents every year and this number is ever rising. Also, a Road safety report from the WHO in the year 2013 shows that India ranks second in the number of road traffic deaths. The MORTH report stated that the fault of the driver i.e. being distracted driving stands the main reason to these accidents. This is a serious problem which needs solution. Safety systems like the Airbags are present, but the problem is that the airbags do not avoidaccidents; they just mitigate the effect of collision. In addition, safety systems like ABS are present but they need human intervention.

II. OBJECTIVE OF SYSTEM

1. To find the distance betweenthe demo bot and the obstacle.
2. As the obstacle can be static or moving, calculation of the relative speed of the bot or the obstacle is also an objective.
3. Also, to find the speed of the bot in front and then control the speed of the bot at the back according to the relative speed and distance between the two.
4.Integrate the system together to form the whole collision avoidance system.

III. PROPOSED SYSTEM

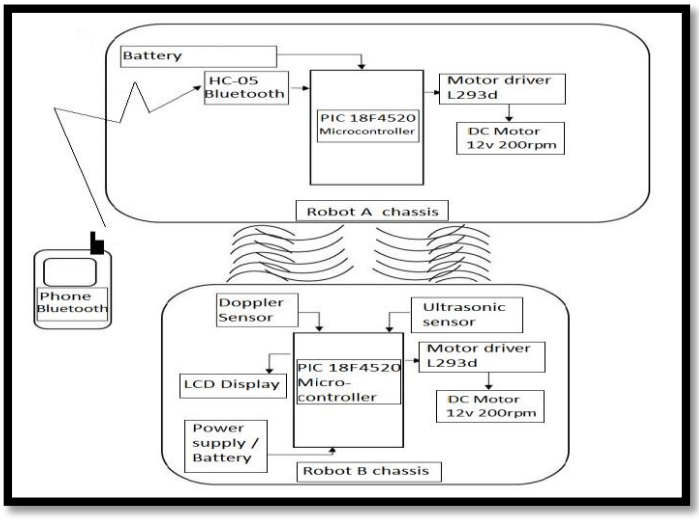

Fig.1: Block Diagram

Figure-1 shows the block diagram of various components of the system.

The detailed explanation of block diagram:

Bot A and Bot B are two independent bots representing two vehicles. The Bot A has a PIC microcontroller interfaced with a Bluetooth module, a motor driver IC and two independent motors all powered by a battery. A smartphone is connected to bot A via Bluetooth. The speed of this bot is controlled via sending commands to with the help of Bluetooth.

Bot B is the main bot which is representing the proposed system, which has sensors like ultrasonic sensor and Doppler sensor. This bot will calculate the speed of Bot A and the distance from it and will take actions accordingly to avoid collision. Monitoring the velocity of the bot in front of our bot continuously is necessary hence, a Doppler sensor is used to do that. The speed of Bot Awhichis to be controlled, is also needed; an infrared sensor has been used for that purpose.

In addition, for finding the distance between two bots, an ultrasonic sensor is usedwhich will also continuously monitor the distance between the two bots.

For displaying the distance and the speed, a LCD is used.The software is a C code, which is embedded into the microcontroller the code is fed by the data collected by the sensors, and it will take decisions accordingly. As the distance becomes dangerously less the system will stop the motors from rotating and hence the braking action will be shown. The code will also find out the speed at which the bot in the front is going at and it will set the motor's rpm to adapt and match its speed.This process will take place continuously until the user decides to switch off the system.

The system is a demonstration for the vehicles running on combustion engines but it is a full prototype for an electric vehicle. We also believe that in next 10 years vehicles running on combustion engines will become less on road and will be taken over by electric vehicles.

This system is ideal for an electric vehicle as a safety system but it can also be used in combustion engine cars with some modifications.

IV. COMPONENTS USED IN BOT A

Pic microcontroller: Pic microcontroller takes main actions like receiving data from Bluetooth module and control the motors based on received data from Bluetooth module. Microcontroller receives data from BT module through serial communication or UART communication. In serial communication, data is transferred bit-by-bit only one bit at time. Motor driver also gets signal from microcontroller.

Motor Driver L293D: Motors and microcontroller pins cannot provide enough output current to drive motors. Another reason to use this dual full bridge driver is that we want to control direction and speed of both DC motor. It is possible with dual full bridge driver only. The pic diagram of this IC is shown in Figure-ii.

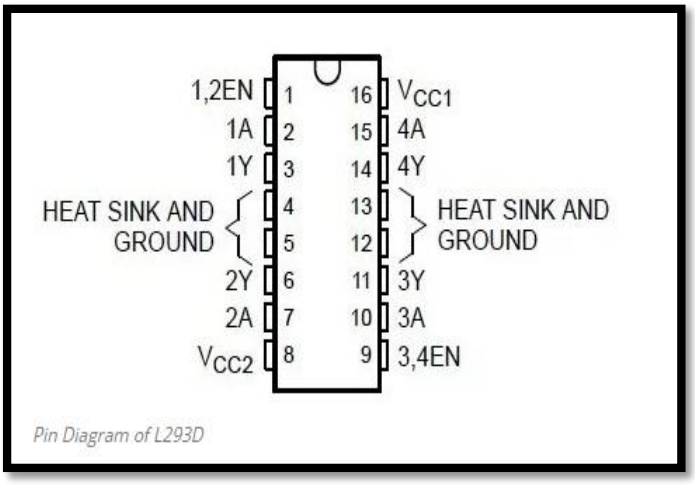

Fig.2: Pin Diagram L293D

DC motors: Two dc motors are used which are interfaced with microcontroller through dual full bridge driver. When both motors rotate clock wise, robot will move forward and when both motors will rotate anti-clock wise, robot will move reverse. Similarly when one motor rotates clock wise with increasing speed and one motor rotates anti-clock wise with decreasing speed, Bluetooth Controlled Robot will move either left or right. Movement direction of robot depends on which motor is rotating clockwise and which is rotating anti-clock wise. The mechanism is similar to car control system.

HC-05 Bluetooth module: HC-05 module is interfacedwith pic microcontroller through serial or UART communication protocol. HC-05 gets commands from android app wireless and send data to PIC microcontroller receive pin.

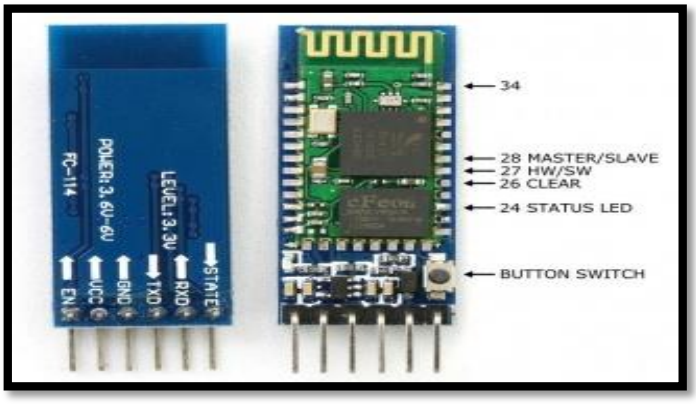

Figure.3:Bluetooth Module

V. COMPONENTS USED IN BOT B

The HC-SR04 Ultrasonic sensor:

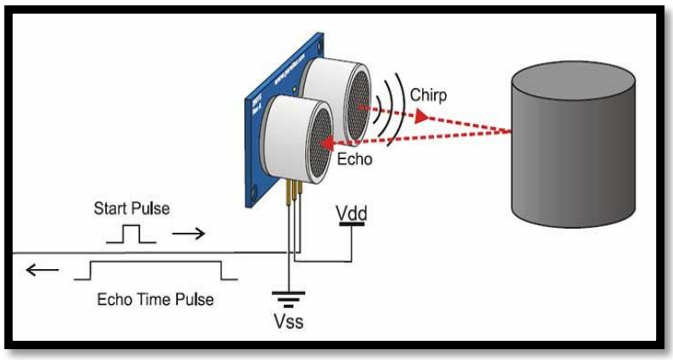

Figure.4: Ultrasonic sensor

[1] Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm also the measuring angle is at 15degrees.

The working voltage is 5volts and the working current is at 15mA.

The Doppler sensor:

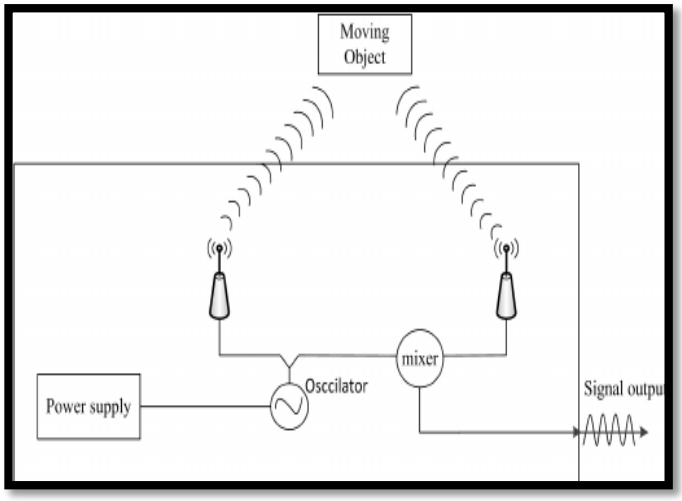

Fig.5: Doppler sensor

This sensor is ideal for speed calculation of the target.

Features:

• Low current consumption (typical 30 mA)

•CW or pulse operation

•Flat profile

•Long detection range (20 m)

•Supply voltage: between 4.75V and 5.25V

HB-100:

[2] HB Series of microwave sensor module are X-Band DRO Doppler transceiver front-end module. This module is designed for movement detection and speed detection. The module operates at +5 Vdc for Continuous wave (CW) operation.

III. Flowchart

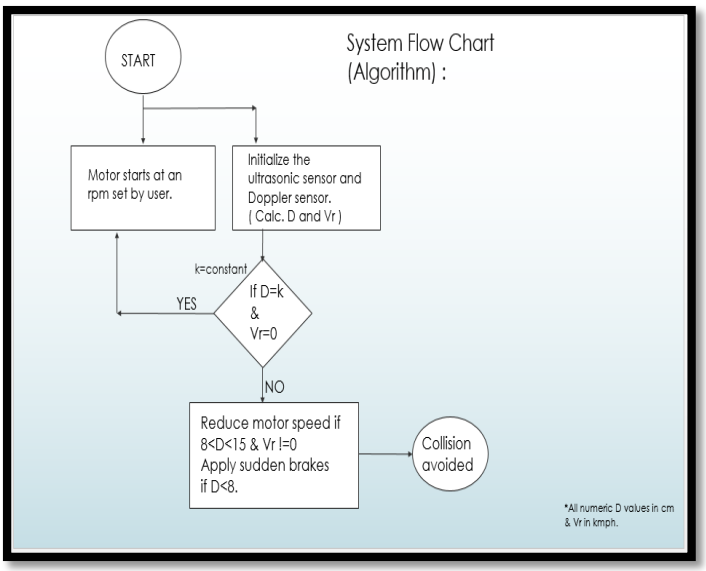

Figure.6: Flowchart/Algorithm

Figure 6. shows the flow chart of the algorithm from which the C code is written and embedded into the microcontroller.

•As the user starts this system, two things takes place- 1.The motors start running on a speed, which the driver sets. 2. The system initializes the ultrasonic and the Doppler sensor [2] and continuously calculate the distance and the speed.

•After that, this data of speed and distance is fed to a decision box where if the distance becomes lower than a predefined value the motors automatically stop. Also in this step, the decision box also monitors the speed of the bot in front and tries to adapt to its speed simultaneously.

•This software algorithm does prove to avoid collision between the two bot.

VI. FUTURE SCOPE OF OUR SYSTEM

Nothing is perfect in this world;hence, our proposed system "INTELLIGENT BRAKING SYSTEM WITH CRUISE CONTROL" also has the scope of more betterment and evolution.

The following future advances and amendments for making this system more efficient are possible.

a) Collision avoidance safety system for both the front and back end of the vehicle.

b) Use of more reliable and more sensitive sensors like radar or

LIDAR for the distance measurement.

c) Auto driving mode can also be added to make driving a better experience and less tiring.

d) Use of high-speed microcontroller for interfacing of sensors, also this system can be embedded into an ECU i.e. the electronic control unit of the vehicle to control the braking mechanism and also the throttle control system[6].

VII. EXPECTED RESULTS

•Upon activation, this system will continuously monitor the vehicles on the road and will always maintain safe distance between two vehicles.

•This system will run in real time and can assist the driver in stressful and hectic situations. During long driving sessions, drivers often feel fatigued and are more prone to distraction.

•This system can work even for long durations and can never get distracted of its task. Hence, it will avoid accidents.

•This system, when implemented on a large scale, i.e. on every vehicle, it can optimize traffic flow, as it can maintain distance between vehicles effortlessly.

•The issue of distracted driving will be solved and the number of accidents due to it will decrease.

•Eventually, it will turn highways and roads more safe to drive.

VIII. CONCLUSION

This paper is written in order to develop and demonstrate the idea of intelligent braking system with the cruise control feature. The intelligent braking is better, beneficial and more reliable safety system as compared to the conventional braking system used in the vehicles nowadays.

In this braking system we have used the ultrasonic sensor and Doppler sensor to calculate the safety distance between the vehicle and the preceding vehicle, and the relative velocity respectively. These two sensors are interfaced with the pic microcontroller to control the other mechanism of the vehicle in accordance with the output of the sensors. This safety braking system also comes with the cruise feature to maintain the constant speed on highways if there is no obstacle in front; this feature makes the driving experience less tiring for the driver. However in future there is the scope of more and more improvisation for better reliability of the system.

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