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ADAPTIVE CRUISE CONTROL USING RASPBERRY PI

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ABSTRACT:

This paper gives the idea to develop Adaptive Cruise Control by using Raspberry Pi. The present world is a result of advancement and continuous change in technology. The automobile industries are trying to improvise with dynamic features by accepting new technology. Nowadays, vehicle owners are more interested in the speed of the vehicle. But as speed increases, the same results in decrease in safety. But advanced technology like Adaptive Cruise Control controls every section of the car and provides safety and comfort. Results from this report show a budget aftermarket adaptive cruise control system is feasible and should be continued with further research. A prototype demonstration unit is being implemented. Full testing of the system will be carried out using a model car to simulate traffic in front. This system will be able to adapt to the simulated changes in traffic and react accordingly with braking and accelerating levels.

Keywords-- Adaptive cruise control, Raspberry pi, sensors.

INTRODUCTION:

Traffic accidents are the most undesirable thing that can happen to road users. According to a survey, more than 80% of accidents happen due to drivers unawareness on driving, loss of their control over the vehicle while they are drunk, due to damaged roads and over speeding of the vehicles. Most road users are familiar with the general rules and safety measures when driving on roads, but only carelessness on the part of road users leads to accidents. Main cause of accidents are human mistakes and some of them are like-drunken driving, over speeding, distractions to the drivers. To reduce number of accidents in roads, we develop a system like Adaptive Cruise control. It consists of sensors that detect an imminent collision. When detected, the system automatically takes control actions without operator intervention.

METHODOLOGY:

The following block diagram shows internal modules of Adaptive Cruise Control System using Raspberry Pi. It consists of Raspberry pi, Ultrasonic sensor, LCD display, Rain water sensor, Accelerometer sensor, Alcohol sensor, Batteries and Motors.

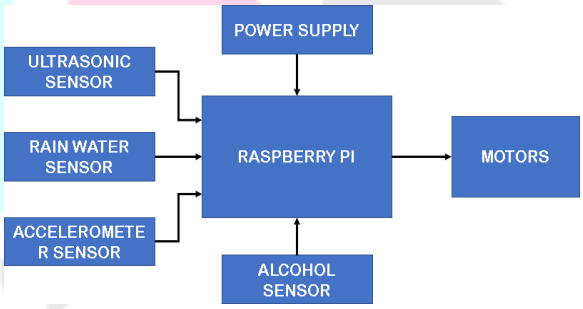

Figure 1: Block diagram of Adaptive Cruise Control system

SCHEMATIC AND CONNECTIONS:

The Raspberry pi is configured in the BCM mode (Broadcom mode) in which the pins of the Raspberry pi are declared based on the General Purpose input/output port numbers whereas the other available mode i.e., "Board" mode in which the pins of the Raspberry pi are declared by their serial numbers.

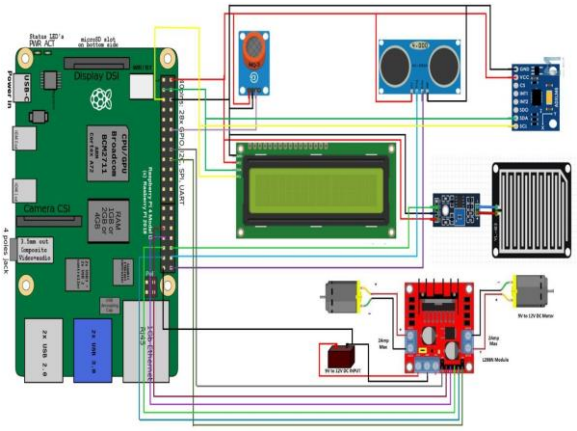

Figure 2: Schematic of Adaptive Cruise Control

• Pin 1 (3.3v o/p) - No connection

• Pin 2 (+5 v o/p) - universal 5v input for all components.

• Pin 3 (GPIO 02 /SDA1) - SDA pin of LCD and ADXL345 accelerometer sensor.

• Pin 4 (+5v o/p) No connection.

• Pin 5 (GPIO 03/SCL1) - SCL pin of LCD and ADXL345 accelerometer sensor.

• Pin 6 (GND)- universal GND pin of all components.

• Pin 7 (GPIO04) - No connection.

• Pin 8 (GPIO14) - No connection

• Pin 9 (GND) – No connection.

• Pin 10 (GPIO15) – No connection.

• Pin 11 (GPIO17) – No connection.

• Pin 12(GPIO18) - D0 pin of MQ3 Alcohol sensor

• Pin 13 (GPIO27) -No connection

• Pin 14 (GND) - No connection.

• Pin 15 (GPIO22) -No connection.

• Pin 16 (GPIO23) - Enable pin of Motor A on L298N motor driver.

• Pin 17 (3.3v) - No connection.

• Pin 18 (GPIO24) - Enable pin of Motor B on L298N motor driver.

• Pin 19 (GPIO10) - No connection.

• Pin 20 (GND) – No connection.

• Pin 21 (GPIO09) – No connection.

• Pin 22 (GPIO25) – No connection.

• Pin 23 (GPIO11) – No connection.

• Pin 24 (GPIO08) – No connection.

• Pin 25 (GND) – No connection.

• Pin 26 (GPIO) – No connection.

• Pin 27 (ID_SD) – No connection.

• Pin 28 (ID_SC) – No connection.

• Pin 29 (GPIO05) – No connection.

• Pin 30 (GND) – No connection.

• Pin 31 (GPIO06) – Motor A negative.

• Pin 32 GPIO12) – No connection.

• Pin 33 (GPIO13) – Motor A positive.

• Pin 34 (GND) – No connection.

• Pin 35 (GPIO19) – Motor B negative.

• Pin 36 (GPIO16) – No connection.

• Pin 37 (GPIO26) – Motor B positive.

• Pin 38 (GPIO20) – Trig pin of HC-SR04 ultrasonic sensor.

• Pin 39 (GND) – Gnd pin of Battery.

• Pin 40 (GPIO21)- Echo pin of HC-SR04 ultrasonic sensor.

WORKING:

The model mainly consists of a Raspberry Pi as the main controller. The Raspberry Pi is powered by a 5V-3amp power supply using a charger adapter. The input section of the system consists of Ultrasonic sensor, alcohol sensor, accelerometer sensor and rain water sensor. The output of the system is given to the DC motors. Initially, the alcohol sensor is used to detect whether the driver is drunk or not. If it is detected as the driver is drunk, the system stops the vehicle from starting and moving.

The ultrasonic sensor is used to detect the leading vehicle and its distance from the host vehicle. If the distance is under the threshold value (minimum clearance distance), the speed of the vehicle eventually varies accordingly with the distance between the vehicles. The accelerometer sensor is used to sense the orientation of the vehicle while it is going through inclinations or uphill. It gradually increases the speed of the vehicle and reduces the speed based on the slope of the road. The rain water sensor is used to detect the rain. Since rain causes the roads to be more slippery than usual which may lead to accidents. When rain (water) is detected, the speed is

reduced. All the sensors are connected to the Raspberry Pi and based on the sensor inputs, the controller adjusts the speed of the motors.

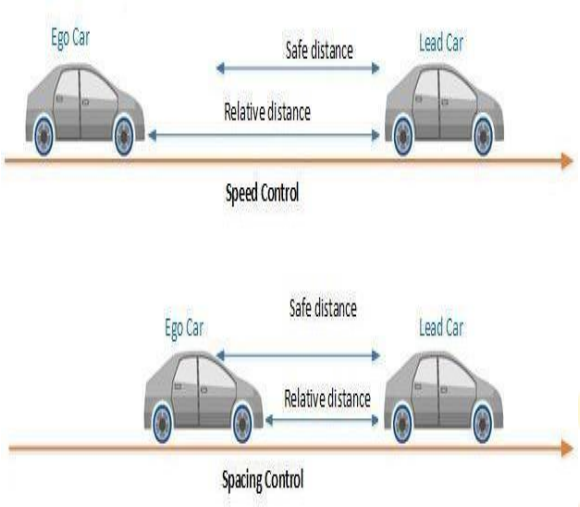

Figure 3: Conceptual visualization

FLOW CHART:

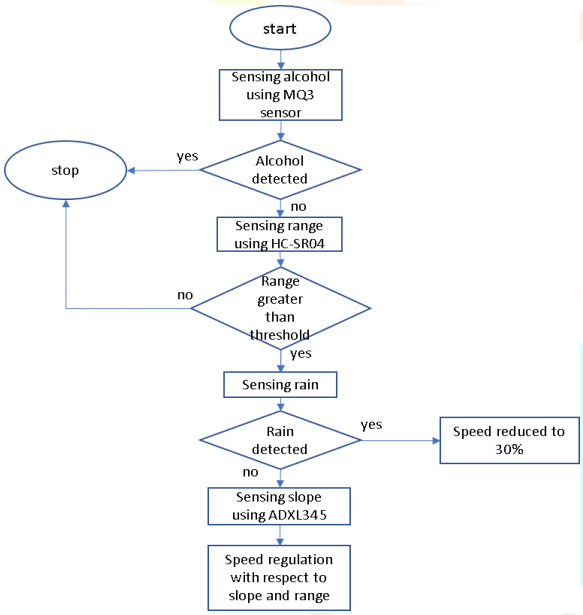

Figure 4: flow chart of Adaptive Cruise Control

RESULTS:

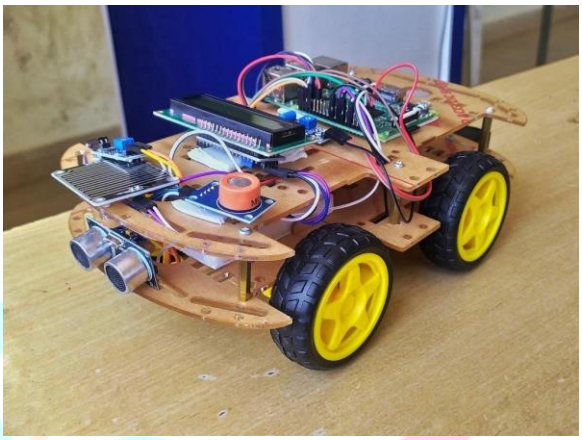

Figure 5: Real Time Adaptive cruise control system integrated vehicle

SOFTWARE RESULT:

- When the system is turned ON, initially it will check for the presence of alcohol.
- If there is any alcohol detected, it will be indicated on LCD screen and the vehicle will turn OFF.
- If no alcohol is detected, the system will continue working and checks for the distance between the preceding vehicle and the current vehicle.

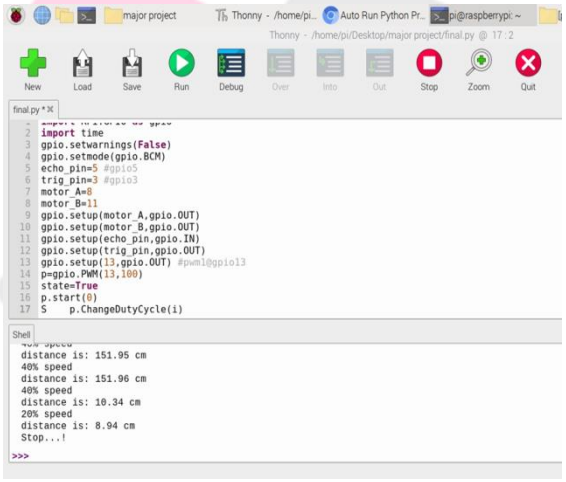

Figure 6: distance-based speed adjustment


```
Python 3.9.2 (/usr/bin/python3)
>>> %Run phase2.py
 Alcohol Detected!
 STOP!
```

Figure 7: detection of alcohol

- If the distance gap is greater then the threshold distance, the vehicle will start to move or else it automatically turns OFF the vehicle by giving an indication through the LCD display.


```
>>> %Run phase2.py
 Alcohol Not Detected!
 distance is lessthan 50cm
 Stop...!
```

Figure 8: detection of distance

- While moving, if there is any wetness or water detected by the rain water sensor, the system automatically reduces the speed of the vehicle to 30 percent of maximum speed and it will be displayed on the LCD.

Figure 9: detection of rain

```
slope is  -10
distance is: 150 cm
20% speed
slope is  -10
distance is: 151 cm
30% speed
slope is  -9
distance is: 151 cm
30% speed
slope is  0
distance is: 271 cm
60% speed
slope is  -1
distance is: 271 cm
60% speed
slope is  -2
distance is: 270 cm
60% speed
slope is  -2
distance is: 271 cm
60% speed
slope is  -2
distance is: 271 cm
60% speed
```

Figure 10: detection of distance & slope and simultaneous regulation of speed

- If there is no rain, it will run normally by eventual sensing through accelerometer and ultrasonicsensors.
- The speed of vehicle is regulated based on the slope of the road and the distance between the vehicles regularly.

CONCLUSION:

The Adaptive Cruise Control helps in dealing with anti-drunk driving and in reducing minor accidents. Minor accidents can be reduced by assisting the driver by providing partial automation during uphill driving, vibrations caused by pot-holes, wet-weather conditions and obstacle detection. This developed system allows the car to be started only when the driver is not drunk. In this way, the system provides such safety features while driving and prevents from crashes or accidents.

FUTURE SCOPE:

In this system there is some delay and to overcome the problem of delay we need to use more powerful processor than the raspberry pi to increase the distance range we can use lidar or we have touse more powerful ultrasonic sensor that can measure more distance.

To make this system we have to use machine learning algorithms that will allow the system to learn itself .So by the use of machine learning system will become self-learner and take action And also reduce the chances of errors. machine learning algorithm. more powerful processor for Image processing. For more distance more powerful ultrasonic sensor having power to measure more distancewith this accuracy.

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