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Intelligent Transportation System

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Abstract: ***This paper proposes a low cost, portable and flexible vehicle security system. It bestows the use of an embedded micro – web server in Raspberry pi -3B microcontroller, with IP connectivity for remotely controlling the devices from another location. The proposed system does not require a dedicated server PC with respect to similar systems and offers an offbeat channel to record and implicate the vehicle environment with more than just the switching functionality. The system for it's the feasibility and effectiveness will be integrated with external devices such as alcohol sensor, gas sensor, ultrasonic sensor and pressure sensors. All of the above features will predict the system to form an intelligent transportation system for a smarter and more secure way of travelling.***

Keywords: Security system, Raspberry pi, Integrated system, Sensors

I. INTRODUCTION

In recent times we hear about a lot of accidents due to drivers irresponsibilities. Certain cases which involve drivers driving under the influence of alcohol or at high speeds which lead to a collision, their rash driving is an inconvenience for other road users and is also a question of life and death. In this phase of the project, we are developing an Auto Lock system as well as a collision avoidance system.

There are also cases where there might be a presence of an unnatural gas or smoke in the vehicle and the passengers in the car might not be aware of. It is important for the driver or the car passengers to be notified about its presence before it aggravates into something that becomes impossible to control.

Many a times, accidental cases due to proximity issues has been recorded wherein due to the driver's blind spots and incorrect judgment of the space between two vehicles, one vehicle collides into another, due to this and both the vehicles suffer major consequences. This project aims to notify the drivers about the distance of a vehicle/obstacle surrounding it and its proximity so the necessary action can be taken and destruction can be eradicated.

The vehicular environment creates unique opportunities, challenges and requirements. First consider the opportunities if the vehicles can directly communicate with each other and the infrastructure, an entirely new paradigm of safety applications can be created and even other non-safety applications can greatly enhance vehicle efficiency. Secondly new challenges are created by high speeds and dynamic operating conditions of the vehicle. Third new requirements necessitated by safety of life applications. In this project, we mainly focus on two added features in a vehicle for better safety precautions and hence ensure a seamless transportation experience for the passengers.

- **Safety lock system** is designed to prevent accident-prone situations by locking the car ignition system when it detects any unnatural conditions that can trigger fatal accidents.
- **Collision prevention system** is to help prevent car collisions due to blind spots and carelessness while driving.

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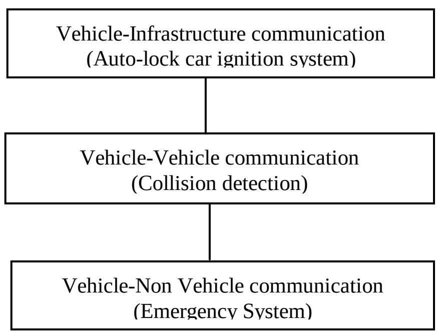
II. THE PROPOSED METHOD

1) Auto Lock Car System - The input of this system is gained from Detection Sensors either from Alcohol, Breath or any other mechanism. The Raspberry Pi keeps looking for the output from these sensors. If there are any traces of Alcohol above the set limit, then the system will turn off the Engine. After this, no matter how many times the driver tries to start the engine, he will be unable to do so unless he has been tested again. The next step is to avoid harmful contact with another vehicle in motion which may be adjacent to ours. In a panic situation.

2) Collision Avoidance - Gauging the distance of an obstacle or vehicle's near/far proximity to our vehicle is implemented using ultrasonic sensors. If the distance exceeds a certain predefined threshold, the driver will be notified and the crash may be prevented which is far more reliable than human judgment.

A. IMPLEMENTATION PROCEDURE



III. IMPLEMENTATION

A. Initialization

Used Raspberry Pi model 3b

- Installation of OS
- Configuration

- Enabling Wi-Fi Installation of following libraries
  - SPI
  - I2C
  - ADAFRUIT BMP180

B. Interfacing Sensors

MQ2 and MQ3 sensors are analog sensors. Hence we had to use an MCP3008 (ADC) to extract the readings and display them on the Raspberry Pi. A pressure sensor BMP180 is used as an indicator to display:

- Tyre Pressure
- Altitude
- Car Temperature

A predetermined threshold value was set above which if the sensors exceeded the car ignition system was automatically shut down and locked. Two ultrasonic sensors are used to measure the distance of any other vehicle or obstacle that might cause collision

MQ2 – Gas Sensor

Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application [8].

- Good sensitivity to Combustible gas in wide range
- High sensitivity to LPG, Propane and Hydrogen
- Long life and low cost
- Simple drive Circuit

MQ3 - Alcohol Sensor

Sensitive material of MQ-3 gas sensor is SnO2, which with lower conductivity in clean air. When the target alcohol gas exist, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-3 gas sensor has high sensitivity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor. The sensor could be used to detect alcohol with different concentration; it is with low cost and suitable for different application [9].

BMP 180

The BMP180 consists of a piezo-resistive sensor, an analog to digital converter and a control unit with E2PROM and a serial I2C interface. The BMP180 delivers the uncompensated value of pressure and temperature. The E2PROM has stored 176 bit of individual calibration data. This is used to compensate offset, temperature dependence and other parameters of the sensor [10].

MCP3008

The **MCP3008** is a 10 bit 8-channel Analogue-to-digital converter (ADC). It is cheap, easy to connect and doesn't require any additional components. It uses the SPI bus protocol which is supported by the Pi's GPIO header [11].

HC-SR04

It is an Ultrasonic sensor i.e a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object [12]. It consists of 4 pins:

1) VCC
2) TRIG
3) ECHO
4) GND

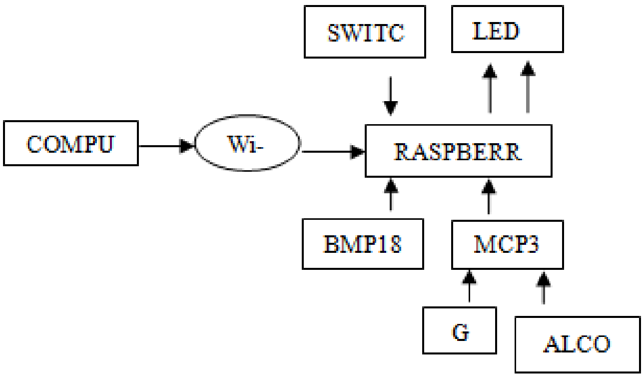


Fig. 1 Block Diagram of the System

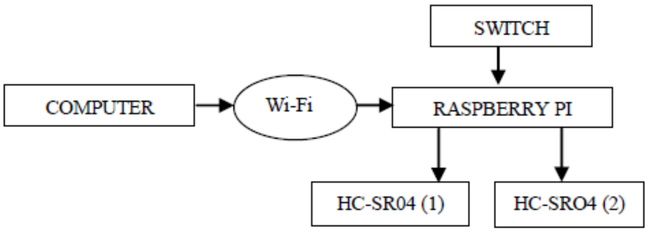


Fig. 2 Block Diagram of the System

The Fig.1 and Fig.2 shows the block diagram of the system

C. Implementation Procedure

- The driver is first asked to start the engine.
- As soon as he does so, the engine ignites and he is automatically getting tested for alcohol consumption and the car is also checked for any abnormal gas conditions.
- If the driver is sober, the Green LED indicates that the system is running and the car can move ahead.
- If at any point alcohol or gas is detected the engine automatically turns off
- The driver is now again asked to try starting the car.
- When he does so, he realizes that he is unable to do so.
- And this is indicated by the glow of a Red LED.
- After this, even if the driver attempts to switch it off and switch it on again, he is still unable to start the ignition system.

- Hence, this automatically locks the car ignition system and prevents the possibility of fatal accidents.
- Now if the car has to be started the driver compulsorily has to be tested again
- If the car is tested and suggested as fit to be turned on then the ignition is turned on and the vehicle sets in motion.
- While the vehicle is in motion it continuously checks for any other vehicle or obstacle from the two sides of the blindspots.

If any other vehicle or obstacle crosses the predefined threshold then the driver is informed using a “TOO CLOSE” message. It also informs the driver from which end there is the possibility of collision.

Fig. 3 and Fig. 4 below show the software implementation of the system.

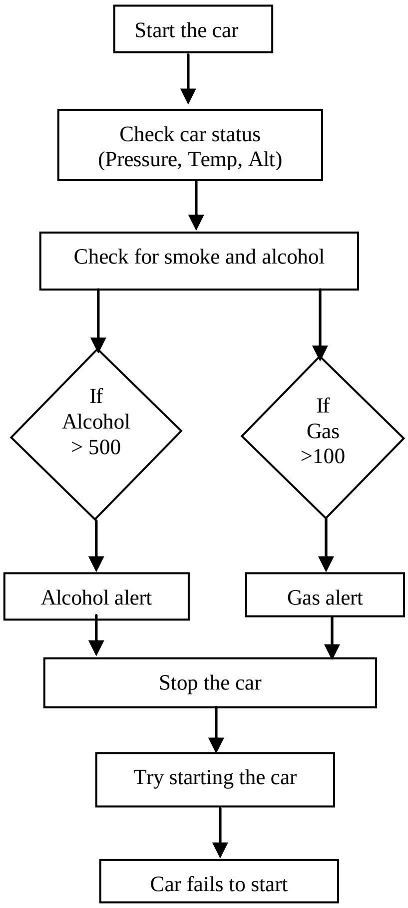


Fig. 3 Flowchart of the System

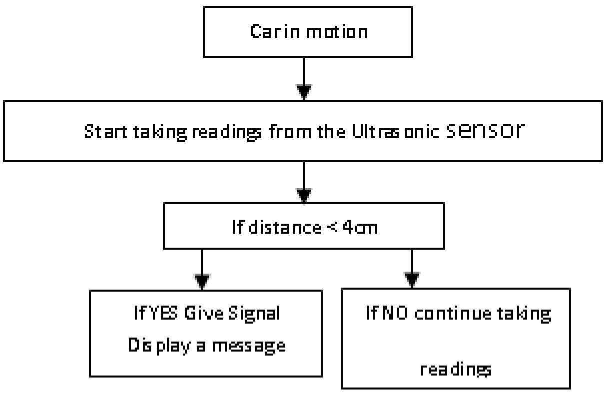


Fig. 4 Flowchart of the System

D. Output

- The ignition system being on has been indicated by a Green LED and the OFF state has been indicated by the Red LED.
- An output message on the server indicating if alcohol/smoke detected
- An output message on the server indicating the current status of the car
- An output message on the server indicating the distance and the direction of the other vehicle/obstacle from our vehicle.

IV. RESULTS AND DISCUSSION

A. TESTING

We tested the project for different types of things containing alcohol or gas:

1) Perfume/Deodorant
2) Sanitizer
3)Incense Stick
4) Lighter/Match stick.

Everytime the sensors exceed the threshold value [Alcohol=500, Gas=100], the ignition system was turned off. The results are shown in the following table 1:

Table 1. Results

Parameters	Alcohol Sensor	Gas Sensor	Ignition state
1)No input	125	13	ON
2)Deodorant	608	15	OFF
3)Sanitizer	571	15	OFF
4)Insense stick	159	116	OFF

A testing sample is as shown below in Fig 5 through Fig 10

1) Current car status and no input

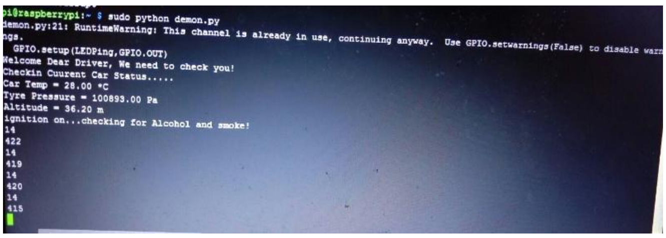


Fig 5. Testing

2) When alcohol was detected (using Deodorant):

Fig 6. Testing

3) When the driver turns the ignition system on after alcohol was detected:

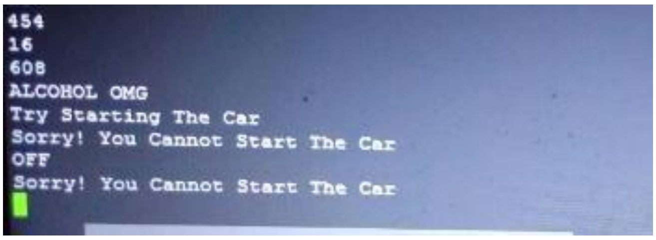


Fig 7 Testing

Fig 8 Testing

Fig 9 Testing

V. CONCLUSION

This system is particularly important when it comes to the widespread implementation of technologies to prevent alcohol-impaired drivers from getting behind the wheel. It also caters to preventing accidents due to major gas leaks. The main advantage of this project is the it is completely wireless and it is completely scalable. The system involves the interfacing of three parts into one whole. The phase I, i.e auto-lock car ignition system is facilitated via a raspberry Pi 3 model B and it's connection to sensors. Phase II consisted of using another raspberry pi connected to different sensors and phase III that operates individually through an application on a mobile phone. An integrated system has been developed wherein two phases work simultaneously through a single system i.e Raspberry pi and phase III independently.

All the three phases of the entire system, being a prototype, can be practically implemented on an automobile by incorporating a few alterations in its operation which will thereby facilitate its functioning specific to every car's requirement.

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