Vehicular Accident Detection System

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Objectives

The Vehicular Accident Detection System primarily detects various obstacles in the surroundings of the vehicle, processes it using raspberry pi, and displays meaningful information to the user. It particularly does the following:

- The ultrasonic sensor attached in the front part of the vehicle calculates the relative velocity of the incoming obstacle/vehicle at regular time intervals and alerts the user if the obstacle is too close.
- The PIR sensor attached on the rear side of the vehicle alerts the user about the obstacles while the vehicle is in reverse gear.
- The IR sensor detects the consciousness of the driver and buzzer goes off if he is unconscious. If the driver remains unconscious for some amount of time, the motor is automatically shut down.
- Additionally, the vibration sensor detects the condition of the road and helps the user to make smart decisions on which route to take while driving.

Introduction

Requirements of safe driving and smart vehicles. Safe driving is very important in today's world. With the population of vehicles exploding, careless driving puts many lives at risk. With the introduction of smart cities, vehicles capable of preventing collisions becomes necessary. In the future, the data generated by the sensors attached in the vehicles will generate data which could later be used to visualize traffic pattern and help in optimizing them.

Advantages of making smart vehicles. It is a lucrative market since there are many vehicles today on the road and with the concept of "smart" city gaining popularity, vehicles have to be made smart as well. This technology costs very less since the sensors used are not expensive while also providing security and support to the users. It is beneficial for both manufacturers and consumers alike.

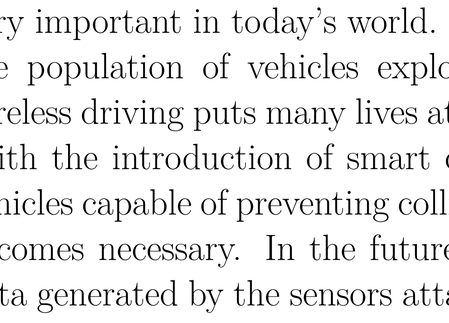


Figure 1: Smart city concept

Sensors and other materials

The following materials were required to complete the project:

- Raspberry Pi 3 model B+
- Ultrasonic sensor (HC-SR04)
- IR sensor (FC-31)
- PIR sensor (HC-SR501)
- Vibration sensor (SW-420)
- Breadboard and jumper cables

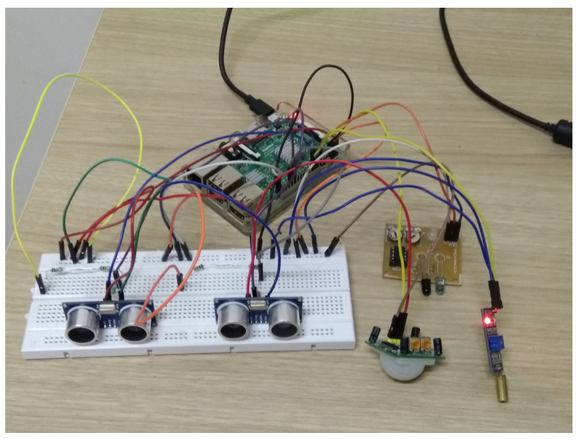


Figure 2: Working model

Working model

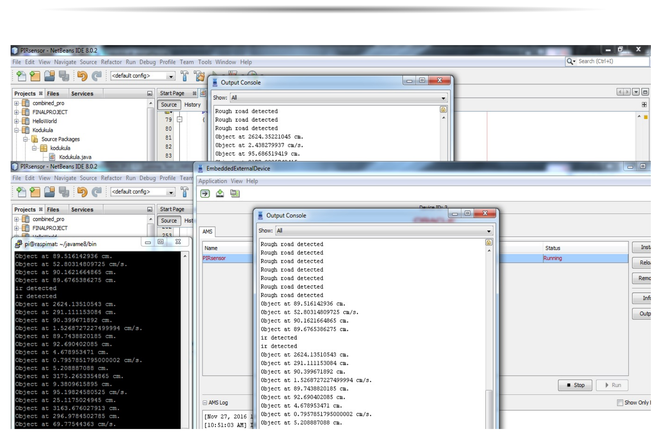
The Vehicular Accident Detection System primarily detects various obstacles in the surroundings of the vehicle, processes it using raspberry pi, and displays meaningful information to the user. It particularly does the following: The ultrasonic sensor attached in the front part of the vehicle calculates the relative velocity of the incoming obstacle/vehicle at regular time intervals and alerts the user if the obstacle is too close. The PIR sensor attached on the rear side of the vehicle alerts the user about the obstacles while the vehicle is in reverse gear. The IR sensor detects the consciousness of the driver and buzzer goes off if he is unconscious. If the driver remains unconscious for some amount of time, the motor is automatically shut down. Additionally, the vibration sensor detects the condition of the road and helps the user to make smart decisions on which route to take while driving. All the data from sensors are sent to Android application which will alert the user for any accidents though user interface.

Approximations and boundary problems

Most of the inaccuracies in the project stems from the limitations of sensitivity of various sensors used. Some examples:

- The PIR sensor will raise alarm even if the vehicle is stuck in traffic due to the prolonged presence of vehicles near it.
- The project also does not take into consideration the fact that the accidents can happen from any direction since there is only one ultrasonic sensor used.
- Also, the project assumes that internet connectivity is always present since the lack of it can disrupt calculations.
- The indications of rough road conditions are not enough to prevent accidents; they are simply given to help the user choose other roads with good conditions.

Additional Pictures



Important Result

The user is able to take smart and timely decisions on the basis of the data provided by the sensors.

Sensor Information

The refresh rate (time interval at which sensors sense data) for different sensors used in the project are as follows:
IR sensor: 5000 ms
Ultrasonic sensor: 1000 ms
PIR sensor: 5000 ms

PIR specifications:
PIR sensitivity range: 3-7 meters, PIR time delay range: 5 sec - 300 sec, Dimensions: 28 X 38 mm, Supply current: DC5V - 20V, Operation temperature: -15 degree C - 70 degree C

Ultrasonic distance sensor specifications:
Power supply: 5V Dc
quiescent current: <2 milli Amperes
effectual angle: <15 degree
ranging distance: 2cm-500cm
resolution: 0.3 cm

Infrared sensor specifications:
Detection angle: 35 degree, Operating Voltage: 3 V - 6.0 V, Detection range: 2 cm - 30 cm, Overall Dimension: 4.5 cm - 5.5 cm

Vibration sensor specifications:
Operating voltage: 3.3 V - 5 V, Dimensions: 3.2 X 1.4

Circuit Diagram

The circuit diagram for the project is described in the picture below.

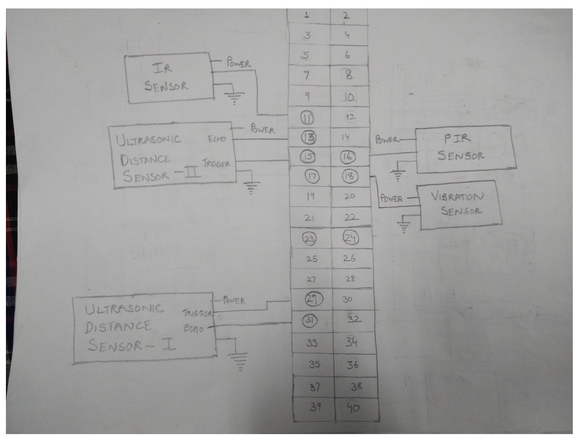
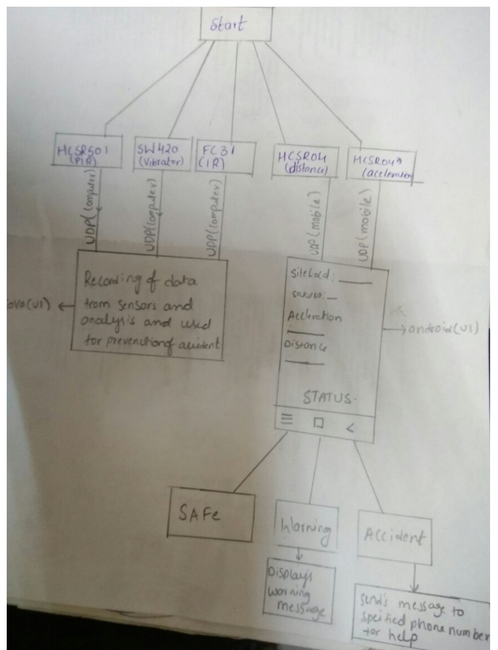
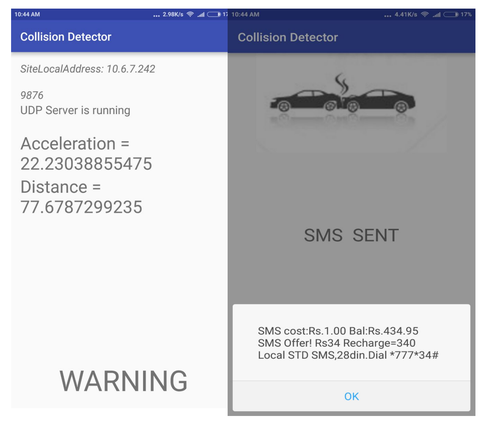


Figure 3: Circuit diagram





References

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[2] https://blogs.oracle.com/java/java-me-8-raspberry-pi-sensorsiot-world

Acknowledgements

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