e-Yantra Ideas Competition 2019-20

Smart Parking Aid System

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Contents

Introduction:

In today's scenario, to take your own four wheeler to travel anywhere is a huge headache. People have to worry about the condition of the roads, heavy traffic, potholes, narrow roads etc. Among all these concerns, finding a vacant parking slot is the biggest worry. Most people in urban areas prefer using car parks. Most of the car parks today have no system to let people know the vacancy status of their slots, plus many car parks are not even visible on Google Maps. So people have to manually look around for car parks, in doing so drivers waste a lot of time and fuel, they also hold up the traffic behind them. On locating one, they have to check each level for a vacant slot. At peak traffic hours, sometimes it so happens that people locate a car park, check every level, just to realize that it's fully occupied, so they have to locate another car park and repeat the same process there. The same scenario exists when people try to find on street parking. Hence the aim of our project is to make a system which will help drivers in locating vacant parking slots.

Market and research:

We found that drivers waste a lot of time looking for parking[4]. A substantial amount of traffic is caused by people circling around for parking[5]. People and municipalities lose a lot of money because of parking related issues[6]. A vast majority of people would like to use an app to help them in looking for a parking slot[7]. The proposed system in the paper[1] constituted ultrasonic sensors, Arduino board, Android application and a WiFi module. The aim of this system is tow help the end user In finding the shortest path to a parking space. The vision based proposed system in the paper[2] identifies the unoccupied parking slot by making use of cameras. This is a camera based framework which utilizes the images around the vehicle.The paper[3] is similar to paper[1] , except that the former utilizes different sensors and controllers, and display the result on an LCD display.

Hardware requirements:

- Five Ultrasonic Sensors HC-SR04
- Raspberry-pi 3
- Jumper wires
- JST connector
- single strand wires

Software requirements:

- For pushing data on the server through the Raspberry Pi 3 : MySQL utility, cyclone.js, LAMP server, MQTT utility etc. (Any one tool from the list, can be used)
- For server side scripting : Node.js, Express.js etc (Any one tool from the list, can be used)
- For building the mobile application : React.js, Ionic etc. (Any one tool from the list, can be used)

Implementation:

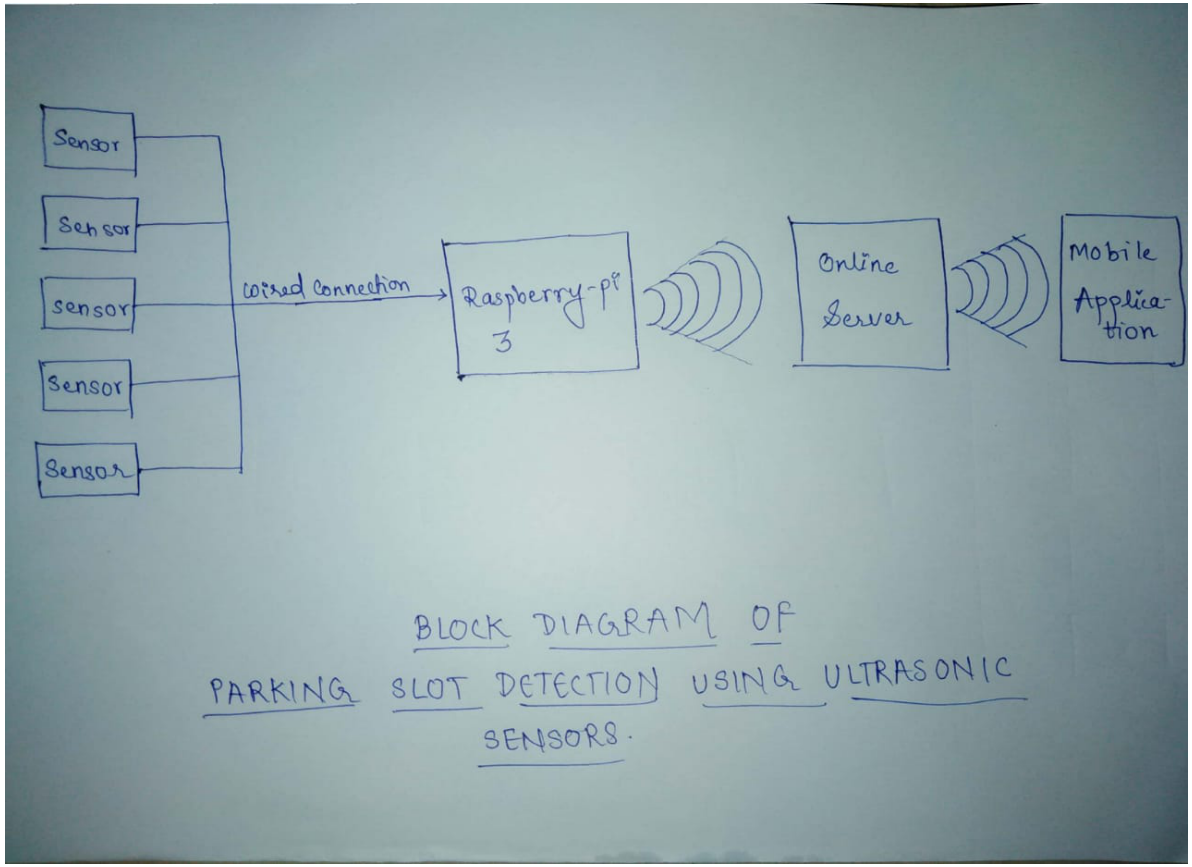

Figure: Block Diagram

Implementation:

We assume that there are five parking slots in a parking area. Each slot is equipped with a HC-SR04 ultrasonic sensor whose range is 4 feet. Ultrasonic sensor has four pins: Vcc,Ground,Echo and Trigger. If high pulse is sent on the trigger pin for more than 10us, the ultrasonic wave of 8 cycle sonic burst is sent by the sensor. Depending on the distance of an obstacle and the time taken by the waves to hit the obstacle and come back to echo pin,the echo pin is high. As soon as a car enters the parking slot, the car will be an obstacle for ultrasonic sensor and it will send the occupied status(Pulse high on echo pin) of the slot to the Raspberry-pi. Henceforth, there will be five sensors in a parking area sending the occupancy status of the slot simultaneously via wired connections to the Raspberry-pi through GPIO ports. This is the data acquisition part of the proposed system.

Implementation:

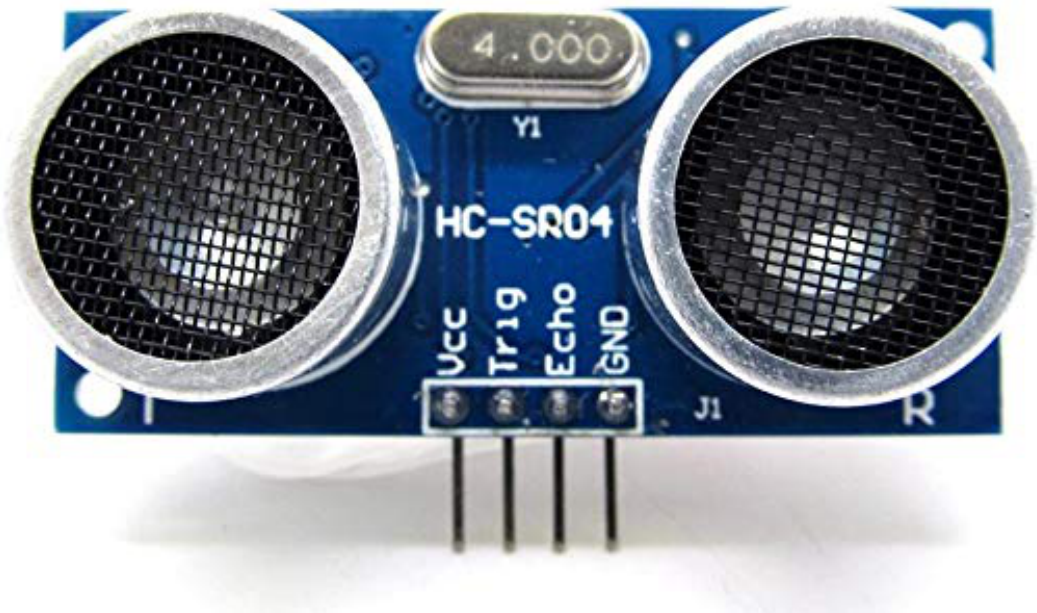

Figure: Ultrasonic Sensor

Implementation:

Once the data is received, the next step is parallel processing of data to avoid any delay in real time implementation. Raspberry Pi has a utility called MAKE FILE. This utility follows a task dependency chart or sometimes helps in parallel processing/execution of tasks simultaneously. Since Raspberry-pi has quad-core processors, it can implement maximum four tasks simultaneously without time lag hence, the speed is fast.

Implementation:

Figure: Control Unit

Implementation:

Raspberry-pi will be then connected to the internet by enabling the WiFi module.Raspberry-pi will push the data to a local server with the help of MQTT (MQ Telemetry Transport) protocol,lamp server,MySQL utility etc. On the reception of data, server side scripting should be done to find out online vacancy, car park location. This part can be implemented using Node.js, Express.js etc. Mobile application can then be linked to the local server.Mobile application can be built using react.js,ionic etc.Depending on the data received by the local host, the mobile application will show up the nearby locations of parking with spaces available in the corresponding parking area. A separate option will be visible for user to find the closest car park from the list of nearby car parking locations made available to him.

Feasibility:

The small scale implementation that we have proposed can handle 12 parking slots at max. The total overall cost for it is around 3K rupees. Inorder to scale up the system, that is to add more parking slots, it would cost around 225 rupees per slot.
All costs mentioned above are installation costs only, operational costs only include server and internet charges. The sensor array is not affected by changes in daylight, temperature (upto a certain extent), is capable of running with minimum maintenance and requires only medium speed, 24/7 internet connectivity. In sheltered parking slots, the system is not affected by almost anything, but in open parking slots, the sensor array can be affected by rain, snow etc.

Feasibility:

It's quite simple, easy to setup the system. If some component is damaged, the replacement is easy to find and re-install. As the sensor array is connected through wires to the processing unit, there is no scope of data loss.The sensor array can't differentiate between people and cars. In order to overcome any form of abuse of the system by people, a PIR sensor can be coupled along with the ultrasonic sensor in the sensor array.

References:

1. Smart Four Wheeler Parking Management System Using Ultrasonic Sensor - Volume 4,Issue 5,May-2017,e-ISSN: 23484470,p-ISSN: 23486406,International Journal of Advanced Engineering and Research Development
2. Vision Based Automatic Parking Slot Detection for ADAS - Volume 5,Issue 4,April-2018,e-ISSN :23950056,p-ISSN:23950072,International Research Journal of Engineering and Technology.
3. Car Parking Systems using IR sensors - Volume 4,Issue 2,February-2017,e-ISSN:23939877,p-ISSN:23942444,International Journal of Advanced Research in Engineering, Science and Technology.
4. link1
5. link2
6. link3
7. link4