Overview

Trying to find a parking space in a city center isn't just frustrating at times, but is also a waste of productive time and resource for everyone. As we all know, “Time is money!”. Additionally, unnecessary fuel usage is also a prime factor to be considered when drivers move around aimlessly only to find a place to park the vehicle. Through this project, we would like to address this social issue for a better change in the parking system.

Abstract

We plan to go about this project by establishing a real time communication system between sensor data, which is directed to the end users via the web. Every pre-defined slot for parking a vehicle is fitted with ultrasonic sensors, which have a basic principle of sending sound waves and measuring distance with respect to an obstacle on receiving the signal back after re-bouncing from the obstacle. Data from each slot is obtained using 2 sensors placed at the corners at an angle such that the lower chassis of the vehicle is covered. The sensors form a network and send data to the Arduino Development Board, which is an Atmega328 based microprocessor, processes the received information accordingly.

This network of sensors can be used in both outdoor as well as indoor car parks. The information can be processed for parking space management applications, such as parking guidance and parking lot utilization analysis. The sensors are powered by batteries. Due to the low power consumption of the sensor, the battery will last long. The batteries can be replaced whenever they get exhausted, ensuring that the system can be adequately maintained. The data from the arduino is sent to the internet using an Ethernet Shield with the help of an RJ-45 ethernet cable. This data is directed to a web-server for storing it. Using this data, a web-browser displaying slots, is processed to display a shaded slot if a car is present and an empty slot if absent. This data received occurs in real-time and hence simultaneous changes in the web-browser are ensured. This helps the driver in deciding which slot is available for parking, in a hassle-free way. Furthermore, every mobile which has internet facility can access this web-browser using a mobile application designed for android users. The system offers benefits for parking lot operators, too. It can, for example, show information about when spaces are typically filled, with statistics then used to improve the occupancy-rate of lots.

The softwares/languages involved are-

- Arduino IDE
- Xampp
- MakerPlot
- Javascript D3
- Android Studio/ MIT App Inventer

Proposed work

Wireless sensor networks offer an attractive choice for low cost and easy-to-deploy solutions for intelligent trafficg guidance systems and parking lot applications. In this paper, we propose the use of ultrasonic sensors for reliable detection of vehicles in a parking lot. We describe a an algorithm for ultrasonic sensors.Through extensive real world experiments conducted in a parking space we compare the pros and cons of using different sensing modalities, and show that ultrasonic sensors is an excellent choice for accurate vehicle detections. We demonstrate the efficacy of our proposed approach by showing promising results using this sensor module. An android application to display the availability of slots in a parking space will be developed for user access.

Literature survey

Wireless sensor networks offer an attractive choice for low cost and easy-to-deploy solutions for intelligent traffic guidance systems and parking lot applications. In the paper[1] , they propose the use of a combination of magnetic and ultrasonic sensors for accurate and reliable detection of vehicles in a parking lot. They describe a modified version of the minmax algorithm for detection of vehicles using magnetometers, and also an algorithm for ultrasonic sensors. Through extensive real world experiments conducted in a multi-storied university parking space they have compared the pros and cons of using different sensing modalities, and that ultrasonic sensors along with magnetometers is an excellent choice for accurate vehicle detections.They have also demonstrated the car counting experiment lasting over a day, and have shown promising results using these two sensing modalities.

In the paper[2], they have proposed à smart traffic light control and congestion avoidance system during emergencies. The system consists of two parts: Smart traffic light control system and Smart traffic routing system. First part of the system controls the traffic light system smartly for emergency vehicles and second part of the system tries to avoid congestions caused by traffic jams. The overall system is based on Arduino. The Arduino used in the system is Arduino duemilanove atmega which is 328P family based. The system contains IR proximity sensor/distance sensor, Arduino and Xbee pro which are mounted on the either sides of roads and in emergency vehicles respectively. The IR system is activated whenever any vehicle passes on road between IR proximity sensor and Xbee pro. Arduino controls the IR system and counts number of vehicles passing on road. Arduino also store vehicles count in its memory. Based on different vehicles count, the Arduino takes decision and updates the traffic light delays. The traffic light is situated at a certain distance from the IR system. Thus based on vehicle count, Arduino defines different ranges for traffic light delays and updates those accordingly.

In another research paper on Android Based Smart Parking System Using Slot Allocation & Reservation[3] ,they have designed the time driven sequence method which solves the problem of parking using slot allocation method. This paper proposes an android application, which is used to implement a prototype of Smart Parking System based on Reservation (SPSR) that allows drivers to effectively find and reserve the vacant parking spaces with the help of IoT (Internet of Things) with slot allocation method and performs automatic billing process.

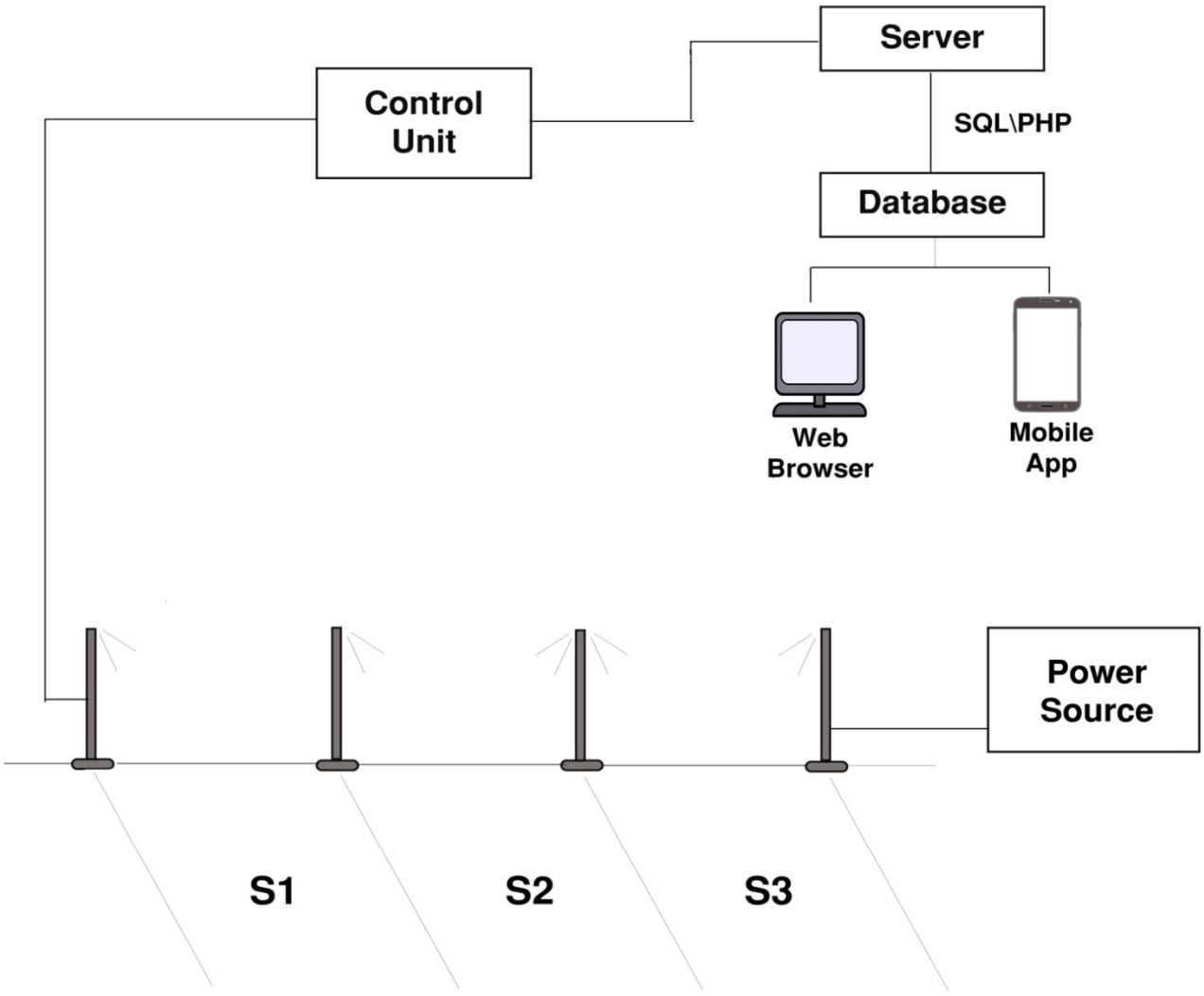
Anticipated bottlenecks

A few existing solutions focus on parking lot applications using sensor technologies, such as magnetometers and video cameras. However, magnetometers are very sensitive on environmental factors, as a result of which their detections are not always accurate. Moreover, since magnetometers measure the change in magnitude and direction of Earth's magnetic field caused by the presence of a vehicle, they need to be placed at close proximity to the vehicle. Although this might be possible near the entrance of a parking lot, it is very difficult to place the min close proximity to vehicles on upper floors simply because there are typically no entrance marked for upper floors and vehicles move at relatively higher speeds than near the entrance. On the other hand, video camera based solutions are energetically expensive and they can generate large amount of data which could be very difficult to transmit over multiple hops in a wireless environment. These disadvantages coupled with the fact that there are other objects moving in a parking lot, such as humans, greatly reduce the applicability of only one type of sensor technology, i.e., only magnetometers or only video cameras for cheap and accurate parking lot management solutions.

Feasibility Study

The system designed for developing the real-time based web-application for efficient parking uses cost-effective equipments when concerned with the prototype modeling. But when a large scale scenario, if the same system design is considered when addressing the real world issue of parking, the resources required for an optimum solution is humongous, bulky and costly. The practicality of the fundamental concept is viable and can be implemented successfully with the exception that the amount of investment would increase by folds when compared to the prototype. The idea used here involves only electronic modulation and server-database management which becomes complex as more such systems are involved at multiple places and requires constant monitoring and sufficing softwares.

Block Diagram of data transfer from System to End-user



The above block diagram shows the data flow from individual sensor, to the nearest control unit. The data is processed in real-time and is updated onto the server. End-user can access data from the database either through a web browser or through a dedicated mobile applocation, as shown.

Hardware Components and Market Survey

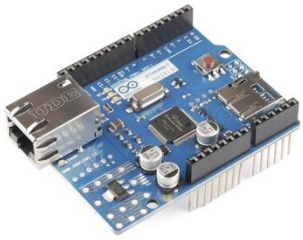
COST: 650/-

QUANTITY: 1

This device was ordered online from the website "www.robomart.com"

The Arduino Development Board

An Arduino board historically consists of an Atmel 8-, 16- or 32-bit AVR microcontroller (Atmega328 IC specifically) with complementary components that facilitate programming and incorporation into other circuits. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator.



COST: 450/-

QUANTITY: 1

This device was ordered online from the website "www.amazon.in"

The Arduino Ethernet Shield

Helps connect the Arduino to the Internet using an Rj45 cable.

- Operating voltage 5V (supplied from the Arduino Board)
- Ethernet Controller: W5100 with internal 16K buffer
- Connection speed: 10/100Mb
- Connection with Arduino on SPI port

COST: 90/- per sensor

QUANTITY: 6

This device was ordered online from the website "www.amazon.in"

HC-SR04 Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses sonar to measure distance to an object.

- Working Voltage : 5V(DC)
- Static current: Less than 2mA.
- Sensor angle: Not more than 15 degrees.

Other Electrical Accessories

- RJ-45 Cable
- 12-Volt Battery
- Multi-strand twisted pair cable
- Single strand wires
- Male/Female header pins

Approx. COST: 600/-

Other Mechanical Accessories

- Steel Poles – 2.5 ft tall
- Square/Circular Base Plates
- Acrylic substance for sensor

Total Cost Estimate for Implementation of the Project:

2240/-