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IoT Based Smart Parking System

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Abstract: Nowadays congestion of traffic level increases with the increasing development of population rapidly. With respect to the amount of population, the utilization of personal vehicles also increased. Due to more use of cars the traffic congestion occurred on the road. Most of the people chooses personal vehicles than public transportation. It is very difficult and time consuming to find parking space in most metropolitan areas, commercial areas, especially during the rush hours. It is often costly in almost every big city in all over the world to find proper and secure parking space. The proposed project is a smart parking system that delivers information to people finding a parking space online. It overcomes unnecessary time consuming for finding the problem of parking space in parking areas. Hence, the website is provided by this project based system where users can view various parking areas and choose the space from available slots.

Keyword: Arduino; IoT; Parking Lot; Traffic Congestion; Ultrasonic Sensor.

1. INTRODUCTION

The recent growth in economy and due to the availability of low price cars in the market, an every average middle-class individual can afford a car, which is good thing, however the consequences of heavy traffic jams, pollution, less availability of roads and spot to drive the motor car. One of the important concerns, which is to be taken in accounting, is that problem of parking those vehicles [1]. Though, if there is space for parking the vehicle but so much time is squandered in finding that exact parking slot resulting in more fuel intake and not also environment friendly. It will be great deal if in some way we find out that the parking itself can provide the precise vacant position of parking slot then it'll be helpful not limited to the drivers also for the environment. Therefore, many innovations are created to find solution [2].

2. EXISTING SOLUTIONS

At present some countries have portals which users can gain information about parking areas via the internet. This system can give user the information about parking space, but it won't be able to give which parking slot is vacant and occupied. Hence, such system cannot smartly handle the issue. Car lifts

along with automated robotic system, which automatically takes car to a particular parking spot as soon as the car enters on a platform. This system can not be installed by medium scale shopping malls, movie theatres as it can cost them a huge amount. At many public places, the system only shows the availability but it cannot show the exact slot and path to the slot available. Hence, there is the need to smartly find the path to the vacant spot [2],[3].

3. MOTIVATION OF THIS PROJECT

The main motivation of this project is to reduce the traffic jam that occurs in the urban areas which are caused by vehicles searching for parking. In the newspapers, we saw many articles regarding the parking problem all over Dhaka City.

In Bangladesh we are still using the manual vehicle parking system that why we are facing problems like wastage of time and energy finding free space across the parking surface when we need to park our car which requires a good amount of fuel. We proposed an automated system where the parking ground will only open if it has free slots for parking. The user can also check it before arriving there by a website. It will save the time as well as reduce the gathering in front of parking area.

4. DESIGN MODEL

4.1 Block Diagram

The proposed system is the combination of smart

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parking and the Slot allocation with the web application.

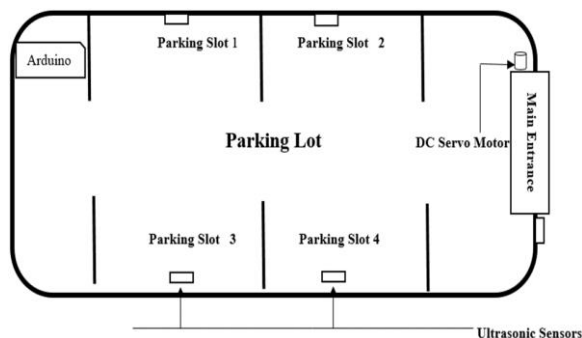


Figure 4.1 Block Diagram of Automated Car Parking Lot

Above diagram shows the modular representation of the automated car parking lot. Here four (this number can be changed according to the demand of the parking slots.) parking slots have been showed where ultrasonic sensors are placed. A DC servo motor is connected with the main gate to make it opened or closed. Outside the main entrance there is an ultrasonic sensor to sense to presence of a car which is trying to make entrance inside the parking lot. The Arduino circuit is placed in a suitable place to which all the components are connected, and it is powered through a battery.

4.2 Flowchart

Below we show a flowchart of our proposed system that will be clarifying the system very well.

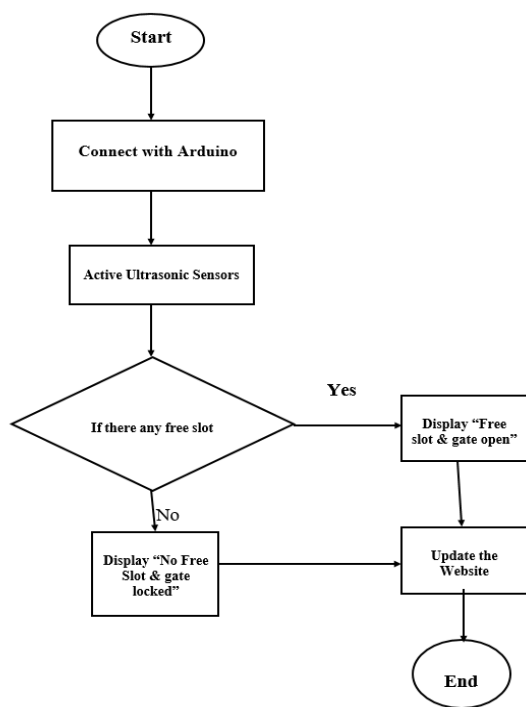


Figure 4.2 Flowchart of Automated Car Parking Lot

4.3 Circuit Diagram

Below we show a circuit diagram of our system that will be clarifying the system very well.

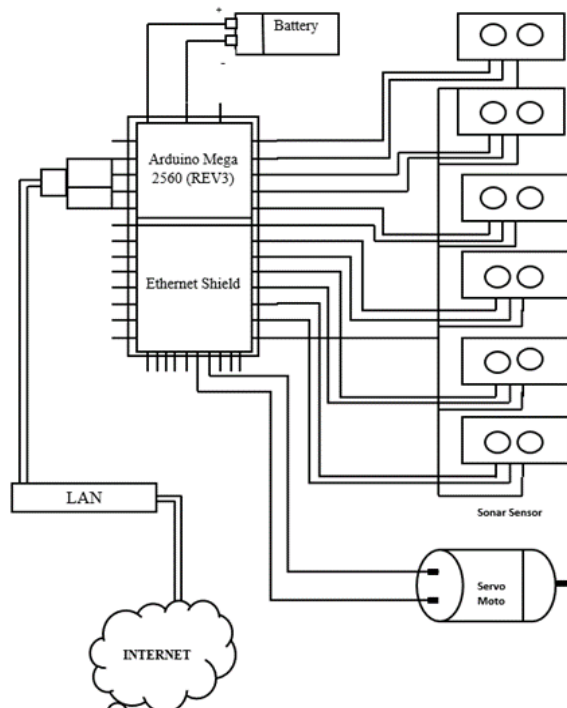


Figure 4.3 Circuit diagram of Automated Car Parking Lot

5. WORKING PRINCIPLE

Arduino is the brain for the whole system. It controls and watches over all the components. The ultrasonic sensors will be placed in the parking slots that will encounter the presence of the cars inside the parking slots. One sensor will be placed beside the main entrance of the parking lot.

As soon as the sensors get the presence of a car in front of the entrance, it will send signal to the Arduino chip to check if there is an empty slot inside the parking lot. When Arduino chip acknowledges that there is an empty slot or more then it will send signal to the dc servo motor which will open the main entrance. On the other hand if Arduino chip encounter no empty slots at the time of a car trying to make entrance, the gate will just not open. In addition, there will be a website linked with the Arduino board to show the number of parking slots remaining empty. The Ethernet shield can be placed on the Arduino circuit board. A 9v dc battery will provide power to the circuit. The connection between an ultrasonic sensor & Arduino board will be provided through 3 wire and the dc servo motor can be operated through 2 connections. Pin configuration of the Arduino circuit board will be done through the simple programming language which will be written and implemented through the Arduino IDE [4],[5],[6].

The system will be connected through a LAN cable

with the internet to send status of the system to the website. It can be easily viewed through mobile phone or any computers.

6. HARDWARE COMPONENTS :

The hardware realization of the proposed IoT based smart parking system using LAN Server and Arduino is detailed below.

6.1. Arduino Mega 2560

The Arduino MEGA 2560 is designed for projects that want more I/O lines, more sketch memory and more RAM. With 54 digital I/O pins, 16 analog inputs and a more substantial space for sketch .It is the suggested panel for 3D printers and robotics tasks. It includes everything had a need to support the micro-controller; simply connect it to a pc with an USB cable or power it with an AC-to-DC adapter or electric battery to get started [7].

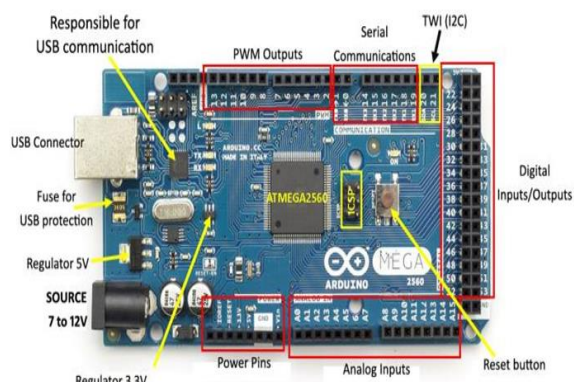


Figure 6.1 Arduino MEGA 2560 [7]

6.2. Ethernet Shield

Ethernet Shield allows internet connectivity for Arduino projects instantly. An on-board Wiz5100 ethernet controller holds up to four UDP and TCP connections, just stack it onto an Arduino to make own networked devices. Check connection status with up to speed indicator lighting easily. Extend design further with two extra rows of pin header that connect to shields and prototyping. Utilize the Ethernet library to create sketches which sketch up to the internet using the protect. The ethernet shield connects to an Arduino board using long wire-wrap headers which extend through the shield.

Arduino Ethernet Shield consist of W5100 IC, in built SD card slot, reset switch and RJ45 jack. The Mac address of board is randomly assigned. The Mac Address is represented in Hexadecimal form. If more than one Ethernet shield is used, then use different Mac address. IP address of board is assigned based on LAN. Arduino Ethernet Shield is shown in Fig. 6.2 [8], [9].

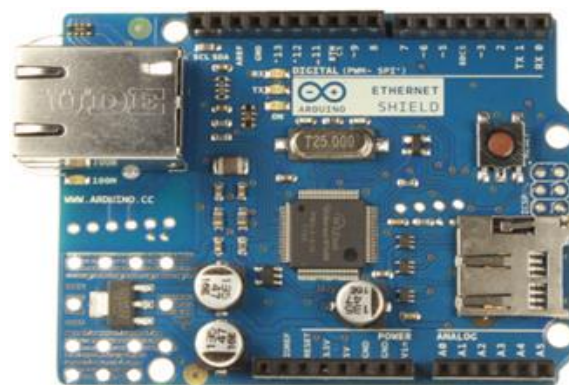


Figure 6.2 Ethernet Shield

6.3. Ultrasonic sensor

A great ultrasonic sensor is a device that measures the length for an object using ultrasonic sound waves. An ultrasonic sensor runs on the transducer to receive and send ultrasonic pulses that relay back again information about an object's proximity. High-frequency audio waves reveal from boundaries to create unique echo patterns.

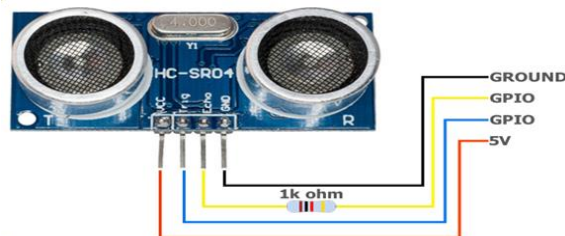


Figure 6.3. Implemented view of system [10]

7. PROJECT IMPLEMENTATION

The picture shows the miniature model of the Automated Car Parking Lot.

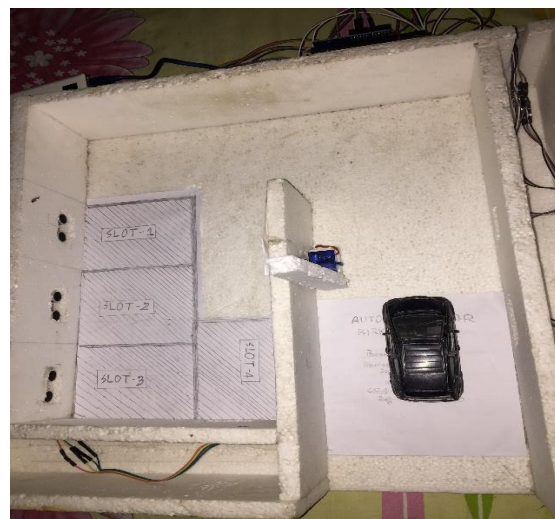




Figure 7.1. Implemented view of system

This model has the capacity of containing four cars. There are two sensors at the entrance to detect the presence of car before going inside or outside of the parking lot. The other four sensors are plotted inside the parking lot to detect the car individually for each parking slot. A DC Servo motor has been used at the entrance to open and close the gate according to the signals sent by the sensors through Arduino.

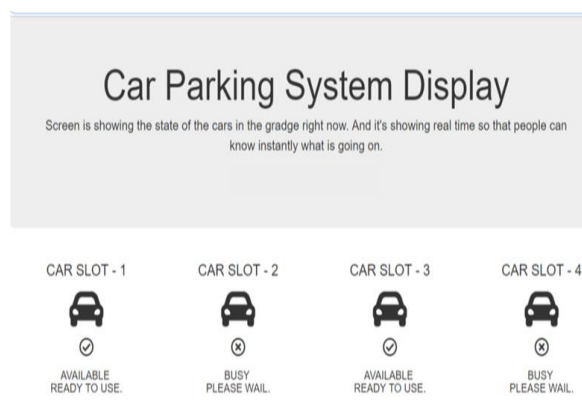


Figure 7.2. Online view of system

The projection on the screen corresponds to the system model parking slots. This is a real time display regarding the status of the parking lot. As this is a web-based representation, anyone will be able to get the status of the parking lot by visiting the website on the URL through their cell phones, laptops, desktops and other internet supporting device. The model of the parking lot has four parking slots. Thus, we can park maximum number of four cars through the system. Right now, the system is showing that the parking slots 1, 3 are available as there is no car on the slots and rest of the slots are busy as there is car on slots.

8. SYSTEM TESTING

Different cases have been explained and showed through the pictures in the following sections. All those two pictures correspondent to each other while occurring an event. For example, when a car is on slot one the web is showing slot one is busy.

Case One

This case shows that all the parking slots are empty and therefore, the system will allow a car to enter into the parking lot.

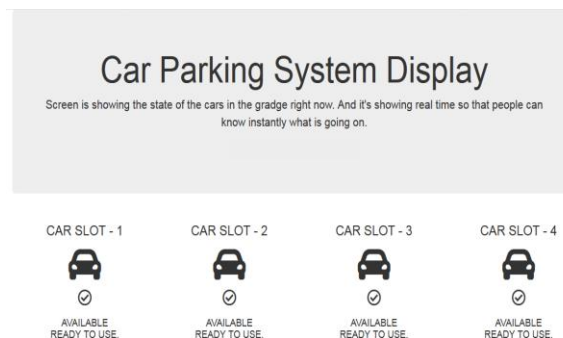


Figure 8.1 Test Case One

Case Two



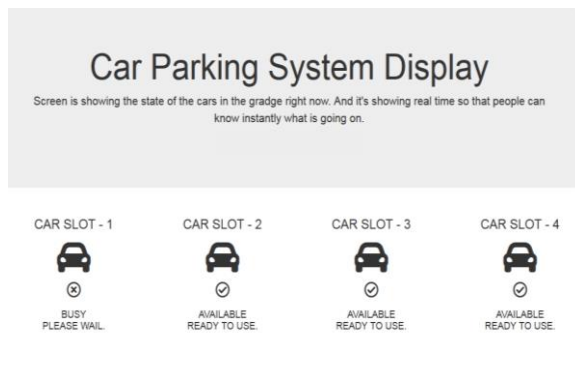


Figure 8.2 Test Case Two

This case shows that only one car is parked inside the garage and rest of the slots are empty. Therefore, the system will allow a car to enter into the parking lot.

Case Three

This case shows that two cars are parked inside the garage and rest of the slots are empty. Therefore, the system will allow a car to enter into the parking lot.

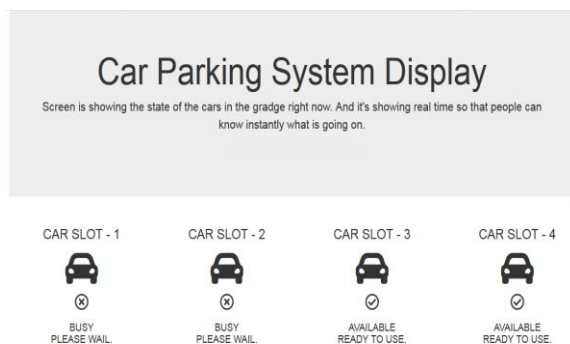


Figure 8.3 Test Case Two

Case Four

This case shows that three cars are parked inside the garage and only one slot is remained empty. Therefore, the system will allow a car to enter into the parking lot.



Figure 8.4 Test Case Two

Case Five



Figure 8.5 Test Case Two

This case shows that four cars are parked inside the garage and there is no empty slot. Therefore, the system will not allow a car to enter into the parking lot.

9. CONCLUSION

After doing study on smart parking project it is found that this system can be introduced in our country and it will be beneficiary in the context of our country. The main benefits are time and fuel saving. It can also provide sustainable parking management in an eco-friendly manner. There is less maintenance cost for this system so it helps the property developer in cost saving. It provides security to the parking ground. It reduces the hassle in parking grounds and traffic jam. It will also encourage Automation Engineering in our country which will make advancement in increasing usage of technology. Therefore, we should implement this project and help to develop our city.

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