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IoT based smart car parking system

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ABSTRACT

This paper presents an IOT Based Smart Car Parking System which displays the parking slot number of vacant slot on the LCD display when car arrives at the gate. It initially checks the presence of the vehicle in each of the parking slot and then displays the slot number of a vacant slot on an LCD display placed near the gate. This guides the new car to park at the appropriate slot. The status of each parking slot is also uploaded onto thingspeak cloud platform. Raspberry pi is used to control the whole mechanism. This prototype also gives an option of controlling the opening/closing of gate by an website. The gate can be controlled by a website created using HTML and flask package in Raspbian Operating System. This feature is added for security purpose. The objective of this paper is to develop an intelligent, user friendly automated car parking system which reduces the manpower and traffic congestion and to offer safe and secure parking slots within limited area.

Keywords— *Internet of Things (IOT), Raspberry Pi, HTML*

1. INTRODUCTION

In recent times the concept of smart cities has gained great popularity. Using the evolution of Internet of things, idea of smart city now seems to be achievable. Consistent efforts are being made in the field of IoT in order to maximize the productivity and reliability of urban infrastructure. Problems such as, traffic congestion, limited car parking facilities and road safety are being addressed by IoT. Traffic in metropolitan cities in India is the common issue faced by people. People prefer to own cars because cars offer an unmatched combination of speed, autonomy, and privacy. Parking problems in cities and urban areas are becoming increasingly important and have been one of the most discussed topics by both the general public and professionals. The imbalance between parking supply and parking demand has been considered as the main reason for metropolis parking problems. Moreover, the parking system plays a key role in the metropolitan traffic system, and lacking of it shows closed relation with traffic congestion, traffic accident, and environmental pollution.

Although efficient parking system can improve urban transportation and city environment besides raising the quality of life for citizens, parking problem is an often-overlooked aspect of urban planning and transportation. Urban planners should seek more efficient and innovative solutions for parking problem on the level of management, planning, and designs. Car parking is a major problem not only in urban areas but also in developed and developing countries. Following the rapid incense of car ownership, many cities are suffering from lacking of car parking areas with imbalance between parking supply and demand which can be considered the initial reason for metropolis parking problems. This imbalance is partially due to ineffective land use planning and miscalculations of space requirements during first stages of planning. Shortage of parking space, high parking tariffs, and traffic congestion due to visitors in search for a parking place are only a few examples of everyday parking problems.

Difficulty in finding vacant spaces quickly in a multilevel parking lot is difficult if not impossible, especially on weekends or public holidays. Finding spaces during weekends or public holidays can take more than 10 minutes for about 66% of visitors. Stadiums or shopping malls are crowded at peak periods, and difficulty in finding vacant slots at these places is a major problem for customers. Insufficient car park spaces lead to traffic congestion and driver frustration. Another problem is Improper Parking made by drivers. If a car is parked in such a way that it occupies two parking slots rather than one, this is called improper parking .Improper parking can happen when a driver is not careful about another driver's rights. This is tackled by the development of automated smart car parking system. This project is an IoT based cloud integrated smart parking system. This system checks out the availability of the vehicle in the parking area and displays the slot number of an empty slot on an LCD display for a new car entering at the gate. The information of the empty slot is also uploaded on to the thingspeak cloud platform. Raspberry pi is used to control the whole mechanism.

2. METHODOLOGY

2.1 Description of block diagram

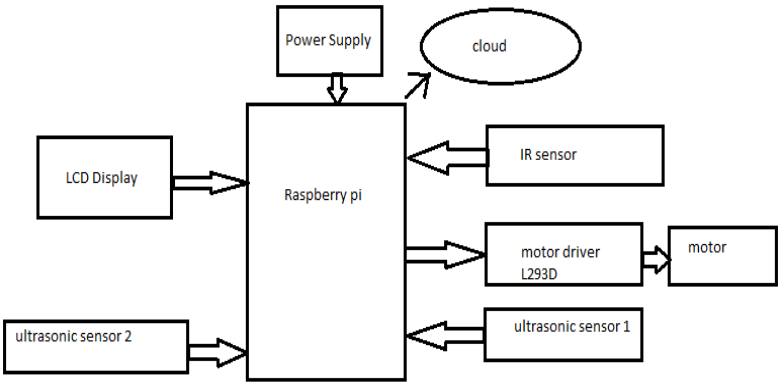

Fig. 1: Block diagram

IR Sensor is placed at the entrance near the gate. Ultrasonic sensors is placed on the roof of the parking slot. Ultrasonic sensor 1 is on the roof of parking slot 1 and ultrasonic sensor 2 is on the roof of parking slot 2. Similarly, each parking slot has got one ultrasonic sensor on its roof. Initially, IR sensor senses the presence of the car at the entrance. Ultrasonic sensors is used to sense whether the slot is free or not. It gives the status of each slots to the processor. If any of the slot is free, then the empty slot number is displayed on the LCD display and as well presented to the cloud. Then the processor drives the motor using the motor driver L293D to open the gate for the new car to enter the parking area. If there is no vacant slots, then it displays as "No slots available". Fig 1 shows the block diagram.

2.2 Functionality of each component

- **IR Sensor**: It senses the presence/arrival of the car at the entrance.
- **Ultrasonic Sensor**: It is used to detect the presence of the car at each of the slot. Ultrasonic sensor 1 is on the roof of parking slot 1 and ultrasonic sensor 2 is on the roof of parking slot 2. Similarly, each parking slot has got one ultrasonic on its roof. Hence each ultrasonic sensor gives the status of each slot whether the slot is free or not based on the air gap underneath.
- **LCD Display**: The vacant slot number is displayed on the LCD display placed at the entrance. If there is no vacant slots,then it displays as "No slots available".
- **Motor driver L293D**: If a slot is free, then motor driver is supposed to drive the motor to raise the gate to make way for the newly arrived car to its parking slot.
- **DC Motor**: It is used to raise the gate at the entrance to make way for the car.
- **Raspberry Pi**: It is a microcontroller used to control the entire mechanism.

2.3 Hardware Description

The hardware components used are Raspberry pi model 3B, IR sensor, Ultrasonic sensor, LCD display, Motor driver L293D, DC Motor.

2.3.1 Raspberry pi model 3B: The Raspberry pi 3 Model B is the latest model of the Raspberry Pi. A Raspberry Pi is a credit card or a cassette sized computer. It is basically a micro-controller. In the smart parking system, the Raspberry Pi is the main controller. All the hardware components will be connected to the pi like IR sensor, Ultrasonic sensor, LCD Display, L293D Motor driver and DC Motor. The different ports of the raspberry pi are 4 USB ports, 1 HDMI ports, 1 ethernet port, 1 port for power supply, a micro SD Card slot, an Audio jack and several pins for connecting various other components. All the instructions are passed on to the various parts through the Raspberry Pi itself. Figure 2 shows Raspberry pi.

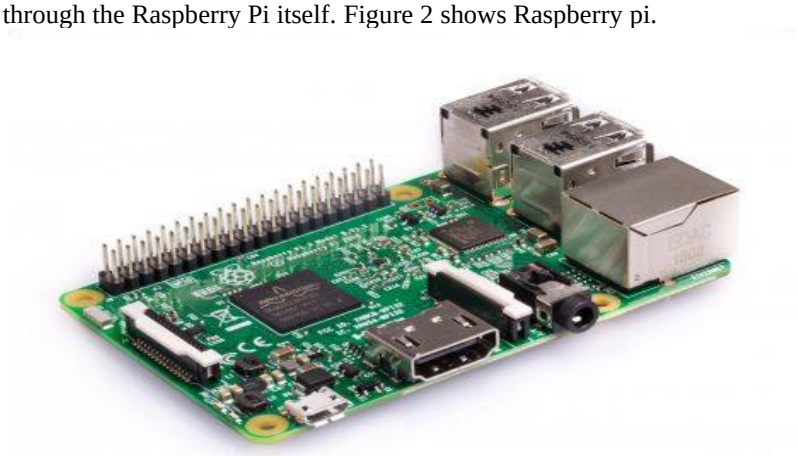

Fig. 2: Raspberry Pi Model 3B

2.3.2 IR Sensor: An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of detecting motion . In this paper, it is used to detect the presence/arrival of car at the entrance. Figure 3 shows the IR sensor.

Fig. 3: IR Sensor

2.3.3 Ultrasonic sensor: An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target) as shown in fig 4. In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is D = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second). In this paper, ultrasonic sensor is to check the presence of the car in the parking slot. Ultrasonic sensor 1 is on the roof of parking slot 1 and ultrasonic sensor 2 is on the roof of parking slot 2. Similarly, each parking slot has got one ultrasonic on its roof. Hence each ultrasonic sensor gives the status of each slot whether the slot is free or not based on the air gap underneath it. The distance between the roof of the car and roof of the parking slot is kept as threshold. If the distance measured by ultrasonic sensor is greater than the threshold, then the parking slot is said to be vacant. If the distance measured by ultrasonic sensor less than or equal to the threshold, then the parking slot is said to be occupied. The status of the parking slot is then sent to Raspberry pi and then the thingspeak cloud.

Fig. 4: Ultrasonic sensor

2.3.4 LCD Display: 16*2 LCD display is been used. An LCD is an electronic display module which uses liquid crystal to produce a visible image as shown in fig 5. The 16×2 translates a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix. In this project, LCD Display is used for displaying the vacant slot number and is placed at the entrance. If there are no vacant slots, then it displays as “No slots available”.

Fig. 5: LCD Display

2.3.5 L293D Motor driver: L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction as shown fig 6. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. It is a Dual H-bridge Motor Driver integrated circuit (IC). In this project, it is used to drive DC motor by Raspberry pi.

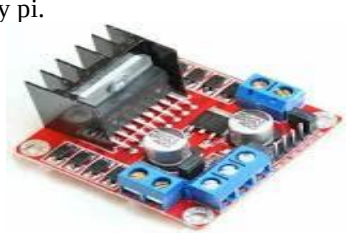

Fig. 6: L293D motor driver

2.3.6 DC Motor: A DC motor consists of an stator, an armature, a rotor and a commutator with brushes as shown in figure 7. Opposite polarity between the two magnetic fields inside the motor cause it to turn. DC motors are the simplest type of motor and are used in household appliances, such as electric razors, and in electric windows in cars. In this project, DC motor is used for raise the gate at the entrance to make way for the car. Raspberry pi drives the DC motor whenever required.

Fig. 7: DC Motor

2.4 Software Description

- **Raspbian Operating System**: It is a Linux based operating system supported by Raspberry Pi . Python language is used for programming.
- **ThingSpeak cloud platform**: ThingSpeak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. The parking slot status is updated on Thingspeak cloud platform too.
- **HTML**: HTML and **flask package** in python is used for creating the website. An HTML file is linked to Flask program to form a web page. Output of the flask program yields the URL of the web page. The web page would be opened in the browser with URL as shown in the terminal. The web page has two radio buttons corresponding to gate open and gate close. Opening and closing of that gate can be controlled by clicking on the radio button. This feature is used for security aspect.

3. EXPERIMENT AND RESULTS

The prototype was developed and desired output was obtained. The working setup is shown in figure 8. When a car appears at the entrance, the status of each parking slot whether it is vacant or occupied is captured by ultrasonic sensor and uploaded onto the thingspeak cloud. The vacant parking slot number is displayed on LCD display. The gate is controlled by the person in the control room. He can control whether to open or close the gate by using a website. Website has two radio buttons. On clicking on “Gate open” option, the gate is opened and on clicking on “gate close” option, the gate will be closed.

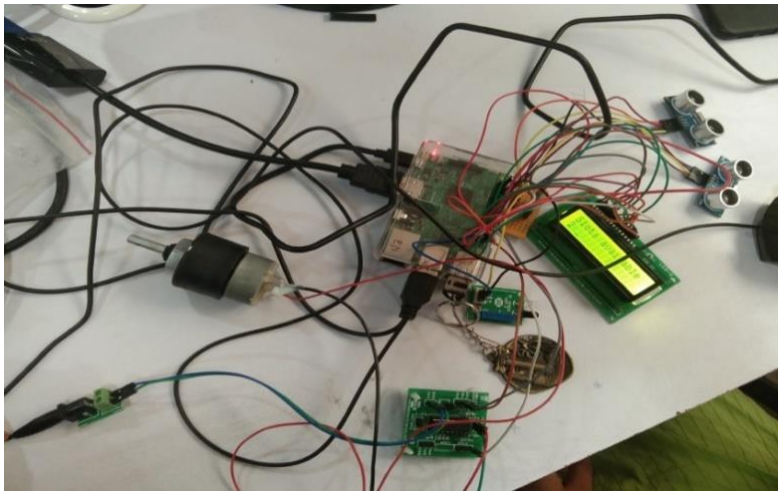

Fig. 8: Working setup

Fig. 9: Output on LCD display

LCD display shows the parking slot number which is free. In Figure 9, LCD display shows that vacant parking slot number is 2.

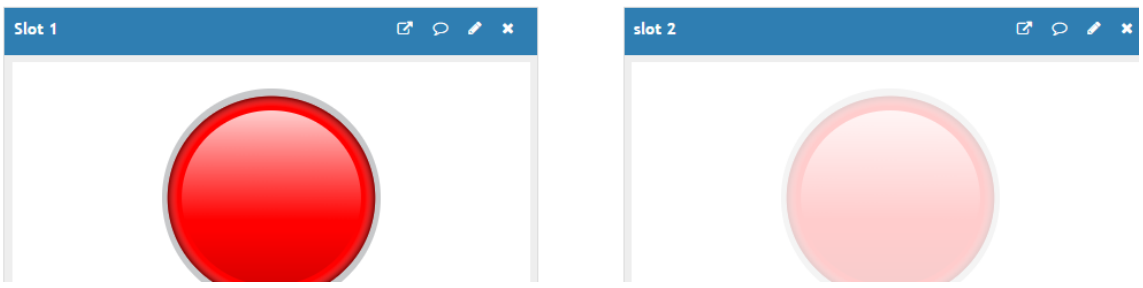

Fig. 10: Status of the parking slot on the thingspeak cloud platform

Figure10 shows that parking slot 1 is vacant and parking slot 2 is parked.

Fig. 11: Output in the ThingSpeak cloud platform when no slot is vacant

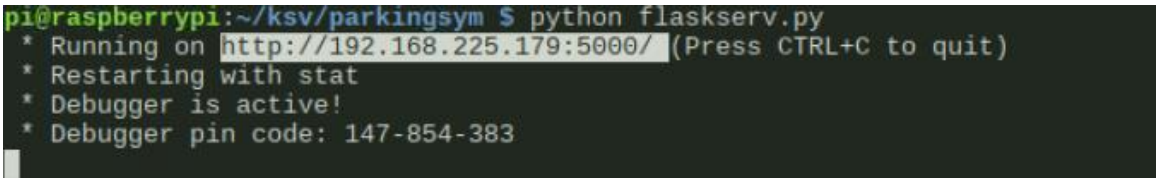

Fig. 12: The URL generated as the output of the flask program in the terminal.

The web page would be opened in the browser with URL as shown in the terminal in figure 12. The web page has two radio buttons corresponding to gate open and gate close. Opening and closing of that gate can be controlled by clicking on the radio button. This feature is used for security aspect.

4. CONCLUSION

The software as well as the hardware was been implemented successfully. When a car appears at the entrance, the status of each parking slot whether it is vacant or occupied is captured by ultrasonic sensor and uploaded onto the thingspeak cloud. The vacant parking slot number is displayed on LCD display. The gate is controlled by the person in the control room. Thus, demonstrates the working of the planned automated smart parking system. The main advantages are space optimization and cost effectiveness. Parking management systems can positively impact customer perception of transit and transportation services. Getting the land in metropolitan cities and other higher order cities for parking space is proving infeasible. The solution for the parking requirements is the multi-level car parking system to maximize car parking capacity by utilizing vertical space, rather than expanding horizontally.

5. FUTURE ENHANCEMENT

E-parking provides an alternative for patrons to enquire the availability and reserve a parking space at their desired parking facility to ensure the viability of vacant car park space when they arrive at the parking facility. The system can be accessed via numerous methods such as SMS or through the internet. Some of the additional benefits of using the E-parking system aside from those collectively gained by smart parking system are that it can be extended easily to incorporate the payment mechanism of smart payment system whereby payments by the patrons are made hassle free using the technologies discussed previously. Thus, In future works, this system can be improved by adding other applications such as online booking. The driver or user can book their parking lot at home or on the way to the shopping mall. This would reduce the time of the driver.

6. REFERENCES

[1] Mahendra B M, Dr Savita Sonoli, Nagaraj Bhat, Raju, Raghu T, "IOT Based Sensor Enabled Smart Car Parking for Advanced Driver Assistance System" 2nd IEEE International Conference on Recent Trends in Electronics Information & Communication Technology (RTEICT), 978-1-5090-3704-9/17, May 19-20,2017.

[2] Ravi Kishore Kodali, Krishna Yogi, Sharan Sai G.N and Jehova Honey Domma, "An IOT Based Smart Parking System using Lora", IEEE International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery, 978-1-7281-0974-9/18, 2018.

[3] D.Vakula and Yeshwanth Krishna Kolli," Low cost Smart Parking System for smart cities", IEEE, International Conference on Intelligent Sustainable Systems, 978-1-5386-1959-9/17/,2017.

[4] Janhvi Nimble, Priyanka Bhegade, Snehal Surve, Priya Chaugule: "Automatic smart car parking system", International Journal of Advances in Electronics and Computer Science, ISSN: 2393-2835 Volume-3, Issue-3, Mar.-2016.

[5] Hossam El-Din I.S Ahmed: "Car parking problem in urban areas, causes and solutions", The 1st International Conference: Towards a better quality of life, Technische Universitat Berlin Campus EI Gourna, Egypt, abstract=3163473,24th November-2017.

