TRACKING AND RESERVING THE PARKING SLOT USING CLOUD

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Abstract— *In the developing cites, traffic plays a vital role. Increase of vehicles day by day is also a major issues for the cause of environmental defects. If people park their vehicles in road side may lead to unsafe. Due to traffic profusion, drivers will face uncomfortable will driving and also in searching of parking slot during peaks hours. This will precede to trouble in searching the destination as well as waste of time in probing a vacancy to park. A new person in a city may not aware of parking area, that person need to search manually to park the vehicle. This also one of the problem in depleting of time, wastage of fuel, possibility of stuck in the traffic. If the parking area is full then driver has to wait for free parking else search for the another parking area. For the safety of the vehicle, slot should be monitored by appointing a man force. To expound these delimit, Reservation of parking slot and tracking the slot using cloud is recommended. This will conceive the driver to conquer the above mentioned issue by parking the vehicle in evident mode. This system allows the drivers to reserve their parking slot by mobile app or web application. Sensor deployed in the parking area are used to identify the availability of the parking, thus it get update in the mobile app. In addition to this, GPS helps to find the reserved parking slot. Reservation is done through online payment and also it can be cancelled, thus the respected amount will be refunded. This proposal is implemented using Arduino, Sensor, Wi-Fi module or Ethernet Shield and mobile app. Every data will be stored in Cloud environment.*

Keywords—parking slot, reservation, traffic profusion, cloud environment.

1. INTRODUCTION

The parking industry generates billions of dollars in annual revenue in the United States alone, and parking regulations may affect people's concerns about traffic congestion, air pollution, drivers' frustration about parking searching, and municipal objectives. For instance, a recent survey shows that during rush hour in most big cities, the traffic generated by cars searching for parking spaces takes up to 40% of the total traffic. Therefore, in these densely populated urban areas, a certain amount of traffic congestion and delay are due to parking. A recent study shows, in a business district of Los Angeles, vehicles looking for parking burn 47,000 gallons of gasoline and produced 730 tons of carbon dioxide, which is equivalent of 38 trips around the world. Clearly, the problems associated with parking imposes significant societal costs, both economically and ecologically. In order to address these problems associated with parking, smart parking systems aiming to satisfy the involved parties (e.g., parking service providers and drivers) have been developed. However, most current smart parking or parking guidance systems only collect and publish live parking information to direct drivers to available parking spaces near their destinations. These systems are not "smart" enough, because they cannot successfully help drivers find a desired parking space in crowded areas, and sometimes make the situation worse. For example, if available spaces in a congested area are less than the spaces in demand, more drivers trying to park will head for the limited available spaces, causing severer congestion. In this case, detailed information associated with parking availability would allow drivers to make better decisions on use of parking lots and road-side parking. In contrast to such parking information guidance systems, this thesis presents a Reservation-based Smart Parking System (RSPS) that not only to broadcast real-time parking price based on the parking availability to the drivers as part of a communal application, but also to provide reservation service as part of user-targeted service. Built on advanced sensing and mobile communication techniques, SRPS processes streams of time stamped sensing data from sensor network in parking lot, calculates the real-time parking price based on parking availability information and publishes the parking price to the drivers. On the other side, the drivers can retrieve parking 3 price and reserve their desired vacant spaces via Wi-Fi or Internet.

To resolve the a for mentioned problems and take advantage of the significant development in technology, the Internet-of-Things technology (IoT) has created a revolution in many fields in life as well as in Smart Parking with Reservation System (SPRS) technology. This paper introduces a cloud based SPRS using internet of things. The proposed system checks the availability of the parking slot using ultrasonic sensor to determine the presence of the vehicles. The information gathered from the sensor is sent to the Arduino uno board. The board will send the information to the cloud environment which then extracted from server app. Based on the request through the mobile app, availability of free slot(s) is sent to the driver and also indicated through LED lights in the parking slot.

2. RELATED WORKS

In some studies [3, 4, 5], the authors proposed a algorithms for treatment planning in real-time parking. First, they used an algorithm to schedule the online problem of a parking system into an offline problem. Second, a mathematical model is proposed the offline problem as a linear problem. Third, is proposed an algorithm to solve this linear problem. Finally, the proposed algorithm is evaluated using experimental simulations of the system. The experimental results indicated timely and efficient performance. However, these papers do not mention the resource reservation mechanism, for assessing the resources system and guiding vehicles to the parking space.

In another study [5], the authors proposed an SPRS based on the integration of UHF frequency, RFID and IEEE 802.15.4 Wireless Sensor Network technologies. This system collects information about the state of occupancy of the car parks, and directs drivers to the nearest vacant parking spot by using a software application. However, in this work, the authors have not included and is not applicable for large-scale parking system. The results of this paper only implement the proposed architecture; they do not mention the performance of the parking system. Hsu et al. [6] proposed an innovative system including the parking guidance service. A parking space can be reserved by a smartphone via Internet access. Upon entering the car park, the reserved parking space will be displayed on a small map using wireless transmission for vehicles under the dedicated short-range communication protocol DSRC.

In this paper, the authors have not evaluated the performance of the parking services, they do not provide any mathematical model of the system, and do not consider the waiting time of each vehicle for service. Other researchers have designed architecture for parking management in smart cities [7]. They proposed intelligent Parking assistant (IPA) architecture aimed at overcoming current public parking management solutions. This architecture provides drivers with information about on-street parking stall availability and allow drivers to reserve the most convenient parking stall at their destination before their departure.

3. SYSTEM ARCHITECTURE

Basic components need for the smart parking with reservation system are:Sensors is a device that detects and responds to some type of input from the physical environment [8]. SPRS uses the HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1” to 13 feet. Figure 1 represent the HC-SR04 ultrasonic senor.

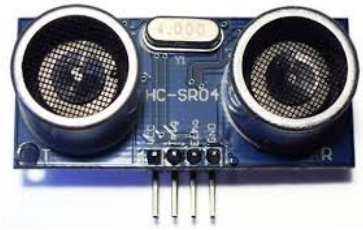


Fig 1. HC-SR04 ultrasonic sensor

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet) [9]. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Arduino Ethernet is a microcontroller board based on the ATmega328 [9]. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz crystal oscillator, a RJ45 connection, a power jack, an ICSP header, and a reset button. Figure 2 represent the HC-SR04 ultrasonic senor.

Amazon Relational Database Service (Amazon RDS) is a web service that makes it easier to set up, operate, and scale a relational database in the cloud [10]. It provides cost-efficient, resizable capacity for an industry-standard relational database and manages common database administration tasks.

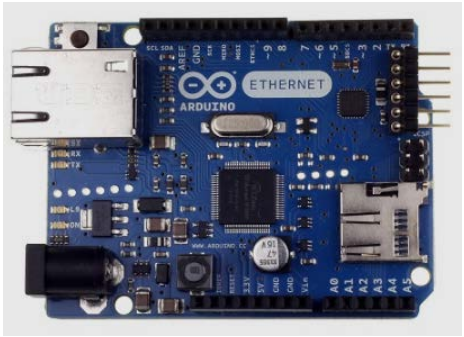


Fig 2. Arduino Ethernet

A. ONBOARD UNIT

The Ethernet shield is connected to the Arduino uno just by placing over the Arduino and 5v plug into the Arduino, lan RJ-45 to the Ethernet. Now the sensor is connected to Arduino where the vcc is connected to pin 2, trig is connected to pin 3, echo is connected to pin 4, ground is connected to pin 5. Buzzer too connected to Arduino where the positive lead is connected to pin 13. Figure 3 shows the onboard unit.

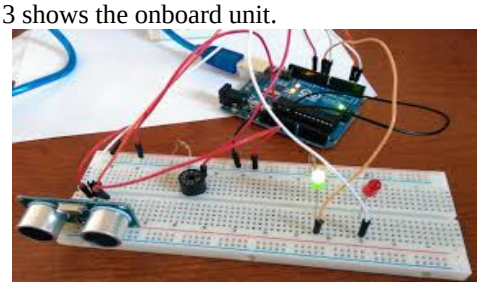


Fig 3. On-board Unit

B. SPRS ARCHITECTURE

The system architecture for the smart parking with reservation system has three major components

User App performs four operations searching, checking availability, reservation and cancelation. User interface of the app is easy to use.

Parking Slots: In the parking slots, all sensor are kept in the induvial lot were that gives the appropriate data to the Arduino uno. Arduino uploads the data to the cloud.

Cloud Management: Amazon RDS stores the sensor values. This database contains the availability of parking slot, reserved slots, and password pin for the reserved slots. It can manages serval request which was given by the user.

Figure 4 represents the system architecture of the smart parking with reservation system. LED lights are used denote the status of the SPRS.

- Green light - denotes the free lots
- Yellow light - denotes the lot is reserved
- Red light - denotes the car is parked

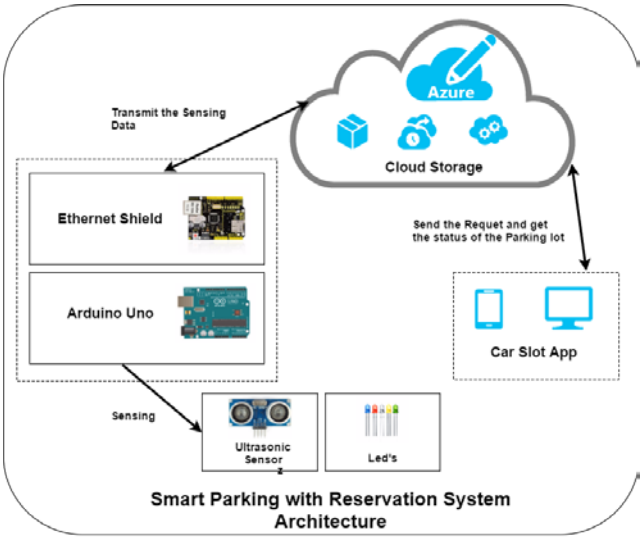


Fig 4. Architecture of the SPRS

These lights helps the other user to look the status of the parking slot. Buzzer is kept in case an unreserved user parked in the reserved parking slot, the buzzer starts alarming. To off the alarm reserved user alone will have the password code in the android device which will be generated during reservation of the slot. After entering the code in the android device sends the code to Amazon RDS checks with the correct code and gives the notification to Arduino uno. Then the Arduino will make the buzzer unalarmed and changes the lights for the parking status.

4. IMPLEMENTATION

The implementation is done in cloud based environment and in the android device. Minimum requirement for the android mobile KitKat 4.1.1 and it can have internet connectivity too. Types of drivers seeking for reservation can be categorized as users. For parking and reservation in the mall the steps as follows,

Step 1: The user specifies the location where parking is required in the mobile app (Fig 5.a).
Step 2: The request is sent via mobile app to the Amazon RDS to determine the parking status.
Step 3: The parking map displays the free slots in he parking area (Fig 5.b).
Step 4: If the user wishes to reserve a slot in the parking area then

4.a. Reserve button is clicked, proceed to step 5 onwards. The reservation should be done within 5 minutes. else the reservation will be cancelled.

4.b. Exit the system

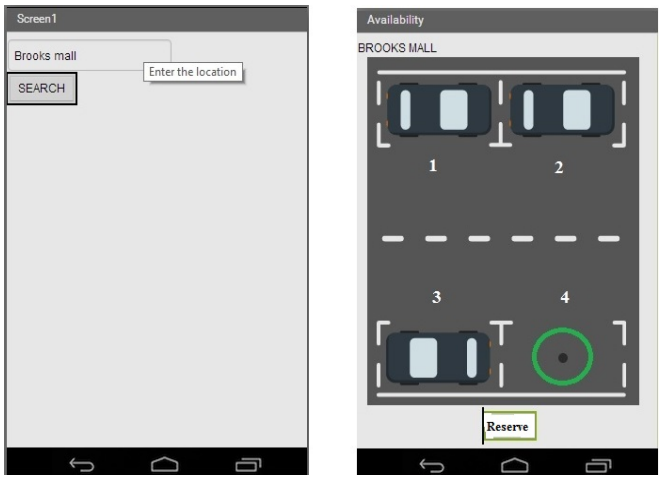
Step 5: Login for payment through payment system. Once the slot is reserved one time password (OTP) is generated for authorization purposes.
Step 6: Notification sent via cloud to Arduino board.
Step 7: Status of the reserved area notified via LED lights in parking area.
Step 8: If user wants to cancel the reservation, user can just give the cancellation request in the mobile app.
Step 9: When the vehicle enters the parking slot, then the user is verified upon entering OTP else the buzzer rings to notify unauthorized vehicle entry.

Mobile app has two user types, they are separated according to their priority

Normal user: If the user doesn't create the account in the mobile app then they could just see the status of the parking slot alone. So they are normal user, they couldn't reserve the parking slot.

Prime user: If the user created the account in the mobile app then they are prime user where they can see the status of the parking slot, reserve the parking slot and cancel the reservation too.

Account creation contains basic information of the user like email, phone number etc. These details is used for the verification of the user. We can login into account by phone number.



5.a Searching screen 5.b Parking map

Fig 5. Mobile App Screen

In Amazon RDS, the database used is Microsoft sql server, were we get the server name, username and password. The database could be easily accessed in the pc itself so the admin can view the database table. Figure 6 shows the

parking data are been stored in the database table in the cloud.

	slot id	location	availability	booking staus	password code	duration(hrs)
	2	brooks mall	no	yes	156	2
	4	brooks mall	yes	no	NULL	NULL
	3	hospital	no	yes	756	1
	77	fun mall	yes	no	NULL	NULL
▸*	NULL	NULL	NULL	NULL	NULL	NULL

Fig 6. Database Table

5. CONCLUSION

This work focuces on a parking system with prior reservation to overcome waiting in the queue. This prototype is developed using ultrasonic sensor, Arduino, Android mobile using cloud based environment, thus by using this prototype the average waiting time for vehicle parking becomes minimal. Smart parking with reservation system increases the revenue for service providers, provides service differentiation for users with different needs, eliminates traffic congestion pertaining for parking. The future enhancement will use Image Encryption to check the car number for security while parking.

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