MANTECH Publications

Journal of Research in Electrical Circuits and Systems
Volume 3, Issue 1, January-April 2018

Survey on Smart Parking System Using Different Methodologies

Priyadarshini R
Student
Department of Computer Science and Engineering
Easwari Engineering College Tamil Nadu, Chennai
Corresponding author's email id *priyanni2008@gmail.com*

Abstract

Now a day's people expect their life to be easy and fast. They don't want to waste a single minute of trivial works. Parking a car in available space is also one of the tedious and time consuming job. People need an assistant for this to guide them. The Internet of Things (IoT) is an evolution for many ideas achievable in the country. This survey proposes parking the car with an easy method and without any guide. The different kind of sensors and technologies are introduced in the survey paper. The various methods used for parking the car with sensors and IoT technology. The sensors can be used to detect the arrival of the car and update the information on the local server. The LED display is used at the entrance of the parking area so that the user can view that and park the car in the available area.

Keywords: *Internet of Things, Smart parking, Ultrasonic Sensors*

INTRODUCTION

IoT is an ecosystem of connected physical objects that are accessible through the internet. The 'thing' in IoT could be a person with a heart monitor or an automobile with built-in-sensors, i.e. objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions taken. Internet of Things can connect devices

embedded in various systems to the internet. When devices/objects can represent themselves digitally, they can be controlled from anywhere. The connectivity then helps us capture more data from more places, ensuring more ways of increasing efficiency and improving safety and IoT security. An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

RELATED WORK

[1] The Ultra Sonic sensors are used to detect the available parking slot. Using the Ultra Sonic sensors will reduce the cost and it is more effective. The slot can be chosen by using the internet or mobile application. An Arduino board is used to glow the 5V bulb either Green or Red for the availability of the parking. Green indicates the available and Red indicates not available. Wi-Fi module is connected to the Ultra Sonic sensors using the AT commands. The problem faced in this model was the Ultra Sonic sensor was getting rust on its surface, thus leading the system to misbehave. Careful Nano coating for sensors and the Arduino board is must for a long-term implementation of the project.

[2] The paper gives more information about the automatic parking system. The automatic car parking system will avoid the accidents. It gives fine and safe parking. Several parking systems are available nowadays parallel parking, vertical parking and oblique parking. The parallel parking is the most popular one. In automatic parking system, three steps can be done accurately detecting the parking space, path planning and path tracking and this paper also propose the same in detail. For automatic parking, this paper proposes the Model-Free adaptive Control scheme.

Detecting the parking space:

To detect the space the Ultrasonic sensors are used here. The Ultrasonic probe detects the space available for parking if space is not available then the car can be moved to detect the space for parking.

Planning the path:

According to the slot available, the driver performs the four steps to park the car referring to straight reversing turning right the steering wheel and reversing, turning back the steering wheel and straight reversing, turning left the steering wheel and reversing to the end. The distance between the two vehicles can be measured and that will be calculated to park the car.

Path Tracking:

Vehicle dynamics model is used to calculate the midpoint of the rear wheel for turning angle.

Control target of the automatic parking system is to maintain a constant speed, then control the orientation angle of the car by controlling the angle of the front wheel which aims to make equal to the target orientation angle of the car so as to ensure that the coordinates of the car fall on the target trajectory constantly.

[3] The paper considers the solution of the problem of the automatic car parking in a parallel process as an accessory in real cars to help to inexpert drivers when the vehicle must be parking in a reduced space. The solution proposed to use fuzzy set theory as the base to develop the making decision models and carry on such process.

A fuzzy control system was developed in combination with neuronal-network to parka simulated truck. The simulation is developed using MATLAB. The fuzzy models used to make a decision on the problem of automatic car parking were implemented on a scale model of an automatic car. The backward and forward parking here implemented at the distance between cars is about 31 cm and over 61 cm respectively.

[4] The paper gives a vision based smart parking framework to assist the drivers in efficiently finding suitable parking slot and reserve it. The parking area is divided into segments, classify each block to identify the car and give the information about the status of the parking either reserved or free. Here the online system gets the results from the camera and offline system gets the results

from the video file. The performance of the algorithm depends on the accuracy of the images captured by the system at different time intervals. The accuracy of the algorithm is found to be100%, 98% 96% and 94%. The results depend on the images captured. Because of less lightning or occlusions, the parking lot are not clear then the efficiency decreases and the accuracy also reduces. It can be further implemented for the customer who was already registered from online for parking space.

[5] The paper gives the idea for smart parking system which enables the user to find the nearest parking area and give the space to park in that parking area. Smart parking design mainly focuses on to reduce the time involved to find the parking area. The paper also provides more accommodation of vehicles, user-friendly parking, less power consumption, it facilitates the more efficient use of space and also solutions to various problems which occur during the parking. It also overcomes the problem of time management as the user can book the parking slot on the website or using mobile application. The main challenges of this proposed system are lack of proper maintenance and response to maintain the parking space from coordinators. It should also give a good platform to all the user for the good experience in time saving and for less fuel consumption. The traditional parking system is improvised for the smart parking system by using the several applications.

[6] The paper proposes the concept IoT based sensor enabled for the car parking system. It enables the user to pre-reserve the parking slot available using the mobile application. Authentication of the user can be validated for the booking space. The system is implemented using the E-parking mobile application in android, Raspberry Pi model and low-cost IR sensors using IoT and cloud technology. IoT technology is used to connect the parking slot in a parking area to the internet. Cloud technology is used maintain the database system for the updating and deleting the information between the user and the system at the central server. The android application provides the user interface to book the parking slot, time status of the parking slot and displays the cost to be paid for the parking. This system provides the ease of use, reduces the fuel cost and deadlocking of the cars while parking. This system is

effectively used only in the smart cities with the availability of the internet.

[7] The paper presents the reliability analysis based on the data produced by a sensor based smart parking system. It is implemented placing the ultrasonic sensor, web service, a mobile application to android mobile and FIWARE platform in a three-layer architecture.

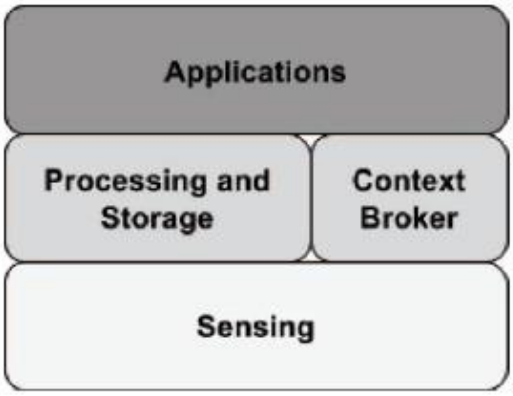

Fig. 1. Three-layer architecture proposed.

Sensor-based smart parking was reviewed basis on how it was deployed and its vehicle detection algorithm. The reliability analysis was evaluating using errors produced by the system and most common kind of error produced. In the paper they used two parking spots to monitor and analyse the system, with the worst case the success rate produces was 96%. The sensors used here are effective even with instability environment. This paper does not provide the information about the driver rights for parking and to identify the driver parked the car or not. Further, the vision-based solution is used to compare the results using the sensor-based system to evaluate the effectiveness.

[8] The paper aims to develop a low-cost sensor-based parking system to map to the parking area. The system consist of sensor nodes to detect the occupancy of a parking space and relay nodes is used to communicate between nodes and server. Server application is used to get data from relay nodes and send data to mobile application and it displays the parking area to occupy. The two-vehicle sensor detection nodes are designed, a magnetic sensor used to detect the presence of the vehicle and the distance sensor is used to clarify it. The mobile application was hosted in Amazon Web Services. The cost of the nodes are in the average market price compared to other sensors. Only few tests are conducted to test accuracy of the system. Further it is implemented by conducting the more test scenarios in the next phase and adding low

power consumption methods in the vehicle detection sensor nodes.

[9] In the paper IoT based cloud integrated smart parking system is developed to monitor and signalize the state of availability of each single parking space. A mobile application provides to allow end user to check the availability of the parking space and book a parking slot accordingly. The two prominent words in IoT are "internet" and "things". Internet means a vast global network of connected servers, computers, tablets and mobiles using the internationally used protocols and connecting systems. Internet enables sending, receiving, or communicating of information. Thing' is used to reference to a physical object, an action or idea, situation or activity, in case when we do not wish to be precise. IoT and cloud technologies gives new possibilities in terms of smart cities. The system provides the real-time information regarding the availability of parking slots. Using the simple mobile application the user can remote the location and book a parking slot using the cloud technology. The efficient sensors are required to monitor the parking area.

[10] The paper gives the idea about the technology of wireless sensor network and IoT for smart parking. Global Positioning System (GPS) and wireless communication system is placed in the vehicle as the GPS gets the vehicle position and wireless communication sends to the server. A smartphone is used to remotely view the parking status and book the slot manually by the user. This paper mainly focus on to decrease the fuel consumption and the Carbon Dioxide (CO2) emission. The result obtained in this paper is by using the simulation. Here the different technologies are analysed to develop the smart parking system such as Hardware based smart parking system, Sensor-based smart parking system, Camera-based smart parking system, neural network based smart parking system, Web-based smart parking system and GPS based smart parking system. The GPS based smart parking system is used to get the faster and easy access to book a slot. The different colours are used to represent the booking of a slot such as green colour shows the slot is empty, red colour shows the slot is filled and the orange colour for the pre-booked state so that user can easily identify the slots and gives the accurate slot for booking. The disadvantage of the system

is if the different user wants to book the same slot then the deadlock occurs. In future, the security and billing will be added to improve for large-scale systems in the real world.

CONCLUSION

Considering the urban population and traffic congestion increase and the reducing land, smart parking becomes a strategic issue to work on, not only in the research field but also from economic interests. In this paper, the summarization of the different methods for the parking system is introduced to develop for the smart cities. To make the parking easy the parking slot is divided into a blocks and the Nano coating Ultrasonic sensors are placed in the slot to detect the presence of the car arriving, based on this the sensor gives the output and that output is displayed in LED television at the front of the entrance of the parking area so that the user can easily view the slots available for the parking.

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