JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, SECTOR 62

MINOR PROJECT REPORT

Project:- Automated Car Parking System

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Project Report Contents

Abstract	(3)
History	(5)
Introduction	(7)
Equipments	(9)
Application	(12)
Current Status of Development	(14)
Future Development	(15)
Vision and Marketing Strategy	(18)
Benefits	(22)
Problems	(23)
References	(24)

Abstract:-

In recent times the concept of smart cities have gained great popularity. Thanks to the evolution of Internet of things the 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. In this paper, we present an IoT based cloud integrated smart parking system. The proposed Smart Parking system consists of an on-site deployment of an IoT module that is used to monitor and signalize the state of availability of each single parking space. A mobile application is also provided that allows an end user to check the availability of parking space and book a parking slot accordingly.

The aim of this project is to automate the car and the car parking as well. It discusses a project which presents a miniature model of an automated car parking system that can regulate and manage the number of cars that can be parked in a given space at any given time based on the availability of parking spot. Automated parking is a method of parking and exiting cars using sensing devices. The entering to or leaving from the parking lot is

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commanded by an Android based application. We have studied

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some of the existing systems and it shows that most of the existing systems aren't completely automated and require a certain level of human interference or interaction in or with the system. The difference between our system and the other existing systems is that we aim to make our system as less human dependent as possible by automating the cars as well as the entire parking lot, on the other hand most existing systems require human personnel (or the car owner) to park the car themselves. To prove the effectiveness of the system proposed by us we have developed and presented a mathematical model which will be discussed in brief further in the paper.

History:-

The concept for the automated parking system was and is driven by two factors: a need for parking spaces and a scarcity of available land. The earliest use of an APS was in Paris, France in 1905 at the Garage Rue de Ponthieu. The APS consisted of a groundbreaking multi-story concrete structure with an internal elevator to transport cars to upper levels where attendants parked the cars.

In the 1920s, a Ferris wheel-like APS (for cars rather than people) called a paternoster system became popular as it could park eight cars in the ground space normally used for parking two cars. Mechanically simple with a small footprint, the paternoster was easy to use in many places, including inside buildings. At the same time, Kent Automatic Garages was installing APS with capacities exceeding 1,000 cars.

The first driverless parking garage opened in 1951 in Washington, D.C., but was replaced with office space due to increasing land values.

APS saw a spurt of interest in the U.S. in the late 1940s and 1950s with the Bowser, Pigeon Hole and Roto Park systems In 1957, 74 Bowser, Pigeon Hole systems were installed, and some of these systems remain in operation. However, interest in APS in the U.S. waned due to frequent mechanical problems and long

waiting times for patrons to retrieve their cars. In the United

Kingdom, the Auto Stacker opened in 1961 in Woolwich, south east London, but proved equally difficult to operate. Interest in APS in the U.S. was renewed in the 1990s, and there are 25 major current and planned APS projects (representing nearly 6,000 parking spaces) in 2012. The first American robotic parking garage opened in 2002 in Hoboken, New Jersey.

While interest in the APS in the U.S. languished until the 1990s, Europe, Asia and Central America had been installing more technically advanced APS since the 1970s. In the early 1990s, nearly 40,000 parking spaces were being built annually using the paternoster APS in Japan. In 2012, there are an estimated 1.6 million APS parking spaces in Japan.

The ever-increasing scarcity of available urban land (urbanization) and increase of the number of cars in use (motorization) have combined with sustainability and other quality-of-life issues to renew interest in APS as alternatives to multi-story parking garages, on-street parking and parking lots. Currently the biggest APS in Europa is in Aarhus (Denmark) and provides 1000 parking spaces via 20 car lifts.

Introduction

A car parking system is a mechanical device that multiplies parking capacity inside a parking lot. Parking systems are generally powered by electric motors or hydraulic pumps that move vehicles into a storage position.

Car parking systems may be traditional or automated. Automatic multi-storey automated car park systems are less expensive per parking slot, since they tend to require less building volume and less ground area than a conventional facility with the same capacity. In the long term, automated car parking systems are likely to be more cost effective than traditional parking garages. Both automated car parking systems and automated parking garage systems reduce exhaust gas — cars do not drive around in search of parking spaces.

Multi-storey car parking is becoming increasing popular as they enable to conserve space [1]. However parking on multiple floors brings it's own challenges such as need of using lift mechanism for moving the vehicle from one floor to another, co-ordination between the vehicle and the lift mechanism, co-ordination between parking and un parking of vehicle etc. The aim of this project is to identify the issues and challenges in development of such a system by implementing a prototype using Firebird IV as

automated self parking vehicles.

As stated the aim of the project was to implement a multi-storey car parking system using the capabilities of Firebird IV robots. Likewise firebird robot was used for the both purposes, i.e. as self parking automated vehicles, and as a lift controller co-ordinating the movement of the vehicle from one floor to another. The infra red sensors of firebird were used to detect obstacles and accordingly identify the empty slot available for parking. Similarly the motors of the firebird were used as a lifting mechanism to elevate the lift while zigbee module installed in the firebird was used for communication between the lift controller and the vehicle. Also, white line sensors were used for sensing the dead end of the given floor and hence communicating with the lift controller the need to move up the floor. The limitation of the system is that currently only car parking is supported and not un parking of vehicles. However, un parking of vehicles can be easily incorporated due to modular design of the system with added functionality of synchronization which can be easily handled by the central co-ordinator. Also since DC geared motors of the Firebird are being used to move the lift up and down and as these posses limited torque, moving of the lift is currently accomplished with human assistance.

Equipments

Ultrasonic Sensor:-

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves.

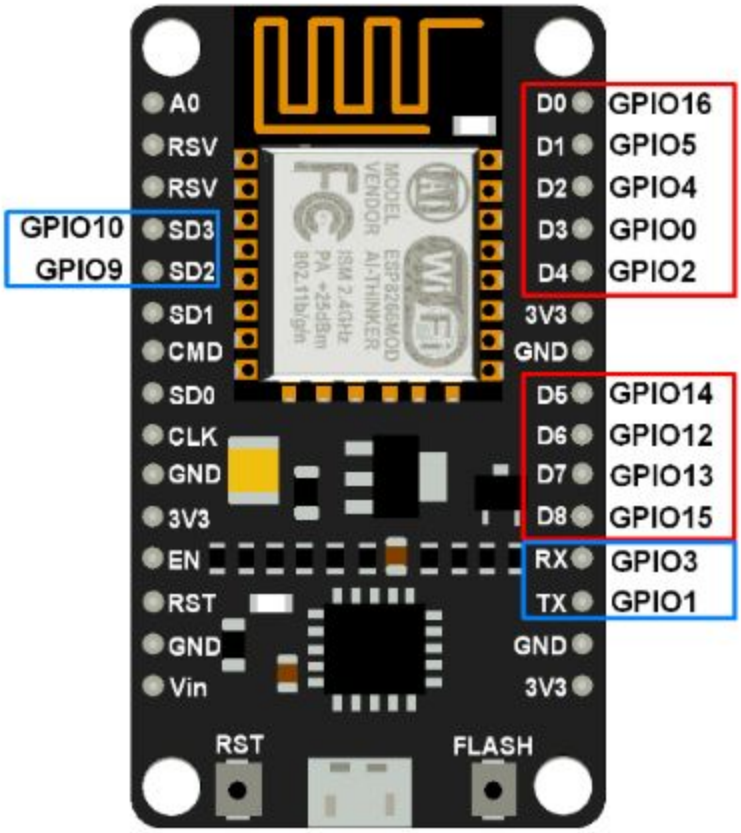
The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head.

Distance L = 1/2 × T × C

where L is the distance, T is the time between the emission and reception, and C is the sonic speed. (The value is multiplied by 1/2 because T is the time for go-and-return distance.)

NODE MCU BOARD



NodeMCU Dev Kit/board consist of ESP8266 wifi enabled chip. The ESP8266 is a low-cost Wi-Fi chip with TCP/IP protocol.

ESP 8266 comes with capabilities of:

- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2),
- general-purpose input/output (16 GPIO),

- Inter-Integrated Circuit (I²C) serial communication protocol,
- analog-to-digital conversion (10-bit ADC)
- Serial Peripheral Interface (SPI) serial communication protocol,
- I²S (Inter-IC Sound) interfaces with DMA(Direct Memory Access) (sharing pins with GPIO),
- UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and
- pulse-width modulation (PWM).

For web part:

Node.js:- For Backend

Bootstrap:-for FrontEnd

jQuery:-api calls

Google Maps Api: For heat Map and Google maps markers

HTML5 & CSS3:- for a good UI/UX

Application:-

Finding a free parking lot in a congested city like Delhi is very hard.
Here, if anyone wants to go outside from home with personal car first
thing comes in his mind is about parking, where he/she will park his car.
Most of the cases, people go to a parking station and find that all parking slot are full and then he have to search for another parking lot or
that there is an available parking slot but difficult to find one in a big and
multi-storied parking slots. So, it is a big hassle and many people keep
in fear about parking of his car when he gets out with his car.
I realized that, to enjoy a better transport a better parking system is
necessary especially in a congested city like Delhi.
So the problem can be solved by a cloud based automated smart parking system and I hope implementing the system can remove the
parking problem of my city.

Using this system a user will be will able to find an available parking lot
easily using mobile or web app from anywhere. The system

updates
parking data every 30 seconds.
By virtue of their relatively smaller volume and mechanized parking systems, APS are often used in locations where a multi-story parking garage would be too large, too costly or impractical. Examples of such applications include, under or inside existing or new structures, between existing structures and in irregularly shaped areas.
APS can also be applied in situations similar to multi-storey parking garages such as freestanding above ground, under buildings above grade and under buildings below grade.

Current Status of Development

Right now the development in my work has not been much as most of the work is in development and the work done is still much to go.

What we have in working conditions is the web application which is hosted at https://minor-ii.herokuapp.com which works perfectly fine with only six custom locations that I have included in it.

When logged onto the app with the asked data it takes us to another webpage as I called it dashboard where it there is a map and bunch of options in these options user can either choose the nearest place that is provided by the user or choose any of the other locations provided by the app by just clicking on it .

Then you will be directed towards another webpage where it automatically detects the saved space and directs you to park at that point.

The hardware is a little different as it doesn't contain any state of the art network but what it has is very efficient and reliable connections which when car is parked in the space detects it and sends the info to the server

Vision and Marketing Strategy

Based on preliminary market research the idea of Parking Finder has been well received and marketing will be critical to develop brand awareness as well as customer base. • The company offers a platform for drivers of personalized vehicles to over-look the situation of parking areas near their destination and find parking spots by the ease of an application, to avoid chaos in parking areas.

Traffic Finder is a new to the market app with a completely new concept. • It is available on google play store. • The target market is almost all the people who travel by private vehicles such as cars, motorbikes etc. • Use of GPS and security web camera technology. • Minimal response time. • Smart scale measurements and voice assistant.

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The app is surely one of its kind, due to a macroscopic street view

using GPS and security cam technology. • The mall parking associations and other public parking lots will be personally met

by the founders to collaborate on this helpful venture. • The promotion will be done mainly by digital marketing techniques and banners, target customers will be drivers who suffer from the everyday hastle of parking spots.

Value Proposition Common people will see this app as a helper in decision making (whether to ride a bike or a car or neither , to the destination). They will also see this app as a time saver due to its quick response time and fast technology used in searching parking spots for the required vehicle. One who gets benefited from the app will become a permanent customer of the app, also becoming a marketing epicentre for the future.

ost of the application features will be free of cost, available on the google play store. • The premium version of the app will cost 1.5 USD which is pretty reasonable according to the features it is providing. • The premium version of the app will have additional features such as measurements, trackers and Probability scenarios of parking positions

In order to fairly assess the attractiveness of this opportunity, we conducted a S.W.O.T analysis and a Porter’s Five Forces analysis to identify our position in the market. The results are shown below

Strength	Weaknesses
❖ Simplifies payment & collection ❖ Reduces need for enforcement personnel ❖ Competitive cost, upgradeable ❖ Elimination of parking gates	❖ No brand recognition in the market place ❖ Technology is not yet familiar to customers ❖ No prior management experience of the team in this domain ❖ Lack of business contacts
Opportunities	**Threats**
❖ Strategic partnerships with lot management companies ❖ Acquisition by Federal APD as a possible exit strategy	❖ Uncertainty of partner interest ❖ Switchover cost to the parking lot owners ❖ Threat of other companies to introduce a similar solution before us

Benefits:

Efficiency:

Comparison between a conventional parking lot and a Skyline Automated Parking System. A key factor in parking garage development is always building size. Compared to conventional parking facilities, Automated Parking Systems require an area approximately 70% smaller and a 50% smaller volume on average to park an equivalent number of cars. This gives the parking garage developer lots more options such as adding more parking spaces, utilising more area for non-parking purposes or green spaces, etc.

Feasibility & Profitability

Car parking and parking garage development often have a direct effect on the feasibility of a real estate project. The design flexibility of Automated Parking Systems like Skyline Parking can

help in terms of both feasibility and profitability by enabling parking to be located in areas where conventional parking won't fit. The possible locations for APS are virtually unlimited: above ground, underground, freestanding, underneath or integrated into existing buildings and even very narrow or irregularly shaped areas.

Eco-Friendliness & Sustainability

Automated Parking Systems can reduce CO2 emissions by 85% or more by eliminating the need for cars to drive and idle while searching for parking spaces. For parking garage development, APS typically require fewer building materials, a much smaller excavation volume, shorter construction time and reduced construction disruption. For the ultimate in sustainability, Automated Parking Systems are most often the least expensive option for underground parking garages.

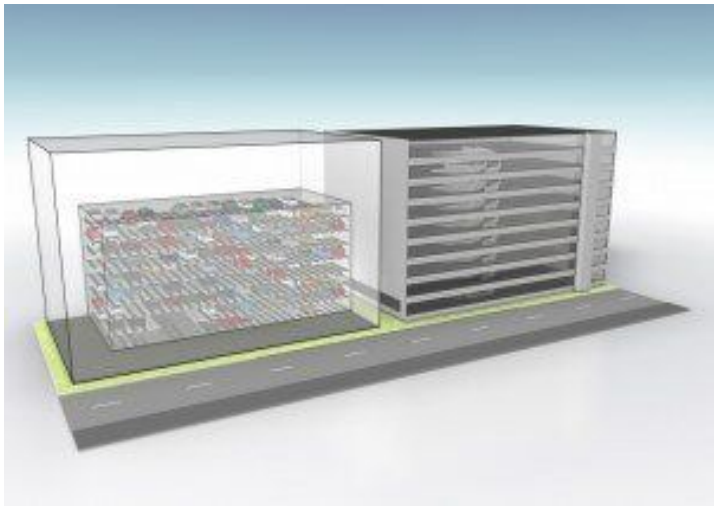
Inherent Safety & Security

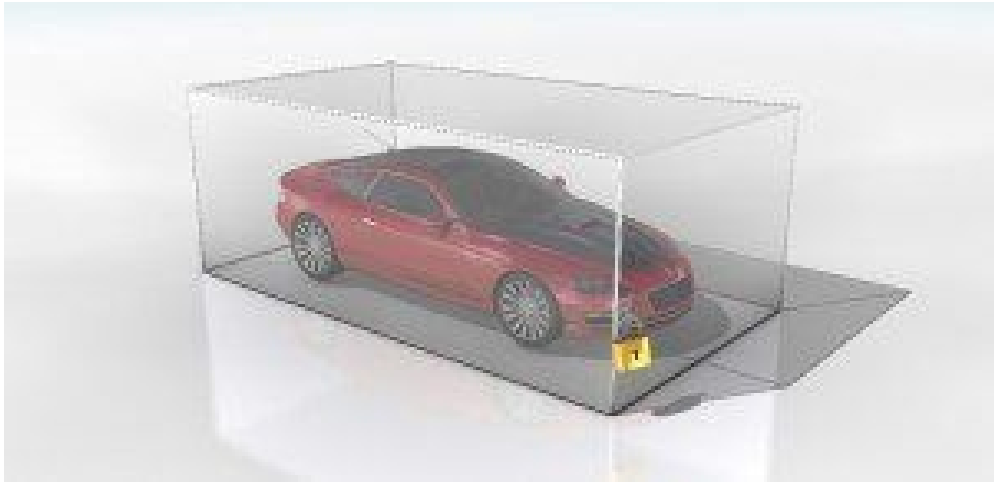
The safety and security of cars, drivers and pedestrians is always a priority for parking garage development projects. Compared to conventional parking garages, Automated Parking Systems are inherently much safer and more secure because they remove driving and pedestrians from the parking area. No driving means no car damage or possibility of stolen cars. No pedestrians means no need to walk through dim, shadowy parking areas and no opportunity for theft, vandalism or worse.

The primary benefits of automated parking systems compared to conventional multi-story car parks are:

- Up to 70% less land area needed
- Up to 50% smaller building volume
- Up to 12% ROI

- Up to 85% fewer CO2 emissions generated by driving





The space-saving provided by the APS, compared to the multi-story parking garage, is derived primarily from a significant reduction in space not directly related to the parking of the car:

- Parking space width and depth (and distances between parking spaces) are dramatically reduced since no allowance need be made for driving the car into the parking space or for the opening of car doors (for drivers and passengers)

- No driving lanes or ramps are needed to drive the car to/from the entrance/exit to a parking space
- Ceiling height is minimized since there is no pedestrian traffic (drivers and passengers) in the parking area, and
- No walkways, stairways or elevators are needed to

  accommodate pedestrians in the parking area.

In addition to the space saving, many APS designs provide a number of secondary benefits:

- The parked cars and their contents are more secure since there is no public access to parked cars
- Minor parking lot damage such as scrapes and dents are eliminated
- Drivers and passengers are safer not having to walk through parking lots or garages
- Driving around in search of a parking space is eliminated, thereby reducing engine emissions
- Only minimal ventilation and lighting systems are needed
- Handicap access is improved
- The volume and visual impact of the parking structure is minimized
- Shorter construction time

Problems:

There have been a number of problems with robotic parking systems.Problems with automated parking garages have reasons:

1) Technical and

2) Bad planning

3) Parking customers

Most problems with automated parking garages are not of technical nature. Architects can be blinded by the large number of cars on very limited space and decide to use mechanical parking system, though they are not suitable for their specific application. Manufacturers are sometimes happy to make a sale, even though they should consult their customers better. So the main reason for dissatisfied customers is the result of bad planning.

Mechanical car parks are a solution for applications with a relatively balanced throughput, like shopping malls, train stations, etc. Most can handle peaks during the rush hour in the morning and evening quite well, but they are not recommended for high peak hour volume. Therefore, if one installs a mechanical car park at a movie theater or stadium, trouble is pre-programmed. One big peak in the morning and another one in the evening without much in between are not suitable for automated parking.And finally many delays are caused by confusion that comes when unfamiliar parkers first use this type of system

Further Advancement:-

The future of the smart parking market is expected to be significantly influenced by the arrival of automated vehicles (AVs). Several cities around the world are already beginning to trial self-parking vehicles, specialized AV parking lots, and robotic parking valets.

The company's automated parking system uses lasers to scan cars and a robotic valet to park the vehicles. Vehicles are transported by a robotic dolly that lifts and transfers them to storage racks. Using this system, up to 4 times as many cars can be parked in the same amount of space as a traditional garage (since there is no need for extra space in between cars). The automated system is expected to deliver vehicles within 3-5 minutes of a retrieval request.

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