A Study on Smart Parking Assistance

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Abstract: *The gradual realization of the true importance of parking a vehicle to the world has made parking system a serious activity for parking a vehicle. Manual parking system is a parking system in which man should be present inside the vehicle and he has to control and park the car in the parking slot but it leads to more cost and maintenance becomes very difficult so automatic parking system was proposed. But in Automated Parking System (APS), it is automatically parks the vehicle (car) in a very limited space where ever the space is available without noticing the parking slot correctly, so to overcome this, Remote Parking Smart Assistance can be used. It is a mechanical system to assist the driver in parking their vehicle.*

Keywords: Automated Parking System (APS), Remote Parking Smart Assistance, sensors, GPS, HMI

1. Introduction

With the quickly expanding urban populace and upgrades in expectations for everyday comforts, the quantity of vehicles has expanded significantly. The quick increment in urban vehicle possession expands the weight of urban traffic as well as compounds the issue of inadequate parking spots. The increased driving distance in the parking process increases fuel consumption and aggravates parking difficulties, which increasing the number of minor accidents, such as scuffing and collisions. At present, smart vehicles are the primary advancement pattern of the automotive industry and is the main focus of major domestic and foreign automobile companies and research institutions. As a key element of smart vehicle innovation, automatic parking technology has turned into a prominent research point. Automatic parking technology completes parking operations safely and swiftly without a driver and can adequately improve driving comfort while significantly diminishing the likelihood of mishaps during parking. At present, there are two primary research strategies for considering automatic parking systems: one is based on ultrasonic sensors and the other which is based on visual sensors [1].

In Manual parking system, man should be present inside the vehicle and he has to find the parking area and have to control the vehicles to the respective parking slots. Whereas in automated systems vehicles itself can identify vacant parking slots and give indications to the driver regarding the parking and the driver have to remember the parking place. In addition to this, if the parking slots are congested, then the drivers cannot get out from the vehicle after parking. In order to overcome this, remote parking system can be used by performing the certain actions on the smart phones like pressing some buttons to locate the vehicle in parking slots.

Remote parking assistance is the technology that assists the driver in parking their vehicle in parking slot. Allows the driver to park the vehicle using the remote control by selecting desired legal parking slot. The system enables the automatic parking and it can move the vehicle in and out of the selected parking slots depends on the driver's command by using smart phone app or remote keys. This system also helps in remembering the parking slot, that where he/she was parked the vehicle but in automatic parking system, remembering the parking space is not possible and also it leads to the ambiguity for the users in searching their cars. It is also helps in time consumption, increases the fuel efficiency and reduces the pollution.

Remote parking assistance also helps the users (beginners) in complicated urban parking areas. This avoids the traffic accidents and traffic jams in urban areas. The system also avoids the small collisions, personal injuries and car damage while parking the vehicle. Vehicle will stop automatically when it recognize any obstacles while parking. It contains control units for regulating the speed, inter distance regulation, lane tracking, steering angle, automatically following the path, brake request, avoid collision, adaptive cruise control and checks if driver is still operating his mobile phone or keys. It also contains the sensors to check the enough distance to park the car. In this system, driver has an option to stay in the vehicle or come out of the vehicle while vehicle is parking itself and also if spaces are so tight to open the doors of car. This system is very safe and comfortable for the users to park the vehicle. Once the remote parking assistance is enabled, means it will not take the driver's action like pressing the accelerator pedal or pressing the gear or brake and the whole control of the vehicle is taken by the remote assistance (or smart phone) by taking three considerations: legal parking area, speed of vehicle, distance of the parking area. It will check for the legal parking area by using sensors, it will check the speed of the vehicle and control the speed by sending required torque request signals to the engine control unit to make the engine to send that required torque and it checks the distance whether it is sufficient to park the vehicle or not by using the distance sensors.

After checking the above considerations, remote smart parking assistance detects the suitable legal parking slot and it informs the driver via display and the driver has to press or touches the display to do certain actions in the mobile phone to park their car in parking space. Once the vehicle reaches its final legal parking position, then the engine control unit make the engine to switch off and engage the parking the brake.

The benefits of the remote parking smart assistance are, can warn of surrounding obstacles while parking the car, it guides the vehicle into the suitable parking space, can move the car in and out of the parking slot, driver has an option to stay in

or get out of car, even in the small tight parking areas also can park the car.

Here we are proposing a remote parking assistance system where the system gives information about free slots for parking. Then driver can set the vehicle to parking mode and get out of the vehicle and can direct the vehicle to the slot by controlling the switches on the remote. And after the vehicle is parked the vehicle engine will be switched off and exits from the automated parking mode. Remote parking systems are used to provide a better quality of services

2. Literature Survey

Over the last two decades there has been a significant work on the parking system using various methodologies, keeping this in view the studies carried out by various researches related to the parking systems are reviewed and presented in this chapter. The summary drawn from the literature review, need, objectives and scope of the present work are presented at the end of the chapter.

Parking system can be achieved through Global positioning system (GPS), but for unmanned vehicles GPS is not able to provide sufficient information to avoid the collisions, and also GPS is not giving accuracy for narrow parking space. However, the GPS signals are not able to receive in the indoor environment and also estimated position is not enough accurate for parking the vehicle by itself. So automatic vehicle parking system is proposed, where wireless sensor networks WSN AhPS and infrared technologies are adopted simultaneously to enhance the precise of positioning. It consists of three sub systems, they are: control and positioning subsystem, WSN management subsystem and Parking Management subsystem. Prototype of automatic vehicle parking system is also implemented [1].

Automated Vehicle Mobile Guidance System for Parking Assistance is a method that proposes a vehicle, which does not have fully automated functions but has partial intelligent functions, is manually or automatically guided to an assigned destination position with a guidance system. The system is featured by intelligent mobile guidance systems will assist many normal vehicles in dedicated areas including parking lots. Human machine interfaces (HMI) which makes it easy for driver to follow the instructions from the guidance system. The system is featured by that a few intelligent mobile guidance systems will assist many normal vehicles in dedicated areas including parking lots [2].

HMI for Elderly Drivers in an Off- vehicle Parking Assistance System provides a comprehensive Human Machine Interfaces (HMI) between a communication-based guidance system and an elderly driver for providing vehicle control instructions, and describes the experimental studies performed for the system evaluation. There are three ways of issuing instructions through an HMI using W-LAN. The new HMI for issuing instructions through the car audio was evaluated with experiment by young drivers. By using this system it was possible for an elderly driver to drive a vehicle to a parking space, and the acceptability and validity of the system as off-vehicle guidance system were also proved. It was found that, it reduces the delay and simplifies the

instructions to guide the vehicle to the target parking space with high precision and efficiency [3].

In an Automatic Guideline Generation for Parking Assistance System based on On-Screen Display, the rear-view camera at the vehicle's backside is equipped for parking supports display system. It requires a wide angle lens for obtaining a broad landscape and the input picture is converted the Barrel distortion. Therefore, a driver cannot make out the distorted input picture in order to overlay the track directly. Therefore they proposed the generation automatic guideline based on on-screen display (OSD) that has new distortion using the intelligent neural networks. The neural network is to harmonize the distorted input picture with the generated guideline which is composed of the parameter of the car-width, the extension line, the expectation track, the camera position, the steering angle, the characteristic of lens, and so on. This method supports the driver for being able to read out the distorted input picture and the generated guideline and also it provides sufficient information with the produced guideline of the proceeding direction and the rear-view system in the beginner driving or the unseen obstacle [4].

Top view Transform Model is an approach for transforming a perspective projection image into its corresponding bird's eye version, providing the driver with an image of the area behind the car and car parking assistant system is installed at the rear of the car. In this it is not necessary to provide an exact intrinsic or extrinsic camera and installation parameters. The optimum tilt angle of the camera is 45°. A prototype system was implemented on an Analog Devices ADSP-BF561 DSP platform. This system will be applied to solve various problems for vehicle applications, such as lane departure, providing the vehicle's surrounding view, and eliminating driver's blind spots [5].

Currently, the parking system is classified into parking assistance system and automatic parking system. The automatic parking system is the modified or improved technology of parking assistance system. The vehicle parking system is lack of an efficient parking algorithm to improve the parking performance. Moreover, the efficient parking algorithm can reduce the required parking space. Therefore, they have proposed an efficient parking algorithm and implemented in a microcontroller based automatic parking system. This method also reduces the vehicle parking space [6].

Parking Assistance System (PAS) provides useful help to beginners or less experienced drivers in complicated urban parking scenarios. In recent years, ultrasonic sensor based PAS and rear-view camera based PAS have been proposed from different car manufacturers. However, ultrasonic sensors detection distance is less than 3 meters and results cannot be used to extract further information like obstacle recognition. Rear-view camera based systems cannot provide assistance to the circumstances like parallel parking which need a wider view. In this surround view based parking lot detection algorithm, an efficient tracking algorithm was proposed to solve the tracking problem when detected parking slots were falling out of the surround view [7].

For conveniences and safety purpose nowadays Advanced driver assistance systems (ADAS) are using. In this design ADAS with computer vision is proposed. This is suitable to all types' of cars. This technique detects parking area that is vacant and also check for the legal, where can park the vehicle. This detects vacant area to park both in indoor parking and also across the road sides. This system output is provided in hundreds   milliseconds. The driver gets the information of the parking area before the vehicle passes the area. This is very useful for the drivers to locate their vehicles and also it made a very good awareness among the people about legal parking space [8].

Automatic position parking has been introduced by using variations of magnetic field in vehicle. Previously drivers have to remember the parking area while parking the vehicle so he has to physically and mentally alert to remember the parking area. This becomes very difficult and inconvenient for the driver to park their vehicle. So they presented an accurate and autonomous parking positioning system called Park Sense that uses the signatures of magnetic field that are captured by the integrated magnetometer in mobile phones by doing a certain operations like pressing a button to turn on their Global Positioning System (GPS). Park Sense system helps the drivers by allowing a mobile phone to sense the location automatically and accurately where the vehicle was parked. In this design to detect the location   it   uses the variations of electromagnetic fields and magnetic fields. Since the magnetic field signatures are correlated to the position of the mobile devices inside de a vehicle and also tied with the driver behaviors, many potential applications can be developed from this observation [9].

Nowadays, the total amount of traffic is increased rapidly and parking space getting smaller. It's to design a drive less car by using RTOS (Real Time Operating System) and a smartphone. It is motivated to configure the guidance system of a flexible (Automated Guided Vehicle) AGV. The driver finds very difficult to park their vehicle in a narrow garage, so it helps to park the vehicle using smartphone via Bluetooth with the range of 100 m, ranges between the car and the smartphone and GPS (Global Positioning System) is also used to know the location. This GPS system will help the user to easily identify the car location. "Car Assist" technology is used to monitor the car driving path and the things happening around the car can be viewed in the smartphone via GPS. It supports live time preview to monitor the car parking garage. The users need not to be present inside the car like some previous generation systems [10].

QR code is really useful technology in automation of parking system in a building/mall/airport/railway station. It will provide security besides the automation of parking through QR code based technology. The project scenario delineates two entryways, one at the passage of the stopping field and the following one at the flight, which can be opened/shut with the assistance of sensor. Presently when a car touches base before door, a QR code slip is given to the driver with a specific stopping space to the car, and furthermore the QR code is sent to his/her respective mail. At that point the passage entryway will open and car is permitted to park in its assigned space. While exit drivers are requested for to demonstrate QR code to the reader machine which is available at the leave door accordingly enabling car to leave the stopping zone. We actualize a productive model and lead colossal analyses in numerous parking structures of various structures and size, and gather information of different vehicles and drivers. Quick sorting technique displays the empty slots available in the parking arena [11].

There are several technologies have been to make pollutant free environment by increasing the fuel efficiency during parking the vehicle. To solve the problems of parking system like manual parking, remote parking systems are came into existence. In Manual parking system, man should be present inside the vehicle and he has to control and park the car in the parking slot but it leads to more cost and maintenance becomes very difficult so automatic parking system was proposed. But in Automated Parking System (APS), it automatically parks the car in a very limited space where ever the space is available without noticing the parking slot correctly, so to overcome this, Remote Smart Parking Assistance can be used. It is a mechanical system to assist the driver in parking their vehicle using mobile phones.

3. Conclusion and Future Scope

An efficient Parking system is an inevitable part for this hectic world. This project aims for providing a solution for existing parking solution. It helps in reducing human effort, time consumption and fuel consumption. Vacant parking slots are identified and is indicated to the driver through displays and the driver can select the slot and move out of the car and can control the car to the parking space through remote.

As the future scope of this project, instead of remote control, computerized system can be developed. This system activates and it will take the car to the nearest parking slot. If the driver wishes to take the car back, then the driver just has to request it from a computer terminal outside of the car park.

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