

Automatic Self- Car Parking using IoT

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ABSTRACT

The purpose of this paper is to provide an design solution for automate car parking. It talks about a project that introduces a small model of an automatically parking toy car that can control and manage itself irrespective of the number of cars that are parked in a given area at any given time depending on the availability of parking space. Automatic parking is a way to park and un-park using sensing devices. To prove the effectiveness of our proposed program we have developed and presented a mathematical model that will be briefly discussed in the paper.

INDEX TERMS: Smart-parking system, Performance metrics.

1. INTRODUCTION

Parking is a major problem in urban areas in both developed and developing countries. After a rapid increase in car ownership, many cities have no parking spaces. This imbalance is due to unsuccessful land use planning and improper calculation of space requirements during the initial planning period. Lack of parking space, high parking costs, and traffic congestion due to tourists looking for parking are just a few examples of the problems of everyday parking. The same parking lot is often a nightmare for the driver because, it not only requires the driver's skills but also increases the chances of other drivers crashing into their parked car. This self-parking car project helps to detect the suitable space for a car to fit into the space and starts moving and adjusting according to the obstacles and over comes them and parks the car without any damage to the car without human effort. The project aims to increase the comfort and safety of parking in restricted areas where care and extensive experience are required to guide a vehicle that looks at the real situation in the environment to ensure inconsistent movement in the space available. In this project, an automatic self-parking car will be developed where we have to choose a parking space; parallel parking for standard parking and select parking direction; left or right then the car model will do the parking itself. Infrared sensors are mounted on the front, back and side of the model car to prevent the car from hitting anything. Servo motors are used to control the to

and fro motion of the model car and DC motors will be used to move the model car forward and backward. Some drivers will experience parking problems while driving larger vehicles once they become accustomed to driving a smaller car. Although reverse sensors are installed in most modern cars today, they can only help the driver to some degree. It is up to the driver to drive the car on his own. Although the parking automation has already been used in cars, such technology comes at a high cost. So, with this project, hopefully it will open up more opportunities in a less expensive system that will benefit people.

The main purpose of the paper can be summarized as:

[1] The purpose of the project involves making the parking process completely automated which means without any help of human interaction or even space finding by human eyes. The project mainly focuses on making the parking of a car easily into the spaces between two cars or between spaces that are difficult for humans to park.

[2] Replacing human force that is used in parking cars and achieving hundred percent effortless parking using IoT and different mechanical devices. Although the self-parking car system has already been used in cars, such technology comes at a high cost. So, with this project, hopefully it will open up more opportunities in a less expensive system that will benefit people.

2. RELATED WORKS

Throughout the research process we have been able to find some good research papers as the foundation of our project, in order to learn and improvise from those phenomenal works. Our project put forwards the implementation of IoT in self-parking cars. So the research papers that are put forward are purely based on methodologies that make use of automation in cars is different techniques. Research papers from the year 2016 to the year of 2019 has been thoroughly analyzed and the best technique is implemented from all. [1] The research paper named smart parking using (RFID) by Shruthi Mudaliar, Shreya Agali, Sujay Mundhol which is based on the Implementation the car parking using reservation, every user will be provided with a different OTP (one-time password). The parking schedule is converted into offline problem same as linear problem. This paper has helped us to go in with self-parking cars that doesn't make use of any OTP reservation system and one which is purely offline. [2] The next research paper which was referred was one named parking using slot availability by the author, Mr. Basavaraju S R. This paper mainly focuses on reducing the time in finding the parking lots. use sensors to sense the speed of a vehicle and an objects, sensing

temperature, pressure etc. these are connected by using technologies like GPS, Wi-Fi, BT/BTLE, RFID etc. One of the limitations of the paper was Sensors were managed by Wi-Fi technology which can be weak at some point. We made the system full offline using Arduino Uno.

[3] Similarly, the next research paper named parking with unique id and password by Sunil Chauhan, Sandhya P from an Asian journal was analyzed and in this paper an infrared sensor has been used on each site to check if the space is empty or full The user can pre-book the parking space and updates are provided on the server. Limitations of the paper were ultrasonicsensors are more reliable than IRsensors. [4] The research paper named self-parking management system by Hicham Lahdili, Zine El Abidine Alaoui Ismaili published in the year 2018 was studied and the paper was based on system equipped with a network of surveillance cameras. The limitation of the system was expensive deployment. Automated self-parking cars with minimal technical errors can replace such systems. [5] The research paper named cloud based smart parking by Badraddin Alturki, Wael Alsafery mainly focuses on smart parking systems that will assist the user to find the parking space. The research paper was published in the year of 2018 It collects the raw data from the proposed system by applying data filtering and fusion techniques to reduce transmitted data over Network. Limitations included, parking systems are expensive in building. Also network errors can cause the system to stop working.

All of the mentioned research papers were thoroughly studied and we came out of the best solution to the problem. Different limitations were observed over the various research papers and was contrasted in respect with our project to bring up the best possible result.

3. SYSTEM ARCHITECTURE

3.1 METHODOLOGY

3.1.1 MODULES:

[1] User Authentication

It's the first process involved in the system where the system asks the user what type of parking must be put into use i.e. sidewise parking or line wise parking. Once after the user gives the input of the parking choice the system processes the choice and starts aligning the car itself and the sensors come into play and parks accordingly. Also it provides user the choice of parking the vehicle between two obstacles.

[2] Free Space identification

The system makes use of the novel algorithm which is already deployed into the system using the Arduino Uno board. The sensor and the processor board works together to find out free slots in the parking space and park accordingly. The system makes use of ultrasonic sensors to detect the presence of any obstruction or another vehicle parked in the slot. If the sensor detects any kind of obstruction the parking process is halted and it moves to the next parking slot.

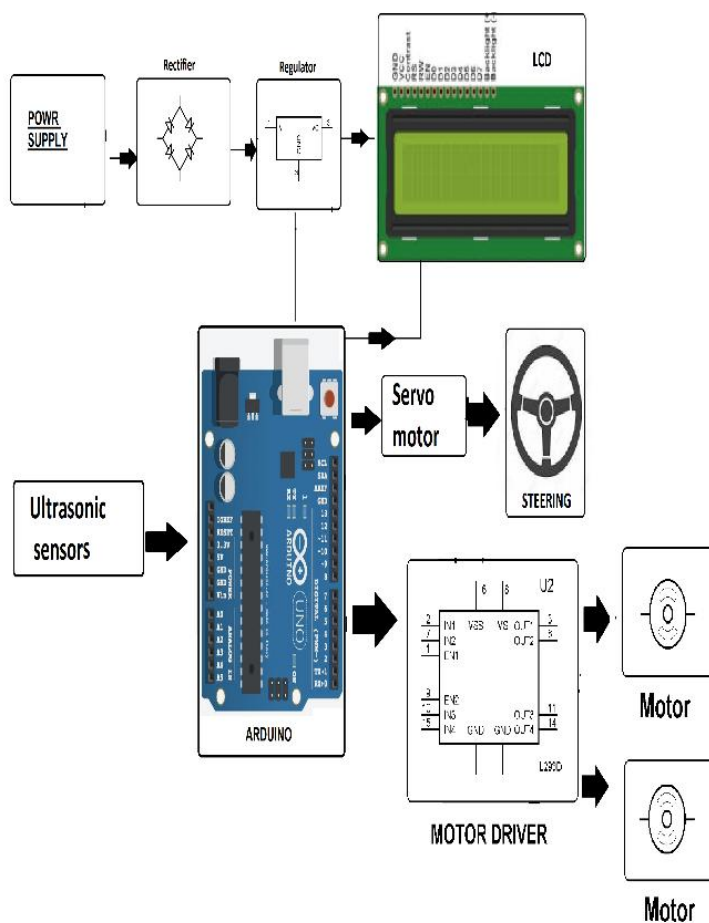


Figure 1. System Architecture

[3] Navigation to the parking slot

The shortest path algorithm or the dijkstra algorithm is used in this system in order to make the system more efficient and fast. After the car detects free parking space it uses the motor present in the car to control the movement of the vehicle upwards and backwards. The servo motor is attached with

the steering lever which helps in better understanding of the self-parking vehicle. After the car is aligned it moved accordingly and is parked successfully. Other than the different modules that we make use of, it also includes various components that coordinated and works together in order to make a working model of our project.

The different components include:

ARDUINO UNO: Arduino Uno is an open source microcontroller board based on Microchip ATmega328P microcontroller and developed by Arduino.cc. The board has a set of digital anchors and I / O (digital) anchors that can be interrupted on various expansion boards and other circuits. The board has 14 digital I / O pins, six analog I / O pins, and can be configured with Arduino IDE with type B USB cable.

The *ultrasonic HC-SR04* sensor uses SONAR to determine the object range as bats. It offers excellent touch detection range with high accuracy and stable reading in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet. In this project we make use of ultrasonic sensor in order to find any parking space between two objects. If it is within the minimum range, then the vehicle is parked.

Active infrared sensors emit and receive infrared radiation. When an object approaches the sensor, infrared light from the LED indicates the object and is received by the receiver. The active IR sensors act as adjacent sensors, and are used in this project. In this project we make use of IR sensors I order to detect any obstacles in the path of the vehicle which can be in front or at the back of the car. Accordingly, signals are collected and the movement of the car is coordinated.

STEPPER MOTOR:A Stepper Motor or step motor is a brushless, compact car, which separates the full rotation into a few steps. Unlike a DC motor without brushes, which rotates continuously when a constant DC voltage is applied to it, the speed of the car rotates with different step angles.

4. RESULT

The successful implementation of our project has given us the best result possible i.e. a fine working model of the automated car that can align itself accordingly to the users wish and park parallel on command. The implementation of the code has been successful and has been added with the results of the project. Basically the result or the output of our project is a working model of a self-parking car that works fine and the code that has been used to run the car. We have made use of c programming in the Arduino IDE and various trial & error runs have given the best result with minimum error.

The screenshots of the results from the project

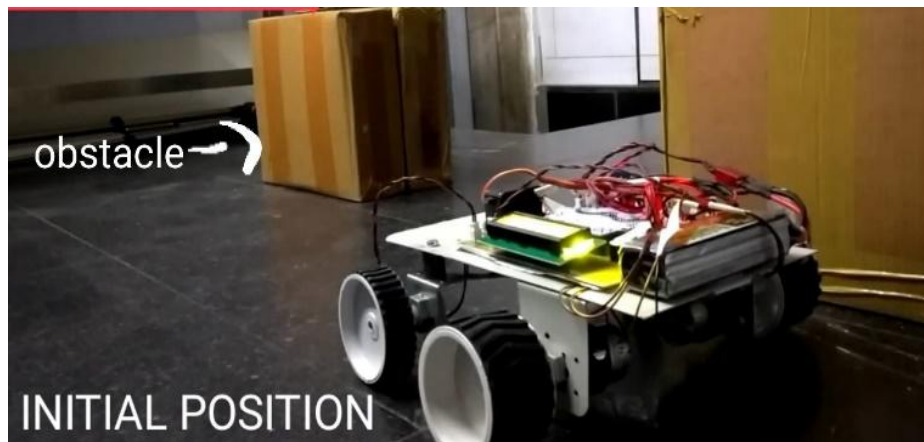


Figure 2. Initial Position

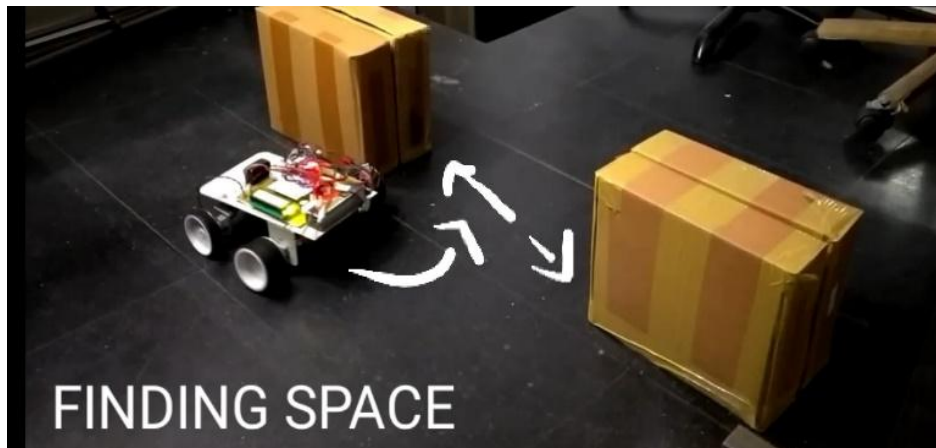


Figure 3. Space finding process

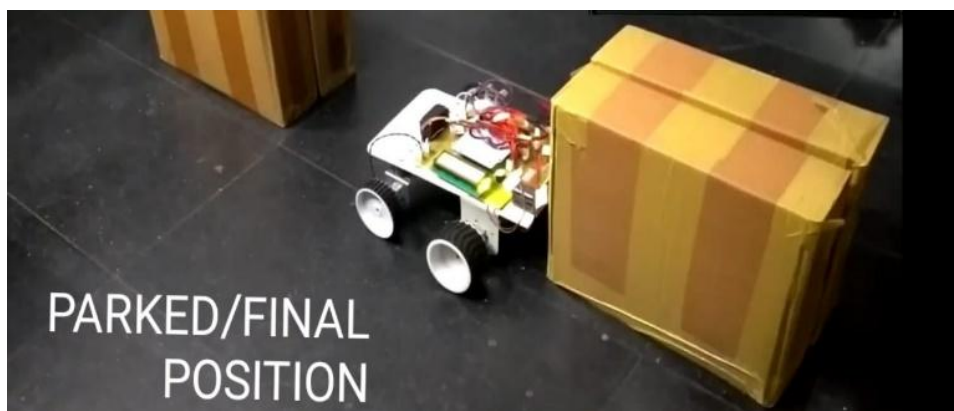


Figure 4: Successfully parked

5. CONCLUSION

This system can be implemented in real time automobiles from domestic to industrial sectors. The working of the system is simple and can be easily understood by any user. The difficulty in parking a vehicle has been overcome through this project. As we know that parallel parking is one of the difficult way of parking cars, this system effectively helps the driver or the user to park his/her car with zero percent effort. Moreover, the system is connected to a LCD display that helps the user to select the mode of parking and also the status of the parking. The efficiency of both Arduino along with ultrasonic sensors, IR sensors, Stepper motors are effectively utilized by the system. The implementation of IOT has helped throughout our project and also future developments and improvements in technology can have our project improvised with best sensors and microcontrollers.

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