International Journal of Future Generation Communication and Networking
Vol.14, No. 1, (2021), pp. 4271 - 4278

Autonomous Vehicles Parking Using Neuro-Fuzzy

Akshay Jain[1], V. A. Yaduvanshi[2], Pranav Kasar[3], Archana Lonkar[4]
Department of E&TC Engineering, SKNCOE, SPPU, Pune, India
[1]jainakshay5590@gmail.com
[2]vijaya.yaduvanshi_skncoe@sinhgad.edu
[3]pranavkasar18@gmail.com
[4]archanalonkar3001@gmail.com

Abstract

Due to high population, traffic congestion problems have become a major issue in today's world. So it is a need to solve the parking problems and provide an effective and efficient solution for parking of the vehicles. Advanced vehicle Parking is an efficient solution for traffic congestion. The objective of this paper is to design an advanced vehicle parking system which will automatically park the vehicle without the help of driver. As everything in the modern world is going automatic, we have built a system which can automatically sense the empty parking slot and the vehicle is parked automatically. This system not only reduces the human efforts, but also reduces the consumption of space. The advanced vehicle parking assures full safety of vehicle and its owner. This system has shown the concept of an automatic vehicle parking system.

Keywords— *Autonomous parking; Neuro Fuzzy; Parallel parking; Pic Microcontroller; Parking Algorithm*

I. INTRODUCTION

In modern times, parking of vehicles is a major issue. Because as vehicles are increasing rapidly the issue to park them are also increasing. Due to these increased vehicles, traffic congestion problems have become a major issue in the current world. So it is necessary to make provision for the parking space and provide an effective solution for parking of the vehicles.

Parking of vehicles is a major issue in both developed and developing countries. Following the rapid increase of car sales, many cities are unable to maintain the minimum threshold required for parking space thus creating an imbalance between supply and demand of space. This imbalance is partly due to a lack of planning and miscalculations in the utilization of these spaces available. Unavailability of parking space, high parking tariffs, and traffic congestion due to visitors in search of a parking place are only a few examples of everyday parking problems. Autonomous vehicle Parking is an efficient solution for traffic congestion.

Many parking algorithms and route planning have been studied. Fuzzy control is applied to the autonomous parallel parking process. Another work demonstrated that the practicable controls of motion (motion of steering and backward/forward motion of vehicle) approximately following a feasible parking path regulated by trigonometric functions are iteratively generated and applied during the automatic parking process. Between iterative motions, the real-time vehicle location data from the sensor feedback monitor the parking maneuver to correct the following motion and avoid collision. There are other works on optimizing the parking path to either the shortest time or route by studying

ISSN: 2233-7853 IJFGCN

the generic non holonomic constraints of the vehicle routes with various mathematical functions, such as circular functions, trigonometric formulae and polynomial functions. These paths have continuously changing curvatures and usually require lengthy periods of orbit planning and continuous wheel steering for path tracking, resulting in shortening tire lifetime.

To simplify the control process, a simple algorithm with fixed turning curvature was proposed and is partially adopted in the setup of this project. The design of this system in which the parking has no intervention of humans at all. This system successfully reduces human efforts and consumption of space. The Autonomous vehicle parking system assures the full safety of the vehicle and its owner.

II.CURRENT AUTOMATIC PARKING SYSTEMS IN THE MARKET

Many automobile manufacturers provide optional automatic parking assistant systems including Toyota, Ford, BMW, Audi, Mercedes-Benz, and Chrysler. However these systems need human 4 monitoring and accelerating/braking inputs and are not completely automatic. Bosch [12] is developing a fully automated parking system by calculating a parking maneuver and monitoring the surroundings, and it allows the driver to leave the car and activate an autonomous parking from a smartphone. All these systems have similar parking strategies and maneuvers with just different levels of automation.

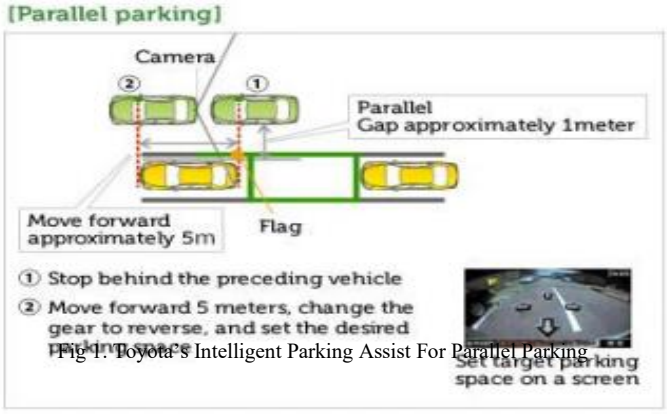

Fig 1. Toyota's Intelligent Parking Assist For Parallel Parking

Take Toyota's Intelligent Parking Assist12 for parallel parking as example, the vehicle moves forward by a particular distance (around 5 meters) after detecting an appropriate parking lot, then the system assists steering the wheel monitored by sensors while the driving force controls the accelerating and braking, as shown in Figure 1. The system demonstrated during this paper is fully automatic almost like the one among Bosch with a parking lot finding function. After the parking procedure is started, the vehicle moves slowly keeping an appropriate distance from the road side parked cars. Once an appropriate space has been detected, the car moves forward with a particular distance then drives backward to park the car automatically. The whole procedure is monitored by ultrasound sensors.

ISSN: 2233-7853 IJFGCN

III. PROPOSED METHODOLOGY

This system is concentrated on achieving one task (automatic parking) by integration of sensors and actuators controlled by microcontroller and strategy planning/coding. There are generally three sorts of parking patterns: parallel, front/back-in perpendicular, and with an angle (usually 45 degrees), and this project is simply focused on the parallel parking. The modified vehicle is expected to do the following tasks in a complete automatic parking process:

1. Drive along an imitated road-side environment and detect the space from the vehicle to the road-side obstacles like parked vehicles or simply curb on the proper hand side.
2. Once the length of a parking lot is larger than the length of the vehicle plus a buffering distance is detected, the vehicle will stop automatically.
3. Performing a smooth and efficient parking behavior consistent with the relative positions of the vehicle

The automatic vehicle parking system has the subsequent major components:

1.The vehicle consists of a 7V DC motor in the back and a servo motor in the front.

2. PIC 18F4550. PIC Micro-controller controls the vehicle's driving DC motor and turning servo motor. The sensors are connected to the PIC Micro-controller and integrated in the system, therefore the parking strategy and algorithm can be programmed and uploaded to PIC Micro-controller.

3. HC-SR04 ultrasonic sensors, shown in Figure 2(a). Currently two ultrasonic sensors are mounted on the vehicle. Two sensors are setup on the proper side to live the space between the vehicle and therefore the road-side objects. The other two IR sensors are mounted on the front and therefore the back bumpers of the vehicle so as to stop collisions during the parking process.

4. L298N H-bridge high current motor drive shield. Arduino's maximum DC current from VCC and GND pins is simply 200 mA. This shield provides up to 2 A current to drive the vehicle's motors. See Figure 2(b).

5. A frame is used to support the ultrasonic sensors. It keeps the sensor stable in order to obtain the most accurate measurement data.

Fig 2(a) HC-SR04

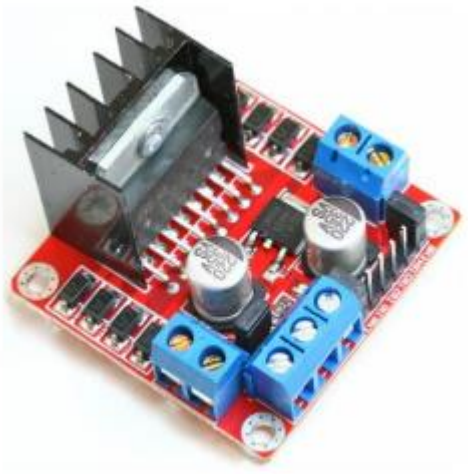

Fig 2(b) L298N

ISSN: 2233-7853 IJFGCN

IV. RESULTS

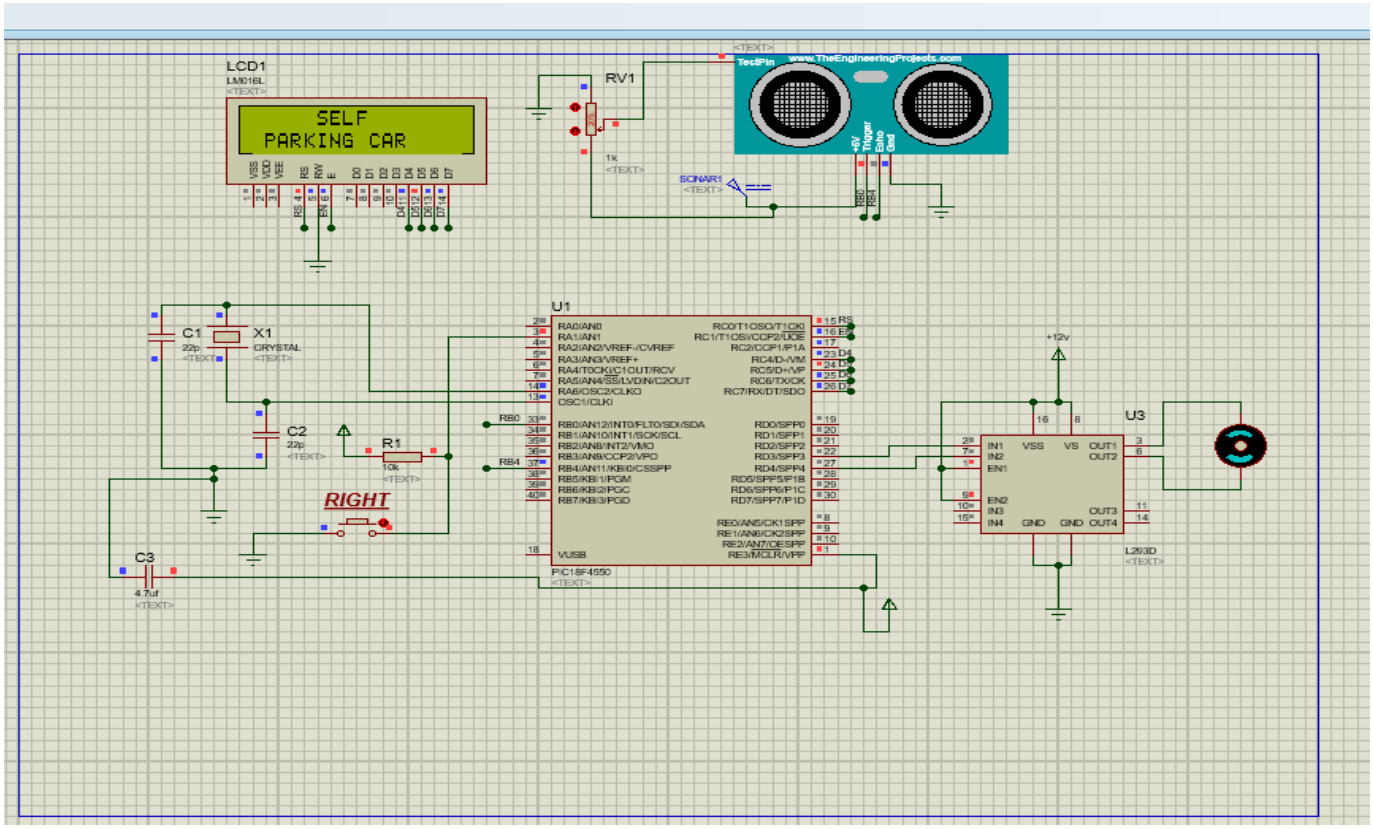

Fig.4.1 Introduction to Self-Parking car

After pressing the switch, parking algorithm is initialized and “Self -Parking Car” message is displayed on the LCD display.

ISSN: 2233-7853 IJFGCN

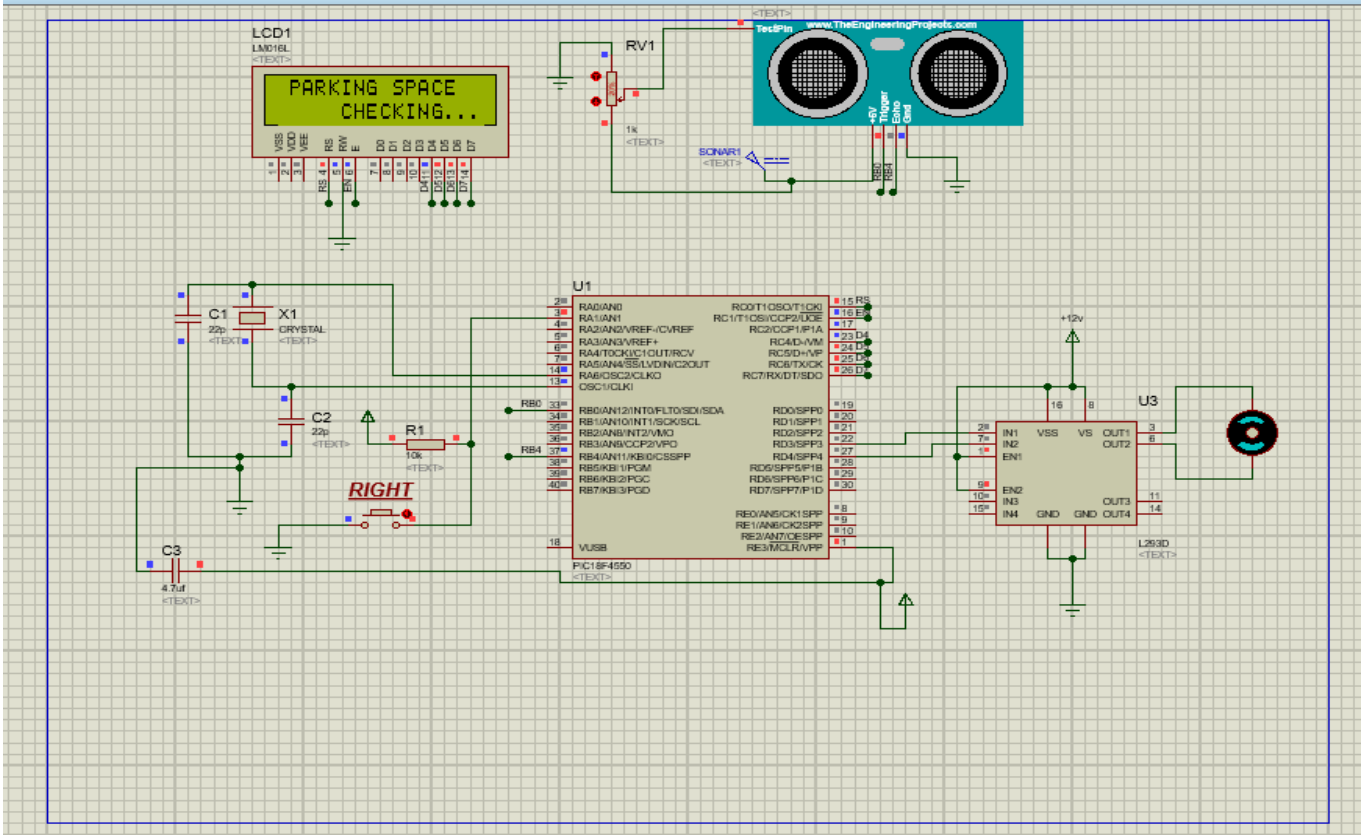

Fig.4.2 Parking Space Checking

Continuously monitoring the distance and verifying if the distance is available or not.

ISSN: 2233-7853 IJFGCN

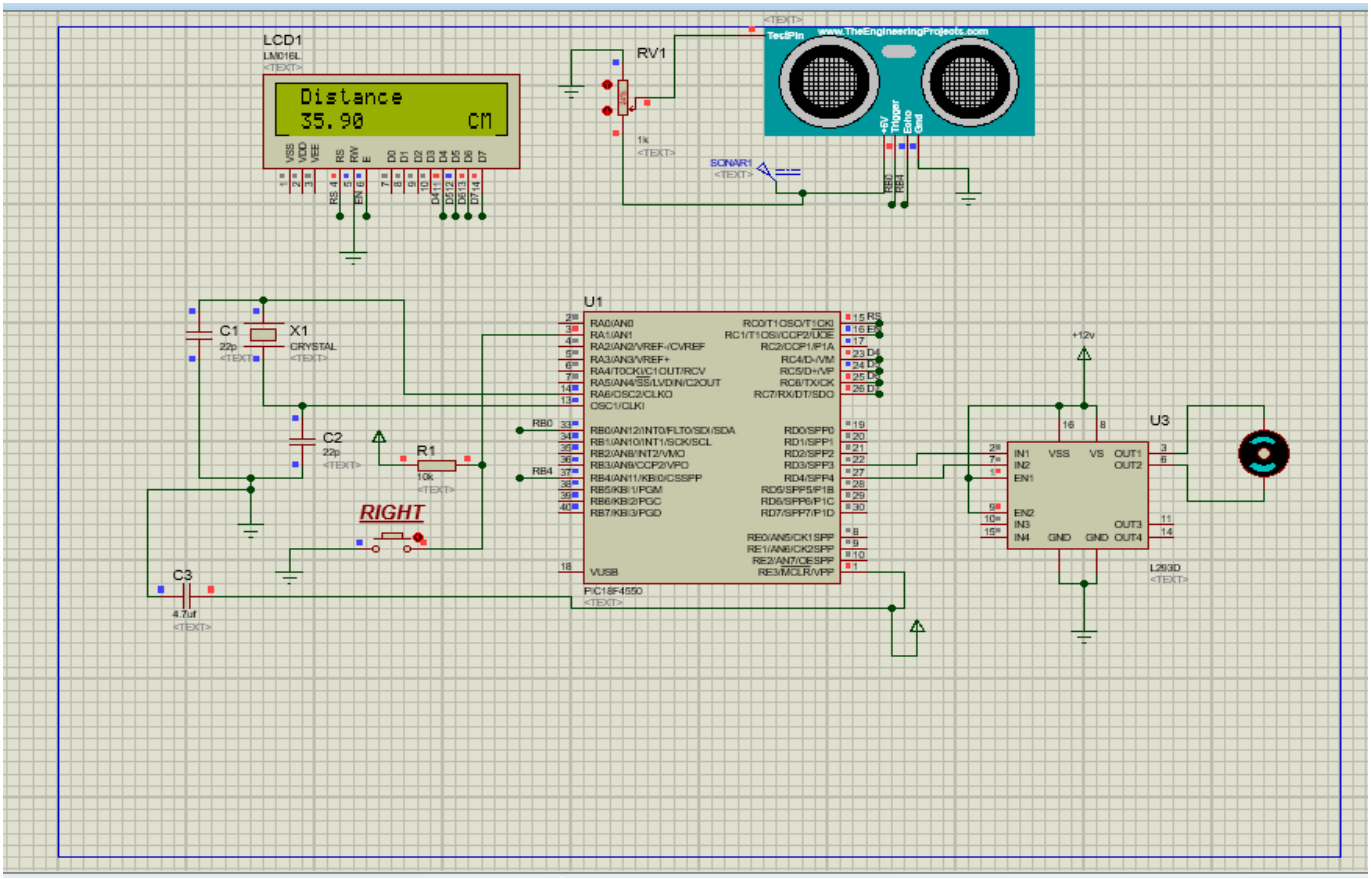

Fig.4.3 Displaying the available distance

Displaying the available distance on the LCD display and checking for required space.

ISSN: 2233-7853 IJFGCN

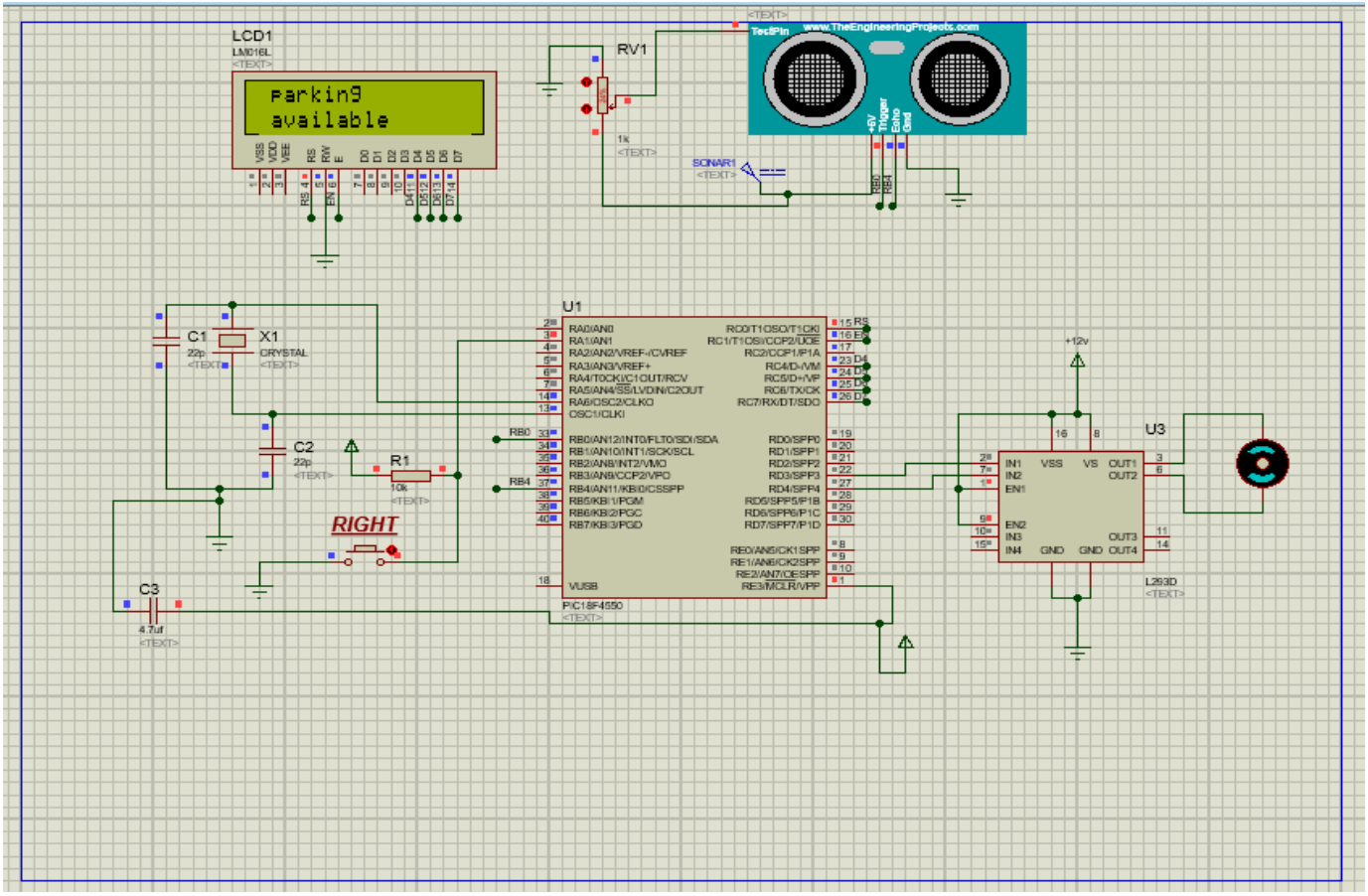

Fig.4.4 Parking available

If the available distance which is displayed is greater than equals to the required distance, then “Parking available” message is displayed and parking procedure is initialized.

V. CONCLUSION

It is focused on the most difficult case of parallel parking that is when the parking space dimensions cannot be identified. The current work is focused on reducing the time to park the Car and save the fuel.

ISSN: 2233-7853 IJFGCN

This type of technology could be implemented in Self Driving car in which most of the functionalities would be Autonomous. The proposed automatic-driving car is successfully simulated and tested

REFERENCES

[1] Surjit Singh and Surya Nepal, "Privacy-Aware Autonomous Valet Parking: Towards Experience Driven Approach", IEEE Transactions on Intelligent Transportation Systems, 2020
[2] Conor Ryan and Joseph Walsh, "Sensor Technology in Autonomous Vehicles: A review",29th Irish Signals and Systems Conference(ISSC), 2018
[3] Xiaojing Zhang ,Alexander Liniger and Atsushi Sakai ,<Autonomous Parking Using Optimization-Based Collision Avoidance>IEEE Conference on Decision and Control, 2018
[4] Ms. Honghong Liu and Dr. Gene Yeau-Jian Liao, "Automatic Parking Vehicle System" by Wayne State University.
[5] A. Singh, A. Chandra, D. Priyadarshni and N. Joshi, "Self-Parking car prototype," 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2018
[6] Lahdili, Hicham; El Abidine Alaouiismaili and Zine, "New approach for self-parking management system", International Journal of Engineering & Technology, [S.l.], v. 7, n. 4, p. 2765- 2772, oct. 2018
Website:
[7] https://www.instructables.com/Autonomous-Parallel-Parking-Car-Making-Using-Ardui/
[8] https://www.researchgate.net/publication/224216215_Autonomous_parallel_parking_system_for_Ackerman_steering_four_wheelers
[9] https://www.sciencedirect.com/science/article/abs/pii/S0967070X18305924#:~:text=Autonomous%20vehicles%20(AVs)%20have%20no,or%20cruise%20(circle%20around).
[10] https://link.springer.com/chapter/10.1007/978-3-642-12990-2_80
[11] http://www.toyota-global.com/innovation/safety_technology/safety_technology/parking/
[12] http://www.bosch.com/en/com/boschglobal/automated_driving/technology_for_greater_safety/pagination_1.html

ISSN: 2233-7853 IJFGCN