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AUTONOMOUS PARALLEL PARKING OF CAR BASED ON PARKING SPACE DETECTION

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Abstract— In extremely inhabited areas it is tough to seek out accessible parking spots. Often parking spots are assail the aspect of the road, specified the motive force has no alternative however to aim parallel parking. Generally it is assumed to be a rather difficult opposing issue. Since parallel parking needs driving backwards it becomes tough to simulate correct concurrent motion of the automotive. A few drivers have to perform multiple evaluations before they park the car in correct location. In the hardest case an accident may happen. A car that can perform parallel parking by itself would save the time of the person driving the car, particularly to those who are bad with parallel parking. It embraces cars which will parallel park mechanically in a very reliable manner would likely decrease the quantity of accidents associated with parking. The goal of our work is to carry out parallel parking of cars. Using our model we suggest a technique to the parallel parking problem which can be autonomous.

Index Terms—Component, formatting, style, styling, insert. (key words)

I. INTRODUCTION

Nowadays, many automobile makers have introduced parking assist system and it is largely accepted due to the actual fact that parallel parking could be a difficult task. This intelligent parallel parking facility has good application when visibility behind the vehicle has decreased attributable to aerodynamic structure .At the same time, the recommended technique provides prevention for the car from hitting at the rear and subsequently reduces the error caused by man .Anyhow, it may be concluded that there are still some gaps and the new directions such as the regulation of brake, sensors efficiency, diagonal parking and system disturbances and environment concerns for the further research .The automated parking maneuver for small mobile vehicle is described using some analytical techniques. Generally, automatic parking can be classified as three sections which are sensory perception, path planning of path, and maneuver execution. This paper aims to develop the intelligent autonomous parking movement of a small vehicle in motion using some analytical techniques and circuit design of the model of mobile vehicle. Earlier , a small mobile vehicle has employed. In the next step ultrasonic sensor is employed to get through the environment detection and data processing using micro controller. Finally, parking maneuver and coding algorithm was developed for successful parallel parking.

Currently, there are cars which already equipped with parking assist system (PAS) which may be semi or fully autonomous such as in Ford Focus, Toyota Prius and Mercedes A45-AMG. Most of the available intelligent parallel parking system in a car includes a set of sensors, visual image captured by the camera and controller and also DSP to find the environment and act accordingly to complete the parking oppose factor. Servo controller which is a radio control is the steering the front tires. Its input and output is PWM (pulse width modulation) waveform. A default speed regulator is applied for controlling direction and speed. Sensors are used to detect the available parking area and then the system will decide whether or not the parking space is enough. Later the parking factor is carried out.

Methods that have been suggested for parallel parking can be classified as two sections. The earliest section employs traditional controllers to tackle the parallel parking problem. On the other hand, the next section employs intelligent management by taking the advantage of the deserves of some tools of computational intelligence .A sensor based maneuver (SBM) provides swish and safe motion for the vehicle whereas undergoing the parking maneuver. It can be initialized by applying some predefined sensor modalities and regulations. The vehicle can perform a particular form of maneuver in a very

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reactive means. Besides that, it also has three main phases which are detection of parking space, retrieving an acceptable beginning position for the vehicle, and processing the parallel parking maneuver .

II. VEHICLE LOCALIZATION

a) System overview

The automatic parking process consists of several steps as shown in Fig. 1. Initially the system verifies the direction of the parking area and so directs forward to succeed in a ready-to-reverse position with the vehicle orientation parallel to the parking space victimizing ultrasonic sensors. Once detection work and scale check of the parking bay has completed, the system makes call on the potential parking technique - 'parallel parking', 'garage parking', or 'impossible'. The vehicle then stops at counseled ready-to-reverse position from which the parking maneuver starts as shown in figure 1.

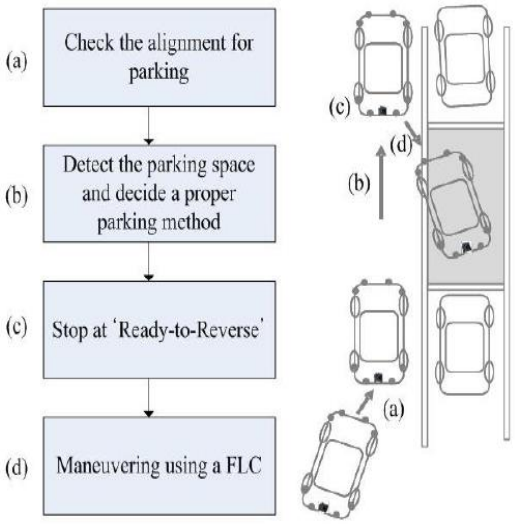


Figure 1 Automatic Parking system

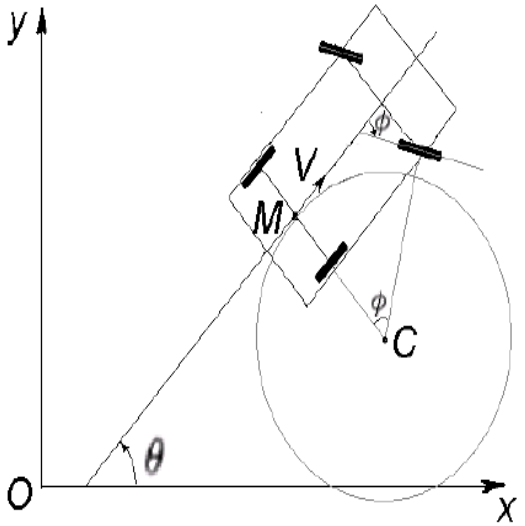
b) Vehicle Localization

In order to autonomously drive itself, a vehicle has to understand its actual position and orientation, i.e., the vehicle state or pose vector, x = [x y θ]. But the vehicle localization must be carried out with respect to the detected parking space. To obtain this data and conjointly to catch up on attainable parking lot detection errors and to stop collision. If alternative vehicles or walls exist, the vehicle state is well determined by ultrasonic sensors. As a result of the ultrasonic sensing element information might contain error according to the approach direction and also the material of the mirrored object, they are integrated. If the amendment of the ultrasonic sensing element value is larger than an explicit threshold, we are able to handle this noise with the average of the each neighboring sensing elements among ultrasonic sensor array. But just in case of a ready-to reverse direction with an outsized approach angle between the vehicle and therefore the car parking zone or the position with no objects behind, we can't estimate the vehicle state.

In this case, the system estimates the vehicle state from the automobile parking space markers in a picture. Once extracting automobile parking space marker candidates applying the edge and intensity profiles, we tend to remodel the extracted automobile parking space markers to the planet coordinates. Then we estimate the vehicle state by extracting feature points.

c) Mathematical Model

Position of a standard car on plane is definitely determined by its sizes (length and width) and coordinates (x, y,Θ) , where (x, y) are coordinates of pointMon the plane xOy , Θ is a corner between a car longitudinal axle and axis Ox (Figure 2).



As the rate of angle Θ change is equal-in-to the angular rate of the point M and it is opposite to it in direction, the automotive movement method on plane within the most simple case is represented with the subsequent equation system:

$$\frac{\partial y}{\partial t} = V \sin\theta$$

$$\frac{\partial \theta}{\partial t} = -\frac{V}{W\,Ctg\emptyset + \frac{W}{2}}$$

III. IMPLEMENTATION

a) Obstacle Avoidance

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While driving down the hallway/road towards its goal, the car might encounter obstacles. We can consider 2 methods; look forward to the obstacle to maneuver or go around it. If the globe is alleged to be static, the second choice is that the only choice. During a globe application, the automobile would go around or wait, looking on the obstacle encountered, size, area and if it appears to be static or not. We assume the globe to be static, that the mechanism can try and go round the obstacle. The problem may be divided into 3 sub problems:

1. Obstacle detection
2. Going round the obstacle
3. Obtaining back on the trail towards the goal

b) Detection of parking spot

In order to find the parking spot we use LabVIEW software for location tracking based on latitude and longitude of the parking space. The google api supported with LabVIEW shows the location of the vehicle using the GPS assisted with the process.

c) Curve following

Once the boundary points of the parking lot have been determined and the robot has stopped at a desired location, the only thing left to do is to perform the parallel parking procedure. In our experiments we have tried several different methods. First we developed an empirical method in which the setting of the differential velocities was determined experimentally. We also attempted to approximate a sine curve by following the arcs of two close by circles. To make our parallel parking more reliable and general we decided to implement curve following. Our robot performs parallel parking by following a sine curve.

d) Modules

The autonomous parallel parking modules are shown in the following block diagram as follows.

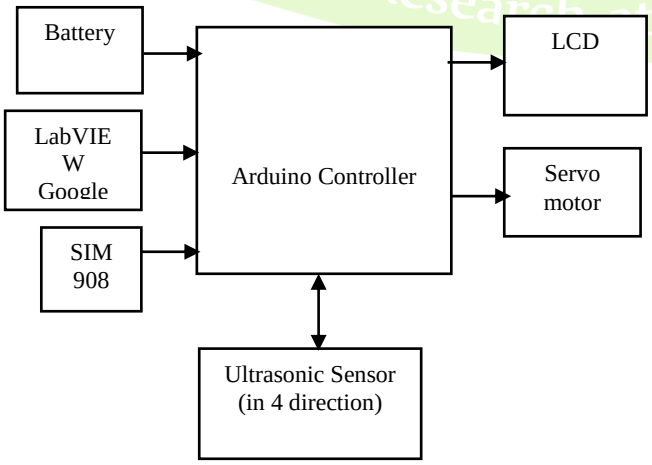

Figure 3 Architecture diagram of parallel parking

The controller requires 5v to operate which could be obtained from battery. The LabVIEW software with Google API interface identifies the location to be trace and distance to be marked in the display. The SIM 908 module is for GPS tracks the location of the module found and to send SMS to the owner for parking based on the location tracked. In order to avoid the obstacles collision we uses ultrasonic sensor for proper obstacle detection.

IV. RESULTS AND DISCUSSION

The autonomous parallel parking using LabVIEW software for back end or schematic end is shown in figure 4.

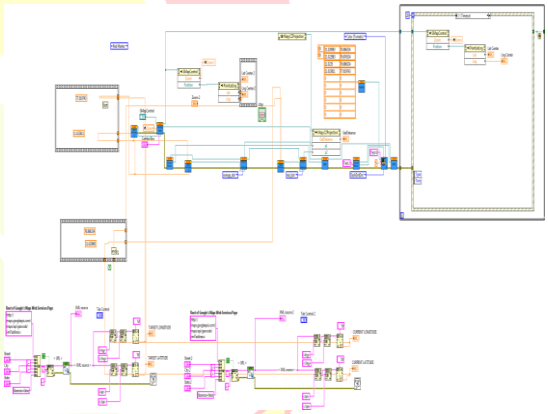

Figure 4 Back panel or schematic design of parking system

The front panel consists of labels and text used to display thedestination and source for the parking system as shown in figure 5.

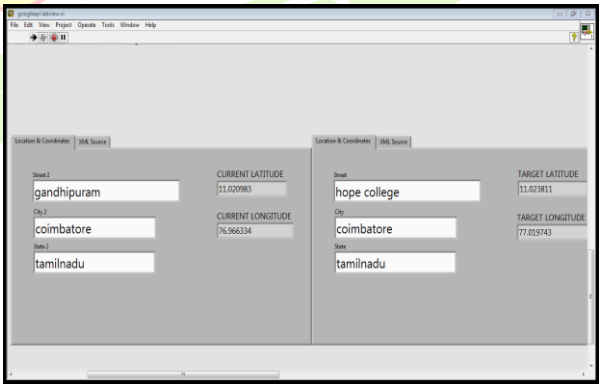

Figure 5 Front panel view of location tracking of parking system

The front display panel displays the google interfaced map which plots the distance between the source and destination as shown in figure 6.

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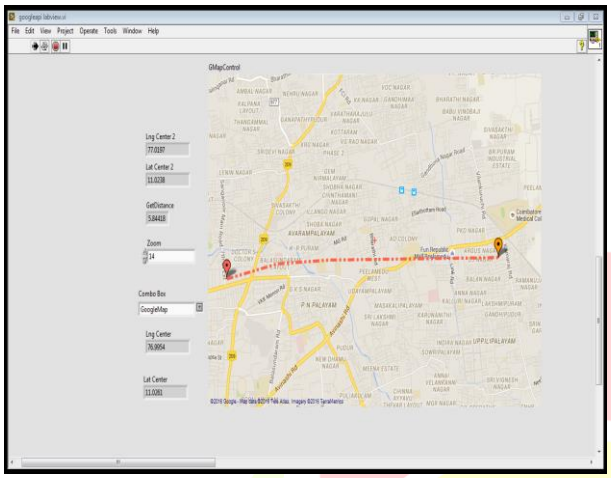

Figure 6 Map shows destination and source distance

The ARDUINO based autonomous car parallel parking module with SIM 908 GPS module which allows to automatic localization of the route in map as shown in figure 7.

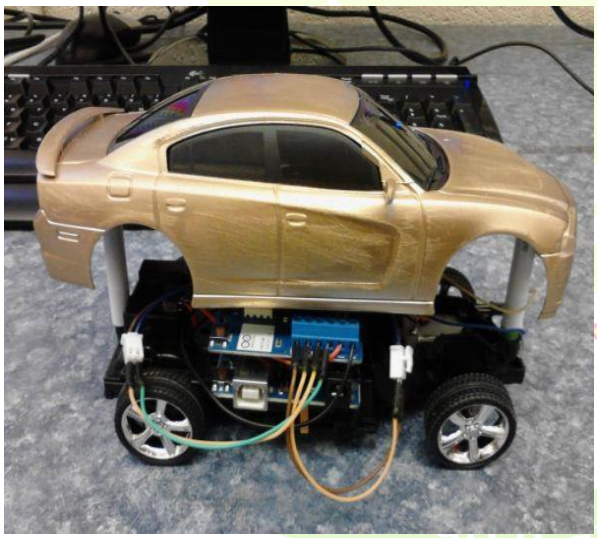

Figure 7 Autonomous car parking using LabVIEW

V CONCLUSION

A novel automated parking system is implemented based on localization and obstacle detection using LabVIEW and Arduino controller. The parking is efficient when the car successfully enters the parking space, the rear and front sensor will detect the distance from the vehicle to the obstacles respectively. Then, the vehicle position is adjusted until the difference between the two distances is zero which means that the car is centered inside the parking space. Generally, during the parking maneuver, speed control is done in such a way that the vehicle accelerates to a desired speed and then remains at this speed for executing some part of the maneuver before it finally decelerate and stop when the vehicle has reached the desired position in the parking space.

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