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Autonomous Reverse Car Parking System Based on Robust Path Generation and Improved Sliding Mode Control

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Abstract: *Now a days car parking is the main issue in progressive countries because the land is less than the population. India also facing the same problem. Like any other countries in India parking of a car in a public areas like street or apartments is a vital task. In this situation manual parking causes accidents and many other issues. To avoid this accident and issues, autonomous car parking is advisable. This paper is to implement a automatic reverse parking system especially in cars, mostly in apartments. This system is implemented by using ultrasonic sensor and by finding the path generation of the parking slot, image processing is also applied. Both software and hardware implementation is being used. The economic cost of this cheap and very low.*

Keywords: *Autonomous reverse parking, sliding mode control (SMC),Indian scenario, ridge detector, extended kalman filter*

1. INTRODUCTION

Recent advances in vehicles with autonomous parking systems have drawn much attention and interest from researchers, media and the general public. Now a days, several commercial car models have been adapted to a certain extend. It is classified into two majar groups, i.e., reverse parking and parallel parking based on the parking slot, with respect to the road parking. This paper fully focused on reverse parking only.

The basic steps to realize the autonomous parking, i.e., target position designation, path planning and path following/tracking. Based on the sensors used it can be classified into three categories, i.e., active ultrasonic or laser-sensor-based, infrastructure-based, and vision based methods.

2. Description

2.1 Ultrasonic Sensor

The main task of the ultrasonic sensor is to identify the suitable parking place within the surroundings. The diameter of the ultrasonic sensor is about 45-55mm.Ping ultrasonic sensor is shown fig 1.

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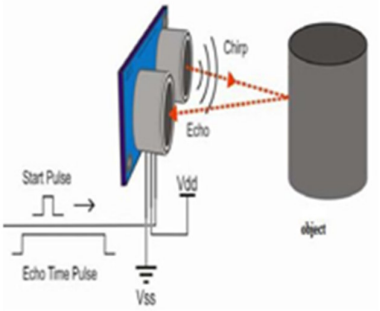

Fig.1 Ping Ultrasonic sensor

Table 1.Electrical characteristics of ultrasonic sensor

Module Type	Sensor
Weight	15.00g
Board size	2.0 x 4.3 x 1.5 cm
Version	1.0
Operation Level	Digital 5v
Power supply	External 5v
Frequency	40KHZ

2.2 LCD Display

LCD: Liquid Crystal Display is used to display the preset words, digits in 7-segment displays as in a digital clock. In the system LCD display is used to display the fuel level in litres to the driver of the vehicle.

2.3 PIC Microcontroller

PIC microcontroller is the smallest microcontroller.PIC microcontroller is made up of microchip technology. It is used to program a large number of tasks. It is used to access external memory and Input/Output. The fig.2 shows the architecture of PIC microcontroller.

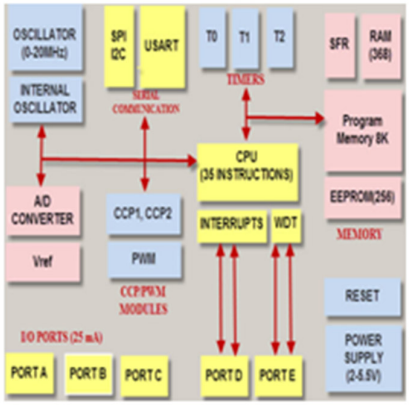

Fig 2.Architecture of PIC Microcontroller

2.4 GSM Module

A GSM module is a special type of module, it accepts a signal and operates over a subscription to a mobile operator just like a mobile phone and sends messages to the concerned person.

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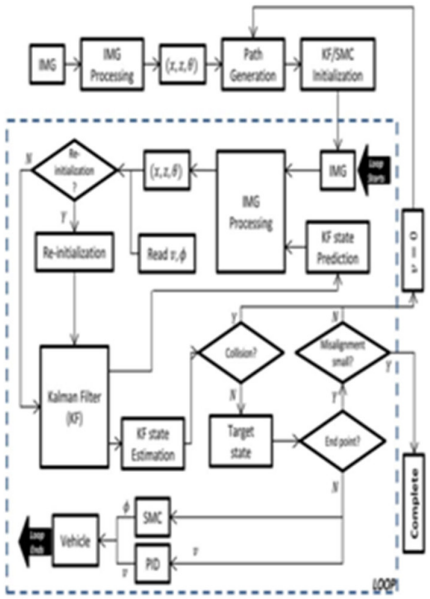
3. Flow Chart



4. Algorithm

Step1: Take the picture and calculate vehicle pose.
Step2: Initialize path generator and the velocity, steering angle are generated.
Step3: Start Kalman filter and SMC.
Step4: Start the iteration at new vehicle pose.
Step5: Derive vehicle pose.
Step6: Scan the in-vehicle moving speed and steering angle.
Step7: The input of new vehicle pose, speed, steering angle is send to kalman filter.
Step8: Monitor the collision on estimated states. If occurs, redo from step3.
Step9: Analyse whether the vehicle passes the end point. If not, proceed further. If yes, stop the vehicle.
Step10: Produce error signals
Step11: SMC commands steering angle to vehicle steering motor.
Step12: Pass the target speed to controller.
Step13: Repeat step 4 and 13 for parking completion.

5. Conclusion

In this paper, we have provided solution to avoid parking slot collision by autonomous parking system. This is based on camera vision. This method is low cost with high performance. Ridge detector and kalman filter. It provides accuracy and consistence. This overall control scheme will make sure that there is no collision in parking slots.

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