International Journal For Technological Research In Engineering
Volume 1, Issue 9, May-2014 *ISSN (Online): 2347 - 4718*

AUTOMATIC CAR PARKING SYSTEM IMPLEMENTED ON A REMOTE CONTROLLED CAR

Aman Kazi[1], Juhi Misra[2], Sagar Kanphade[3], Prof. V.N. Ghodke[4]
Department of Electronics and Telecommunication, AISSMS IOIT, University Of Pune
Pune, Maharashtra, India.

Abstract: With the rapid increase of cars the need to find available parking space in the most efficient manner and to park the car successfully without any damage is becoming tough day by day.Current car park system is dependent on a sensor based system that monitors the obstacles while the parking is carried out by human personnel. This paper presents a method, to create a Remote controlled car that can identify a parking space and parallel park by itself. The Remote control car will drive down a street searching for a parking space to its right using a distance sensor. When the car has identified a space, it checks to see whether that space is large enough to park in. If it determines that there is sufficient space, the car will begin parallel parking into that space. It uses information from sensors placed on the front, right, and rear of the car to direct the car into the parking space. This system reduces the possibility of human error while parking the car and avoid unwanted collisions. It is user friendly without compromising on the efficiency of the system.
Index Terms: ATMEGA16 communication, Automatic Parking, Distance Sensors, GP2D12, H-Bridge (LN 298).

I. INTRODUCTION

With the advancement of technology making everything so convenient for us in this day and age, we all wonder why it comes with such a heavy price tag. This being said only because why could we all not be able to make use of the latest technology without having to be able to make way for its exorbitant rates to be able to avail it. With all the latest cars that have come into existence driving has only become easier for the everyday man, but we still thrive on making it easier and more comfortable. The biggest problem people face while driving is not actually driving the car, but Parking it. Yes, that is true. People find parking more difficult than actually driving the car on the roads. Beginner drivers dread having to park the car because getting that judgment does not come easy for some. And this can completely hamper the confidence of a new driver. We have implemented a system of parking the car in parallel. This means that on a road where cars are parked in front of each other, bumper to bumper, length wise and there exists a gap we can park the car between it, in parallel. This has been troublesome for a lot of people and causes problems for even the experienced drivers. Making parking easier in a car has been implemented by a few top end cars like the new Audi A7 and while it still has to be launched to the masses Volkswagen has implemented this in their car. [12] However these cars are out of the reach of some people and it makes this technology which should be implemented in all cars used by just a few who can afford it. In this paper, we have implemented the car parking system on a remote controlled car. We have had to completely understand first the mechanism of this remote control car and after taking it down and putting it back together a number of times did we finally figure its working module. We have used ATmega 16 microcontroller to make our circuit and configure all our other components which help the remote controlled car manoeuvre itself and park itself automatically without the use of the driver.[5] The ATmega 16 receives the information from the infrared sensors and the distance sensors. The distance sensors used here are the GP2D12. These distance sensors measure the distance between the two cars, i.e. the gap between the two cars on the road where this car is supposed to be parked. If the distance between these cars is adequate enough or in our case it is one and a half times the length of the car the car will identify it as a parking space and it will begin to park.

II. MATERIALS AND METHODS

A. Materials

To detect a parking space we use GP2D12 sensors on the left side of the car as these sensors take continuous distance reading and the output is an analog voltage proportional to the distance and thus help in determining if the length of the parking space is sufficient. The range of the sensors is 10 to 88cm so that the depth of the parking space can be judged accurately. [9] There are two infrared sensors placed on the front and rear side of the car so the depth of the parking space can be judged accurately. The front and rear sensors are used mainly while parking the car.

The output of these sensors are nonlinear and their output varies. So we will have to use an analog to digital converter to quantize the readings. We have used TIL81 and TIL38 sensors as these are designed to emit near infrared radiation when they are forward biased. They also have high reliability processing and wide acceptance. They are connected in obstacle detection configuration. The range of these sensors can be adjusted with the help of a pot. We have also used a 16*2 matrix LCD to display which state the parking has entered into. [8] We have mounted two motors, one of which is for the reverse and forward movement of the rear wheels and the other is to turn the front wheels left or right. These motors are controlled by a simple DC input. For this purpose we have used an H bridge which is a motor driver. A +5V turns the rear wheels in the clockwise direction and the front wheel to the left. A -5V input turns the rear wheels counter

 Copyright 2013.All rights reserved.

clockwise and turns the front wheels to the right.L298 is used here to control two motors suitable for robot differential drive. It has a flexible design which allows unipolar and bipolar motors and since it is micro controller based, the winding excitation, motor speed, control word format and other such parameters can be tailored using software. The L298 is an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. [7]
Criteria for selection of Microcontroller:

- In System programming required as the car needs to be repeatedly programmed
- It should be fast in operation
- It should have an inbuilt ADC
- It must be economical and easy to handle
- Power consumption should be low
- On chip memory required for storage of program code

Thus, we have selected ATmega16 microcontroller.
ATmega16 is an 8 bit AVR microcontroller with an advanced RISC architecture. It is a high performance, low power microcontroller. 131 instructions that take just one or two clock cycles. The AVR family of processors was designed with the efficient execution of compiled C code in mind and has several built-in pointers for the task. Since our project requires repeated programming to enable the car to respond as required the In System programming feature comes in handy.

The internal ADC (8 channel 10 bit) is useful in linearizing the sensor inputs. It also eliminates the need to interface an external ADC with the controller. The ADC noise reduction mode can be used for increased accuracy. It has an internally calibrated RC oscillator which we have used. The power consumption is low around 1.1 mA. It has 4 PWM channels which can be connected to the motor for speed control. It also has on-chip flash memory for program storage (16k).The DC Motor used has torque of 2kg-cm, rated speed range of 1 to 100 r.p.m and operating voltage of the motor is 12V DC. The voltage regulator 7805 is used to supply a regulated 5V Vcc to the circuit. It provides a constant output irrespective of the variations in the battery output especially as it gets discharged. A separate battery pack is used to run the motors. A voltage regulator 7805 is used to supply a regulated 5VVac to the circuit. [10] It provides a constant output irrespective of the variations in the battery output especially as it gets discharged. A separate battery pack is used to run the motors. [6].

B. Methodology

Our system tries to simulate how a human would park a car. Ones it detects a parking spot it makes the car move forward by a certain amount to give it enough space to move and rotate into the parking space. The system turns the front wheel to right and it commands the car to go reverse until the

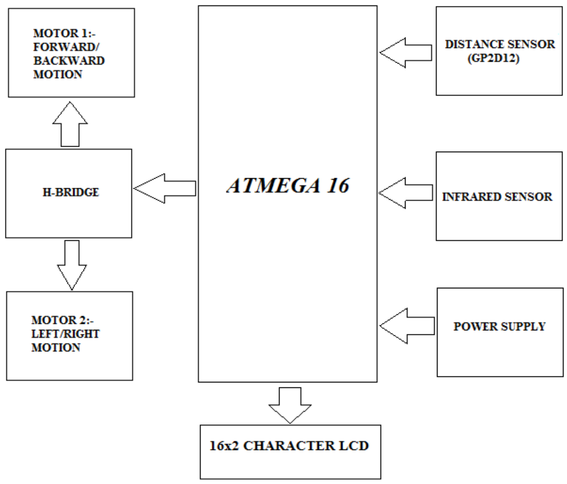

Fig1: Block Diagram of Automatic Car Parking System Implemented On a Remote Controlled Car.

car has passed the edge of the parking space. The care continues to reverse right until the rear distance is close to the edge. [4] These conditions are checked as to verify that the car is deep enough inside the parking lot. After the verification the car moves rear left until the rear of the car is closed to the side walls of the parking space. These judgments are calculated by distance sensor at the rear of the remote controlled car. Ones close enough to the rear value the system commands the car to move forward right in order to straighten out the car and align it nicely inside the spot. Ones aligned the car is parked and the message “Car is parked” is displayed on the LCD and the car stops. [2]

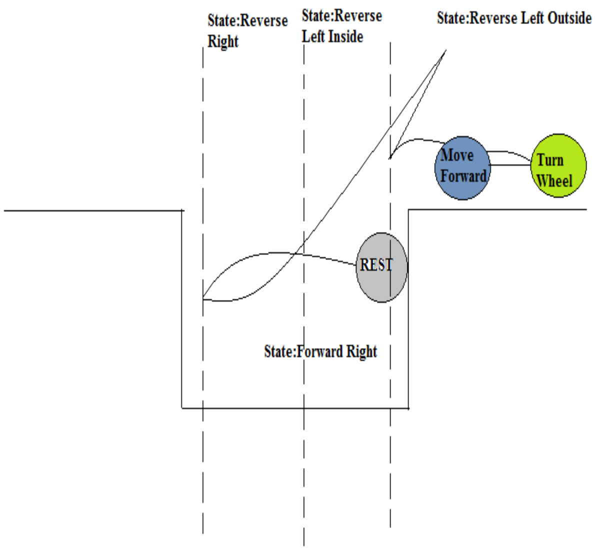

Fig 2: Parking motion of remote control car

 Copyright 2013.All rights reserved.

C. Calculations

For the analog to digital conversion we made use of the built in ADC function of the MCU. Since we have used three distance sensors, we had to figure which distance sensor has torotate andwhich was connected to the ADC. This was simply done by changing the value of ADMUX. One out of the three sensors is sampled every millisecond. The calculations we used for the same are as given below:-

$$Distance = \frac{slope*100}{ADCH-intercept*100}$$

$$Distance^{(-1)}*slope+ intercept = \frac{\frac{ADCH*Vref}{1024}}{4}$$

$$Distance^{(-1)} = \frac{ADCH- intercept*100}{Slope * 100}$$

Where Slope is the Voltage Vs Distance readings.

III. EXPERIMENTAL RESULT AND DISCUSSIONS

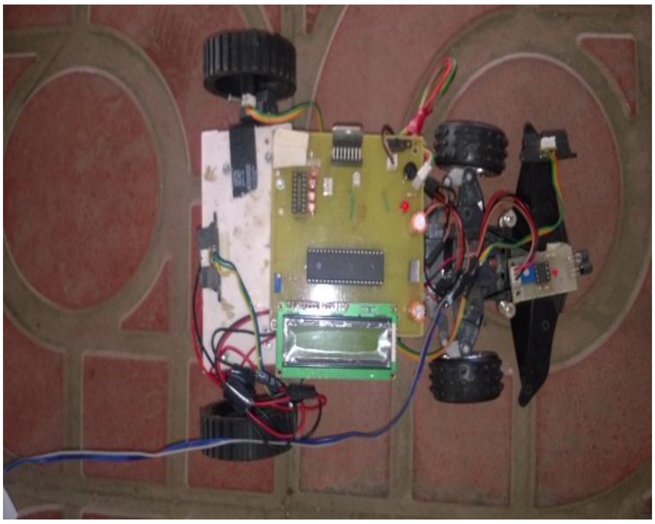

Fig 3: Top View of Final Car

The performance in parallel parking of vehicle is restricted by the ability of the infrared sensors used. Since these low-cost and hence, lower quality sensors are used in the experiment, the distance calculated and thus, the data sent to the microcontroller system of the parallel parking system constantlyfluctuates even when the vehicle is standing still. In addition to this, the characteristics of each sensor are not standardized,i.e., each one of the infrared sensors used returns a different voltage value. The output of each sensor is, moreover.Thus, an important issue in parallel parking system has to be addressed i.e. if a car is unable to perform an accurate wall following procedure then to gather an estimate performance of the sensors used, an effective technique would be to not obtain the data from the specification sheet, rather gather it by observing the characteristics of the input and output of the sensors. This would, in turn, help in fine-tuning of the sensors used and reach to more accurate results thereby resulting in a better performance of the autonomous parallel parking car.

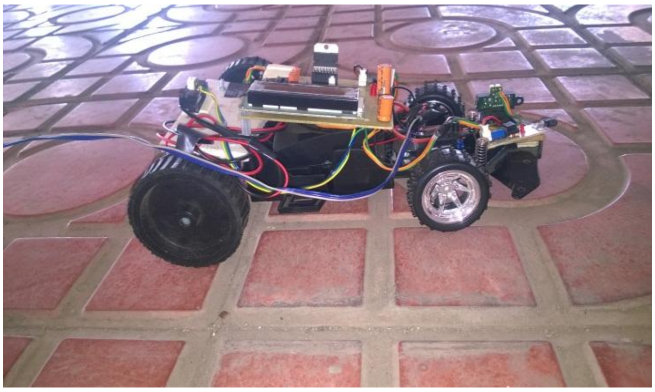

Fig 4: Side View of Final Car

IV. CONCLUSION

The initial design for the first part of this design project underwent gradual changes as the research progressed. The tedious design process of the remote controlled car collision avoiding already developed provided a very firm basis, based on which the automatic car parking system. The use of groundwork that had already been implemented, all that was needed was further development and not on a prototype like we have implemented here. The car successfully detects a parking space and parks itself. This when further enhanced can be fitted in an actual car and with the necessary configurations will allow for this system to be used perfectly.

V. ACKNOWLEDGEMENT

In order to get an idea of the project requirements we referred sites of car manufacturers such as BMW, Mercedes, and Volkswagen etc. Each of them had implemented the system with a number of derivatives in different way. We express our sincere and deep gratitude towards our guide Prof. V.N. Ghodke, Assistant Professor in Electronics & Telecommunication, Engineering Department for his valuable guidance and empowering support. We thank Mrs. M.P. Sardey, Head of E&TC Engineering Department for her cooperation with us on this system and all her help throughout the year. Also, a thank you to Our Principal Dr. P.B. Mane, Principal, and AISSMS's IoIT for providing all the technical help we required.

REFERENCES

Proceeding papers:

[1] Ankit Gupta, Robin Divekar, Mohit Agarwal, "*Autonomous Parallel Parking System for Ackerman steering four wheelers",* in Proceedings of the Computational Intelligence and Computing Research(ICCIC), pp. 1-6, 2010.

[2] Igor E. Paromtchik, Christian Laugier,"*Autonomous Parallel Parking of a Nonholonomic Vehicle*", in Proceedings of the Intelligent Vehicles Symposium, pp.

 Copyright 2013.All rights reserved.

13-18, 1996.

Technical Reports:

[3] M. Khoshnejad, K. Demirli, "*Autonomous Parallel Parking of a Car-Like Mobile Robot by a Neuro-Fuzzy Behaviour-Based Controller*", in Proceedings of the Annual Meeting of the North American Fuzzy Information Processing Society, pp. 814-819, 2005.

[4] BenjamasPanomruttanarug, SarayutTungporntawee, ParnupongThongsuk, and Kohji Higuchi, "*An Emulation of Autonomous Parallel Parking System Using Fuzzy Logic Control*", in Proceedings of the ICROS-SICE International Joint Conference, pp. 4548-4552, 2009.

[5] ParisaMasoumiMoghri, Mohammad Reza Karami, Reza Ghaderi, "*A Real-time Intelligent Parallel Parking System for a Carlike Mobile Robot*", in Proceedings of the 16th International Symposium on Artificial Intelligence and Signal Processing (AISP), pp. 533-537, 2012.

Datasheets:

[6] "*ATmega16 Datasheet*", ATMEL Corporation.

[7] *"L298 Dual Full-Bridge Driver Datasheet", STMicroelectronics.*

[8] "*16x2 Character LCD*", Vishay Intertechnology.

[9] *"GP2D12 General Purpose Type Distance Measuring Sensors", Sharp Electronic Components.*

[10] *"LM78XX / LM78XXA — 3-Terminal 1 A Positive Voltage Regulator",* Fairchild Semiconductor.

Book:

[11] Embedded C Programming and the Atmel AVR by Richard H. Barnett, Sarah Cox and Larry O'Cull.

World Wide Web:

[12] "*Park Assist: Volkswagen UK*", http://www.volkswagen.co.uk/technology/parking-and-manoeuvring/park-assist

 Copyright 2013.All rights reserved.