ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 4, Issue 10, October 2015

DRIVERLESS VEHICLE

Prajkta Ravindra Jape, Prof. Rajesh M. Autee, Prof. Arti R. Wadhekar

***Abstract*— A driverless car or self driving car or autonomous vehicle is a robotic vehicle designed to trip between destinations without a human or any human like robotic operator. Qualification for fully autonomous vehicle is that vehicle should be able to navigate to a predetermined destination without human intervention. Driverless vehicle designed under this project is a low cost automobile controlled by a 32- bit ARM processor, in which functions such as wireless guiding by processor like GPS, obstacle avoidance, motion control and wireless communication are possible. The self driven vehicle developed in this project can traverse the map downloaded by system in it. By the use of electronic and electromechanical components of higher specification this proposed technology can be transplanted to vehicles running on road in the near future.**

***Keywords* – ARM, GPS.**

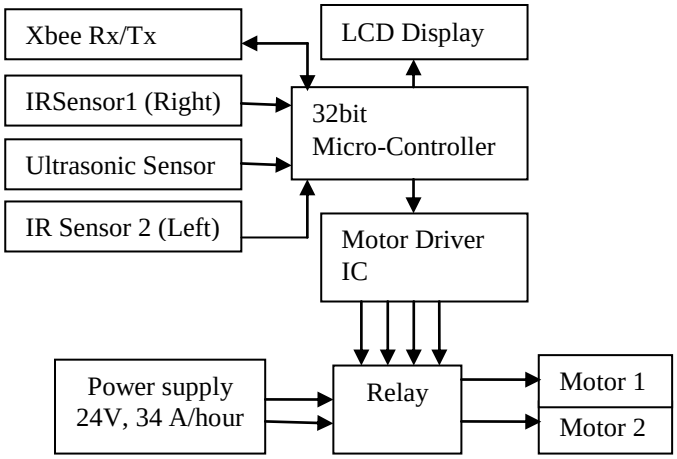
I. INTRODUCTION

Now a days the automotive industry has been Shifting from high-performance vehicles to safe and comfortable Vehicles. This shift has accelerated the development of various intelligent vehicle technologies. Finally, maximized safety and comfort can be achieved by autonomous cars. For autonomous driving, the car has to understand driving environments and should also perform path planning and control without human intervention. To bring such a driverless car into reality Google's engineering team started working on it since year 2000 and they were successful to bring up driverless car with neither steering wheel nor pedals by year 2014 [1]. Meanwhile, the 2005 DARPA Grand Challenge [2] competition and the 2007 DARPA Urban Challenge [6] competition confirmed that autonomous cars that can travel off-road terrain as well as in urban areas by themselves. Inspired by this we were struck by an idea of developing a driverless vehicle which can be driven by handicapped people for traversing a defined path, also it can be used in industries to carry load from one department to other. Google's driverless car and vehicle developed under this project have one thing in common that is they both receive positional signals of their own and road from a data server. Also the vehicle can sense obstacle in front as well as in rear using ultrasonic sensor sensors. The vehicle is able to sense left and right side obstacle using infrared sensor placed at both the sides. This project is a low cost implementation of important features that are necessary to make a vehicle driverless.

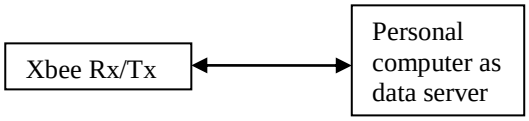
II. SYSTEM ARCHITECTURE

A. *Electrical and Mechanical system*

The project vehicle looks like single sitter four wheeler. Above the chassis of wheels a chair is mounted. On the chassis and under the chair there is electric power source of two batteries- 12 Volt and 34Ampere/hour each. Two permanent magnet DC series motors (one on left and other on right side) are used to drive the vehicle having specification of 24 Volt and 9 Ampere (on no load condition), four 'double pole single throw' relays of 40 Amperes each, having coil input 12 V & 1Ampere , 6 mm^2 multithreaded cable for dc power transmission have been used. The vehicle dimensions are 0.7m*0.6m*1.21m and it weighs about 140 kg along with battery weight. Fig.1 shows the block diagram of system that makes vehicle driverless.



(a)



(b)

Fig.1. (a) driverless vehicle- slave unit (b) personal computer - Master unit

B. *Electronic components*

The system consists of two parts as shown in Fig.1. One part consists of personal computer and Zigbee module (XBee-PRO S2B) that can also be called as master unit because it guides the vehicle by map. Other part consist of a 32-bit MCU-ARM7-LPC2148 Development Kit, Zigbee module (XBee-PRO S2B), two Infrared sensors GP2Y0A02YK (20cm-150cm range of detection), Vivotech HC-sr04 ultra sonic distance measuring sensor (2cm-450cm), 2*16 Character LCD display with back Light ,L293D relay driver IC and this unit is slave unit. Because it traverse the path given by master unit.

III. SYSTEM OPERATION

A. *Starting up the car*

To start the vehicle a window flashes on the screen in which we have to enter correct password. The program for this login window is coded in Matlab7.6.0 software. Fig.2 shows the window that will appear to enter password for starting up the car.

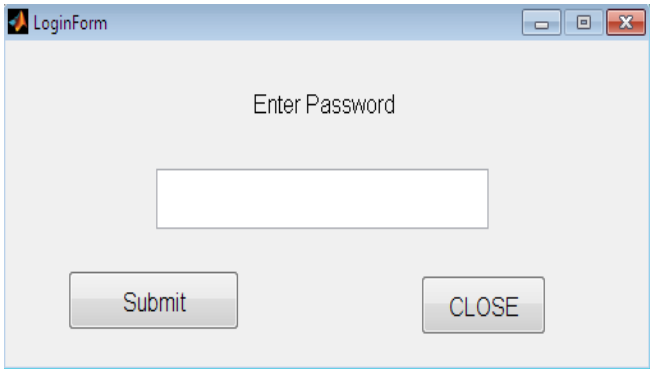


Fig.2 Login Form window

By chance any wrong password is entered in the login form then 'wrong password' flashes on the form and vehicle doesn't start. This password acts as key to vehicle.

B. *Commutation to the destination*

Once the vehicle has started the user has to select map of destination. For the purpose of demonstration we have stored four maps in the personal computer that acts as a data server. As the user selects one of the maps the vehicle starts moving according to the path. Fig.3. shows window of maps on personal computer that has been used for demonstration purpose.

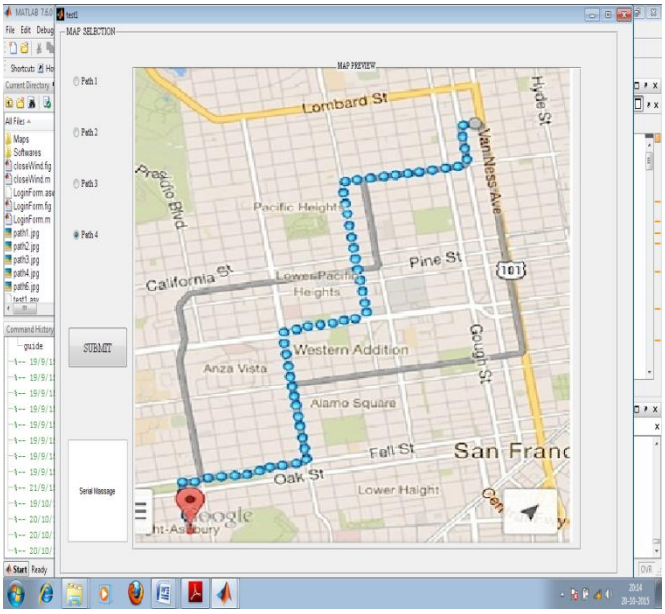


Fig .3 Destination map for driverless vehicle

Here this map is considered just for demonstrating that vehicle can take left and right turns as shown in map. But when the vehicle is to be made customized, the map of that particular area where user of vehicle has to travel frequently can be saved in the database of driverless vehicle system. In the designed driverless system of this project as the vehicle gets the information like latitude, longitude of the landmarks and the distance between them it starts calculating the time to travel and convert it in ratio of distance by speed and starts travelling to the selected destination. In the past years, some researches on GPS applications have been presented for vehicle control design. Use of reflective photo interrupter for sensing motion of the wheels, GPS and magnetic compass for guiding direction to vehicle has been demonstrated in [3].

C. *Obstacle avoidance*

To avoid the obstacle vehicle has ultrasonic sensors placed in front as well as in rear and infrared sensors placed at left and right side of the vehicle. The vehicle can sense obstacle in front and in rear using ultrasonic sensors. Also it is able to sense left and right side obstacle using infrared sensor. It can be said that the vehicle is having some human like intelligence while traversing path because if it is stuck by the obstacle in front it will wait for the obstacle to move aside in certain time but even then the obstacle doesn't move and there is no clearance of path then infrared sensors check if there is any obstacle at left and right side. If there is no obstacle sideways then vehicle takes a turn to one of the side where there is more path to move. Thus overcoming the obstacle and coming over to original path, the vehicle resumes its journey to destination. When it reaches the destination the vehicle stops. In [4] the ARGO project from Parma University implemented stereo camera to procure the road information in front of the vehicle and inserted an actuator into steer wheel for achieving the lane keeping function.

D. *Indication*

On the LCD whenever the vehicle moves forward, reverse, right and left , 'forward', 'reverse' , 'right ', 'left ' is displayed respectively. Thus LCD works like an indicator. As destination is attended by vehicle 'stop' is displayed on LCD.

E. *Braking of speed*

As the vehicle senses an obstacle at certain distance it reduces its speed as it goes nearer to obstacle and when it reaches very close to obstacle it stops.

IV. RESULTS

A. *Performance Analysis*

Speed of designed driverless vehicle 2.19 Km/hr. The vehicle can be driven continuously for 14 hours if the batteries are fully charged. Also it can be said that vehicle can cover 30 Km with fully charged batteries. Total weight carrying capacity of vehicle is 300 Kg along with system weight.

Infrared sensors used here do not give spontaneous response of obstacle being detected to microcontroller. It takes few seconds to detect obstacle on sides. Whereas ultrasonic sensors gives spontaneous response of obstacle being detected.

V. CONCLUSION

The vehicle designed under this system can be made more customized for handicapped people by applying image processing system for obstacle detection, traffic signal detection. So that it can be used on heavy traffic roads. This vehicular technology can also be transplanted to shuttle bus in air port. Further the project can be extended by implementing automatic parking system in the vehicle as well as automatic pickup and drop facility. An approach for autonomous navigation of cars in multi-level parking garages is presented in [5]. With the help of GSM system its owner can communicate with the car and call the car to pick him up at his location. The designed vehicle readily performs basic functions of driving on the path, obstacle avoidance and attaining the destination safely.

REFERENCES

[1] http://en.m.wikipedia.org/wiki/Google_driverless_car
[2] http://en.wikipedia.org/wiki/DARPA_Grand_Challenge
[3] Ray-Shine Run, Jui-Cheng Yen ,Cheng-Yu Tsai, " A low cost implementation of GPS guided driverless car" 5th IEEE Conference on Industrial Electronics and Applicationsis, pp. 1610-1614,2010.
[4] Bing-FeiWu, Tsu-TianLee, Hsin-HanChang, Jhong-JieJiang, Tien-YuLiao, Jau-Woei Perng,"GPS navigation based autonomous driving system design for intelligent vehicles." IEEE International Conference on Systems, Man and Cybernetics, pp. 507-511, 2007
[5] Rainer K¨ummerle, Dirk H¨ahnel, Dmitri Dolgov, Sebastian Thrun, Wolfram Burgard, "Autonomous driving in a multi-level parking structure" 2009 IEEE International Conference on Robotics and Automation Kobe International Conference Center, Kobe, Japan, May 12-17, 2009
[6] Chris Urmson, William "Red" Whittaker, Carnegie Mellon University, "Self-driving cars and the urban challenge" , Published by the IEEE Computer Society, IEEE Intelligent Systems, March/April 2008

Prajkta Ravindra Jape - M.E. student, Department of Electronics and Telecommunication Engineering, Deogiri Institute of Engineering and Management Science, Dr. Babasaheb Ambedkar Marathwada University,Aurangabad,Maharashtra.

Prof. Rajesh M. Autee -Head of the Department, Electronics and Telecommunication Engineering, Deogiri Institute of Engineering and Management Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra.

Prof. Arti R. Wadhekar, Department of Electronics and Telecommunication Engineering, Deogiri Institute of Engineering and Management Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad ,Maharashtra.