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Autonomous Self Parking and Self Retrieving Vehicle With GPS Less Keyfob for Vehicle Tracking

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***Abstract*—Assistant driving system in vehicle makes driving safe and smooth for modern vehicles. One among the driving systems is self parking. In self parking method, self retrieving service is not available. Now-a-days, the retrieving is done by the driver. It is difficult for the novice drivers to retrieve from the tiny parking lot and leads to traffic, collision and wastage of time in dense urban areas. This paper involves introducing a system Advanced Parking Guidance System (APGS) that overcomes these difficulties. A vehicle equipped with APGS can steer itself into the parking space with little input from the user. For retrieving, constructing a car like wheel robot that act as self parking and self retrieving vehicle assisted by lateral and rear SONAR sensors as parking scanner and wireless transceiver to track the direction of the wireless signal emitted by the smart keyfob. In park mode, once the user presses the auto mode button, the robot starts to move forward and the system calculates the parking gap beside it using the parking scanner and when it finds one, it positions itself for steering maneuvers needed for reverse parking. In retrieve mode, the user presses the retrieve button on the wireless keyfob and the car starts to track the direction of the wireless signals emitted by the smart keyfob and steers itself automatically out of the parking lot and drives itself to the point where the user would be available with his keyfob. During retrieving stage, if there is any environmental obstacle, around the vehicle while returning from the parking space then the vehicle stops and the retrieving section is aborted. This information is intimated to user by red light on the keyfob.**

Keywords: Self-Parking, Self-Retrieving Keyfob, Autonomous, Ultra sonic

I. INTRODUCTION

With the development of automobile industry, the number of vehicles is increasing dramatically while driving space available in a city is decreasing drastically. Almost all drivers feel that driving in a city is more difficult and they have to pay more attention than ever before. Meanwhile, traffic accidents occurred frequently in recent years, especially during rush hours every day. Many automobile manufacturers have applied assistant driving system into vehicles to make driving safe and smooth. Furthermore, the increasing number of vehicles also results in the requirement of large amount of parking lots while the land use for parking spots is limited in a city, the parking lots cannot meet the requirements. It seems that parking is difficult for a lot of drivers especially for new drivers. A new one often lack experience to accurately estimate the space between his vehicle and other objects or parking boundaries while handling the steering, brake, accelerator at the same time.

This paper organized as follows. In section II, describes the design and implementation of autonomous self parking of vehicle is addressed. In section III, autonomous self retrieving of vehicle is explained and developed a prototype system model. In section IV, concludes this paper and section V suggests some future work.

II. AUTONOMOUS SELF PARKING

Automated parking aid systems have been demonstrated by several car manufacturers. It is a fully automated parking system, meaning that driver interaction is restricted to acceptance or rejection of the identified parking space. The vehicle has the controller to take parking itself. The controller diagram present in the vehicle section is shown in Fig.1

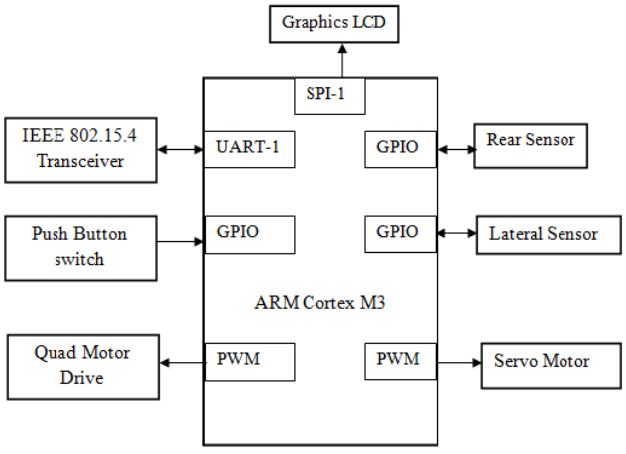


Fig. 1 Robotic vehicle unit

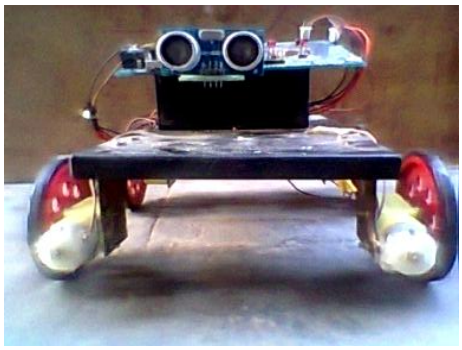
The controller ARM Cortex™-M3 processor is the industry-leading 32-bit processor for highly deterministic real-time applications and has been specifically developed to enable partners to develop high-performance low-cost platforms for a broad range of devices including

microcontrollers, automotive body systems, industrial control systems and wireless networking and sensors. The processor delivers outstanding computational performance and exceptional system response to events while meeting the challenges of low dynamic and static power constraints. The processor is highly configurable enabling a wide range of implementations from those requiring memory protection and powerful trace technology through to extremely cost sensitive devices requiring minimal area.

A. Car like Wheel Robot

As pointed out above, our proposed system is related to a Car like Wheel Robot (CLWR). Therefore, we give a brief introduction to this CLWR here. The architecture of a CLWR has adopted an ARM Cortex M3, Ultrasonic sensor, Quad drive motor, Push button and servo motor. Each of these is explained sequentially. There were two batteries to provide power to the CLWR. One was 3V lithium battery providing power to the controller LPC 1333 and other was a 12V lead acid battery providing power to the Quad motor drive. The overall appearance of a CLWR is shown in Fig. 2.

(a)



(b)

Fig.2 overall appearance of a CLWR (a) Side View (b) Front View

B. Ultrasonic sensor

The task of the sensing is to identify the sustainable parking space within the vehicle surroundings. Ultra sonic sensors are considered due to robustness, cost and installation requirements. A typical opening angle sensor have mounting diameter of about 45-55mm. Ping ultrasonic sensor is shown in Fig. 3

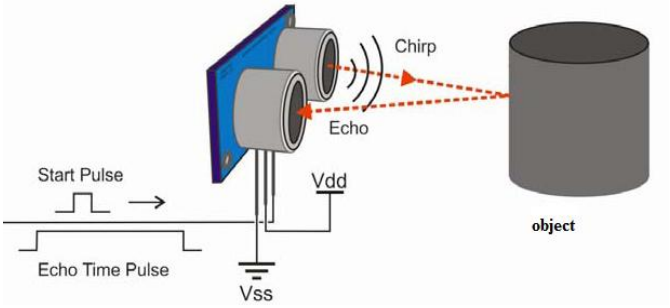


Fig. 3 Ping ultrasonic sensor

Table 1. Electrical characteristics of ultrasonic sensor

Module Type	Sensor
Weight	15.00g
Board Size	2.0 x 4.3 x 1.5cm
Version	1.0
Operation Level	Digital 5V
Power Supply	External 5V
Frequency	40kHz

Table.1 shows the electrical characteristics of ultrasonic sensor

C. Push Button and Graphics LCD

Graphics LCD is used to display the mode of park using the push button as its main user interface. There are two modes. They are

1. Self-park
2. Manual

After selection of mode the controller gives the control to the quad motor drive to move forward, reverse, left and right. Then scanning of the vehicle surrounding is done using ultrasonic sensors. Distance measurement from the ultrasonic sensors is combined into knowledge of the detected parking space size and position in relation to the vehicle.

A schematic view of the parking procedure is shown in Fig. 4. It is worth mentioning that it is commonly accepted as good practice to drive by the space first and then park the car into the space in on is reverse. That behavior is used here to identify the parking space. The system notifies the driver when a sufficiently large parking space is found, and asks to stop and gently reverse the vehicle as well as release the steering wheel. Control of the steering is taken care of by the system, which even informs the driver about the distance to the vehicle behind in brakes are actuated when the vehicle has reached its final parking position and in the case of a suddenly appearing object.

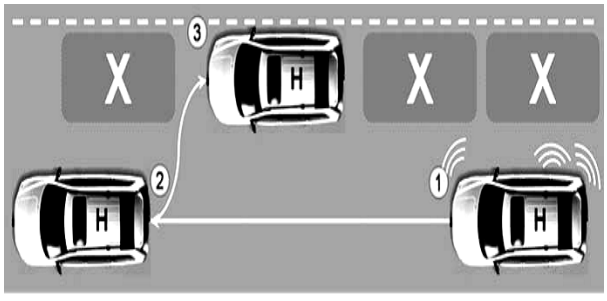


Fig. 4 Schematic view of the parking procedure

Schematic view of the parking procedure are:

1. Start acquiring parking space
2. Space identified Reversing vehicle
3. Finish parking complete.

The trajectory has three segments, as shown in Fig. 5. In the first phase the vehicle is reversed in parallel to the curb. In the second phase the inclined line shown in the figure is followed, and in the last phase the vehicle is turned to align with the curb.

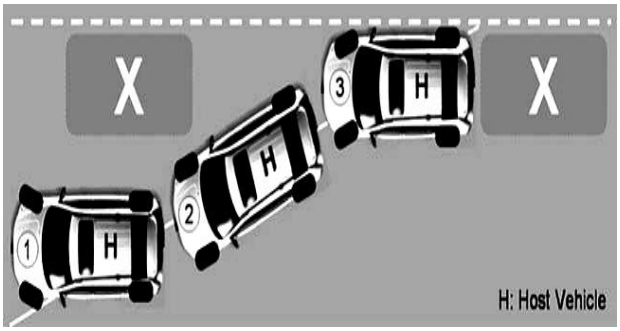


Fig. 5 Three segments of the parking procedure

The segments of the parking procedures are explained by the system state diagram. If the push button is activated, the first transition from deactivated to activated takes place and the system enters the first sub state, namely 'sensors activated'. The requirement for changing to the subsequent 'parking space accepted state' is an identified valid parking space. The next state transition is reversing of vehicle, which activates the actual steering and brake control. In case of detected obstacles condition, the 'parking aborted' state is entered and the vehicle is either stopped or the function is aborted. It is shown in Fig. 6.

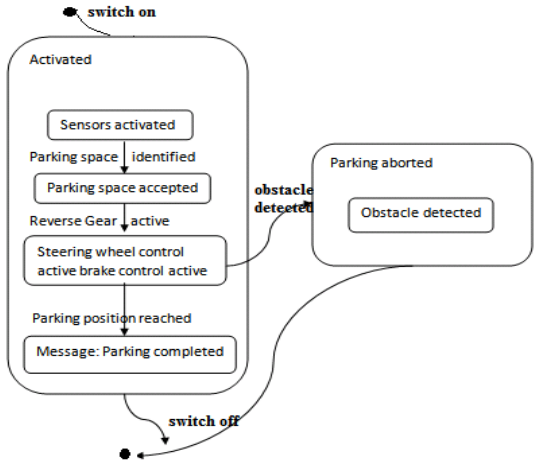


Fig. 6 System state Diagram.

III. Autonomous Self Retrieving

We all live in a time compressed society. Nearly every minute of the day is used for critical tasks, and few can afford to waste those minutes on trivial issues. Yet, trivial issues seem to present themselves and require us to divert our attention to less important things.

A. *Why Self-Retrieving*

Retrieving our car from the tiny parking area is difficult for newly learned driver. So many problems will be faced at the congested parking area while retrieving the car. One of the problem is other users are not parked correctly in that particular slot. Its shown in Fig. 7

Fig. 7 Not Parked Correctly

So that, the user cannot open the door and do not go to inside of the car. This creates the problem to the user to retain our vehicle from the parking space.

In retrieve mode, the user presses the retrieve button on the wireless keyfob and the car starts to track the direction of the wireless signals emitted by the smart keyfob and steers itself automatically out of the parking lot and drives itself to the point where the user would be available with his keyfob. The keyfob tracking process is assisted by means of a wireless transceiver with direction sensitivity and a servo motor to control the direction of this transceiver.

The robotic car unit communicates with the keyfob unit using 2.4 GHz IEEE 802.15.4 wireless network protocol. The keyfob unit is shown in Fig. 8.

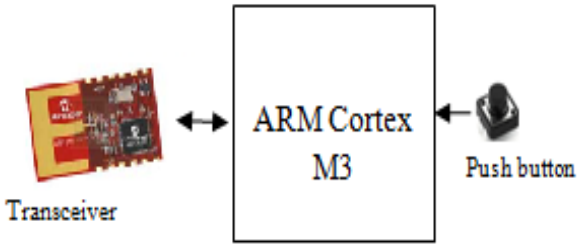


Fig. 8 Smart Keyfob

After pressing the push button, the signal is processed by the ARM cortex M3 controller and then it is transmitted to the vehicle unit through miwi protocol which is similar to Zigbee protocol. In the vehicle servo motor is used for tracking the direction of the signal from the keyfob. After that the vehicle receives the signal through miwi protocol then the signal is processed and the gives the signal to the quad driver motor. Then the vehicles will come out of the parking space. It is shown in the Fig. 9

Fig. 9 vehicle come out of parking lot.

The vehicle comes out of the parking lot with the help of scanner and quad motor drive. The Auto Sonar system is a safety device that accurately detects all objects, as children, toys, pets, another autos, etc. that are behind your vehicle while you back up. The beeping as well as LCD display inside the car warns the driver of the danger and prevents a potential accident

Fig. 10 Obstacle Detection.

If the vehicle detects any of the obstacles while returning from the parking lot, then the vehicle stops and the retrieving section is aborted.

This information is intimated to user by red light on the keyfob. Green light indication is used for successful retrieving. It is shown in Fig. 10.

IV. Conclusion

Intelligent autonomous CLWR (Car like Wheel Robot) have been implemented by using the embedded controller. The controller is capable of parking the CLWR in an appropriate parking space effectively by integrating the sensor data. The system has the ability to make the vehicle to avoid collisions to ensure the safe parking. In last, retrieved the vehicle from the parked space by tracking the signal strength emitted by the wireless keyfob where the user available.

V. Future Work

In future, Prevention of keyfob is very important. It will prevented by implementing the encrypted signal giving by the user through air gesture or some codes. By adopting new technology, vehicle to vehicle communication will be implemented in future. It will help to automatically adjusting of vehicles in the parking area to park and our retrieve our vehicle without need of human intervention.

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