

SOLAR POWERD AUTOMATIC VALET PARKING SYSTEM

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Abstract - Technology is rapidly changing and the automotive world is constantly improving. One of the challenges for automotive industry is to develop the completely autonomous car. Even if proven feasible, the autonomous driving car is still an important research subject due to systems complexity, costs and legislation. The paper describes an experimental car that Renault is actively developing in partnership with research laboratories and outlines its usage in terms of Autonomous Valet Parking (AVP). During development, a common Renault Zoe vehicle was equipped with sensors, electro-mechanical actuators and a system of data processing. The perception system corresponds to a fusion between an ultrasonic system and a camera. It provides the localization of the vehicle, the navigable area around the car and a map of already visited areas. This information is used afterwards as input for the car control system in order to ensure its integrity during navigation. The Autonomous Valet Parking system is able to take control of the car and to drive it from the drop-off zone to the parking and from the parking to the pick-up zone. In the following it will be described the hardware and the software system architecture and the main principles of algorithms.

Key Words: Solar Power, Ultrasonic Sensor, IR sensor, Line Follower Robot, PIC Microcontroller.

1. INTRODUCTION

Parking space has always been a problem since the invention of vehicles. At the start, people parked their car manually. Then at fancy restaurants and parties men were used to park cars, this is referred as valet parking. Due to advancement in technology human operated robots were used to park cars in slots. Shortage of parking spaces led to multistory parking areas. Conventional systems had a runway in which the user has driven all the way and park the car. To save space these runways were eliminated and robotic arms were used to pick and place the car in those slots. They were controlled by humans. Then it was automated. Tokens were given to users when they leave. They have to return them to get back their cars. Then video based systems were used to park the cars in those slots. This system uses high resolution cameras to acquire real time images of the slots and free slots are identified with the help of image processing. The robotic arm is made to function based on these results. Human operated robotic arms were also used to place the cars in those desired slots. Here the human identifies the free slot and controls the robotic arms with the help of a console. The arm is controlled and moved to pick the car and place it in a desired slot. These parking systems must not be complex for the user. It should be user friendly only then they can

implement with greater efficiency. The backend processes should not affect the user at any cost. The safety of the cars is ultimate. Cars should be handled with care and there should be no chances for error.

1.2. LITERATURE REVIEW

This research started from the following necessity: how to design an autonomous car able to perform safely an entirely parking maneuver in a private home residence.

Previous researches have already been led about the subject of Autonomous Valet Parking. B. Song addressed an article [1] for cooperative lateral control for AVP but the solution developed there relied on a V2I (Vehicle to Infrastructure) communication which is economically not always viable. In [2] publication, the feasibility of a lateral vehicle control is demonstrated and tested in the particular case of forward driving and backward parallel parking maneuvers. In [3], [4], a complete AVP service is designed and implemented, including 3 modules: AVP Mobile, AVP Server, AVP Vehicle Controller, however the need of a complex centralized server makes this solution less flexible and less movable. From customer's point of view, the AVP system will either have to execute the parking sequence using only the information gathered by the on-board sensors as well as any previously recorded data. The goal is to achieve an accurate and a more efficient system than those currently available on the market, while minimizing the costs. The development of the system shall respect a modular architecture, which is advantageous for future developments. The system shall take into account the complexity and diversity of parking environments which is a less complex situation than driving on an open road.

2. PROPOSED SYSTEM

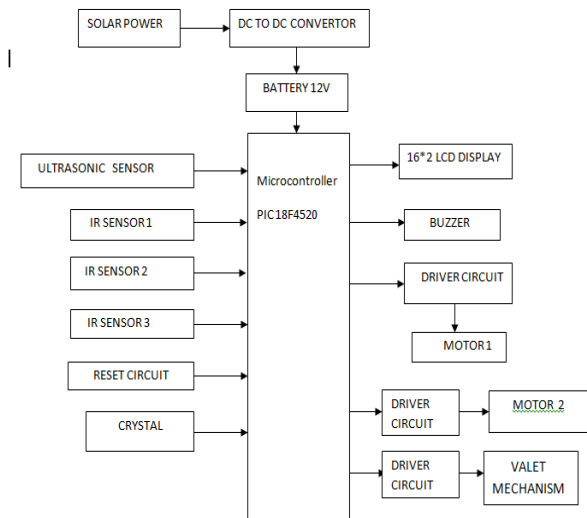


Fig 1: Block Diagram of System

In this, we present the theory on solar powered automatic valet parking system. In this proposed block diagram consist of several sensors (ultrasonic sensor, IR sensor,) are connected to our controller. The controller is accessing the sensor values processing them and find out path as well as empty slot to park vehicle. The robot parks itself in the available visitor slot closest to the out position of the arena. The robot enters the arena as a visitor vehicle and parks in the available visitor slot; it doesn't parks in the resident slot.

A. PIC 18f4520 microcontroller:

Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF

- Divided into 256-byte banks
- There are total of F banks
- Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bits
- Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.
- Program memory stores the program and also static data in the system.
- On-chip External
- On-chip program memory is either PROM or EEPROM.
- The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).

- Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000



Fig -2: PIC18f4520

B. ULTRASONIC SENSOR (HC-SR04):

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

- (1) Using IO trigger for at least 10us high level signal,
- (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

$$\text{Test distance} = (\text{high level time} \times \text{velocity of sound} (340\text{M/S}) / 2,$$



Fig -3: Ultrasonic sensor

C. IR Sensor:

Proximity Sensor are used to detect objects and obstacles in front of sensor. Sensor keeps transmitting infrared light and when any object comes near, it is detected by the sensor by monitoring the reflected light from the object. It can be used in robots for obstacle avoidance, for automatic doors, for parking aid devices or for security alarm systems, or contact less tachometer by measuring RPM of rotation objects like fan blades.



Fig -4: IR Sensor

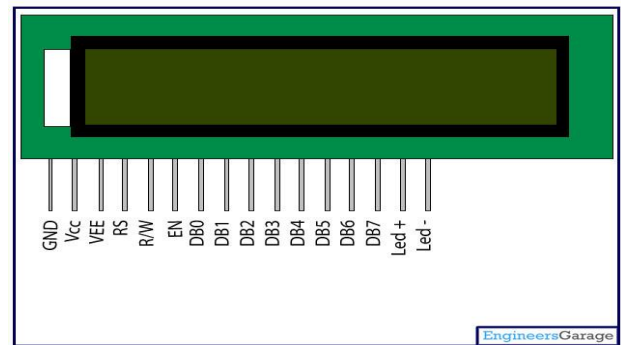


Fig -6 LCD display

D. L293D MOTOR DRIVER IC:

A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver act as an interface between controller and the motors. The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. We will be referring the motor driver IC as L293D only. L293D has 16 pins.

The L293D is a 16 pin IC, with eight pins, on each side, dedicated to the controlling of a motor. There are 2 INPUT pins, 2 OUTPUT pins and 1 ENABLE pin for each motor. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor.

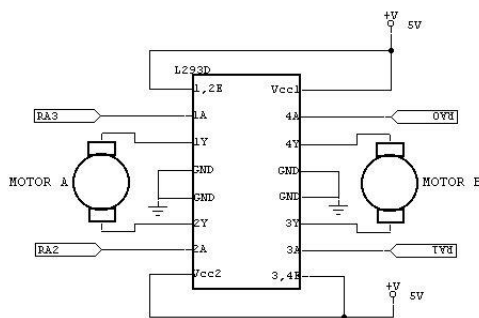


Fig -5: L293D MOTOR DRIVER

E. LCD display:

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

F. SOLAR PANNEL:

Solar power works by converting light from the sun into electricity. This electricity can then be used in your home or exported to the grid when it's not needed. This is done by installing solar panels on your roof which generate DC (Direct Current) electricity. This is then fed into a solar inverter which converts the DC electricity from your solar panels into AC (Alternating Current) electricity. A solar power plant is any type of facility that converts sunlight either directly, like Photovoltaic, or indirectly, like Solar Thermal plants, into electricity. They come in a variety of 'flavors' with each using discretely different techniques to harness the power of the sun.



Fig -6: SOLAR PANNEL

3. CONCLUSIONS:

In this article it was described the system architecture for Autonomous Valet Parking developed on a solar power prototype vehicle. The concepts rely on cheap sensors that are already used in conventional cars. Another main goal was to avoid the use of data provided by external infrastructure.

The robot parks itself in the available visitor slot closest to the out position of the arena. The robot enters the arena as a visitor vehicle and parks in the available visitor slot; it doesn't parks in the resident slot. The proposed model has presented a novel automated car parking system using line follower and artificial intelligence technology. when car enter in parking slot parking robot pick car and start to find out empty slot using ultrasonic sensor. The line follower

robot which is operated by microcontroller identifies the free slots and parks the car in the destined slot. Our proposed work can be well suited for real time efficient parking implementation.

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