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**Abstract-**A parking lot (i.e. car park), also known as car lot, is a cleared area that is intended for parking vehicles. A parking lot needs fairly large space for accommodating many vehicles. In day to day life we experience a lot of car parking and traffic problems in cities. In order to overcome all these difficulties we bring forward an automated robotic car parking system which provides high-speed automated parking structures from hundreds to thousands of cars in half the space of a conventional parking system. Automated Robotic parking is a system that automatically identifies, moves, stores and retrieves cars and thus provides customers with fast ,safe and efficient car parking facility. The car park consists of a number of parking rings; each consists of a certain number of parking places. At the center of each ring there is an elevator with an arm. The lift is designed to move only on the vertical axis, whereas the arm can rotate around the lift axis. A car is placed at the end of the container arm. The car is kept on this container arm while transporting to the desired parking place. Provision is made for the users to notice the vacant slot as well as reservation facility is made possible. This design will really wipe out all the parking congestion faced by the customers roaming in areas such as shopping mall, super market, hospitals, educational institutions etc.

**Keywords-** GSM, Microcontroller, ASIC, USART, DC Motor, Stepper Motor.

## I. INTRODUCTION

An Embedded system is predefined for a specified task and is also defined as the merger of both software and hardware. All embedded devices include computers or microprocessors. Some of these processors are very simple systems as compared with a personal computer. The simple embedded systems are capable of performing only a single function or a group of functions to meet a single predetermined purpose. In more complex systems, a microprocessor may be designed in a manner that application software for a particular purpose can be merged to the basic software in a second process, after which it cannot make any further changes. The application software on such processors is sometimes referred to as firmware. The simple device often called a “chip” which itself be packed with other chips in a hybrid system or in an Application Specific Integrated Circuit (ASIC). The input comes from a detector or sensor and its output goes to a switch or activator which may start or stop the operation of a machine or can be done by operating a valv

An Embedded system is defined as both software and hardware which is explained in figure 1.

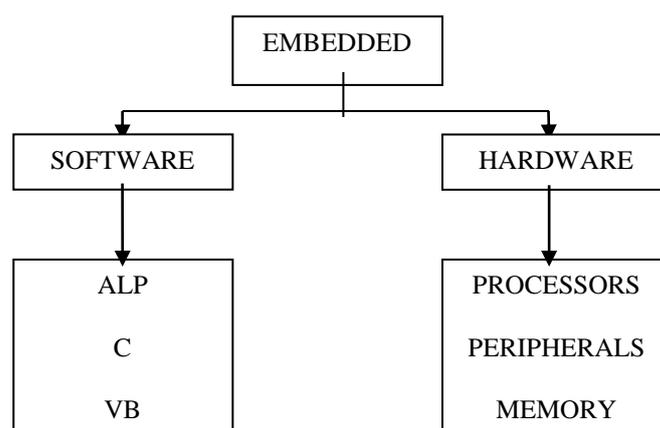


Fig.1: Block diagram of Embedded System

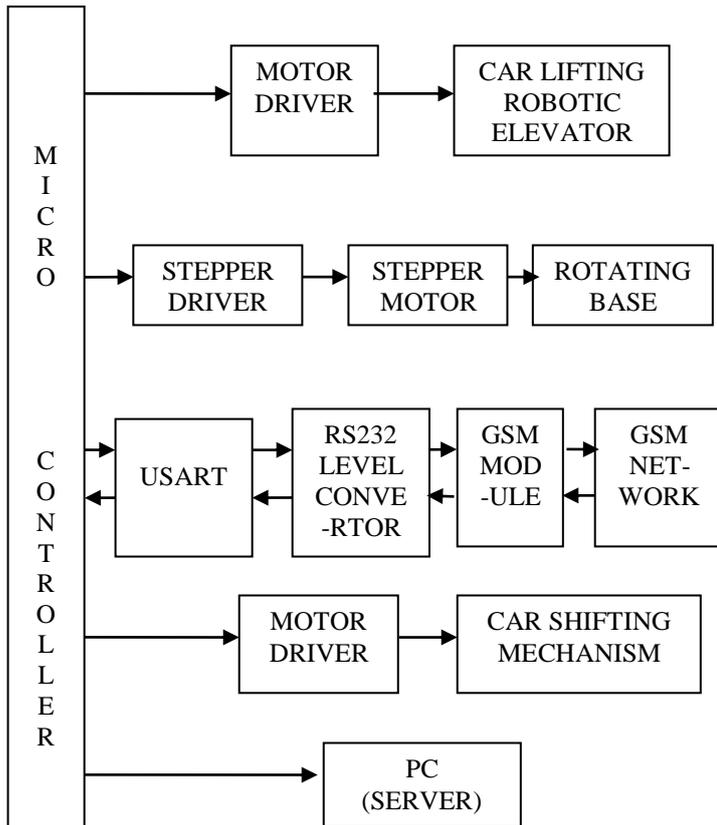
Software consists of languages like ALP, C, and VB etc., and Hardware deals with Processors, Peripherals, and Memory. Memory is used to store data or address. Peripherals are the external devices connected. Processor is an IC which is used to perform some task. They are classified into four types: Micro Processor, Micro controller, Digital Signal Processor & Application Specific Integrated Circuits. Embedded controllers may be found in many different kinds of system and are used for many different applications. An item in the list may be relevant to a particular company because either it involves a core process or product or involves an ancillary function or service performed by the company or it refers to a product or service provided by a firm that undertakes a contract under some form of agreement and the vulnerability of the supplier may need to be considered. The lifetime of embedded systems tends to be large than that of commercial data processing systems, they remain in use in future without alteration to their software.



Fig. 2: A Real Time Embedded System

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 Recently, car parking and their innovative technologies have increased and enlarged. Car parking systems have been implemented since the time cars were invented. Normally in rush places such as in cinema halls, multiplexers, large industries and function halls, we can notice that there is a problem in car parking, the driver have to go and search for a vacant place and which space has the place to park the vehicle and maybe for parking they need workers for parking in correct position, it consumes time, which is shown in figure 2. In case of insufficient car parking spaces \ leads to traffic congestions and driver frustration. So to avoid such problems Smart & Automated Robotic Car Parking System is implemented.

## II. BLOCK DIAGRAM



## III. HARDWARE DESCRIPTION

Basic elements used in Robotic Circular Car Parking system are:

- A. PIC16F877 Micro Controller
- B. DC Motor
- C. Stepper Motor
- D. GSM Module
- E. RS232 Level Converter
- F. USART
- G. PC (Server)

### A. PIC16F877 MICRO CONTROLLER

The microcontroller used is PIC16F877, which is named as Peripheral Interface Controller, figure 3. The PIC uses the Harvard architecture. The 16F87X series micro controller contains flash memory.

A micro-controller being packed in a tiny integrated circuit (IC) whose size and weight is usually negligible, it is becoming the desirable controller for robots or any machines requiring the kind of intelligent automation they deserve. A single microcontroller can be adequate to con-

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 machine or a security system. The special features of PIC16F877 is 256 bytes of EEPROM data memory, self programming, LCD, 2 comparators, 10 bit ADC, 3 wire Serial Peripheral interface or two wire inter integrated circuit bus and a USART. Microcontrollers are used in automotive, industrial and consumer applications.

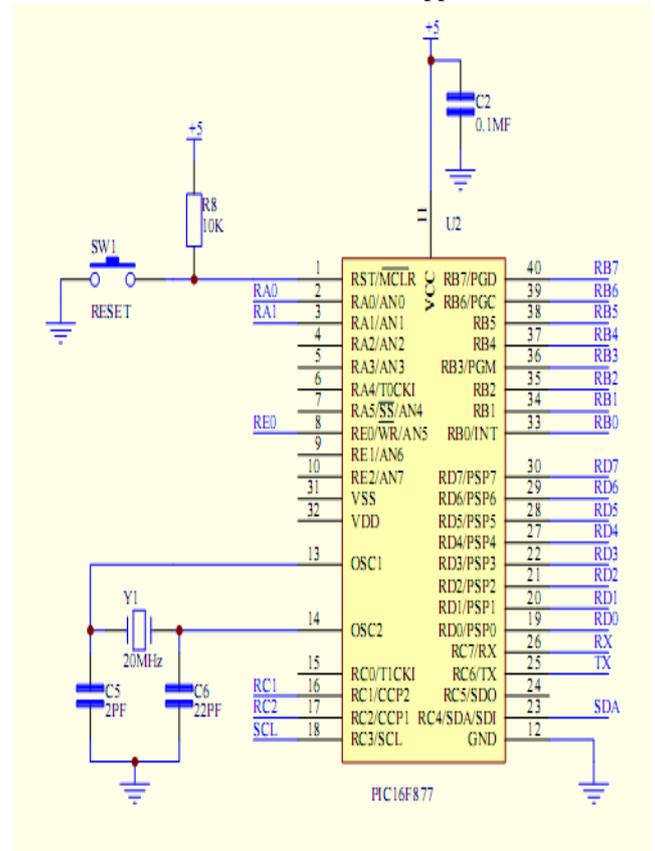


Fig. 3: Pin Diagram of PIC16F877

### B. DC MOTOR

DC motor follows linear laws of operation therefore it is easier to fully exploit its characteristics compared to synchronous or asynchronous motors. The stator is made by a metal carcass and one or more magnets that form a permanent magnetic field inside the stator. At the rear of the stator are the brush mountings and the brush gear which provides electrical contact with the rotor. The rotor is combined to create a metal carcass carrying coils which are interconnected at the commutator at the rear of the rotor. The commutator and brush then selects the coil through which the electric current passes in the opposite direction, as shown in figure 4.

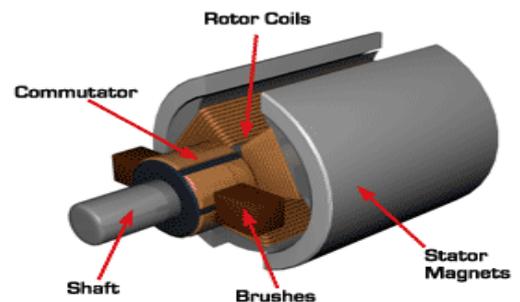


Fig. 4: DC Motor

Depending on the complexity of the rotor coil windings, once they are energized, they are entiled in the lenoid wrapped

around it. The wires of the solenoid in the wire bundle located in each groove of the rotor. The rotor, when supplies energy, then acts as an electromagnet, the magnetic field following the axis separates the wires of the solenoid in the direction of the current which continuously flows through them. The motor consists of fixed permanent magnets (the stator), a moving magnet (the rotor) and a metal carcass to focus the flux (the motor body). By the attraction of opposite poles/magnets and repulsion of like poles/magnets, a torque then acts on the rotor and makes it rotate to a particular direction. This torque is at maximum when the axis between the poles of the rotor is vertical to the axis of the poles of the stator. As soon as the response, the rotor begins to rotate and the fixed brushes make and break contact with the rotating commutator segments. The rotor coils are then energized and de-energized in such a direction as that of the rotor rotates; the axis of a new pole of the rotor is always perpendicular to that of the stator. The rotor is in constant motion due to the arrangement of the commutator. Fluctuation of the resultant torque is decreased by increasing the number of commutator segments, thereby producing smoother rotations. By reversing the power supply to the motor, the north and south poles is reversed. The torque which acts on the rotor thus rotates in the opposite direction and the motor changes its direction of rotation. D.C. motor is a motor with a reversible direction of rotation.

### C. STEPPER MOTOR

A stepper motor is an electromechanical device which changes the form of electrical pulses into discrete mechanical movements, shown in figure 5. The shaft or spindle of a stepper motor rotates in discrete step increases when electrical command pulses are applied in the proper sequence. The sequence of the applied pulses is directly related to the orientation of motor shafts rotation. The speed of the motor shafts rotation is proportional to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

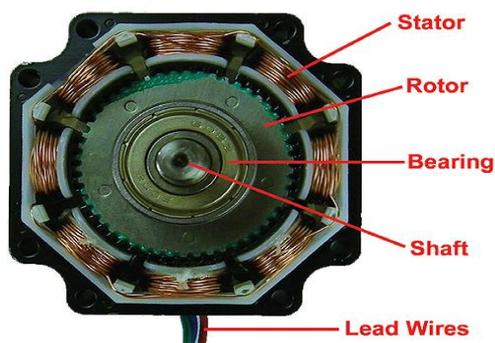


Fig. 5: Stepper Motor

### D. GSM MODULE

GSM modem is a flexible plug and play modem for easy integration with RS232 and audio interface, shown in figure 6. It is equipped with features of circuit switched data, SMS, FAX, voice and GPRS. GSM engine has frequencies of 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem. The Modem is delineating with RS232 Level converter circuitry, which allows you to directly interface PC Serial port. This GSM RS232 Modem is

and (GND) except power supply to interact with microcontroller/host PC. The built in low dropout linear voltage regulator allows to link wide range of unregulated power supply (4.2V -13V). This modem will be able to send & read SMS which connects to internet via GPRS through simple AT commands.



Fig. 6: GSM Module

### E. RS232

RS232 is a standard for serial communication between various devices, shown in figure 7. This standard is not directly compatible for communication with 8051 microcontroller. Microcontroller has serial port, which is TTL compatible. TTL signal should be converted to RS232 and vice versa. An interface is provided for connecting RS232 and TTL serial logics.

MAX232 is a dedicated chip for TTL to RS 232 interface. It converts RS 232 signals from PC serial port to TTL signal port to TTL signal for microcontroller serial port and vice versa. It works from a single 5V, produces high voltage by using internal charge pump voltage converter.

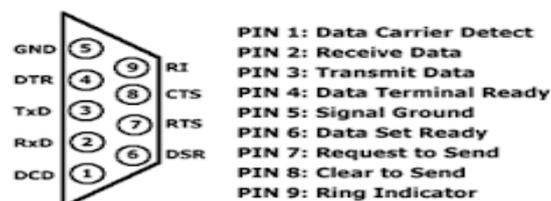


Fig. 7: Pin Diagram of RS232

### F. USART MODULE

The Universal Synchronous Asynchronous Receiver Transmitter (USART) is used as a serial I/O module. The USART can be designed as a full duplex asynchronous system that can exchange the information with the peripheral devices such as CRT terminals and personal computers, or it can be arranged as a half-duplex synchronous system that can exchange information with peripheral devices such as A/D or D/A integrated circuits.

## IV. PROPOSED WORK

The goal of the proposed project comprises of an embedded based controller which forms the main part of the system. Design consists of an embedded based controller to which we interface obstacle sensors, GSM modem, servo motors, dc motors and a PC system consisting of application software. This design is implemented in such a way that to the controller section, all the hardware section is interfaced i.e., an elevator with dc motors and

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 implemented in such a way that elevator is made to rotate vertically with the help of DC motor. Container arm is made to rotate continuously with the help of stepper motor. This is done in order to place the car to certain slot. So that car can be placed in any vacant slot. When the person enters the name as well as mobile number in the PC consisting of application software, automatically it scans for the vacant slot and decision can be made to place the car to that particular slot. The car container is kept at the container arm to place the car. When the car is placed, automatically transports the car to a specified location is done with the help of this design. Here the robotic arm is continuously made to rotate which helps in moving or sliding the car to the specified parking area. In order to place the car in the appropriate place on the container arm, a distance sensor is placed. This will help in placing the car on the container arm accurately. System automatically notices the maximum and minimum distance. If the car is placed in fault way on the container arm, system detects it with the help of distance sensor and indication is given as alarm, so correct alignment of vehicle on the container arm is made possible. Motor driver mechanism is used for lifting the elevator. Rotating base i.e., container arm section is made to rotate with the help of stepper motor. The GSM Terminal is a GSM Modem for the transfer of data.



Fig. 8: Smart & Automated Robotic Car Parking System

## V. ADVANTAGES

This model has a feature of slot arrangement of cars therefore, it can save space and also it reduces time. This system is safe, fast and efficient. This model is easy to park and retrieve the car. Another advantage of this system is that user can notice the vacant parking slot as well as reserving the slot is also made possible using this system.

## VI. CONCLUSION

In latest research we know that vehicles are increasing day by day. Parking of vehicles in a busy city or areas such as airports, railway stations hospital etc is a crucial problem that faced by the consumers. By implementing the project we can avoid this type of problems. And also this project is useful for a safe, secure, high speed and efficient car parking system i.e., it can avoid accidents and traffic jams etc caused by parking in busy cities. This proposed system can be used in hospitals, airports, railway stations, shopping

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 ready to consent to undertake it. So it will solve many problems like slot availability, wastage of time, fuel and will also guarantee security to the vehicle. Hence Smart & Automated Robotic Circular Car Parking Using GSM has got a huge potential as many Smart City projects are coming up in India and a huge expenditure has already been in progress.

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