RADIO FREQUENCY IDENTIFICATION BASED VERTICAL CAR PARKING SYSTEM

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Abstract :Lack of space availability has always been a problem in urban areas and major cities and to add to it there are cars parked callously on the streets that further limit the space. In order to handle the issue of parking in busy places various types of vehicle parking systems are used worldwide namely Multi-level Automated Car Parking, Vertical Car Parking System, Volkswagen Car Parking and many more. The present project work is aimed to develop a reduced working model of a car parking system for parking 6 cars within a parking area of two cars. The platform is fabricated to suit the working model. The procurement and manufactured items are in hand and are ready to be assembled with the structure. This model is further useful for various branches of engineering in order to develop different types of automations like PLC, micro controller and computerization. By testing and analysing the working model we can definitely get the view to develop the parking lots at difficult and busy commercial places. The Slot uses a microcontroller along with sensing circuits monitoring entry and exit of cars. The car owners are allowed an entry only if their RFID card is swiped .The amount in the card automatically gets reduced with a display indication besides indicating the available number of parking. For loading the amount 2 push buttons are used and SW2. Example is shown for 6 cards but it can be extended to many numbers. On every parking 10rs is deducted from the card and each card can be easily recharged up to 500rs. There are two push buttons to increment and decrement the amount in the card. An H-bridge arrangement operates the entry and exit boom motors operating clockwise and anticlockwise for opening and closing. A buzzer sound comes while the card is swiped. Upon every entry of a car the parking availability gets reduced by one number while every exit the number increases. A standard power supply is used. A seven segment display displays the status of every action done and the amount deducted or incremented during recharging.

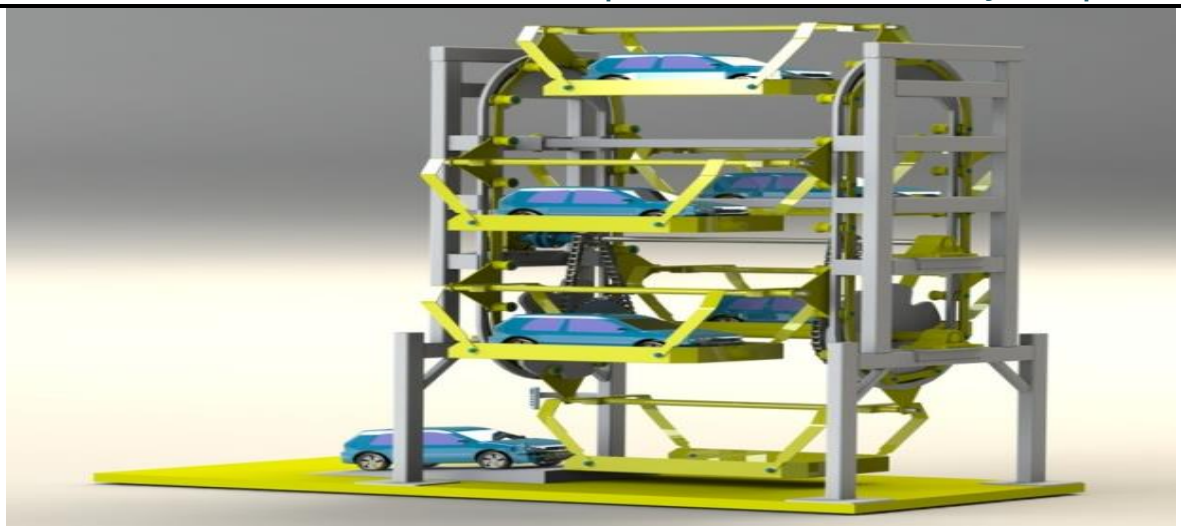
***IndexTerms*–RFID,callouslyPLC, multilevel, automated car parking, rotary parking system.**

I. INTRODUCTION

VERTICAL CAR PARKING SYSTEM

Personal vehicles usage is increased with increasing the population in India which creates serious problem of parking place at busy market area, shopping mall, public places. As per as survey carried out in India it is roughly estimated that out of 8760 hours in year the car runs for an average for only 400 hours leaving 8360 hours in parked condition. Increasing concentration of human activity on limited land both in terms of residential activity and commercial activity causes the parking problem. Every car owner would wish to park the cars as closely as possible to his destination so as to minimize his walking distance. Leading to congestion of On-street spaces in official neighbourhood may give rise to inappropriate parking area in office and shopping mall complex during the peak time of official transactions. The demand also leads to economic, social and environmental losses and with increase in population the problem becomes more critical. As such parking spaces optimization and control has become a real challenge for city transport planners and traffic authority.

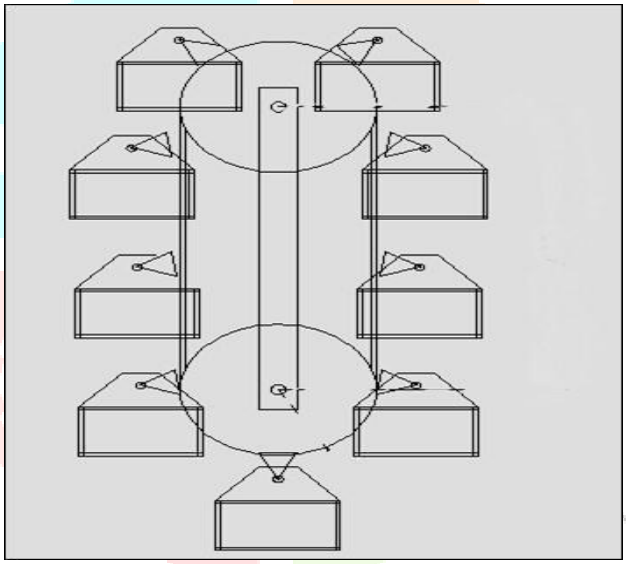
By comparing various automatic cars parking systems and proposes the characteristics required by a smart rotational car parking system suitable for Indian environment. These characteristics form the basis for designing Automatic car parking system for cinema theatres, malls, hotels and offices in India. Embedded system can provide quality efficient, cost effective solution to manage multi-storey parking requirements. Proposed system can provide solution to manage multi-storey car parking system. Multi-storey parking system requires boom barrier, direction indicator, webcam, etc… devices connected in control manner. These devices are controlled by microcontroller based embedded systems which work on different electrical signal levels. There are also many other benefits like the parked cars and their contents are more secure since there is no public access to parked cars, prevents minor parking lot damage such as scrapes and dents are eliminated, drivers and passengers are safer not having to walk through parking lots or garages, driving around in search of a parking space is eliminated, thereby reducing engine emissions, only minimal ventilation and lighting systems are needed, handicap access is improved, the volume and visual impact of the parking structure is minimized and shorter construction time.

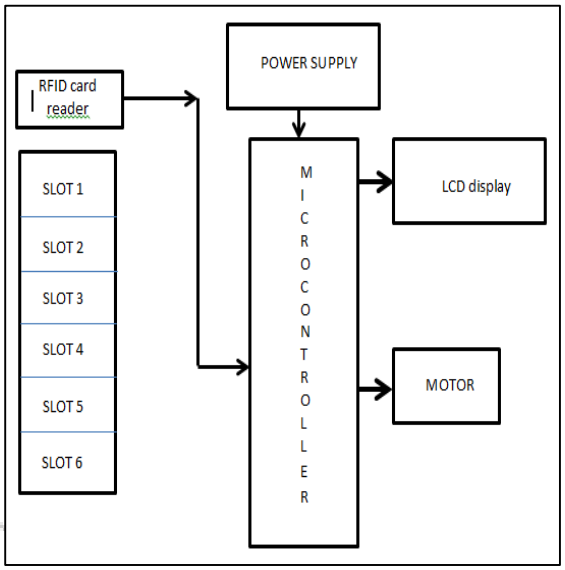


Basic Structure of Parking System

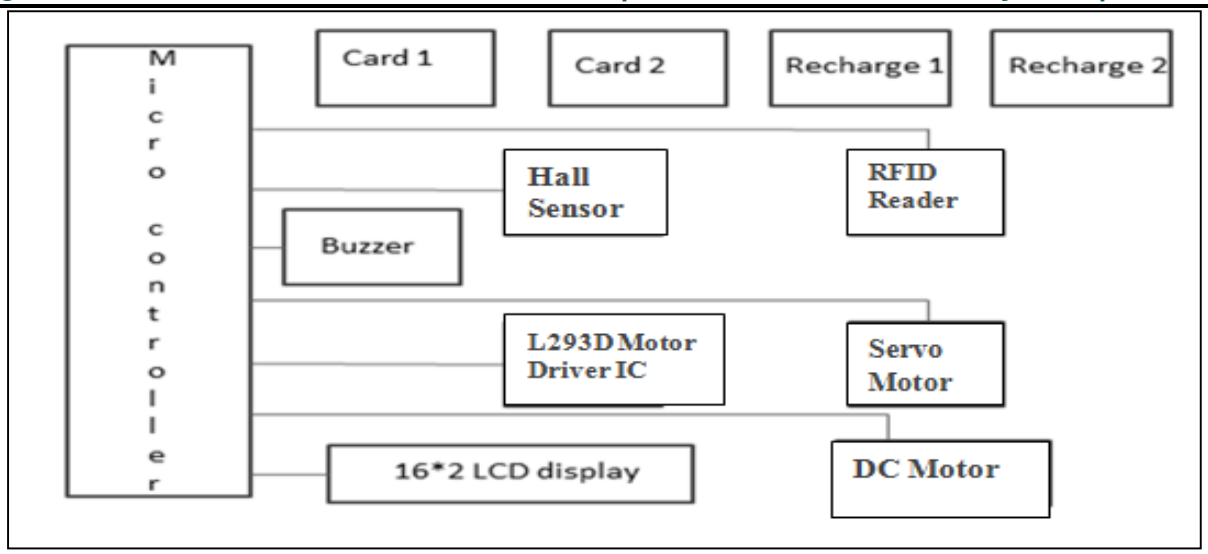
II. METHODOLOGY

The project consists of 6 RFID tags, RFID reader which is placed in front of the vehicle parking system. Microcontroller controls the vehicle parking system. It is simple to operate with the driver entering the parking lot and the empty parking slot automatically comes down, the driver then leaves the parking area leaving the vehicle in the system at the ground level. The rotation will stop as soon as the vehicle is parked in its designated place. Once the driver leaves the incorporated safety zone the barricade closes on its own with the servo motor and the vehicle is automatically parked and the status gets updated on the LCD.





The parked car is easily retrieved by swiping the card on the RFID reader module, Down to ground level ready for the driver to enter the safety zone and reverse the car out of the parking lot safely. It will be possible to see secure, atomized parking-lots functioning with RFID technology with the help of one man only. Entry and exit of the car during parking will be handled in a fast manner so that traffic jam problem will be avoided during these processes. The application of RFID technology makes parking effective, convenient and safe. The slot uses a microcontroller along with sensing circuits monitoring entry and exit of cars. The car owners are allowed an entry only if their RFID card is swiped .Specific amount in the card automatically gets reduced on every parking done. The amount in the card can be recharged with an increment or decrement switch. It can be recharged up to an amount of 500rs. Example is shown for 6 cards but it can be extended to many numbers. An H-bridge arrangement operates the entry and exit boom motors operating clockwise and anticlockwise for opening and closing. A buzzer sound comes while the card is swiped. Upon every entry of a car the parking availability gets reduced by one number while every exit the number increases. A standard power supply is used. A seven segment display displays the status. Thus we can summarize the introduction that in almost every major city in India and other countries, parking problems are ubiquitous. The present day metropolitan areas have seen a sprouting growth in human population as well as vehicles. This is directly proportional to the requirement of parking lots. The advent of smart rotational car parking system has made the parking management system easier.



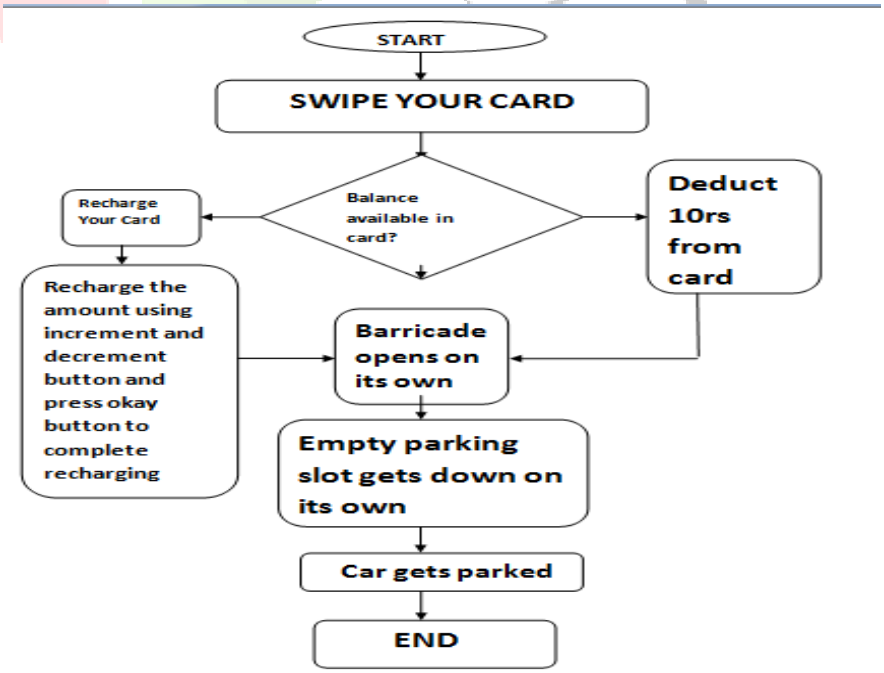
Basic Block Diagram of Slot

III. WORKING OF THE CIRCUIT

The Vertical Car Parking System works on the principle of RFID card reading. The supply given to the circuit is 230V AC supply, which is then fed to a half bridge rectifier to rectify the AC signal. The rectified AC signal is then fed to step down transformer (9-0-9) which converts the signal to 9V. Since 9V signal is not desired in our circuit, as the microcontroller (80328), LCD (Liquid Crystal Display) and the other components work at 5V supply, therefore, we are using a voltage regulator (7805). This voltage regulator converts the 9V signal to 5V supply voltage. Now the input ac signal of 5V is fed to the microcontroller (80328), LCD, Motor drivers, RFID card readers and the other components. The RFID card reader placed at the bottom reads the card and accordingly stops the rotation of the motors. Now if the user wants to park then he has to swipe the RFID card in the reader module, a message "PLEASE PARK" gets displayed on the LCD. Now the empty car slot gets down on it's own and the user can park the car. After the car is parked the barricade closes and the motor starts rotating until another empty slot comes.

The RFID card reader keeps on reading the slot numbers and when it matches the user's choice it automatically stops the movement of the motors now the user can park his car in. If the user wants to unpark his car then he has to swipe the card again and the same slot he parked his car in comes down automatically the LCD displays the command to "Please Unpark". If the balance in the card gets low user can also recharge the balance in each card by using the Incrementing and decrementing button. While parking if the user has zero balance the barricade won't open and LCD will display the message "Please Recharge". Then the user can recharge his card using the increment and decrement switch.

The slot uses a microcontroller along with sensing circuits monitoring entry and exit of cars. The car owners are allowed an entry only when their RFID card is swiped .Some amount in the card automatically gets reduced in each parking done. User can recharge up to a maximum limit of 500rs. A Motor operates the entry boom clockwise and anticlockwise for opening and closing. A buzzer sound comes while the card is swiped. Upon every entry of a car the parking availability gets reduced by one number while every exit the number increases. A standard power supply is used. A 16 X2 line LCD display gives the status. Standard power supply of 12 volt DC and 5 volt through a regulator are made from a step down transformer along with a bridge rectifier and filter capacitor. Alternatively a 6 volt battery can be used in series with a diode to get 5 volt approximately. An LCD display registers all the conditions for information of the user. The basic flow chart of the working of the parking system is as shown below.



Basic Flow Chart of the Project

3.1RFID Card Reader

RFID (radio-frequency identification) is the wireless non-contact use of radio-frequency electromagnetic fields, for the purposes of identifying and tracking tags attached to objects. This is the ID-20LA, a very simple to use RFID reader module from ID Innovations. With a built in antenna, the only holdup is the 2mm pin spacing. Power the module, hold up a 125 kHz card, and get a serial string output containing the unique ID of the card.

Specifications:

- Water-Resistant Proximity Reader
- EM80 Water-Resistant Proximity Reader Measuring 240 x 240 x 48mm.
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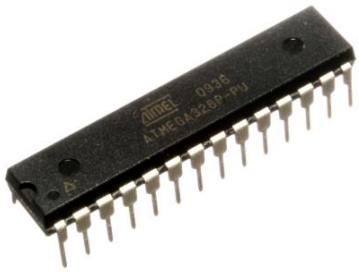
- Frequency: 125kHz
- Card (transponder): 125kHz serial card
- Read distance: 700mm maximum
- Indicator: two LEDs
- Protocol: Sun Best standard protocol
- Baud rate: 9,600 bauds
- Output interface: W34, W26, RS232
- Water resistance: yes
- Operating temperature: -10 to 60 degrees Celsius
- Storage temperature: -25 to 85 degrees Celsius

3.2 Microcontroller ATmega328

The ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages) , a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended standby mode, both the main oscillator and the asynchronous timer continue to run.



3.3 Hall Sensor 3144

The A3144 is an integrated Hall Effect no latching sensor. That's nice but what does it do? Holding a magnet near the sensor will cause the output pin to toggle. This makes for a robust presence sensor. A reed sensor also works nicely, but can be limited by the glass encapsulation and size. A Hall Effect sensor is much smaller, but can handle less current than a reed switch.

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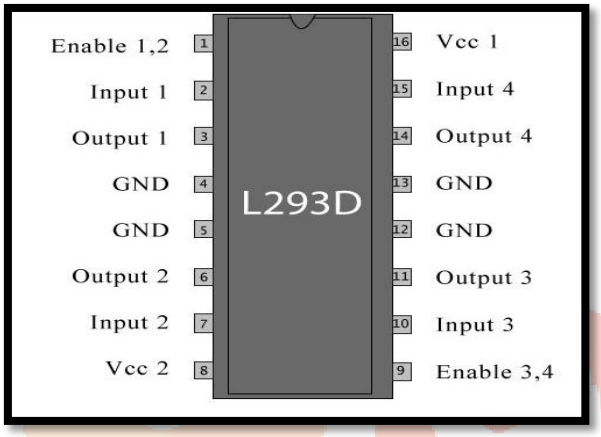
- Superior Temp. Stability for Automotive or Industrial Applications
- 4.5 V to 24 V Operation … Needs Only An Unregulated Supply
- Open-Collector 25 mA Output … Compatible with Digital Logic
- Reverse Battery Protection
- Activate with Small, Commercially Available Permanent Magnets
- Solid-State Reliability
- Small Size
- Resistant to Physical Stress

Hall Sensor

3.4L293D Motor Driver IC

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

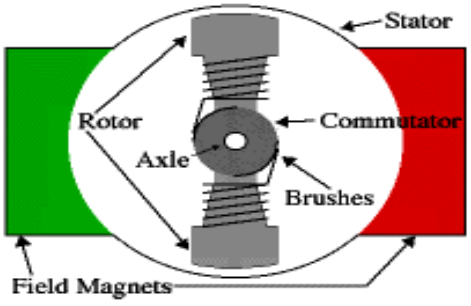
Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.



Basic Pin Diagram

3.5DC Motor

A DC motor is an electric motor that runs on direct current (DC) electricity. In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion. Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets1. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator.

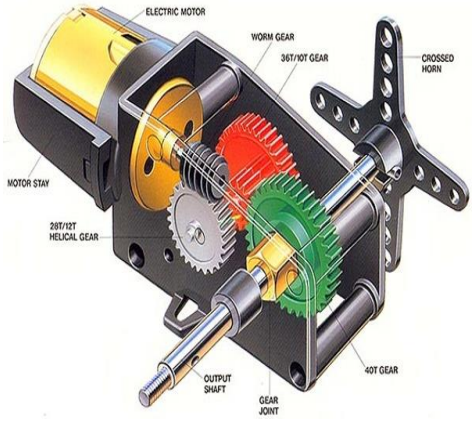


DC motor

3.6Servo Motors

Servo motors (or servos) are self-contained electric devices (see Figure 1 below) that rotate or push parts of a machine with great precision. Servos are found in many places: from toys to home electronics to cars and airplanes. If you have a radio-controlled model car, airplane, or helicopter, you are using at least a few servos. In a model car or aircraft, servos move levers back and forth to control steering or adjust wing surfaces. By rotating a shaft connected to the engine throttle, a servo regulates the speed of a fuel-powered car or aircraft. Servos also appear behind the scenes in devices we use every day. Electronic devices such as DVD and Blu-ray DiscTM players use servos to extend or retract the disc trays. And of course, robots might not exist without servos. The simplicity of a servo is among the features that make them so reliable. The heart of a servo is a small direct current (DC) motor, similar to what you might find in an inexpensive toy. These motors run on electricity from a battery and spin at high RPM (rotations per minute) but put out very low torque (a twisting force used to do work— you apply torque

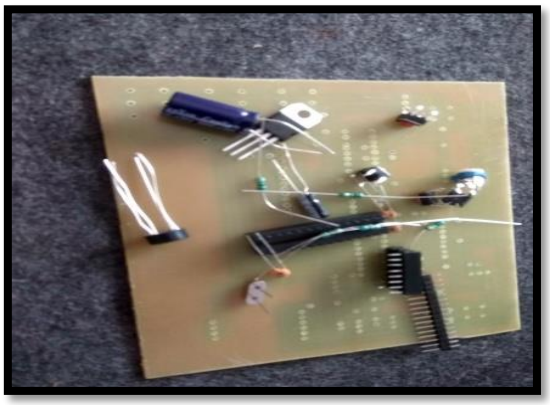
when you open a jar). An arrangement of gears takes the high speed of the motor and slows it down while at the same time increasing the torque.

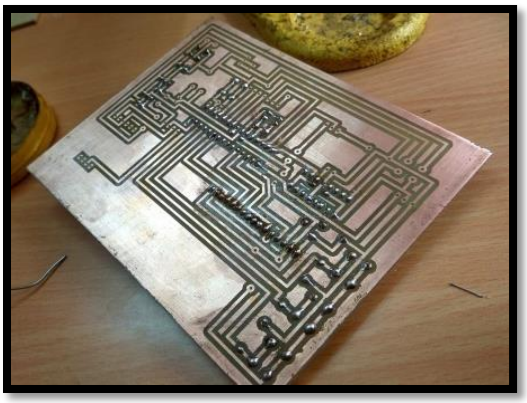


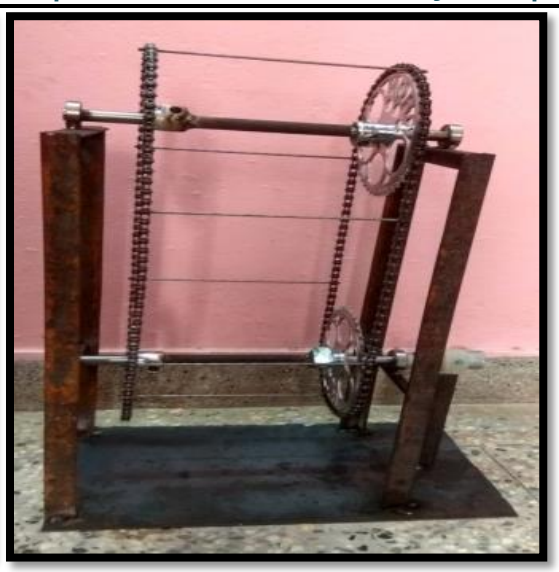
Servo Motor

IV. RESULT

Vertical Car Parking model has been designed; all the parts in it were manufactured and assembled and tested successfully. Analysis of the model has been done and developed with the scaling of 1:9 for life size model Such as SUV's like Fortuner. As the life cycle model involves proper design and advanced methods are to be used to meet the requirements of the customer. Quick Automated Parking and retrieval of vehicles is possible. Up to 12 cars can be easily and safely parked. Surface space required equivalent to just 2 surface car parking spaces. Most suitable for staff or dedicated user parking. Engineered to ensure driver safety by use of an electronic safety zone. Low maintenance levels required by the system. The final model is as shown below. By virtue of their relatively smaller volume and mechanized parking systems, Vertical car parking is often used in locations where a multi-story parking garage would be too large, too costly or impractical. Examples of such applications include, under or inside existing or new structures, between existing structures and in irregularly shaped areas. Vertical car parking can also be applied in situations similar to multi-storey parking garages such as freestanding above ground, under buildings above grade and under buildings below grade.







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