"Rfid Based Rotational Car Parking System"

Kushagra Agrawal, Parmeshwar Singh, Pankaj Chandrakar, Neha Verma

Abstract

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 car 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.

1. Introduction

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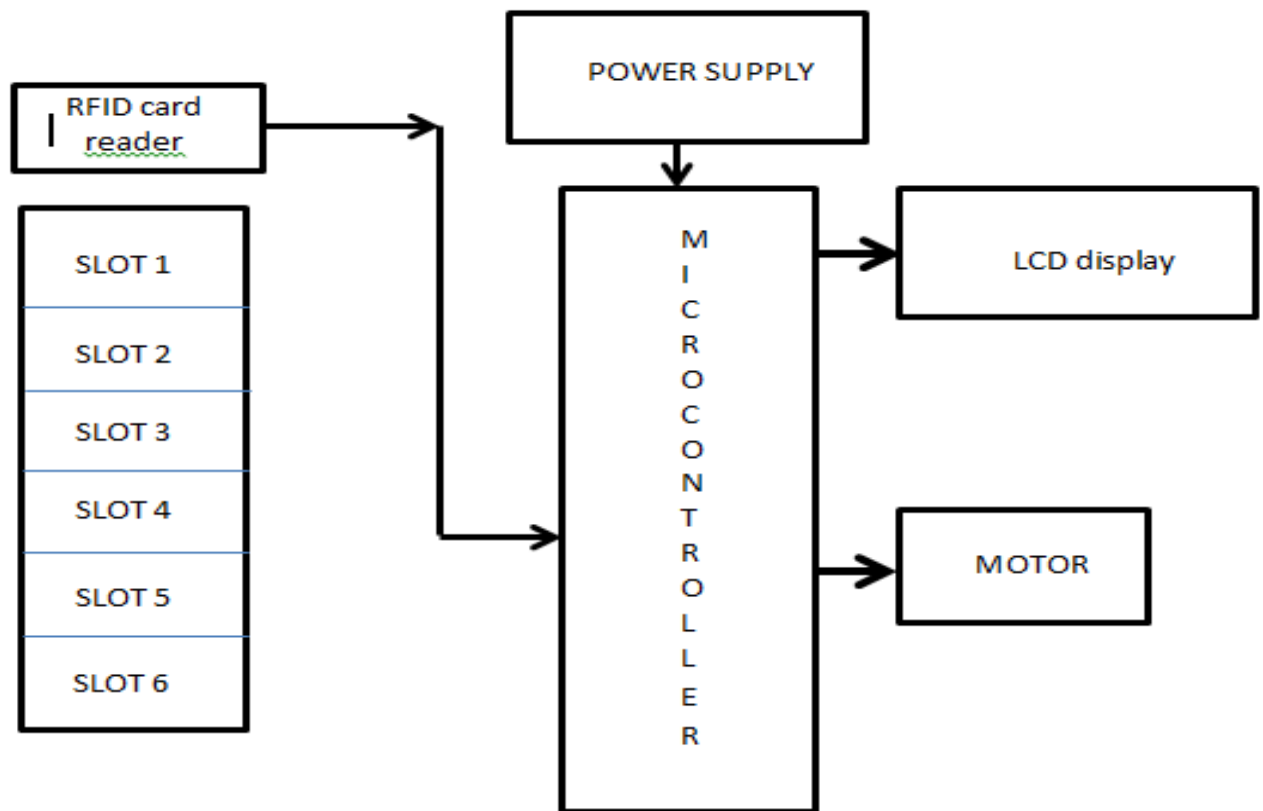

Fig.1.1.1 Basic Block Diagram of Mechanical Assembly

1.2 Description of the Project

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 upto 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.

2. Literature Reviews

2.1.1 Optimal Automatic Car Parking System for Indian Environment.

Hitendra and et. al proposed the proliferation in the number of vehicles on the road, traffic problems are bound to exist and the several different types of car parking systems are available in the market today. This system consists of a lift to take the car to upper stories. Two doors have to be provided in a car lift for entry and exit of vehicle. An additional lift is provided which connects all the floors for the driver to return to ground floor after parking the car and if he/she wants to retrieve his/her vehicle, driver can reach to that floor just by pressing the button of that particular floor. It is a fully computer controlled mechanism which becomes user friendly as it ensures maximum utilization of space allowing the machines to park the car in the allocated space. Fully automated parking systems use auto car lifts. They are designed for high density parking. These parking systems allow for virtually unlimited stacking capacity and provide fully integrated storage and retrieval functionality.

2.1.2 Rotary Automated Car Parking System
Chandni Patel, and et. al; in their journal have proposed a model for the parking management system. The model has been developed using IR based communication system. At the entry of the parking system vehicle type is identified by measuring vehicle length using different IR LEDs. Based on vehicle type and category, Central Control Unit will provide token number to vehicle and will send token message to parking slot unit by using Controller Area Network. Although the construction of this system seems to be easy, it will be difficult to understand without the knowledge of materials , chains, sprockets, bearings, machining operations, kinematic and dynamic mechanisms. The rotary model or the parking lot will be as shown in the figure. All the calculations are done and accordingly each and every part of the parking system is bought into reality.

Fig.2.1.2 Basic Mechanical Assembly

2.1.3 Safety & Security in RFID Based Multilevel Vehicle Parking System

R.Jayanthi, offers specification and installation tips that can not only increase the reliability of presence, but also help engineers to improve overall system productivity. It first gives an overview of types of sensor, in particular distinguishing 2-,3- and 4 wire sensors. It then discusses engineering practices, third party ratings built-in protection mechanism and interfacing considerations. The diagram consists of RFID tag, RFID reader which is placed in front of the vehicle parking system.PIC microcontroller controls the vehicle parking system using Dijkstra's shortest path algorithm. It is simple to operate with the driver parking and leaving the vehicle in the system at the ground level. Once the driver leaves the incorporated safety zone the vehicle is automatically parked by the system rotating to lift the parked car away from the bottom central position. Exceptrotational car parking system all other systems use a large ground area,rotational car parking system is developed to utilize maximumrotational area in the available minimum ground area. It is quite successful when installed in busy areas which are well established and are suffering with shortage of area for parking.

2.1.4 RFID Based Automated Toll Plaza System

AungMyintWin, Chaw MyatNwe, KyawZinLatt has mentioned that the micro simulation model for the automated toll plaza system using RFID technology. The 8051 microcontroller is used for the control system. This system mainly reviewed the research and development work for toll collection at the toll gate on highway with the help of passive RFID technology. By developing this system, the knowledge of RFID system, PIC 18F4550 microcontroller, the database construction, GUI design and USB connection between PC and PIC using c# language are realized. Moreover, the designs of IR transmitter and receiver circuits are convenient for this system. So, these results can use for another IR sensing application. For this system, passive tags are better than

the active tags because of low cost, low power consumption and also radio signals environmental factors. By using RFID based automated toll collection system, the vehicle can check for security with the passing time, save the time for toll collection and reduce traffic congestion at the toll plaza. RFID based toll collection system is the best way for toll collection at the toll plaza.

2.2 Problem Statement

Now days in many multiplex systems there is a severe problem for car parking systems. Every car owner would wish to park the car as closely as possible to his destination so as to minimize his walking distance. Leading to congestion of On-street spaces in official neighbourhoods 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 an automatic multi-storey car parking system suitable for Indian environment. These characteristics form the basis for designingrotational car parking system for cinema theatres, malls, hotels and offices in India .These multi-storey parking system requires proper management with context to traffic management, allotted parking lot direction indication.

- Parking area should be as close and as automated as possible
- How to prevent damage
- Mechanical assembly
- Cashless Payment Options
- Parking and moving a car with no disturbance to the already parked cars is another major problem.
- Cashless payment options are not available to make transactions easier.
- Unauthorised access to cars kept in public or parked callously increases the security threats.
- Identification of driver to avoid unauthorised users to access the parking slots.
- Handicap accesses to parking places are not thought about.

Methodology

Therotational 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.

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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 doen on its 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.
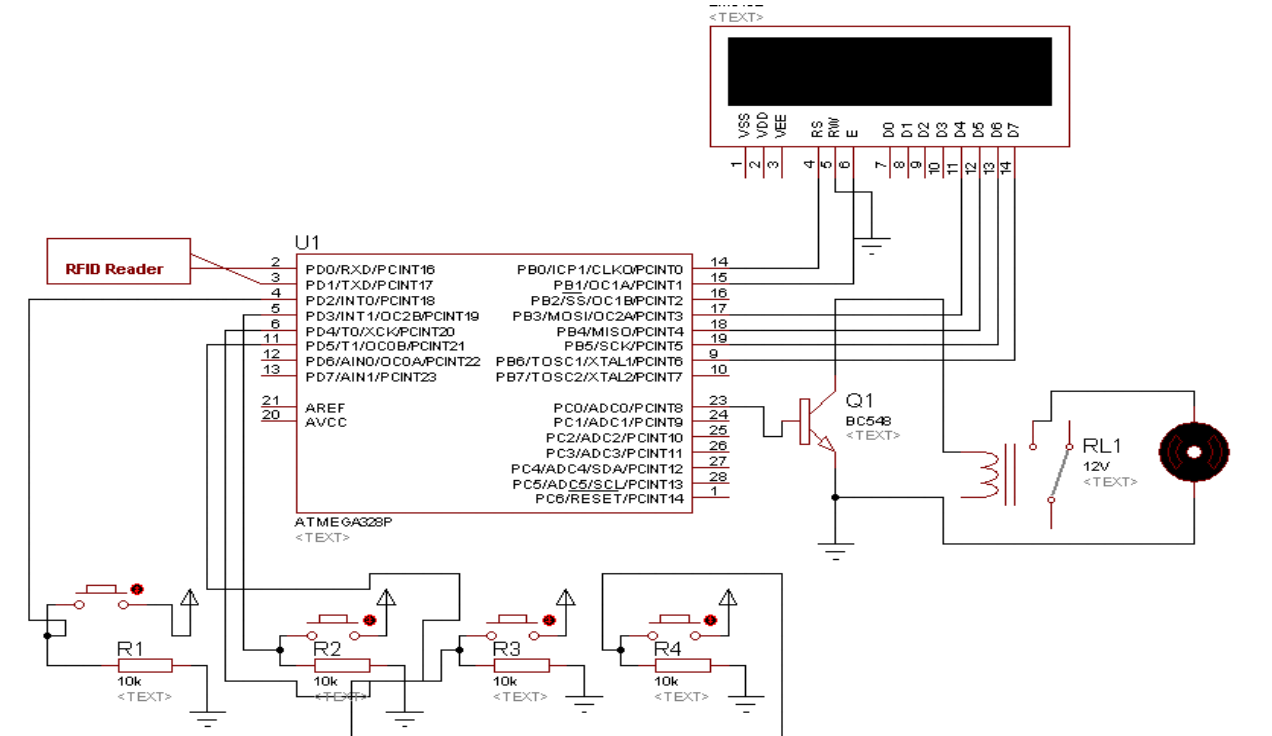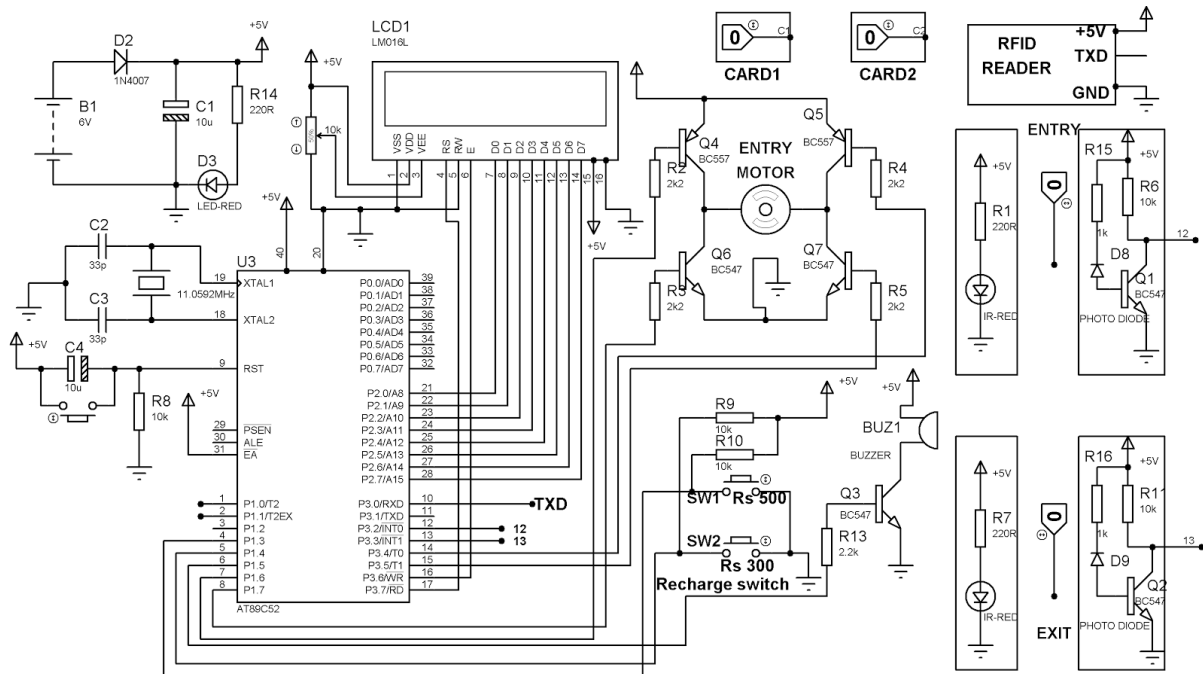
Fig Circuit Diagram of Mechanical Assembly

Fig Circuit Diagram of One Slot

Results & Performance Analysis

The below figures show the lcd display while working of the project displaying the status of the slot and the swiped card.
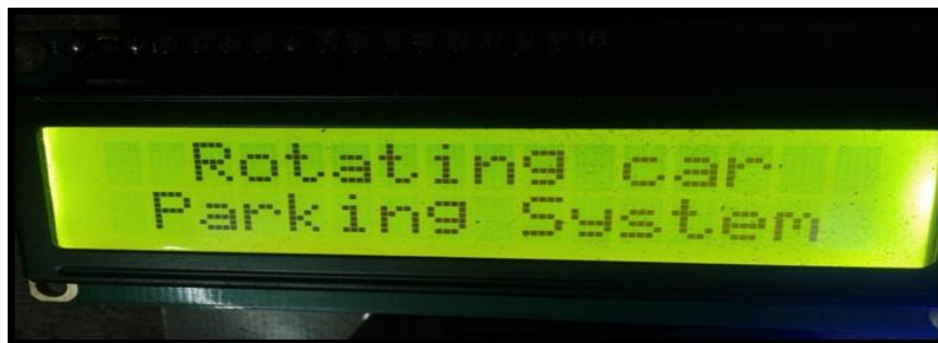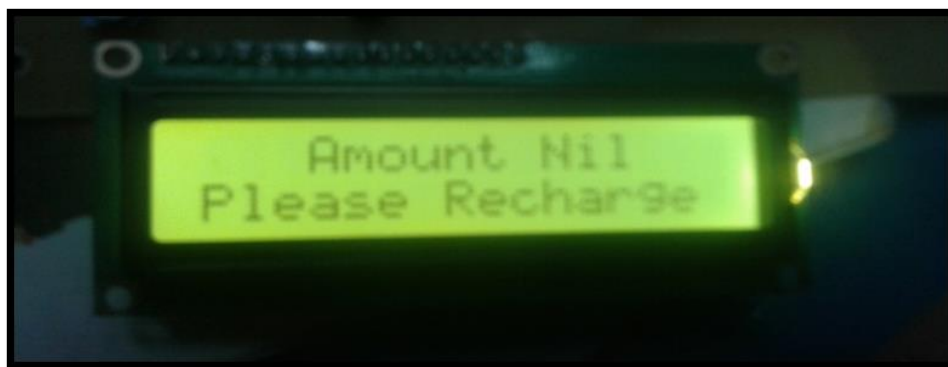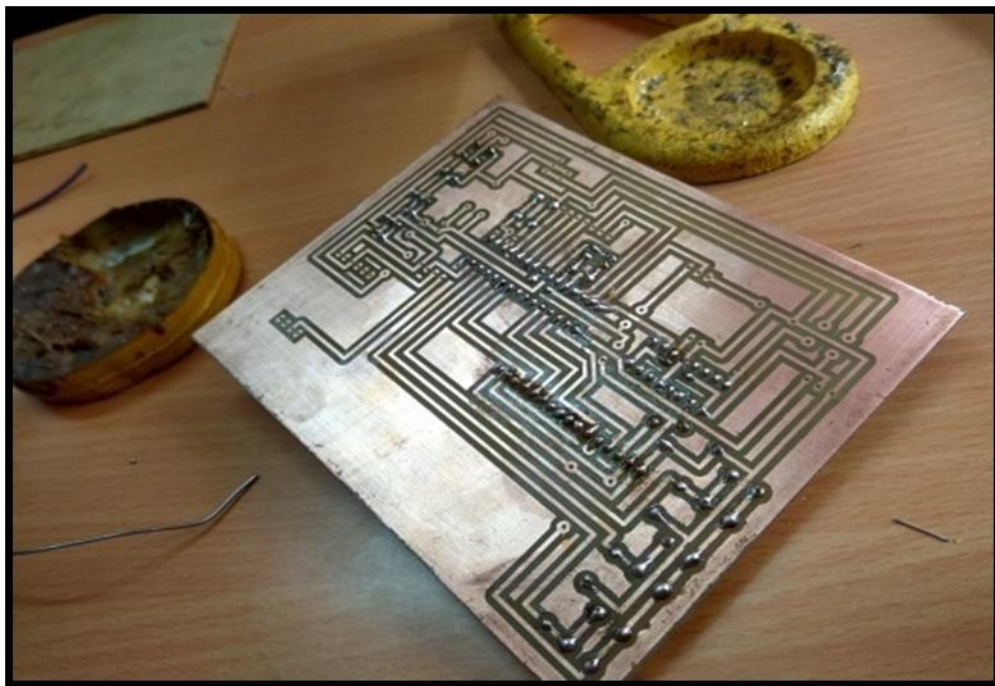

Fig. LCD Display Output

The below figure shows the mechanical structure

Fig. Mechanical Structure
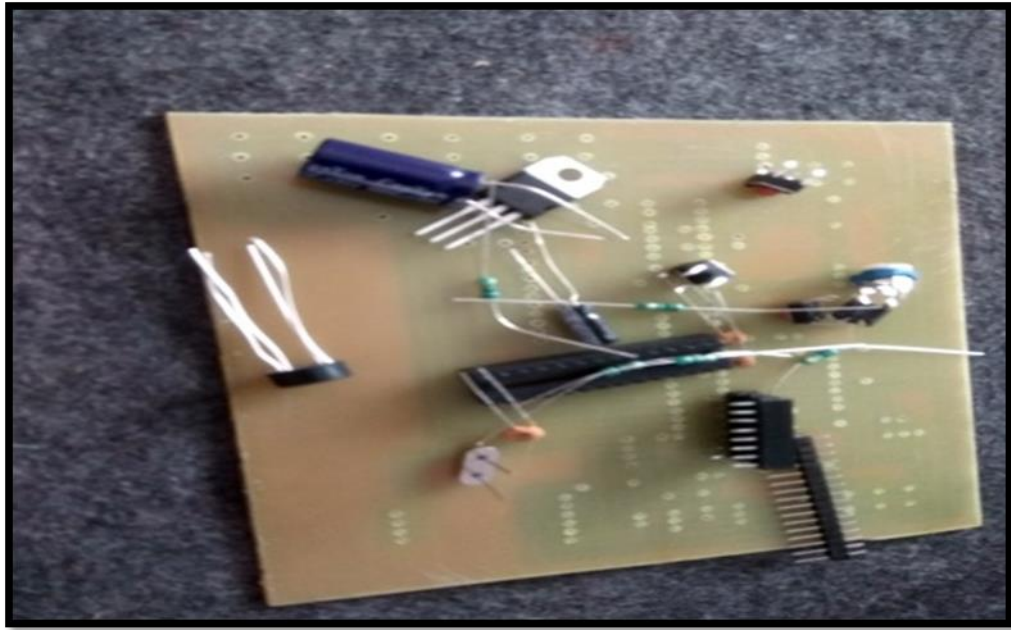
The PCB board and components

Fig. PCB Board

Conclusion and Scope of Further Work

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.

In this document we described the rotational car parking system using RFID readers. The car owners are allowed an entry only when their RFID card is swiped .The amount in the card automatically gets reduced with a display indication besides indicating the available number of parking. 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 16 X2 line LCD display gives the status.

We implemented a full-fledged prototype model as a proof of concept to realise and understand the real time scenarios in parking system. Through our prototype system we demonstrated that the proposed architecture can effectively satisfy the requirement of a car parking system and we believe that this can be a promising technology to solve future parking problem.

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