(Autonomous Institute, Affiliated to VTU)

Mini Project 2019

Automated Parking System Using RFID

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Introduction:

The ever-increasing scarcity of available urban land (urbanization) and increase of the number of cars in use (motorization) have combined with sustainability and other quality-of-life issues to renew interest in automatic parking system as alternatives to multi-story parking garages, on-street parking and parking lots.

The concept for the automated parking system is driven by two factors:

1) Need for parking spaces and

2) Scarcity of available land.

APS (Automatic parking system) takes advantage of a common concept to decrease the area of parking spaces - removing the driver and passengers from the car before it is parked. With fully automated APS the car is driven up to an entry point to the APS and the driver and passengers exit the car.

The components used in the project are
## 1. Arduino Uno

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

2. Radio-frequency identification (RFID) module

Uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method of automatic identification and data capture (AIDC)

3. Stepper motor
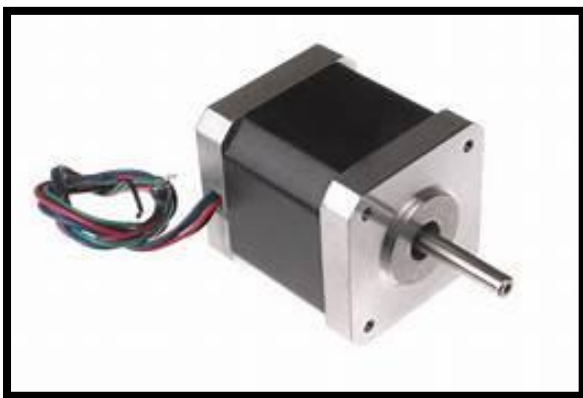
A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

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4. DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

4. LCD (16/2 display)
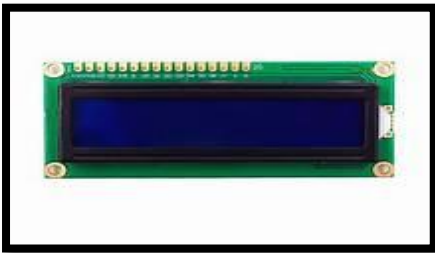
It is for the users to know the number of vehicles parked and number of slots available for parking.
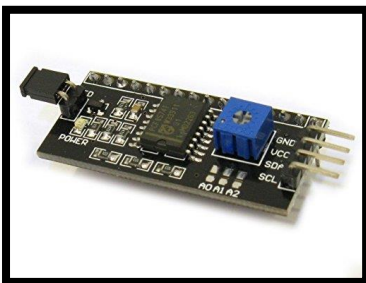
We Use A Serial Interface Module Connected to the Arduino To Make the Process of Powering and Displaying Text in the LCD Module Easier.

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Motivation

The uneconomical time that people take in order to park their vehicle in malls, Hospitals and Super markets is main source of motivation for our project. In the existing system one has to spend ample Amount of time before they find out an empty parking slot.

Objectives

1) To develop intelligent, user friendly automated car parking system which reduces the man power and traffic congestion.

2) To offer a safe and secure parking facility.

3) Eco friendly: other parking garages and parking lot designs require drivers to expand gas and put harmful emissions while driving around searching for a parking spot or idling while waiting for a spot to become available.

Since the automation of Smart Parking system removes the need for drivers to waste time and gas parking their cars themselves thereby reduces the harmful greenhouse gases, such as CO_2 and other emissions.

4) Reduction on traffic loads as less number of vehicles will be there in search of parking in open area.

5) Economy growth: as separate charges can be applied for different space location.

6) Deforestation can be reduced: as in less space more vehicles can be placed so cutting of trees for the availability of large space can be reduced.

7) Less labour costs because of automation and reduced resource exhaustion.

8) Better real time management and monitoring of available space.

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Proposed Methodology

This project is based on the very popular RFID (radio frequency identification) technique, which can be used to track and identify any object like books in library or item that we purchase from shopping malls or vehicles and even birds and animals. This RFID technology is somewhat similar to the barcode technique. The only difference is that RFID does not require any line of sight communication which is very important in barcode reader.

RFID has two main parts:-

1) RFID Reader
2) RFID Tag

RFID Reader:-

It is also known as "Interrogators" and is the brain of the RFID system. Thus the main work is to transmit and receive radio waves in order to communicate with RFID tags. It consists of three components:

1) Signal generator
2) Microcontroller
3) Receiver or Signal detector

Signal generator generates radio waves and transmits to the RFID tag antenna. To receive the data sent by the RFID tag, there is a receiver or signal detector and to process the information and control the flow of radio waves a microcontroller is also required.

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2) RFID Tags:-

These are the actual data carrying tool of an RFID system. In general it comprises of an antenna (coupling element) and an electronic microchip. It receives the radio waves coming from RFID reader. It is attached to objects which are to be identified. The RFID commercially available in the form of ATM card or keychain or label. There are two types of RFID tags

1) Active tag 2) Passive tag

Active Tag: - they have transponder (in the form of antenna) and own power source. Transponder is a device through which the signal is received by the RFID tag as well as the feedback signal is sent from it to the RFID reader for generating feedback (or back scatted signal) and it has inbuilt power supply. Passive tags: - like active tags it consists of a transponder but no power supply of their own. Hence for generating a feedback signal, it has rectifier circuit which store energy from the incoming radio waves. This energy is used to supply to the controller and the memory element present in the microchip.

Working principle of RFID system:-
The working principle depends on the frequency of the radio waves that it is used for the communication, by the RFID tags. There are three frequency ranges used:

1) LF (125 - 139 kHz)
2) HF (13 - 56 MHz)
3) UHF (860- 960MHz)

For LF (low frequency) and HF (high frequency) operations: we have a concept of inductive coupling wherein there is mutual coupling between the antenna of RFID reader and the transponder of RFID tags, due to which a

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voltage is induced across the coil of RFID tags. Some part of induced voltage is used for power supply in case of passive tags. The RFID tag transmits the data present in it using a "load modulation" technique. The carrier wave is being modulated by the help of this technique.
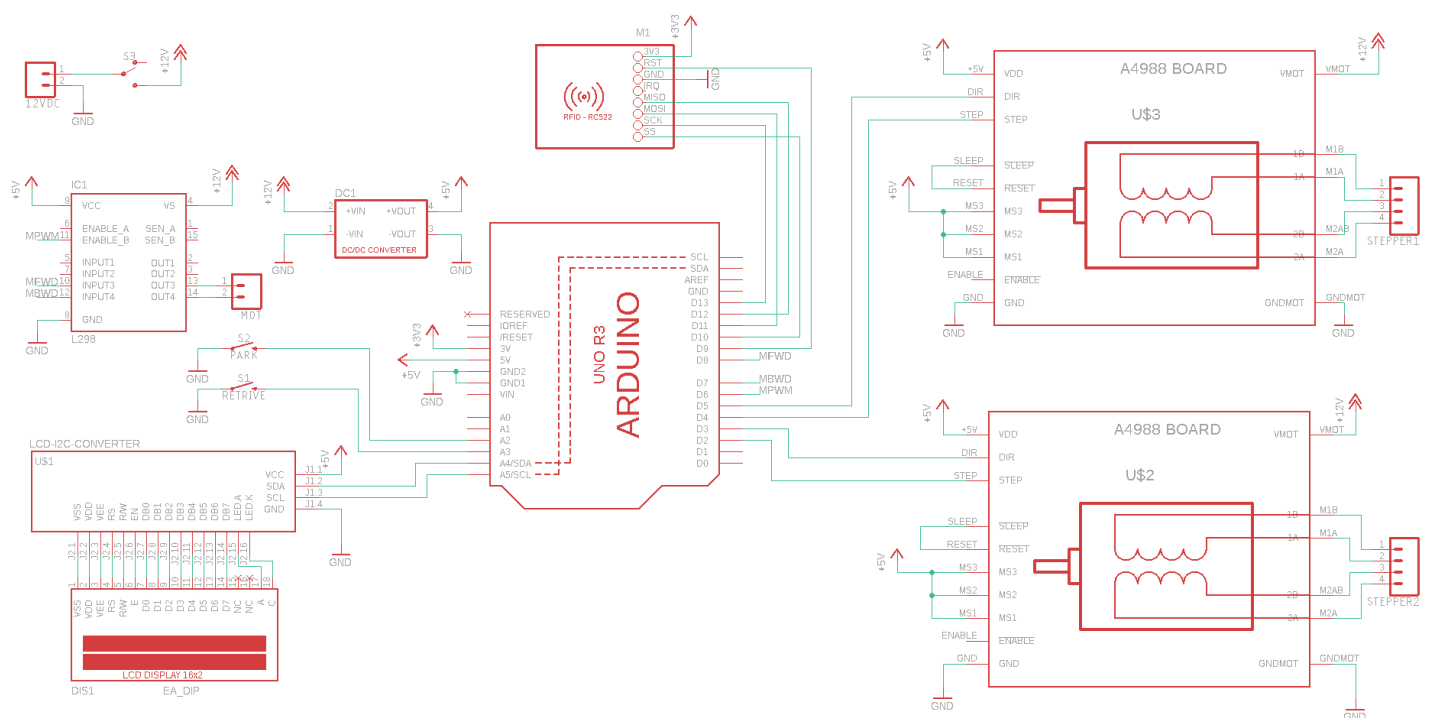
In case of UHF (ultra-high frequency): the electromagnet coupling concept is used. By changing the condition of load, the intensity of the backscatter is changed. Signal is changed based on the data stored in RFID tag thus the load condition and the intensity of the backscatter signal is also changed. So, by varying the intensity of the signal we can modulate the carrier wave.
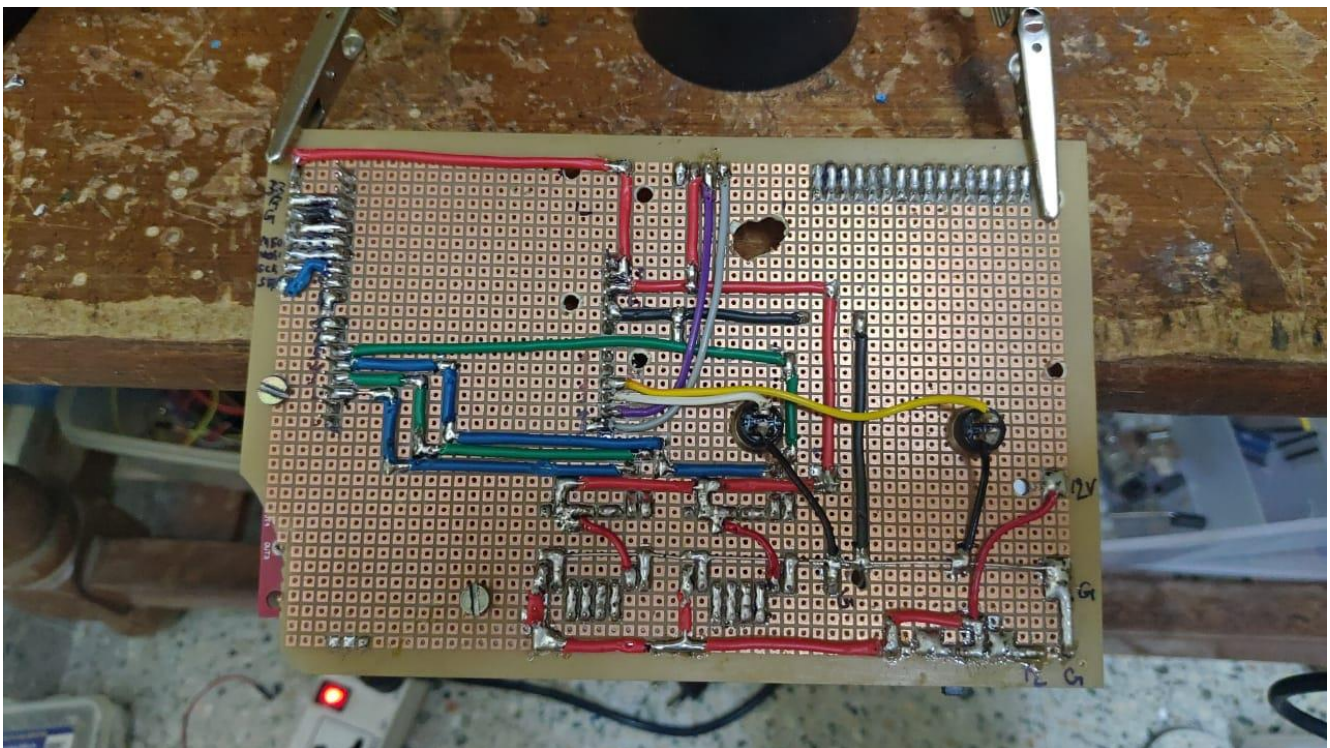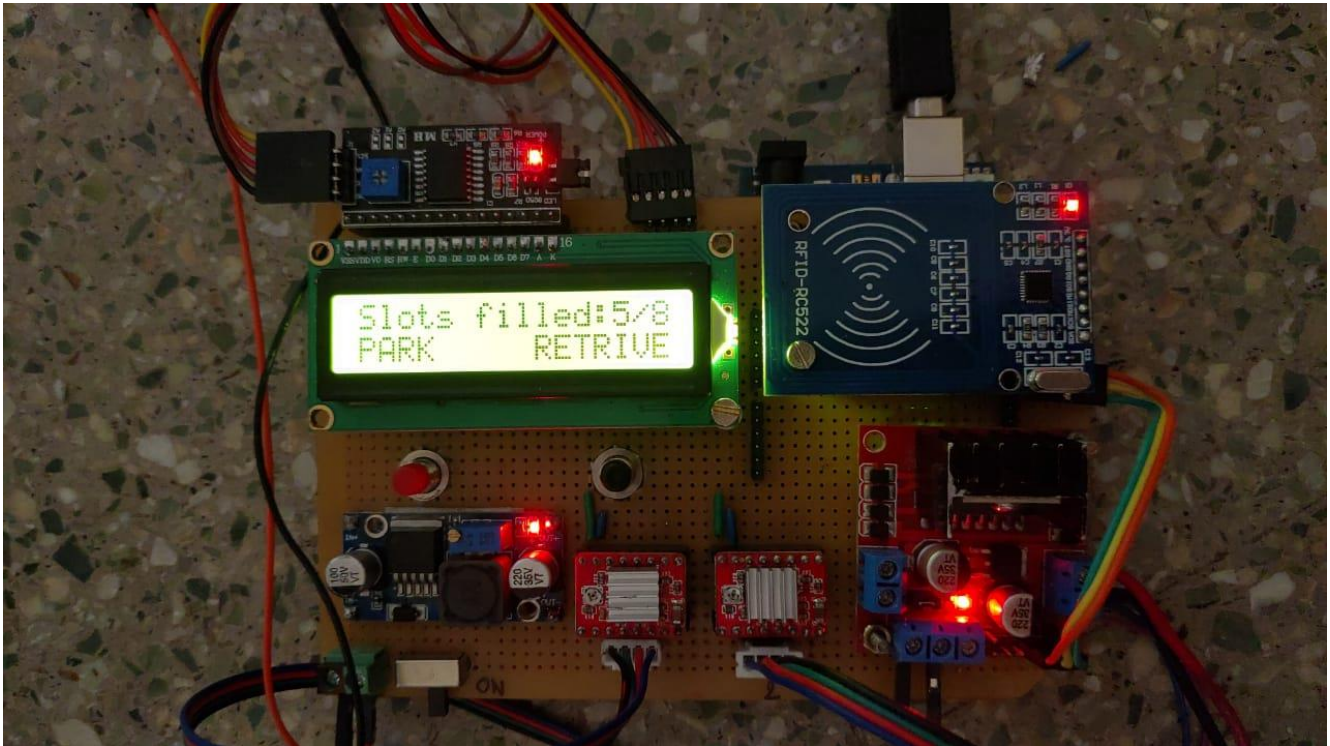
Hardware
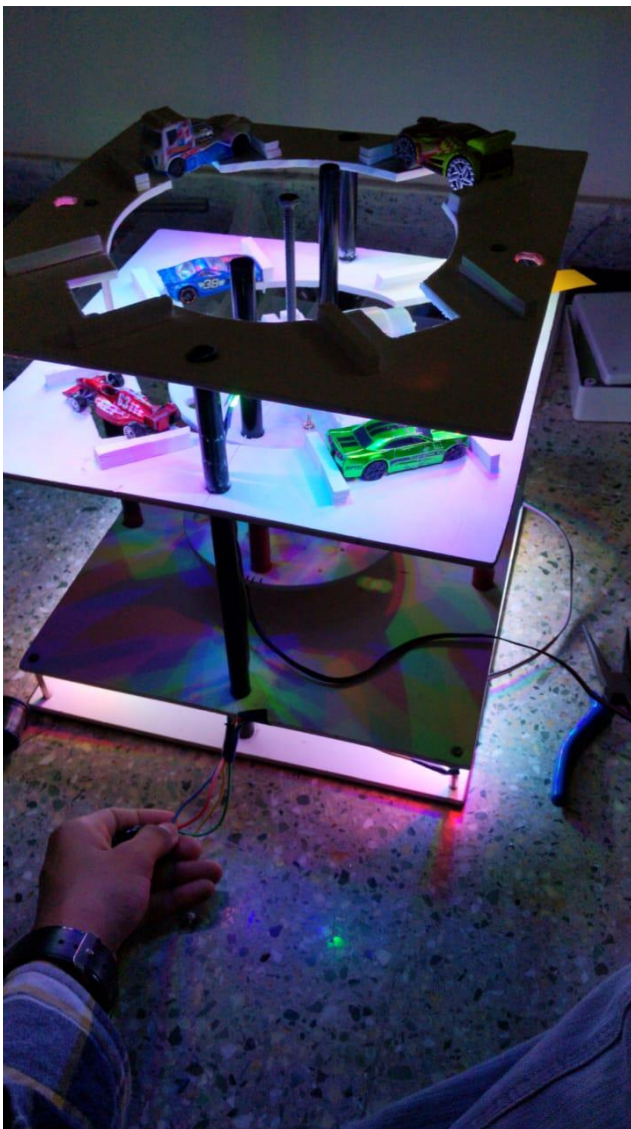
The Project Itself Features Different Parts. The Structure Is Made with Sun board and has Metal Spacers/Standoffs In Between Floors. The Entire Project

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Consists of Two Stepper Motors, A High Torque Motor and Other Small Mechanical Parts. The Electronic Components Involved Are Already Summed Up Above. Stepper Motor 1 Rotate the Entire Disc Whereas The Stepper Motor 2 Rotates The Linear Actuator Assembly. The High Torque Motor Rotates the Rack and Pinion Which Pushes And Retracts The Arm Forward And Backward.

Circuit Diagram

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PCB Assembly

All the Components Are Then Placed Strategically on a Perf Board and Soldered According to the Circuit Diagram

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Flow chart

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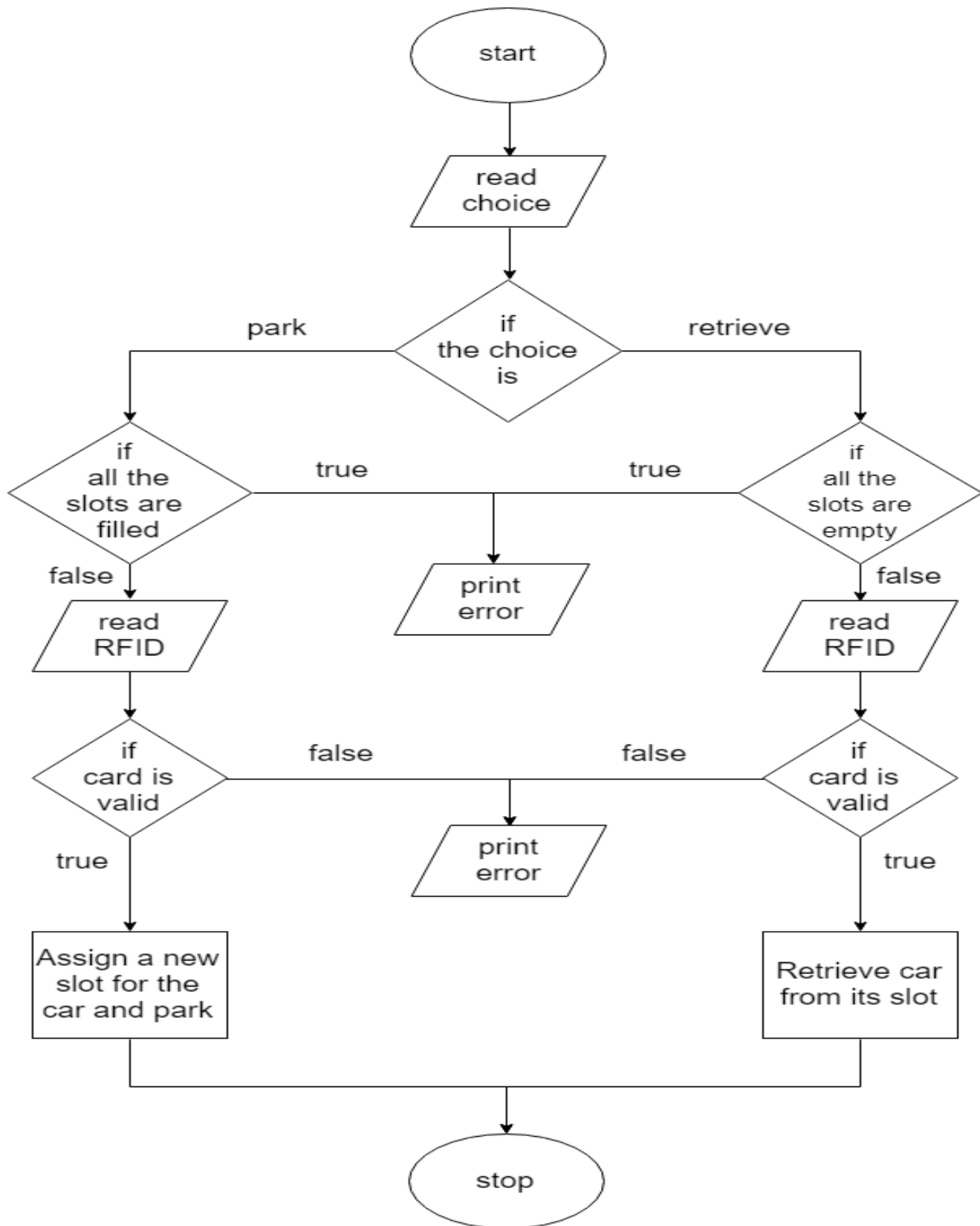
Conclusion

Automated car parking system is one of the most important factor in this modern world where finding a small place has become a big problem. Car parking system that is discussed here is automated without a Person that means if the driver leaves it at the starting of this system the elevator takes the car to the parking slot.

This Project Is Socially Beneficial as It Relives the Tension in Finding Parking Spots In the crowded of cities as this structure can be Placed/Built Underground Saving Space and storing a Peak Capacity of Cars.

It also Relives the Problem of Cutting Trees or Harming Nature to Make Mere Parking Spaces for Cars.

And It Mainly Avoids Situations Like These.

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