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RFID based EV Charging Station (Solar)

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Abstract: *An electric vehicle is a new and upcoming technology in the transportation and power sector that has many benefits in terms of economic and environmental. This study presents a comprehensive review and evaluation of various types of electric vehicles and their associated equipment in particular battery chargers and charging stations. A comparison is made on the commercial and prototype electric vehicles in terms of electric range, battery size, charger power, and charging time. The various types of charging stations and standards used for charging electric vehicles have been outlined and the impact of electric vehicle charging on utility distribution systems is also discussed.*

Keywords: Battery charger, charging station, electric vehicle, standards.

I. INTRODUCTION

1.1 Background

An electric vehicle charging station is equipment that connects an electric vehicle (EV) to a source of electricity to recharge electric cars, neighborhood electric vehicles and plug-in hybrids. Some charging stations have advanced features such as smart metering, cellular capability and network connectivity, while others are more basic. Charging stations are also called electric vehicle supply equipment (EVSE) and are provided in municipal parking locations by electric utility companies or at retail shopping centers by private companies. These stations provide special connectors that conform to the variety of electric charging connector standards. Fees for using EVSE vary from monthly or yearly flat rates to per-kWh to hourly rates. Charging stations can be free and are usually subsidized by the local government. Different types of EVSE provide different speeds of charging. Level 1 charging stations use a 120 volt (V), alternating-current (AC) plug and require a dedicated circuit, offering about 5 miles of range for every hour of charging. Level 2 stations charge through a 240V, AC plug and require home charging or public charging equipment to be installed. Level 2 stations provide 10 to 20 miles of range for every hour of charging. Level 2 chargers are the most common and charge at approximately the same rate as a home system. Level 3 chargers are also known as DC fast chargers. Level 3 uses a 480V, direct-current (DC) plug. They bypass the onboard charger and provide DC electricity to the battery via a special charging port. DC Fast Chargers provide up to 40 miles of range for every 10 minutes of charging but are not compatible with all vehicles. Additionally, some propriety charging stations, such as the Tesla Supercharger, are designed for significantly higher-speed charging. As demand grows for more publicly accessible charging stations, there is a greater need for equipment that supports faster charging at higher voltages and currents that are not currently available from residential ESVE. Globally, the number of electric vehicle networks is increasing to provide a system of publicly accessible charging stations for EV recharging. Governments, automakers and charging infrastructure providers have forged agreements to create these networks.

Theme

Energy in the form of electricity plays a very important role in our day to day life. Electricity is one of the greatest wonders of science. Next to man, it is the most important and revolutionary creation in this world of ours. The gradual but excessive use of electricity has come to bring about remarkable changes in industry. Computers as calculators sum up totals and make other calculations with the utmost accuracy. Newspapers and books are printed in millions overnight. There is not a single phase of human life that is not indebted to electricity for its progress. The modern age has, therefore, been truly called the "age of electricity."
The infrastructure element that provides the crucial link between an Electric Vehicle (EV) with a depleted battery and

the electrical source that will recharge those batteries is the Electric Vehicle Supply Equipment or EVSE.

1.3 Problem Statement

The aim of RFID based EV Charging station is that, the system exploits opportunities of connectivity to computation capabilities of big data (because we are using google sheet for store the information). Firstly, a source data to support defining use cases that represent driving patterns and functionality. Second, connection to big data and computation capabilities in cloud enables optimizing the EV energy which leads to a reliable range prediction, eco-driving, eco-routing as well as novel functionalities like smart fast charging and assured charging.

II. LITERATURE REVIEW

In recent years, Electric vehicles (EV) are receiving significant attention as an environmental-sustainable and cost-effective substitute of vehicles with internal combustion engine (ICE), for the solution of the dependence from fossil fuels and for the saving of Green-House Gasses (GHG) emission. In this framework, different standards for EVs charging systems have been explored by several organizations around the world. For defining them, organizations consider the safety, the reliability, the durability, the rated power and the cost of the different charging methods. The charging equipment for EVs plays a critical role in their development, grid integration and daily use: a charging station generally includes charge cord, charge stand, attachment plug, and power outlet and vehicle connector and protection system. The configuration of the charging station can vary from Country to Country depending on frequency, voltage, electrical grid connection and standards. In any case, charging time and lifetime of an EV's battery are linked to the characteristics of the charger that first must guarantee a suitable charge of the battery. Then a good charger should be efficient and reliable, with high power density, low cost and low volume and weight. After a complete overview on different types of EV charging stations and a comparison between the related European and American Standards, the paper includes a summary on possible types of Energy Storage Systems (ESSs) and possible layout of charging stations including them. ESSs can become fundamental for the integration in smart grids of EV fast charging stations of the last generation: in this case the storage can have peak shaving and power quality functions and also to make the charge time shorter. From this brief analysis, it is possible to conclude that a good ESS for the coupling fast EV charging stations can be considered a system including batteries and ultra-capacitors: the first are suitable for their high energy densities and the second for their high power density. About the integration of ESSs, another important issue investigated is the way of integration in terms of electrical scheme. Two possibilities have been found in literature, based on an AC-bus configuration and DC-bus configuration. The AC-bus scheme is generally preferred, because the AC components have well defined standards, and AC technologies and products are already available in the market. However, DC-bus based system provides a more convenient way to integrate renewable energy sources and also higher energy efficiency thanks the inferior number of conversion stages.[1]

In paper [2], the fast charging of electronic vehicle is explained. The versatile converter topology is based on the concept of the power electronic transformer. For the direct transformer-less coupling to the medium-voltage grid, a cascaded H-bridge (CHB) converter is utilized. On the level of each sub module, integrated split battery energy storage elements play the role of power buffers, reducing thus the influence of the charging station on the distribution grid. The power interface between the stationary split storage stage and the EV batteries is performed through the use of parallel-connected dual-half-bridge dc/dc converters, shifting the isolation requirements to the medium-frequency range. By choosing several different sub module configurations for the parallel connection, a multiport output concept is achieved, implying the ability to charge several EVs simultaneously without the use of additional high-power chargers.

A four-stage intelligent optimization and control algorithm for an electric vehicle (EV) bidirectional charging station equipped with photovoltaic generation and fixed battery energy storage and integrated with a commercial building is proposed in this paper. The proposed algorithm aims at maximally reducing the customer satisfaction-involved operational cost considering the potential uncertainties, while balancing the real-time supply and demand by adjusting the optimally scheduled charging/discharging of EV mobile/local battery storage, grid supply, and deferrable load. [3]

In paper [4] the power electronics aspects of the EV charging station is discussed. The paper [5] discusses a model of charging station for fast DC charging is proposed. A DC bus is realized using grid connection through an AC/DC converter. The converter is so designed that near to unity power factor operation is obtained and minimum line current

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harmonics are drawn. Good performance is observed with change in load. Results show a proper dynamic behavior of the DC bus voltage, the battery voltage, and the battery current. The line current harmonics are greatly reduced by the use of proposed control technique. Electric vehicles (EVs) have been considered to be a key technology to cut down the massive greenhouse gas emissions from the transportation sector, and they are also expected to mitigate the fossil fuels scarcity problem. Thanks to the policies and plans for promoting EVs from the regions and countries worldwide (e.g., the sales of EVs including PHEVs in US will reach 50% of total sales of mobile vehicles by 2030, and Europe has the similar targets), the amount of EVs is expected to reach a sizable market share in the next decade.[6]

III. METHODOLOGY

3.1 Introduction

Energy in the form of electricity plays a very important role in our day to day life. Electricity is one of the greatest wonders of science. Next to man, it is the most important and revolutionary creation in this world of ours. The gradual but excessive use of electricity has come to bring about remarkable changes in industry. Computers as calculators sum up totals and make other calculations with the utmost accuracy. Newspapers and books are printed in millions overnight. There is not a single phase of human life that is not indebted to electricity for its progress. The modern age has, therefore, been truly called the "age of electricity." The infrastructure element that provides the crucial link between an Electric Vehicle (EV) with a depleted battery and the electrical source that will recharge those batteries is the Electric Vehicle Supply Equipment or EVSE.

3.2 System Architecture

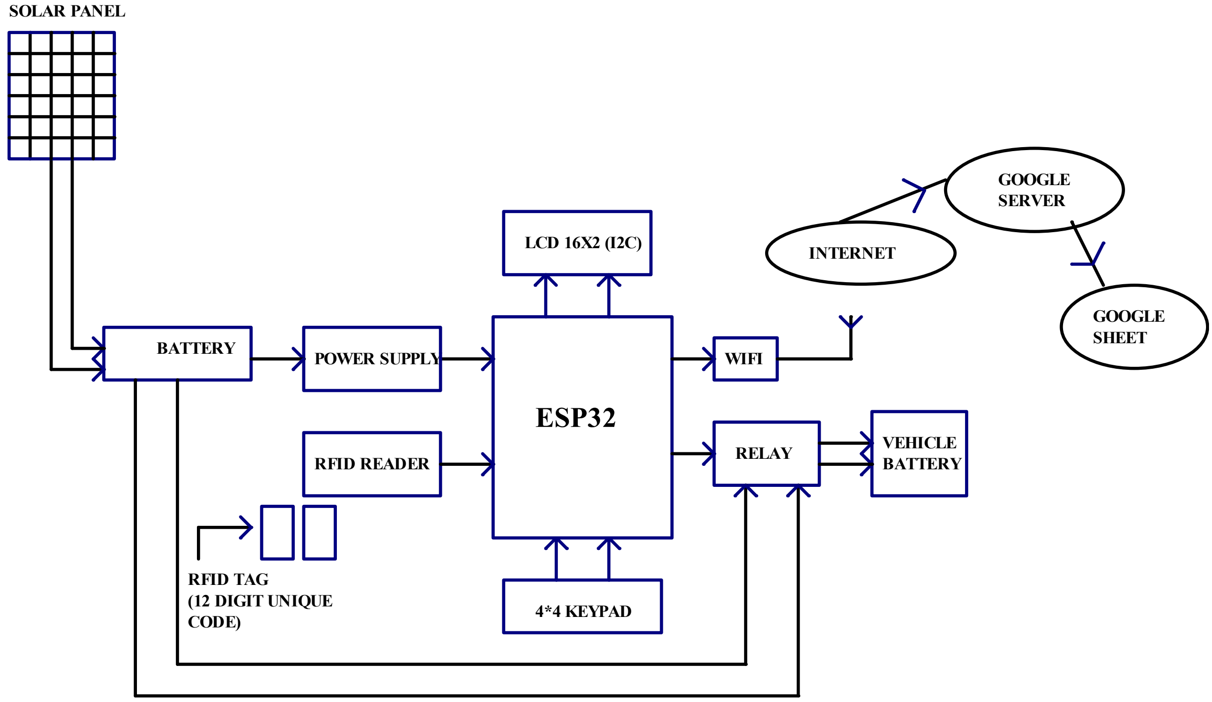

Figure 1: Block Diagram

3.3 Working

The prototype of EV charging station is proposed such that it uses the renewable energy (Solar Energy). An electrical vehicle battery recharging system composed of photovoltaic solar panel connected to the electrical power grid. With the help of Solar panel, energy will be stored into the battery. Here we are providing RFID card to each customer with which customer can access petrol at the charging stations. Before using this card we have to recharge it like a prepaid card. Whenever we want to charge the vehicle battery, just we have to enter required amount and place the RFID card near the RFID reader. Then microcontroller reads the data from the RFID reader and performs the action according to the customer. This system also provides the security for the customers for vehicle battery charging at the EV charging stations by avoiding the involvement of human beings, so to avoid the risk of carrying money every time and charge the battery on hours basis as well whenever required. All the data is display on OLED and saved in Google sheet. When vehicle is parked at the charging station, vehicle battery will be charged by charging station battery.

3.4 System Design

Overall system design involves following steps:

- Power Supply Design
- Interfacing various modules to micro-controller
- PCB designing

Let's focus on the steps one by one:

A. Power Supply

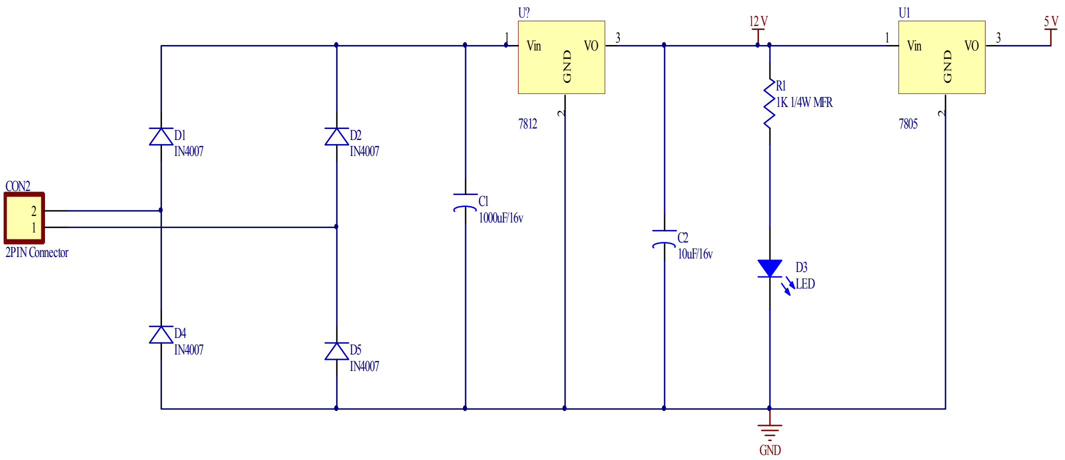

Figure 3.2: Power Supply

The following information must be available to the designer of the transformer.

- Power output
- Operating voltage
- Frequency range
- Efficiency and regulation

Size of core is one of the first consideration in regard of weight and volume of a transformer. This depends on type of core and winding configuration used. Generally following formula is used to find Area or Size of the Core.

$$Ai = \sqrt{Wp} / 0.87$$

Where Ai = Area of cross section in square cm.

Wp = Primary Wattage.

For our project we require +5V output, so transformer secondary winding rating is 9V, 500mA.

So secondary power wattage is,

$$P2 = 9 * 500mA$$
$$= 4.5 Watt$$

So, $Ai = \sqrt{4.5} / 0.87 = 2.43$

Generally 10% of area should be added to the core.

So, $Ai = 2.673$

a) Turns per volt:- Turns per volt of transformer are given by relation.

$$\text{Turns per volt} = 100000 / 4.44\, f * Bm * Ai$$

Where, F = Frequency in Hz.

Bm = Density in Wb / Square meter.

Ai = Net area of the cross section.

Following table gives the value of turns per volt for 50 Hz frequency.

Flux density 0.76 Wb /sq m	1.14	1.01	0.91	0.83
Turns per Volt 45 / Ai	40 / Ai	45 / Ai	50 / Ai	55 / Ai

Generally lower the flux density better the quality of transformer. For our project we have taken the turns per volt is 0.91 Wb / sq.m from above table.

Turns per volt = 50 / Ai

= 50 / 2.673

= 18.7055

Thus the turns for the primary winding is,

230 * 18.7055 = 4302.265

And for secondary winding,

9 * 18.7055 =168.3495

b) Wire Size :- As stated above the size is depends upon the current to be carried out by winding which depends upon current density. For our transformer one tie can safely use current density of 3.1 Amp / sq.mm.

for less copper loss 1.6Amp/sq.mm or 2.4sq.mm may be used generally even size gauge of wire are used.

R.M.S secondary voltage at secondary to transformer is 9V. so maximum voltage Vm(Vp) across secondary is

VP = Vrms x√2

Vrms =VP / √2

= 9 / 1.141

= 7.88

D.C output voltage Vm across secondary is,

Vdc = 2 * 7.88/pi

= 2 * 7.88/3.14

= 5.02 V

P.I.V rating of each diode is

PIV = 2Vdc

= 2 * 5.02

= 10.04 V

Maximum forward current, which flow from each diode is 500 mA. So from above parameter, we select diode 1N4007 from the diode selection manual.

B) Design of Filter Capacitor

Formula for calculating filter capacitor is

C = ¼ √ 3 r * F * R1

Where, r = ripple present at output of rectifier, which is maximum 0.1 for full wave rectifier.

F = frequency of AC main.

R1 = input impedance of voltage regulator IC

C = 1/(4 *(√ 3 * 0.1 * 50 * 28))

= 1030 µf

= 1000 uF

Voltage rating of filter capacitor should be greater than the i/p Vdc i.e. rectifier output which is 5.02 V so we choose 1000µf / 25V filter capacitor.

B. PCB Design

Printed circuit boards may be covered in two topics; technology and design. Printed circuit boards are called PCB in short. Printed circuit consists of conductive circuit pattern applied to one or both sides of an insulation base, depending upon that ,it is called single side PCB or double sided PCB(SSB and DSB).Conductor materials like silver, brass, aluminum and copper are most widely used. The thickness of the conducting material depends upon the current carrying capacity of circuit. Thus a thicker copper layer will have more current carrying capacity.

The printed circuit board usually serves three distinct functions:

1. It provides mechanical support for the components mounted on it.
2. It provides necessary electrical interconnections.
3. It acts as a heat sink that is it provides a conduction path leading to removal of most of the heat generated in the circuit.

Manufacturing process of printed circuit board:

The conductor pattern which is on the master film is transferred on copper clad laminate by two methods:

1. Photo resist printing
2. Screen printing.

Photo Resist Printing

Photopolymer resist is a light sensitive organic material like KPR (Kodak Photo Resist) which is applied to the board as thin film. The photo resist when exposed to ultraviolet light hardens or polymerizes. Once it is polymerized, it becomes insoluble to certain chemical solvents known as developers.

The developer dissolves the portion which is masked or which is not exposed to light. Thus the pattern that is to be drawn on PCB is derived from the artwork which is photographic process. This is transferred to a master film on 1:1 scale. This can be reduced to any small size thus miniaturization is possible. The pattern is transferred to a mask. This mask is kept on PCB. The whole process is known as Image Transfer.

The unpolymerized or masked portion is washed away in developer leaving wanted copper pattern on board KPR or photo resist is then removed.

Requirements of photo resists:

- It should have good resolution and light sensitivity.
- It should be resistant to developers which are used to remove unwanted copper.
- It should have possibility to strip after unwanted copper is removed.
- Its cost must be less.

Photo resist is normally applied by:

- Flow coating OR
- Roller coating OR
- Dip coating OR
- Spraying

Screen Printing

This technique is similar to the one used in printing industry. The copper foil is covered with printing ink where the conducting paths are going to be. The screen which is used for pattern is of either stainless steel or polymer mesh which is dimensionally accurate and fine mesh. The open meshes of screen correspond to the pattern.

PCB is placed under the screen. Printing ink is placed at one end of the screen, and by means of a rubber squeegee it is pushed through open meshes. Printed circuit board is then removed for drying. After drying board is washed in ferric chloride which acts as etchant. Etching is chemical process by which unwanted copper is removed. The portion which is covered by ink is not removed, that is the pattern remains intact. Later ink stripping is done with trichloroethylene.

Protection of Copper Tracks

Copper when exposed to atmosphere for a long time gets tarnished and problems arise at the time of soldering. The tracks can be protected by applying lacquer or varnish depending upon the thickness of the track. Copper is also protected by plating. There are three methods of plating.

1. Immersion plating
2. Electro less plating
3. Electroplating

Immersion plating utilizes tin and its alloys and gold. It is done by chemical replacement from coating material salt solution. This method is simple and less costly. In electro less copper coating electric current is not used. Instead, a chemical reducing agent is used which supplies electrons for reaction in which copper is reduced from its ionic state. In electroplating, a DC current is passed between two electrodes, and a thin coating is deposited on cathode when immersed in electrolyte.

Etching:

Removal of unwanted copper, to give final copper pattern is known as etching. Solutions which are used in etching are known as etchants.

1. Ferric chloride
2. Cupric chloride
3. Chromic acid
4. Alkaline ammonia

Out of these chemicals, ferric chloride is widely used because it has short etching time and it can be stored for a longer time. Rinsing follows etching.

Solders and Soldering Techniques

Solders are special alloys which are used to get either a mechanically strong joint or electric joint of low contact resistance. Solders have low melting points compared to metals to be joined. Therefore when solder is heated, molten solder wets the metal, spreads and joints. Any contamination on the surface of the metal to be joined acts as a paired and hampers the action of wetting. Solders are divided into two groups, soft and hard. Soft solders have lower melting point and lower tensile strength. Soft solders are largely tin lead alloys and silver based compositions. Fluxes are auxiliary materials used while soldering is done.

1. They dissolve and remove oxides and contaminants from surface of metals to be soldered.
2. They protect the metal surface and molten solder from oxidation.
3. They reduce the surface tension of molten solder.
4. They improve the ability of solder to wet the metal.

1. Active or acid fluxes: they are prepared on the basis of active substances, such as hydrochloric acid, chlorides and fluorides of metals, etc. these fluxes intensively dissolve oxide films on the metal surface and thus make for better adhesion of the solder to the base metal, the residue must be thoroughly removed after soldering. Active fluxes are not used in soldering the circuit wires of radio devices.
2. Acid –free fluxes: these are rosin and rosin base material with the addition of inaction substances such as alcohol and glycerin.
3. Activated fluxes: these include rosin base fluxes containing activating agents in small quantities, such as hydrochlorides and phosphates of aniline, salicylic acid and hydrochlorides of diethyl amine. A high activity of some of these fluxes makes the preliminary removal of oxides after degreasing unnecessary.

3.5 Software Requirements

Sr. No	Software Name	Description
1	Arduino IDE	For programming on ESP-32 Microcontroller
2	OrCAD	To designing purpose

3	Altiun	For PCB designing
4	Proteus	For simulation purpose

Table 3.1: Software Requirements

A. Arduino IDE

The open source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. For microcontroller ESP32 we are going to use Arduino IDE with embedded C programming language.

B. OrCAD 9.1

The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics, perform mixed-signal simulation and electronic prints for manufacturing printed circuit boards. For development of software schematics and simulation we will use OrCAD.

C. Altium 6.0

Altium Designer is a PCB and electronic design automation software package for printed circuit boards. It is developed by Australian software company Altium Limited. For PCB designing we are going to use Altium.

D. Proteus

Proteus design Suite by Labcenter Electronics, leading EDA software including schematic capture, advanced simulation, PCB autorouting, MCAD integration. Power supply design is prepared in Proteus and various signals are captured prior to actual system development.

3.6 Hardware Requirements

Sr. No	Hardware Name	Description
1	ESP -32 Microcontroller	It will use as microcontroller
2	RFID Tags	It will store the information along with tags
3	Solar Panel	It will store the energy of Solar
4	RFID Reader	To read the information provided by RFID Tags
5	LCD with I2C module	To display the result
6	Keypad	For enrolling the new person with the system

Table 3.2: Hardware Requirements

A. ESP 32 micro-controller

This is the latest generation of ESP32 IoT development module. This development board breaks out all ESP32 modules pins into 0.1" header and also provides a 3.3 Volt power regulator, Reset and programming button and an onboard CP2102 USB to TTL converter for programming directly via USB port. At the core of this module is the ESP32 chip, which is designed to be scalable and adaptive. ESP32 integrates a rich set of peripherals, ranging from capacitive touch sensors, Hall sensors, low-noise sense amplifiers; SD card interface, Ethernet, high-speed SDIO/SPI, UART, and I²C.Using Bluetooth, users can connect to their phone or broadcast low energy beacons for its detection. The use of Wi-Fi enables a large physical range, as well as a direct connection to the internet via a Wi-Fi router. Perfect for wearable electronic or battery powered applications, the ESP32 chip uses less than 5µA.

Figure 3.3: NodeMCU

B. RFID Tags

This basic RFID tag works in the 125 kHz RF range and comes with a unique 32-bit ID. It is not re-programmable. This blank, smooth, and mildly flexible RFID tag is ready for your logo.

Figure 3.4 RFID Tags

Features of RFID:

- EM4001 ISO based RFID IC
- 125kHz Carrier
- 2kbps ASK
- Manchester encoding
- 32-bit unique ID
- 64-bit data stream [Header+ID+Data+Parity]

C. Solar Panel

Figure 3.5: Solar Panel

Features of Solar Panel:

- Voltage : 12 Volts
- Current : 0.4167 Amp
- Power : 5 Watt
- Size : 29 cm x 18.5 cm x 1.7 cm

D. RFID Reader

RC522-AN module uses Philips MFRC522 original chip design circuit card reader, easy to use, low cost, suitable for equipment development, the development of advanced applications reader users, the need for RF card terminal design / production users. This module can be directly loaded into the variety of reader molds. Module uses voltage of 3.3V, simple few lines through the SPI interface directly with any user CPU board is connected to the communication module can guarantee stable and reliable work, reader distance.

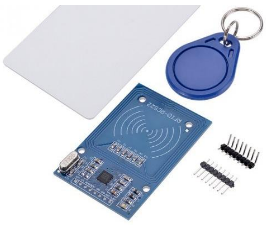

Figure 3.6: RFID Reader

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Specification of RF522 Mifare Reader/Writer

- Module Name : MFRC522-ED
- Working current : 13—26mA/ DC 3.3V
- Standby current : 10-13mA/DC 3.3V
- sleeping current : <80uA
- peak current : <30mA
- Working frequency : 13.56MHz
- Card reading distance : 0～60mm（mifare1 card）
- Protocol : SPI
- data communication speed : Maximum 10Mbit/s Card types supported: mifare1 S50、mifare1 S70、mifare Ultra Light, mifare Pro, mifare Desfire
- Dimension : 40mm×60mm
- Working temperature : -20—80 degree
- Storage temperature : -40—85 degree
- Humidity : relevant humidity 5%—95%
- Max SPI speed : 10Mbit/s

E. LCD Display with I2C Module

This board has a PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display. The I2C address is 0x3F by default, but this can be changed via 3 solder jumpers provided on the board. This allows up to 3 LCD displays to be controlled via a single I2C bus (giving each one it's own address).

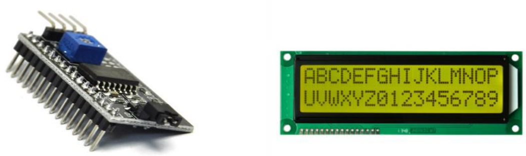

Figure 3.7: LCD Display with I2C Module

Features of I2C Module for 16X2 LCD:

- 5V power supply
- Serial I2C control of LCD display using PCF8574
- Back-light can be enabled or disabled via a jumper on the board
- Contrast control via a potentiometer
- Can have 8 modules on a single I2C bus (change address via solder jumpers)address, allowing
- Size : 41.6mm x 19.2mm

F. Keypad

Figure 3.8: Keypad

Features of keypad:

- This is a Low cost 4X3 Matrix Keypad with 12 Membrane Switches

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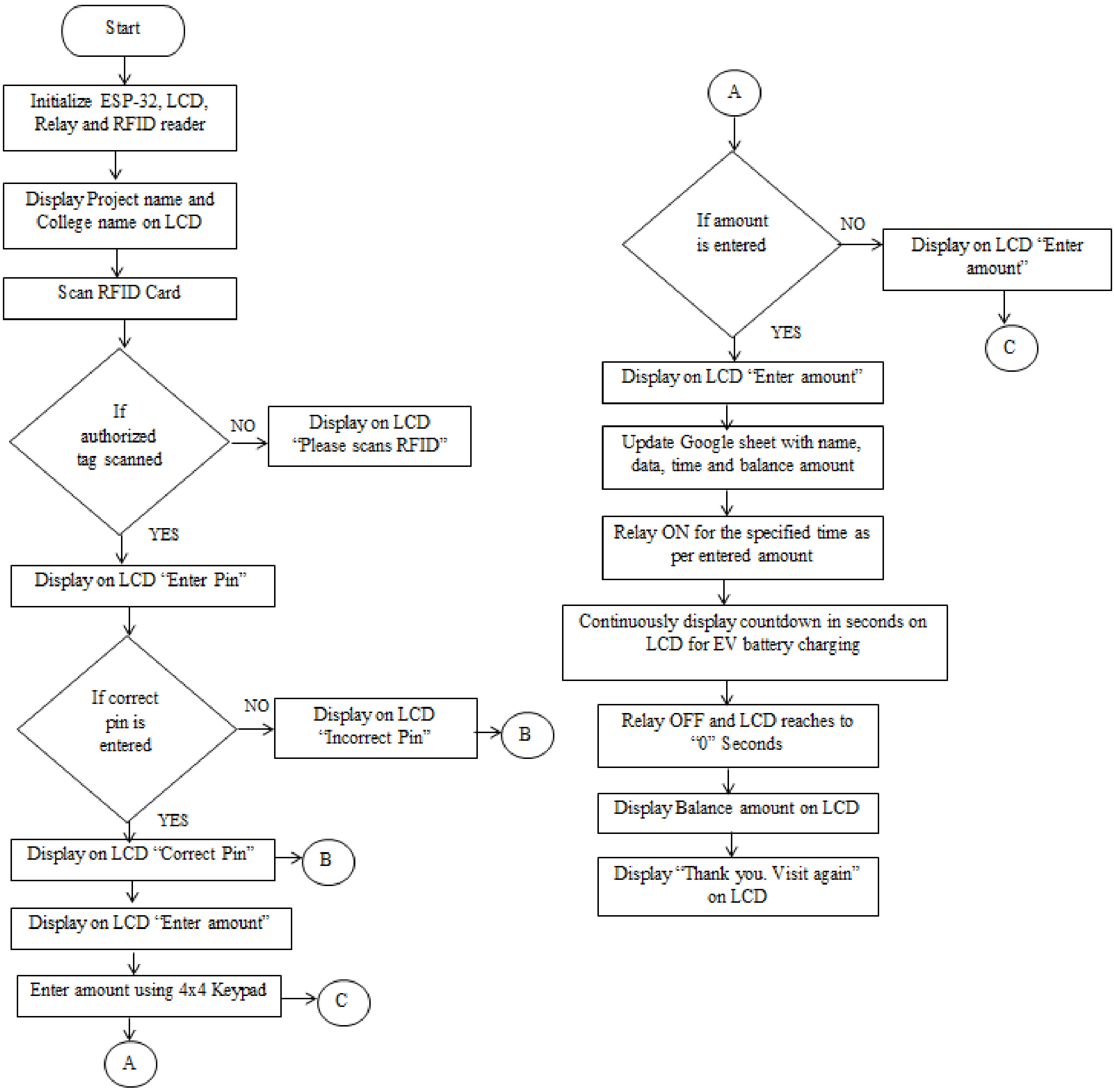
- 4 x 3 Matrix Membrane Keypad
- 7 pin connector
- Adhesive mounting (sticker on the back side)
- Operation Temperature: 0 to +60 centigrade
- Humidity: 40 centigrade, 90%-95%, 240 hours
- Fexible Circuit Length: Approx. 3.3 inch / 83 mm

RFID Reader will read the RFID Tags for the specific person Identification. The signal goes to ESP32 microcontroller and LCD Display 16 X 2 will display the code assigned to the RFID Tag. The entry of this event occurred is done in the Google sheet through wi-fi connectivity of ESP32 microcontroller. For prototype we have kept Rs 1/- deduction for each second of charging at the station.

3.7 Flowchart



IV. EXPERIMENTAL ANALYSIS

The experimental analysis is based on charging infrastructure, it provides an overview of optimization metrics such as: Minimizing various chagrining infrastructure cost type, minimizing total travel time, minimizing trip failure, maximizing flow captured, maximizing covered demand, maximizing chagrining post usage, minimizing number of charging stations and grid management. The main objectives are to maximizing chagrining point usage and minimizing the number of charging points, while maximally covering the demand.

The charging station with energy storage has some notable synergies with benefits to both the charger user and operators. The energy storage can buffer and localize solar electricity. The charging system with intelligent energy management can localize power electricity for energy vehicle charging and eliminate the energy vehicle charging power demand from the grid and shift battery reloading into off peak period if needed. The power electricity, energy vehicle charging load, the grid electricity consumption and the electricity fed back to the grid are integrated to evaluate the energy between the system and the utility grid.

Energy vehicle charging load forecasting or predicting is extremely important for the economic operation and optimum control of solar powered battery buffered energy charging station. The battery target solar based charging station is optimized on estimated power electricity and energy vehicle charging load. Disparate other battery buffered charging station, in which the battery is fully replenished during off-peak hours; the battery in the present system is recharged only if the battery of solar energy is less than the optimal target solar energy at night. This approach will optimize the usage of energy storage and minimize energy exchange with the grid.

The intelligent energy management strategy is best suited for charging station systems having one large energy storage battery and multiple charging outlets.

V. RESULTS AND DISCUSSION

Stepwise photos of hardware using LCD while processing for EV charging

Hardware Parts

Solar Panel

Front Side

Back Side

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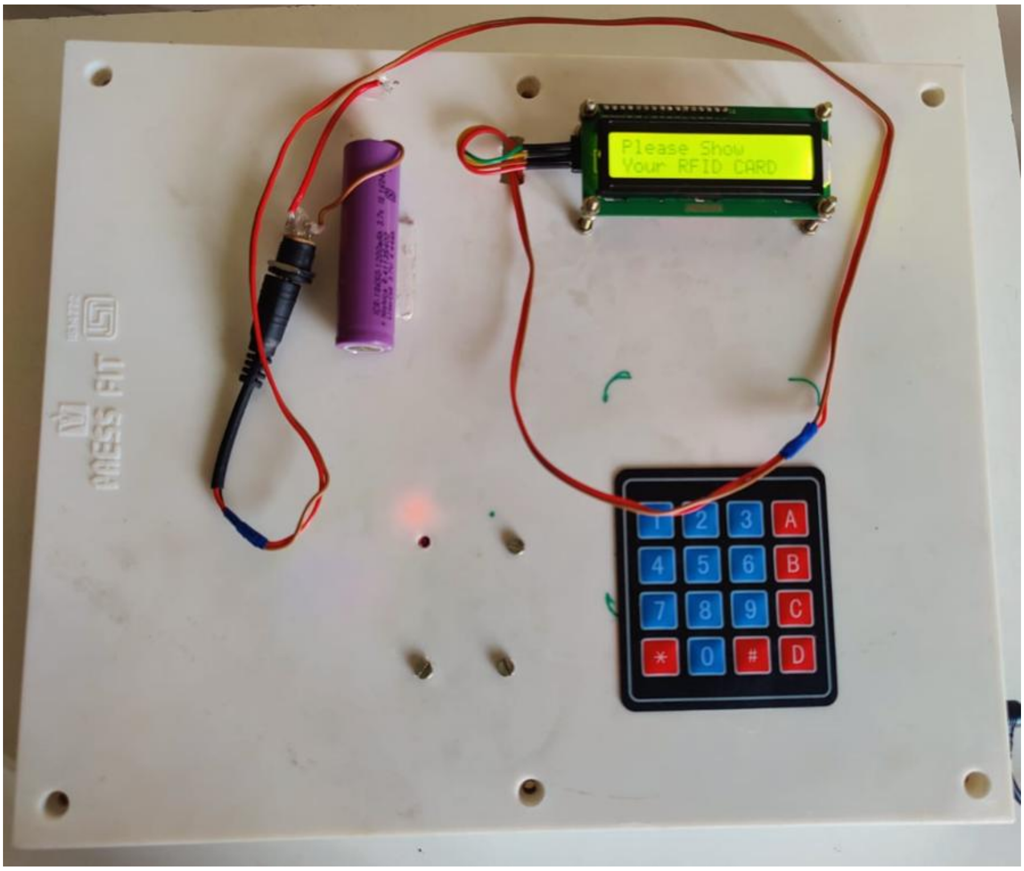
RFID With RFID Tag

First step, Show the RFID



If any car need to charge then first they need to pay amount and for the transaction they need to insert unique pin with the help of keypad

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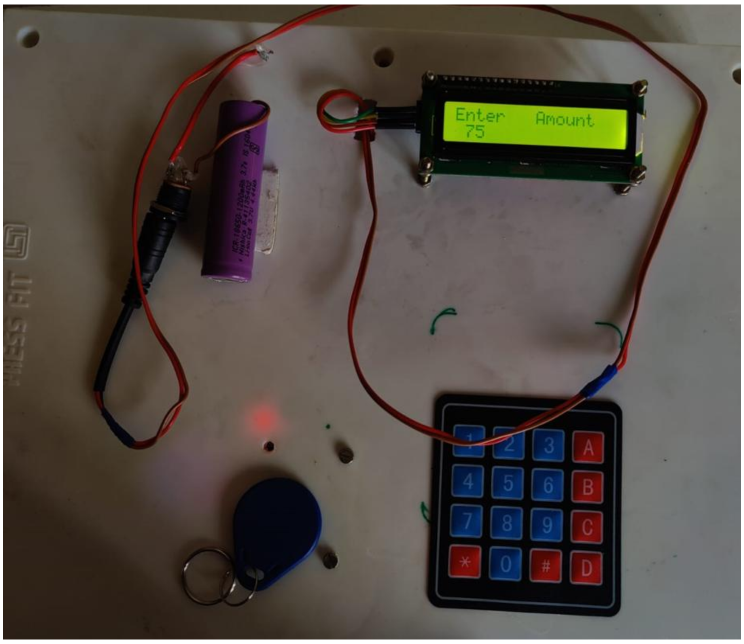
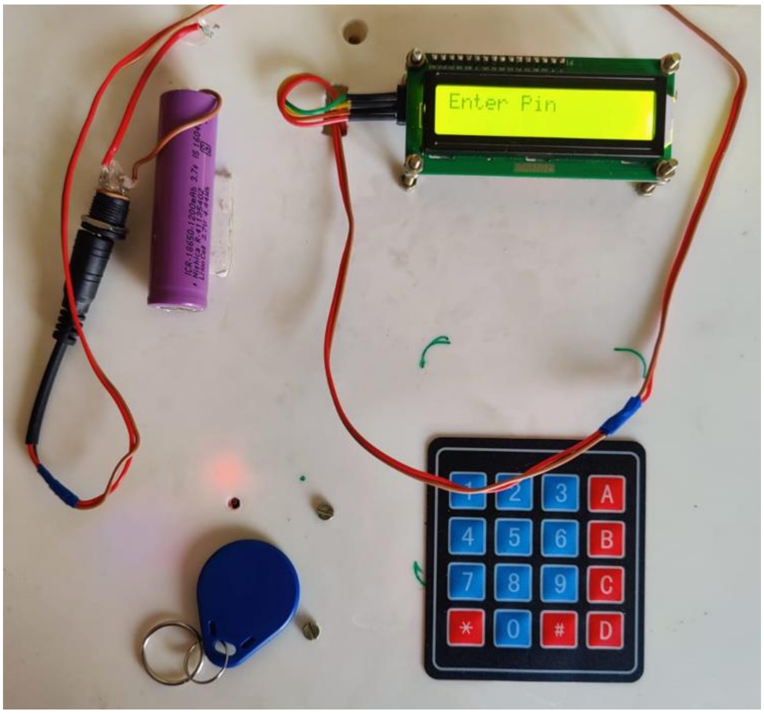
Enter the amount for pay the charging bill



Once you enter amount then next step is to enter the pin then system will check the pin is valid or not for verification purpose.



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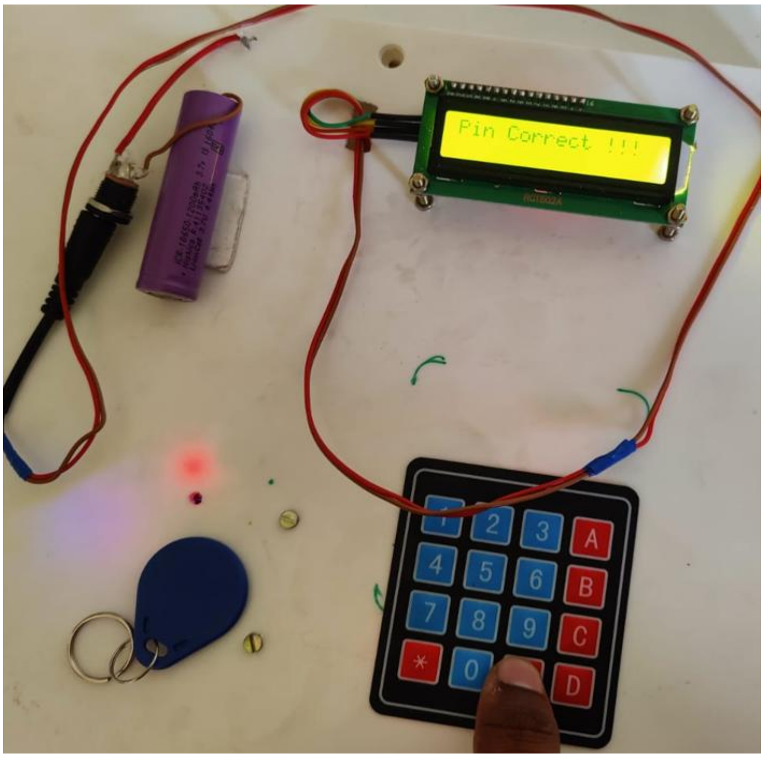
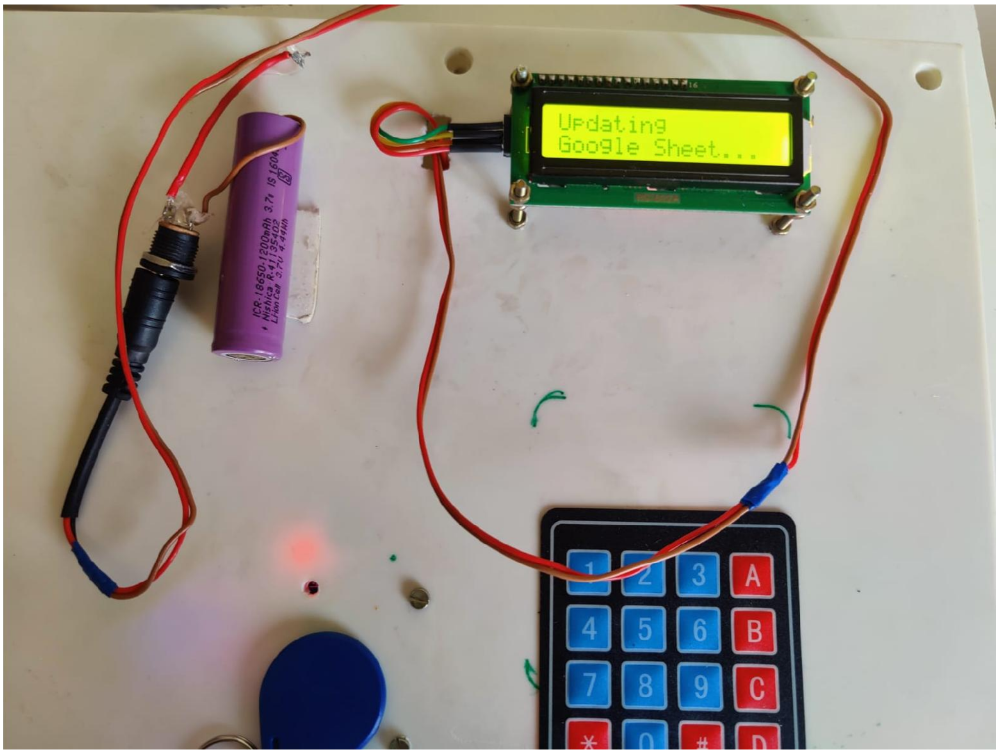


After transaction completed, it will automatically update the balance sheet of Google sheet and balance amount will show in LCD as well as in Google sheet

Update message show in LCD



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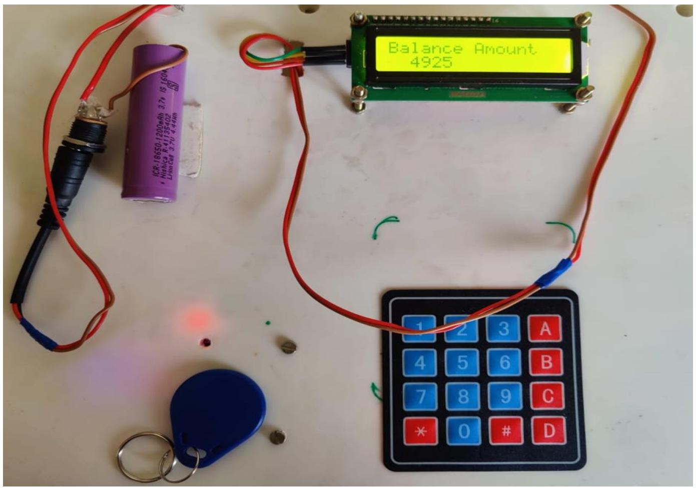
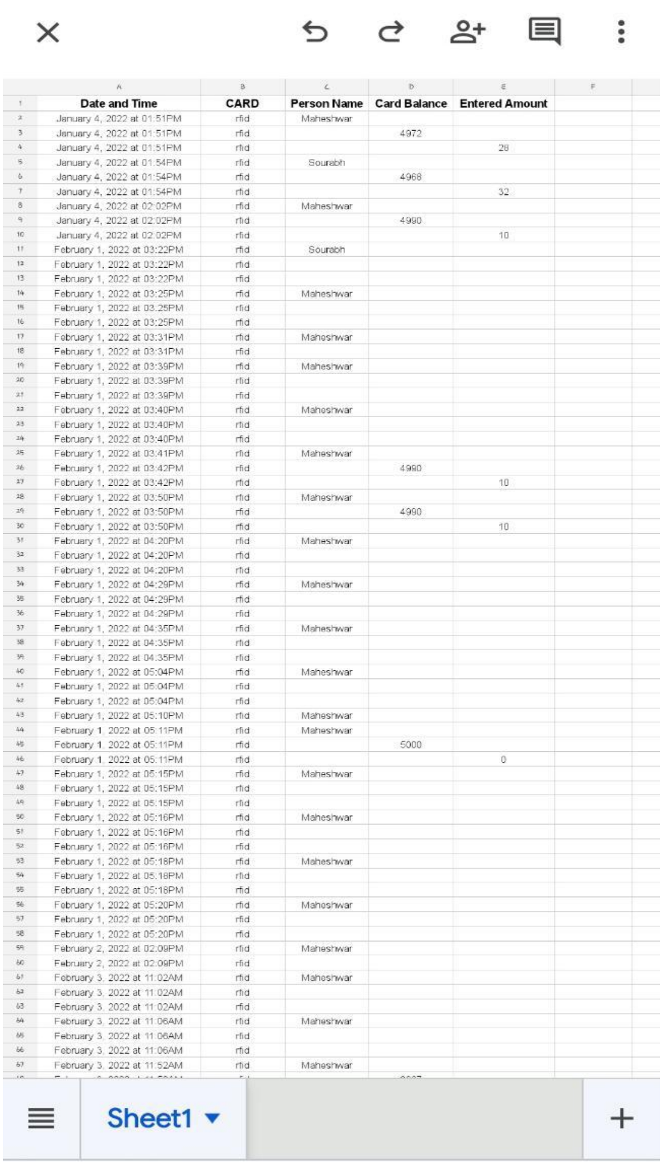
Balance amount show in LCD



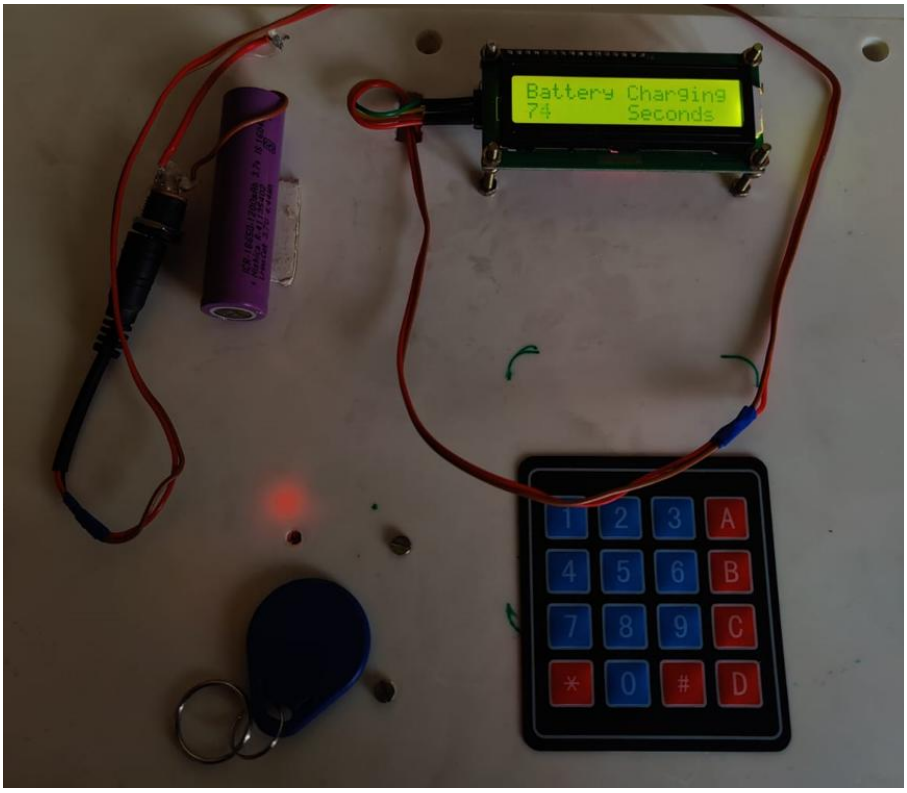
Google Sheet Results



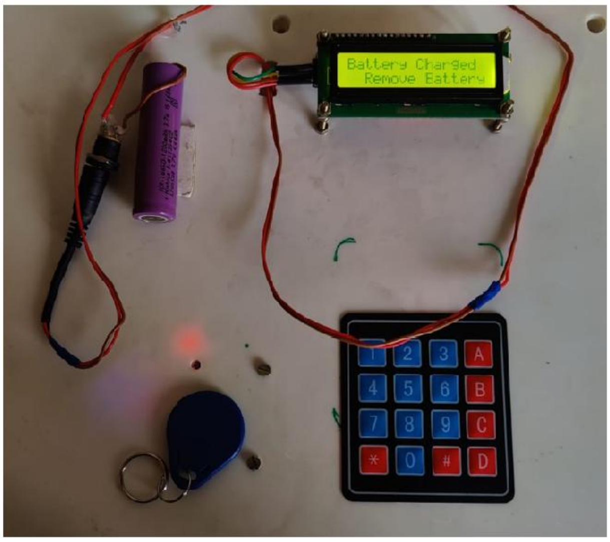
	Date and Time	CARD	Person Name	Card Balance	Entered Amount	
2	January 4, 2022 at 01:51PM	rfid	Maheshwar			
3	January 4, 2022 at 01:51PM	rfid		4972		
4	January 4, 2022 at 01:51PM	rfid			28	
5	January 4, 2022 at 01:54PM	rfid	Sourabh			
6	January 4, 2022 at 01:54PM	rfid		4968		
7	January 4, 2022 at 01:54PM	rfid			32	
8	January 4, 2022 at 02:02PM	rfid	Maheshwar			
9	January 4, 2022 at 02:02PM	rfid		4990		
10	January 4, 2022 at 02:02PM	rfid			10	
11	February 1, 2022 at 03:22PM	rfid	Sourabh			
12	February 1, 2022 at 03:22PM	rfid				
13	February 1, 2022 at 03:22PM	rfid				
14	February 1, 2022 at 03:25PM	rfid	Maheshwar			
15	February 1, 2022 at 03:25PM	rfid				
16	February 1, 2022 at 03:25PM	rfid				
17	February 1, 2022 at 03:31PM	rfid	Maheshwar			
18	February 1, 2022 at 03:31PM	rfid				
19	February 1, 2022 at 03:39PM	rfid	Maheshwar			
20	February 1, 2022 at 03:39PM	rfid				
21	February 1, 2022 at 03:39PM	rfid				
22	February 1, 2022 at 03:40PM	rfid	Maheshwar			
23	February 1, 2022 at 03:40PM	rfid				
24	February 1, 2022 at 03:40PM	rfid				
25	February 1, 2022 at 03:41PM	rfid	Maheshwar			
26	February 1, 2022 at 03:42PM	rfid		4990		
27	February 1, 2022 at 03:42PM	rfid			10	
28	February 1, 2022 at 03:50PM	rfid	Maheshwar			
29	February 1, 2022 at 03:50PM	rfid		4990		
30	February 1, 2022 at 03:50PM	rfid			10	
31	February 1, 2022 at 04:20PM	rfid	Maheshwar			
32	February 1, 2022 at 04:20PM	rfid				
33	February 1, 2022 at 04:20PM	rfid				
34	February 1, 2022 at 04:29PM	rfid	Maheshwar			
35	February 1, 2022 at 04:29PM	rfid				
36	February 1, 2022 at 04:29PM	rfid				
37	February 1, 2022 at 04:35PM	rfid	Maheshwar			
38	February 1, 2022 at 04:35PM	rfid				
39	February 1, 2022 at 04:35PM	rfid				
40	February 1, 2022 at 05:04PM	rfid	Maheshwar			
41	February 1, 2022 at 05:04PM	rfid				
42	February 1, 2022 at 05:04PM	rfid				
43	February 1, 2022 at 05:10PM	rfid	Maheshwar			
44	February 1, 2022 at 05:11PM	rfid	Maheshwar			
45	February 1, 2022 at 05:11PM	rfid		5000		
46	February 1, 2022 at 05:11PM	rfid			0	
47	February 1, 2022 at 05:15PM	rfid	Maheshwar			
48	February 1, 2022 at 05:15PM	rfid				
49	February 1, 2022 at 05:15PM	rfid				
50	February 1, 2022 at 05:16PM	rfid	Maheshwar			
51	February 1, 2022 at 05:16PM	rfid				
52	February 1, 2022 at 05:16PM	rfid				
53	February 1, 2022 at 05:18PM	rfid	Maheshwar			
54	February 1, 2022 at 05:18PM	rfid				
55	February 1, 2022 at 05:18PM	rfid				
56	February 1, 2022 at 05:20PM	rfid	Maheshwar			
57	February 1, 2022 at 05:20PM	rfid				
58	February 1, 2022 at 05:20PM	rfid				
59	February 2, 2022 at 02:09PM	rfid	Maheshwar			
60	February 2, 2022 at 02:09PM	rfid				
61	February 3, 2022 at 11:02AM	rfid	Maheshwar			
62	February 3, 2022 at 11:02AM	rfid				
63	February 3, 2022 at 11:02AM	rfid				
64	February 3, 2022 at 11:06AM	rfid	Maheshwar			
65	February 3, 2022 at 11:06AM	rfid				
66	February 3, 2022 at 11:06AM	rfid				
67	February 3, 2022 at 11:52AM	rfid	Maheshwar			

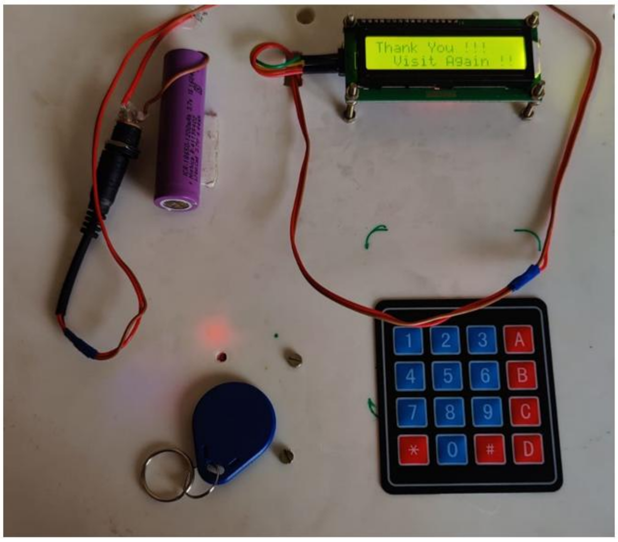
Sheet1

Once everything is verified and updating balance sheet then system will starts the charging car and it will show you how much time is remaining to complete chagrining.



When car charging completely then system automatically give notification that unplugged the charger





VI. CONCLUSION

The prototype of EV charging station with renewable energy source is successfully implemented. The project shows how we can have the accounting facility for EV charging station with Google sheets. The usage of microcontroller with RFID module helps the accounting process for smoother operation. The take away part of the project is microcontroller programming, power supply design and the PCB design. The operation of the opto-coupler in the high and low voltage separation can be easily understood by this process. Hence using the regular components, the prototype of EV charging station is implemented through this project.

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