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Smart Mobile Charging Station with Anti–TheftProtection

POORNIMA G N, GANAVI V, KAARTHIKEYA PAHALWAN, KARTHIK C M, YASHU N R

Department of **Electronics and Communication Engineering Bapuji Institute of Engineering andTechnology**

Davanagere - 577004, India

***Abstract*—** The idea of this Smart Mobile Charging Station with Anti-theft Protection helps us in the emergency posture by the way of charging our mobile. The major drawback of the mobile phone is that it should be frequently charged for efficient purposes. The problem lies in carrying a heavy power bank or a tangled mobile charger. This can be used as emergency charging stations for deliberate charging of mobile phone.

This project helps to tackle the mentioned issues and provide a hazzle free user experience to charge the mobile. The charging stations are installed in densely engaged areas such as shopping malls, cafeteria's, hospitals, airports, railways and bus stations.

The basic working of this protect is that the user has to swipe the RFID card over the sensor and place mobile insidethe station and latch the box. Once the charging is completed the user can retrieve the mobile. The solenoid lock present in the project helps in Theft Protection.

Keywords—component, formatting, style, styling, insert (key words**)**

I. INTRODUCTION

THE USAGE OF MOBILE PHONES IS INCREASING IN MANY WAYS. HENCE, CHARGING THE MOBILE PHONES HAS BECOME A GREATER TASK THESE DAYS. BATTERY HEALTH CONDITION IS THE MAIN CONCERN WHEN BUYING NEW MOBILE PHONE. USUALLY, PEOPLE HAVE THE HABIT OF TAKING THE MOBILE PHONES REGULARLY BUT NOT THE CHARGER AT ALL SITUATIONS. AT THAT TIME THE RFID BASED MOBILE CHARGING STATION TAKE THE ROLE. THIS STATION PRESENT AT A DESIGNATED AREA PROVIDE A SENSE OF REPOSE TO THE PERSON IN NEED OF CHARGING. THE BASIC WORKING OF THIS PROJECT IS THAT THE USER HAS TO SWIPE THE RFID CARD OVER THE SENSOR AND PLACE MOBILE INSIDE THE STATION AND LATCH THE BOX. ONCE THE CHARGING IS COMPLETED THE USER CAN RETRIVE THE MOBILE. THE SOLENOID LOCK PRESENT IN THE PROJECT HELPS IN THEFT PROTECTION.

II. RELATED WORKS

In RFID based Access Control System with GSM Technology. The authors in this paper have mentioned about the knowledge and application of new techniques in electronics and telecommunication has made our life more secured and comfortable. RFID based security system is one of such applications. RFID security access control system with GSM technology presented in this work is based on microcontroller.

In Mobile Charging Station based on Coin Insertion System. In this paper a coin insertion based mobile charging system is designed and developed, which can be installed at public places to display advertisements to generate revenue. Upon inserting the coins, the user will be allotted a specific time to charge its device, which depends on the number of rupees entered into the system.

In MEDICINE VENDING MACHINE The authors in this paper have mentioned about components that are used such as PIC micro controller. From this paper, the vending of the charging cable is inspired for our project.

In RFID Based Petrol Pump Automation System In this paper the model proposes to remove all the shortcomings of the manually operated petrol pumps by replacing them with automated ones. RFID is a versatile technology, easy to use and it can be efficiently used in this real time application. The proposed model consists of certain goals like ensuring right amount of fuel dispensed, removing all human errors by the use of RFID cards and ensuring customer's trust for a fair sale of the product.

In Coin Based Mobile Charger The authors in this paper have generated the results of a create-and-design research aimed at providing a Coin Based Mobile Charger usingArduino, Coin Sensor and relay. This plays a vital role in charging the mobile phones. The sensor has been fabricated for particular type of coin. Once it was fabricated for accepting many types of coins, then it will be very useful and can be implemented in many areas.

III. BLOCK DIAGRAM

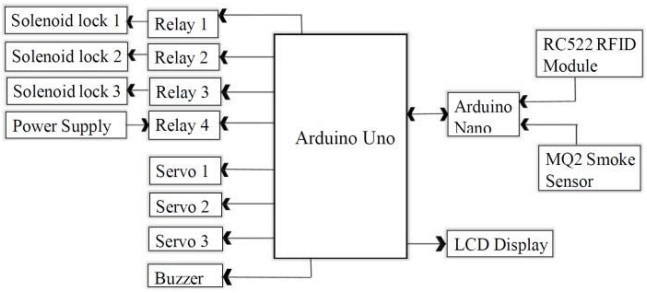


Fig 3.1: Block Diagram

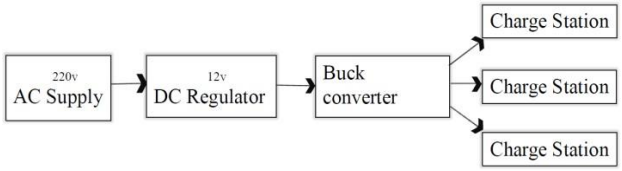


Fig 3.2: Block Diagram of power supply

- Fig 3.1 shows the block diagram of the project and Arduino board is the brain of the project.
- Fig 3.2 shows the block diagram of the power supply.
- The Buck converter is used to convert the 12V into required regulating voltage of 5V.
- RFID card is used to open the charging slots when locked. When a user comes to charge the phone on the station, the user has to scan the card and the solenoid lock will be unlocked.
- The servo motor is used to open the lid of the charging slot.
- Once the mobile is placed inside the specific slot, the user has to close the lid, and the solenoid lock present in slot will be latched.
- LCD display is used to display the completion of the charging of the mobile phone.
- If an unauthorized user tires to access the charging station then the buzzer will emit sound and alert the nearby authorities.
- The smoke detector is used in case of hazard caused due to bad battery health of the phone kept for charging. So, if smoke gets detected the whole charging station power will be switched off by the use of relay.
- There are two main function of the relay, one of which is, when there is fluctuation in the input voltage that is exceeding 12V (threshold voltage) which can cause short circuit in the system, to avoid this the current passing in the whole station will cut-off. Secondly if there is any detection of smoke which can cause fire hazard in the charging slot then to the current passing in the whole station will cut-off.

IV. HARDWARE REQUIREMENTS

The components required are
- Arduino UNO
- Arduino NANO
- 16x2 LCD Display
- Buzzer
- Relay
- Buck Converter
- Solenoid Lock
- Servo Motor
- RC522 RFID Module
- MQ2 Smoke Sensor

1. Arduino UNO:

The Arduino UNO board in Fig 4.1 can be used without been concerned about doing something wrong with the board, worst case scenario the chip can be replaced with a new and cheap one and start over again. Each of the 14 digital pins and 6 analog pins on the Arduino can be used as an input or output, under software control (using pin Mode (), digital Write (), and digital Read () functions). It operates at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull- up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any Vout pin to avoid permanent damage to the microcontroller. The Arduino has 6 analog inputs, labeled A-0 through A-5, each provides 10bits of resolution (i.e., 1024 different values).

Fig 4.1: Arduino UNO Board

2. Arduino NANO

The above fig 4.2 shows an Arduino NANO Board. This microcontroller is based on Atmega168 or Atmega328p. It is fairly similar to Arduino Uno board but when it comes to pin-configuration and features, this nano board has replaced Arduino Uno due to small in size. While designing an embedded system small size components are preferred. Arduino boards are mainly used to build electronic projects. Embedded systems, robotics, etc. The Arduino Nano has a total of 30 pins, including 14 digital pins, 8 analog pins, and 6 power pins. The digital pins can be used for both input and output and support PWM, while the analog pins can be used to read analog voltage levels. The Arduino Nano supports a range of communication protocols, including I2C, SPI, and UART. It also has a USB port for serial communication with a computer.

Fig 4.2: Arduino NANO Board

3. LCD Display

The above fig 4.3 shows pin configuration of an LCD display. LCD's are used in a wide range of applications, including LCD televisions, computers monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. LCD screens are also used on consumer electronics

products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode- ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to very large television receivers. LCDs are slowly being replaced byOLEDs, which can be easily made into different shapes, andhave a lower response time, wider color gamut, virtually infinite color contrast and viewing angles, lower weight fora given display size and a slimmer profile (because OLEDs use a single glass or plastic panel whereas LCDs use two glass panels, the thickness of the panels increases with size but the increase is more noticeable on LCDs) and potentially lower power consumption (as the display is only "on" whereneeded and there is no backlight).

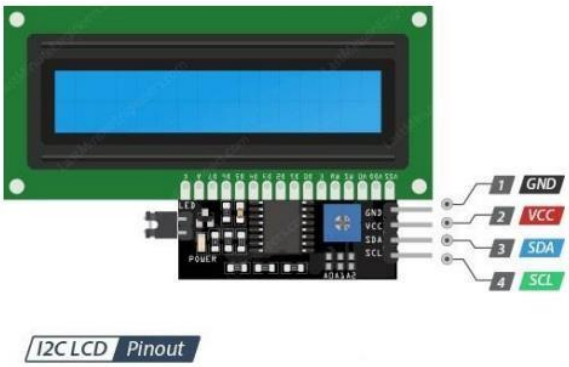


Fig 5.3: LCD Display

4. Buzzer

The above fig 4.4 shows positive and negative pins of a buzzer. There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6 Volts whereas the negative terminal is represented with the '- 'symbol or short terminal and it is connected to the GND terminal. Buzzer is used for theft alerting.

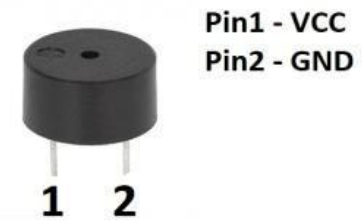


Fig 4.4: Buzzer

5. Relay

The above fig 4.5 shows a relay. A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. This relay module has two channels (those blue cubes). There areother models with one, four and eight channels. This module should be powered with 5V, which is appropriate to use with an Arduino. There are other relay modules that are powered using 3.3V, which is ideal for ESP32, ESP8266, and other microcontrollers.

Fig 4.5: Relay

6. Buck Converter

The above fig 5.6 shows a Buck Converter. The Buck Converter is used in SMPS circuits where the DC output voltage needs to be lower than the DC input voltage. The DC input can be derived from rectified AC or from any DC supply. It is useful where electrical isolation is not needed between the switching circuit and the output, but where the input is from a rectified AC source, isolation between the AC source and the rectifier could be provided by a mains isolating transformer. The buck converter is a form of DC to
devices, printers, alarms, computers, etc. It includes two pins namely positive and negative. The positive terminal of

DC converter that can take an input directly from a DC source, such as a battery. The input could also be DC derived from the AC mains (line) via a rectifier/reservoir capacitor circuit. The AC input to the rectifier circuit could be AC at high voltage directly from the AC mains supply, or alternatively at a lower voltage via a step down transformer. However the DC applied to the Buck Converter is obtained, it is then converted to a high frequency AC, using a switching or 'chopper' transistor, driven by a (usually pulse width modulated) square wave.

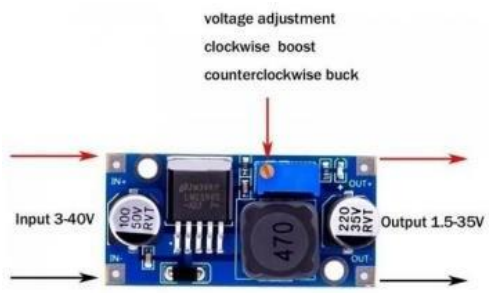


Fig 4.6: Buck converter

7. Solenoid Lock

The fig 4.7 shows the solenoid lock. Solenoids are basically electromagnets made of a big coil of copper wire with an armature (a slug of metal) in the middle. This DC 12V Solenoid lock is used for locking sell-machine, storage shelf, file cabinet and etc. This solenoid lock features steady, durable, energy-saving, and had a long lifespan with an anti-theft and shockproof design. 12v solenoid lock consists of a slug with a slanted cut and a good mounting bracket. Under normal conditions, it does not use any power. So lock is active and can't open the door because thesolenoid slug is in the way. When a 9-12v dc is applied to the solenoid lock, the slug pulls in. As a result, doesn't stick out. Thus the doors can be opened. The slug is pulled intothe centre of the coil when energized. Hence the solenoid is able to pull from one end. The slanted slug in the solenoid can be opened using head screws by rotating it 90, 180, or 270 degrees so that it matches the door to which the lock is attached. It is very important to check polarity while connecting the solenoid lock.

Fig 4.7: Solenoid Lock

8. Servo Motor

The above fig 4.8 shows a servo motor. Servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply, then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a geararrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

Fig 4.8: Servo Motor

7. RC522 RFID Module

The above fig 4.9 shows RC522 RFID Module with tags. the RC522 RFID reader/writer module is a low power, low cost, very rugged, easy to interface and extremely popular. An RFID or radio frequency identification system consists of two main components, a tag attached to the object to be identified, and a reader that reads the tag. An RFID or radio frequency identification system consists of two main components, a tag attached to the object to be identified, and a reader that reads the tag. The RC522 RFID module based on the MFRC522 IC from NXP is one of the cheapest RFID options you can get online for less than four dollars. Itusually comes with an RFID card tag and a key fob tag with 1KB of memory. And the best part is that it can write a tag that means you can store any message in it. The RC522 RFID reader module is designed to create a 13.56MHz electromagnetic field and communicate with RFID tags. The module's operating voltage ranges from 2.5 to 3.3V, but the good news is that the logic pins are 5-volt tolerant, so we can easily connect it to an Arduino or any 5V logic microcontroller without using a logic level converter. Technical specifications of the components are as follows: frequency range 13.56 MHz ISM Band, Host interface are SPI/ I2C/ UART, operating supply voltage is 2.5 V to 3.3 V.

Fig 4.9: RC522 RFID Module with tags

8. MQ2 Smoke Sensor

The above fig 4.10 shows a MQ2 Smoke Sensor. It is a versatile sensor that can detect LPG, smoke, alcohol, propane, hydrogen, methane, and carbon monoxide concentrations in the air. This makes the MQ2 Gas Sensor Module an excellent choice for building an indoor air quality monitoring system, a breathalyzer, or an early fire detection system. The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemi resistors because sensing is based on the change inresistance of the sensing material when exposed to gasses. The MQ2 gas sensor operates on 5V DC and consumes approximately 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations ranging from 200 to 10000 ppm.

Fig 4.10: MQ2 Smoke Sensor

V. SOFTWARE REQUIREMENT

Arduino IDE:

Software used: “ARDUINO IDE”

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.The board can be controlled by sending a set of instructions to the microcontroller on the board by using the Arduino programming language (based on wiring), and the Arduino software (IDE), based on processing.
Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.
As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completelyopen-source, empowering users to build them independentlyand eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.
The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board youcan simply use a USB cable.

I. CIRCUIT DIAGRAM

The below Fig 6.1 shows the Circuit diagram of the project.

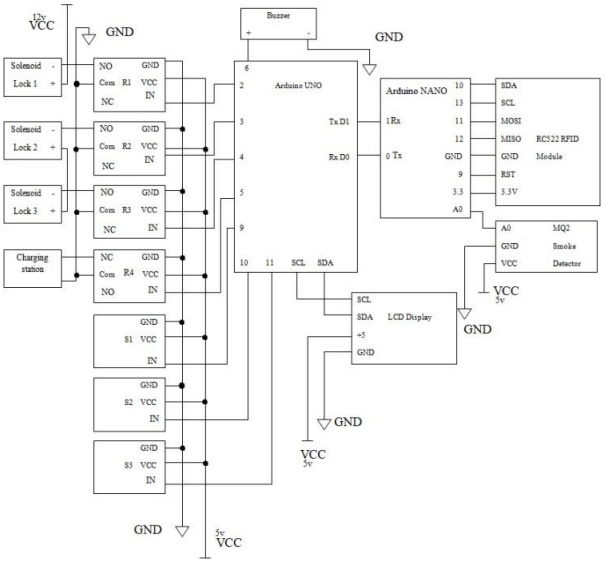


Fig 6.1: Circuit Diagram

- Arduino UNO and Arduino NANO communicate with each other through I2C. The transmitter pin (Tx) of Arduino UNO D1 is connected receiving pin (Rx) 1, similarly Rx D0 is connected to Tx 0.
- RC522 RFID Module is connected to Arduino NANO, in which the pin connections are as follows, the connection are made from RFID module to Arduino NANO, SDA pin to pin 10, SCL pin to pin 13, MOSI pin to pin 11, MISO pin to pin 12, GND to GND, RST pin to pin 9, 3.3V to 3.3v.
- Smoke detector is connected to Arduino NANO via pin A0 to A0 pin of Arduino.
- The positive pin (+) of the buzzer is connected to pin 6 of Arduino UNO and the negative pin (-) is grounded.
- Smoke detection is done if smoke is detected then the power supply will cut off

I. FLOWCHART

The below fig 7.1 shows the flowchart of the project,

- UID Detection will takes place once the station is turned on.
- RFID tag will be identified, if the tag is authorized then the specified charging slot will be operated, else the buzzer will be alerted as the detection of unauthorized user.

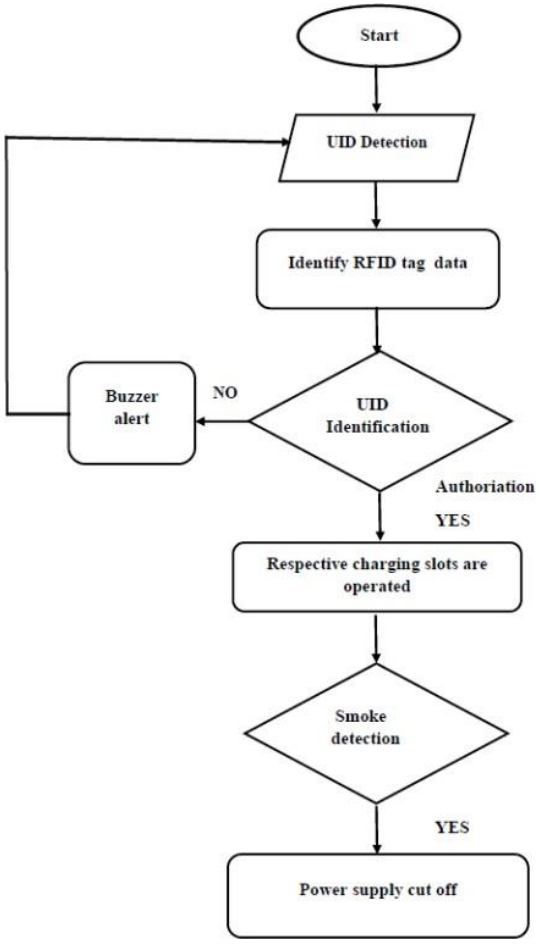


Fig 7.1: Flowchart of the project

- SCL and SDA pins of LCD are connected to the similar pins in Arduino UNO.
- NC pin of relay1 is connected to the negative pin (-) of the solenoid lock 1, similarly all the NC pin of remaining relays are connected with the respective negative pins (-) of the solenoid locks. And the Com pins of all the solenoid locks are grounded.
- Input pin of relay 1 is connected to pin 2 of UNO, input pin of relay 2 is connected to pin 3, input pin of relay 3 is connected to pin 4, and input pin of relay 4 is connected to 5
- Input pin of servo motor 1 is connected to pin 9 of UNO, input pin of servo motor 2 is connected to pin 10, input pin of servo motor 3 is connected to pin 11.

II. RESULTS

The system is programmed in Arduino IDE. It comprises of Arduino UNO Microcontroller, Arduino NANO, 16x2 Liquid Crystal Display, Servo motor, buck converter, smokedetector, solenoid lock, DC 5V Single Channel Relay, DC 12V Adapter, and RC522 RFID Module. Firstly welcome message is displayed by using microcontroller and displayed in liquid crystal display as shown in fig 8.1. Then, based on user input RFID tag the UID will be detected and respective servo motor will operate to connect the cable. After, RFID tag is accepted microcontroller sends HIGH signal to relay module and Relay changes it state from NO to NC and solenoid lock will get open , as shown in fig 8.2 the station 2is operated. Thereby user can charge the mobile. When an unauthorized user tries to access station then buzzer will beep sound and display unauthorize as shown in fig 8.3. Thefig8.4 shows the overview of the system.

Fig8.1: Welcome message of station

Fig8.2: Charge Station 2 operated

Fig8.3: unauthorized access

Fig8.4: overview of system

III. APPLICATIONS, ADVANTAGES ANDLIMITATIONS

Applications:

This charging station can be placed at public transport hubs such as

- Bus stations
- Railway stations
- Airports
- It can be placed at public recreational areas such as Shopping malls
- Convince stores
- Movie theatres
- Cafeteria

Can also be placed at areas such as hospitals, college campus, and corporate parks.

Advantages:

- Anti-theft feature
- Buzzer alert system
- Smoke detection to control fire hazards ¬ Short circuit prevention
- User friendly interface

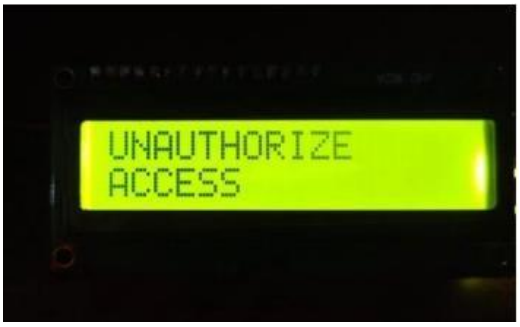
Limitations:

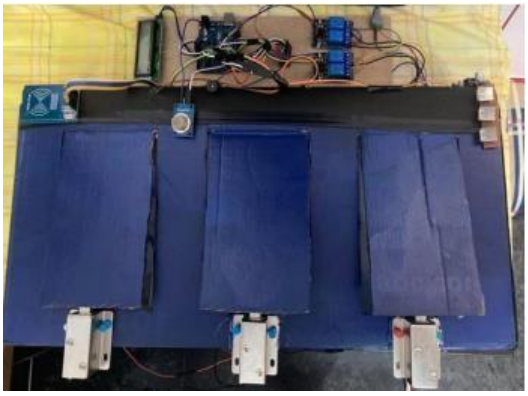
- Requires timely maintenance
- It's limited to single user for time being per slot, after the user is done with the procedure of charging others can use the charging slots.

CONCLUSION

For communication the mobile phone plays a vital role, but most of the time carrying a charger with it is tedious task, because of forgetting or due to storage issue. The knowledge and application of new techniques in electronics and telecommunication has made our life more secured and comfortable. RFID based security system is one of such applications.

This station can be installed at bus stations, railway stations and streets of the city. Each person accessing the station would be given a unique ID using which the user can be identified. It is an efficient, cost-effective and reliable system to charge mobile phones in public places. The system contains buzzer





alert system which protects from unauthorized user and smoke detection to control fire hazards.

FUTURE SCOPE

- System will be implemented with QR code to introduce the pay and charge.
- Implementing the connected network to use this device in any area for pre-register users.

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