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Smart Multi Mode Universal Mobile Charging Station

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Abstract: *In today's digital era mobile phone is an integral part of every growing individual. Progressively mobile phone is not just a medium for telecommunication but also become an multimedia entertainment provider. Due to its multi facilities and corresponding unitization, it's a great challenge to maintain battery performance for longer duration. Therefore, convenient and effective mobile charging solutions are in high demand in today's digitally connected world, particularly in public areas. In this regards we are providing an ultimate solution over the problem of charging at outside. Our research project prototype combines the ease of UPI payments along with the conventional methods of mobile charging to provide a novel way to system that runs on coins insertion. An ESP8266 WiFi module, a relay module, an IR sensor for coin detection, an LCD display, an I2C module, and an Android application are some of the essential parts used by the system. The system's central server and hardware components get communicate with each other more easily due to the ESP8266 WiFi module. Relay module management ensures safe and effective charging by managing the charging station's power supply.*

Keywords: ESP8266 WiFi Module, I2C Module, Android Application, etc.

I. INTRODUCTION

The need for practical and effective mobile charging solutions in public areas has grown in light of how quickly technology is developing. Combining conventional coin-operated mechanisms with digital payment methods offers a possible path for meeting this requirement. This project presents a novel method of charging mobile devices by integrating the dependability of coin insertion with the convenience of UPI payments. It is made possible by a number of essential components, such as the Android application, relay module, LCD display, IR sensor for coin detection, ESP8266 WiFi module, and LCD. The ESP8266 module connects to a WiFi router to start the system, allowing it to communicate with the central server without any issues. The system waits for charging inputs from the specific Android application when it has been initialized.

BLOCK DIAGRAM: To deliver a smooth and effective charging experience, the Mobile Charging On UPI & Coin, Insertion project includes a number of essential components. A description of the parts is given below. and how they communicate inside the framework:

1. **ESP8266 WiFi Module:**
   Acting as the hub of the system, the ESP8266 WiFi module allows wireless communication between the Android app and the charging station. By initializing the connection to a WiFi network, it makes control commands and data exchange possible.

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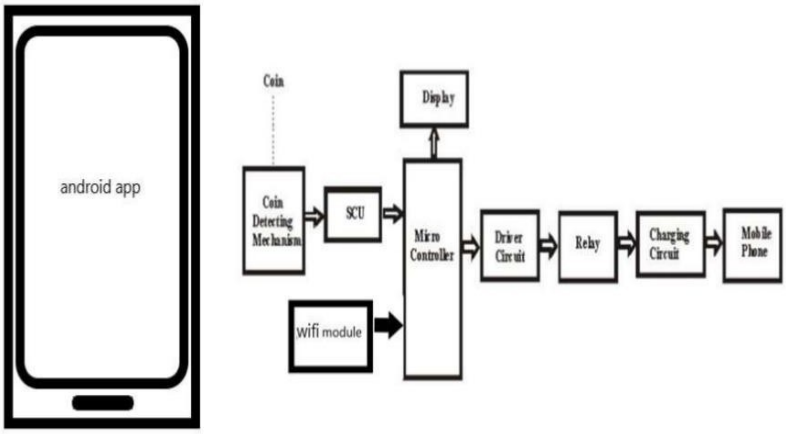

Figure: System Architecture

2. **Relay Module:**
   The relay module regulates the flow of electricity to the charging station by acting as a switch. It can start and stop the charging process since it is enabled when it receives commands from the Android app.

3. **IR Sensor for Coin Detection:**
   This feature ensures safe and verified payments by detecting when coins are inserted into the charging station. It works in conjunction with the relay module to permit charging only after effective identification of coins.

4. **LCD Display:**
   The LCD display shows the charging state and time in real time. It improves visibility and user engagement by gathering data from the ESP8266 module and presenting it to the user in an understandable manner.

5. **I2C Module:**
   The I2C module allows real-time charging status data to be presented by facilitating communication between the ESP8266 module and the LCD display.

6. **Android App:**
   Users can communicate with the charging station through the Android app, which acts as the system's user interface. It has functionality including payment processing, charging initiation, and device registration. The software gives consumers a flawless charging experience by sending and receiving commands and status updates wirelessly with the ESP8266 module.

Overall, by fusing cutting-edge technology with approachable features, the Mobile Charging On UPI & Coin Insertion project is able to provide a practical and safe charging option for mobile devices.

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II. IMPLEMENTATION OF PROPOSED WORK

This idea suggests creating a state-of-the-art system that combines the ease of UPI payments with the conventional coin-operated mechanism in response to the growing demand for effective and user-friendly mobile charging solutions in public locations. A number of crucial parts are included in the system, such as the Android application, LCD display, I2C module, relay module, ESP8266 WiFi module, and IR sensor for coin identification.

The ESP8266 module starts the process by connecting to a pre-designated WiFi router and creating a reliable connection with the central server during system initialization. The Android application is then used as the primary interface for consumers to interact with the charging station, and the system waits for charging inputs from it.

Through an auto-configuration feature, the Android application simplifies the setup procedure. By supplying device IDs and names, users may quickly register charging devices within specific sections. Users are required to finish the UPI payment process after registering their smartphone before they can use the charging feature.

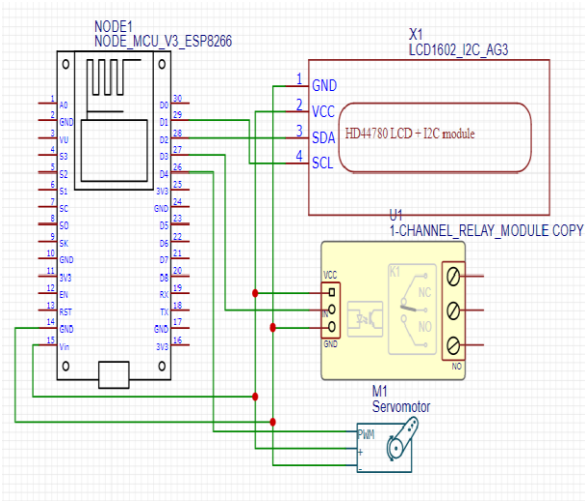
Upon successful payment processing, users can start charging sessions by navigating to the charging switch inside the program interface. Users just insert their Android mobile devices inside the area box that is assigned for charging, then use the application's button to close it.

Transparency and ease of use are ensured by providing users with real-time updates on charging state and elapsed time through the Android application and the linked LCD display.

Transparency and ease of use are ensured by providing users with real-time updates on charging state and elapsed time through the Android application and the linked LCD display.

The suggested solution intends to transform public mobile charging stations by providing a smooth and effective charging experience that combines conventional coin-operated mechanisms with contemporary digital payment methods. This project aims to improve accessibility to mobile charging facilities by integrating cutting-edge technology and user- friendly interfaces, meeting the changing needs of users in the current digital era.

III. CIRCUIT DIAGRAM



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IV. COMPONENT DESCREPTION

1. ESP8266:

By examining the design of the ESP8266 DevKit Board, a well-liked, reasonably priced ESP board on the market, we will be able to determine what an average ESP8266 Development Board looks like. The design of the ESP8266 Development Board I own is depicted in the above image.

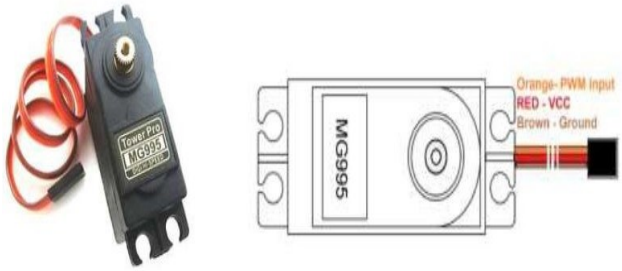
Important Information: There are numerous ESP8266 Boards on the market that are based on the ESP-WROOM-ESP8266 Module. Every board is different in terms of functionality, pinout, and layout.

There are thirty pins on the board I own-fifteen on each side. Certain boards have thirty-six pins, while others have a few less. Thus, make sure all pins are in order before connecting anything or even turning the board on.

The following components make up the ESP32 Board, as seen in the image:

- Module ESP-WROOM-ESP8266
- IO Pins arranged in two rows, with 15 pins on each side
- The micro-USB connector for power and programming is the CP2012 USB-UART Bridge IC.
- AMS1117 Regulator IC 3.3V Button (for Reset) Enabled The boot button, which flashes
- Red Power LED, Blue User LED (attached to GPIO2)
- A few inactive parts

2. SERVO MOTOR:



A well-liked servo motor due to its affordability and performance is the MG995. The majority of the uses for motors are in robotics and drones.

Pinout Layout for MG995 Servo Motor Description

According to the pin diagram, the MG995 has three terminals; the purpose of each pin is listed below.

Pin Name Purpose

- Signal pin (Orange pin): This pin receives the PWM signal that indicates the axis position.

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- VCC (Red pin): This pin receives the servo motor's positive power source.
- Ground (Brown Pin): This pin is linked to the power source or the circuit's ground.

3. IR SENSOR:

Configuration of Pinout for IR Sensor Module / Features of an IR Sensor Module

- Operating voltage of 5VDC
- I/O pins comply with both 5V and 3.3V. Sensing range is adjustable; up to 20 cm
- Mounting hole Ambient light sensor built-in 20mA supply current

A synopsis of the IR Sensor Module: The IR Transmitter and Receiver, Op-amp, Variable Resistor (Trimmer Pot), output LED, and a few resistors make up the majority of the IR sensor module.

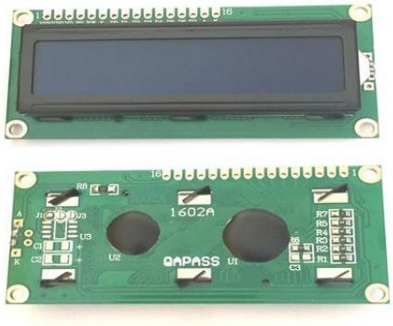
IR LED Transmitter:

Light within the infrared frequency range is emitted by an IR LED. Since the infrared spectrum (700nm–1mm) is far longer than that of visible light, infrared light is invisible to humans. IR LEDs can emit light with an approximate angle of 20-60 degrees and a range of a few centimeters to several feet, depending on the manufacturer and kind of IR transmitter. The range of some transmitters is measured in kilometers. IR LEDs are transparent or white in color, allowing them to emit the most light possible.

Photodiode Receivers:

When light strikes a photodiode, it conducts, functioning as an infrared receiver. A photodiode is a semiconductor with a P-N junction that operates in reverse bias, which means that when light strikes it, it begins to conduct current in the opposite direction and that the current flow is proportionate to the light. It is beneficial for IR detection because of this feature. A photodiode that resembles an LED has a covering of black on the outside, which absorbs the most light.

4. 16x2 LCD DISPLAY:



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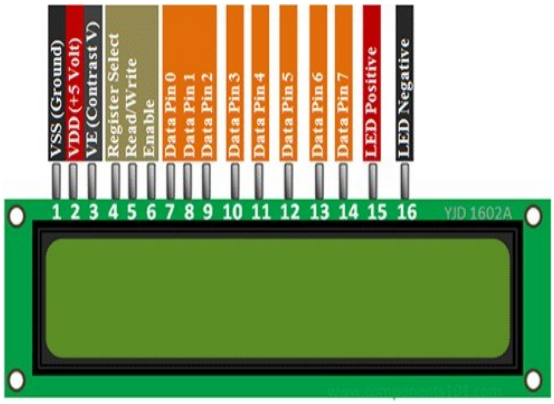

The majority of embedded applications employ 16x2 LCD modules since they are readily available, reasonably priced, and have accessible teaching resources.

Features and Technical Details of the HD44780 LCD Voltage range for operation is 4.7V to 5.3V. There is no lighting and a 1 mA current consumption.

Alphanumeric LCD display module: capable of displaying both numerals and alphabets consists of two rows with a 16 character print limit for each row.

A 5x8 pixel box is used to construct each character. It can operate in both 8-bit and 4-bit modes. Additionally, it can display any custom- generated characters.

Available with a blue and green backdrop.

5. I2C MODULE

Controlling an LCD display could be laborious because microcontrollers and microprocessors have limited pin resources. With just two pins, serial to parallel adapters like the I2C serial interface adapter module with PCF8574 chip simplify tasks. A 16x2 LCD can be connected to the serial interface adapter, which also has two signal output pins (SDA and SCL) that can be used to interact with an MCU or CPU.

Characteristics and Details of the I2C Serial Interface Adapter Module.

- A few of the I2C Serial Interface Adapter Module's features and specs are covered in this section.1. 5V DC is the operating voltage
- I2C management with PCF8574
- Eight modules can share an I2C bus.
- I2C Address: 0X20~0X27 (you can modify the original address, which is 0X20).

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V. SOFTWARE RESULT SUMMARY

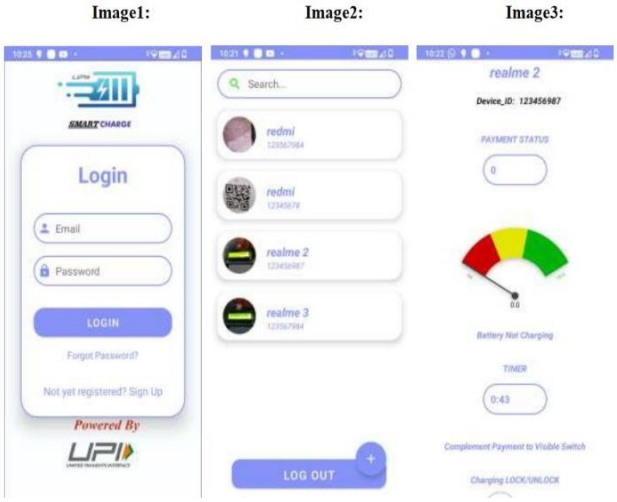

Figure: Android Application GUI Explanation

1. ***Use Your Email Address and Password to Log in:*** This function enables users to access the Android application by providing their email address and password.
   - The login request is safely forwarded to Google Firebase authentication services for validation and authentication upon submission.

2. ***Machine Mobile Charging Profiles are Displayed by Recycler View:*** The second picture shows a Recycler View component that shows machine mobile charging profiles.
   - By scanning the unique identifiers (UIDs) connected to every charging device, these profiles are generated.
   - A list of available charging stations can be viewed by users, along with information about each one.

3. ***Card View Showing Machine Mobile Charging Information:*** In the third picture, a Card View component is shown providing comprehensive details on a chosen machine mobile charging station.
   - Details include the length of time the charge takes, an on/off switch to manage the charge, and a payment gateway to finish transactions.
   - Through this interface, users may access and control charging sessions with ease.

4. ***Machine Mobile Charging Process:*** The integrated system's mobile charging procedure is depicted in the fourth image.
   - The ESP8266 WiFi module, relay module, LCD display, I2C module, Android application, and IR sensor for coin identification are among the parts used in the process.
   - After the ESP8266 module is connected to a WiFi router, the system is initialized and waits for charging inputs from the Android app.

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- The Android app has an automated setup procedure that first registers charging devices and then finishes payment transactions.
- Users can start charging once their payment has been approved and the charging switch appears in the app.
- Users insert their Android smartphones into specially marked section boxes and use the app to start charging.
- The Android app and LCD display provide real- time updates on the charging status and time, guaranteeing simplicity and transparency throughout the charging process.

These outcomes show how different parts and features have been successfully integrated to give consumers a smooth and effective mobile charging experience in public areas.

Figure: Hardware Implementation Prototype

VI. APPLICATIONS

1. Public Spaces: To meet the needs of people who need a quick and easy way to charge their mobile devices while they're on the go, the project's mobile charging solution can be put into place in public areas including parks, airports, train stations, and shopping centers.
2. Transportation Hubs: The project can provide travelers with a dependable way to recharge their devices while they are traveling, improving the trip experience overall and guaranteeing connectivity all the way. Examples of these hubs are bus terminals and train stations.
3. Event Venues: To give guests a convenient way to keep their devices charged during the event, event organizers can set up mobile charging stations at locations holding concerts, festivals, conferences, and exhibitions.
4. Educational Institutions: By installing the project's charging stations on campus, colleges, and universities may free up staff and students' time to charge their gadgets without having to worry about remembering to bring along charging adapters.

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5. Workplaces: By providing employees with a comfortable option to charge their devices during work hours, the initiative can help offices and corporate environments increase productivity and guarantee continuous connection throughout the day.
6. Commercial Establishments: By offering mobile charging stations, restaurants, cafes, and coffee shops can draw in clients by enticing them to stay longer and improving their overall dining experience.

In general, the project's applications include a range of industries and settings, offering a flexible response to the expanding need for easily accessible and easy mobile charging stations in today's.

VII. ADVANTAGES & CHALLENGES

Advantages:

1. Convenience: Without bringing cables or charging adapters, users may easily charge their mobile devices in public areas.
2. Accessibility: The technology makes mobile charging stations more accessible, meeting the demands of those who are constantly on the go.
3. Payment Method Integration: The project gives customers the freedom to select the payment method of their choice by combining UPI payments with coin insertion.
4. Real-Time Monitoring: Using the Android application and LCD display, users can conveniently and transparently keep an eye on the charging status and elapsed time in real-time.
5. Improved User Experience: The project provides a smooth and intuitive charging experience, improving users' happiness and system usage.

Challenges:

1. Dependency on Internet connectivity: The system's components must be able to communicate with one another via the internet, which can be problematic in places with spotty or inconsistent network coverage.
2. Maintenance Requirements: To guarantee the best possible performance and dependability of the charging stations, routine maintenance and care of the hardware components may be required.
3. Cost: The project's mobile charging solution may need a sizable upfront expenditure in addition to recurring operating expenses for implementation and upkeep.
4. Security Concerns: The system's processing of money and personal information may give rise to security issues, necessitating the implementation of strong security measures to protect user data.
5. Compatibility Problems: There may be problems with specific mobile devices or operating systems that prevent the charging stations from being accessible to all users.

VIII. CONCLUSION

To sum up, the Mobile Charging on UPI & Coin Insertion project is a huge advancement in the field of mobile charging options. This project provides a smooth and user-friendly charging experience by

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utilizing a variety of cutting-edge parts, including the ESP8266 WiFi module, relay module, IR sensor for coin detection, LCD display, and an Android app.

The ESP8266 module is initialized first, and it quickly establishes a WiFi network to allow communication with the Android app. With the help of the app's auto-configuration feature, which requires the device ID and name, registering charging devices is made easier. After registering, consumers easily finish payments using the app, turning on the charging switch.

Users only need to place their Android smartphones inside the appropriate area box and use the app to initiate the charging process. The security and authenticity of coin insertions during payment are guaranteed by the inclusion of an infrared sensor. Both the Android app and the LCD display offer real-time data on the charging status and time, improving user visibility and control.

The Mobile Charging On UPI & Coin Insertion idea is essentially a prime example of how contemporary technology and everyday convenience come together. Its cutting-edge method of device registration, payment processing, and charging initiation raises the bar for mobile charging solutions and meets the changing demands of modern consumers.

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