Low Cost IoT based EV Charging Station with Power Bank Vending Mechanism

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Abstract — As the CO2 level in the earth's atmosphere is increasing, it is causing major problems such as increase in surface temperature of earth which is resulting in global warming and climate change. To reduce CO2 emissions and to avoid petroleum products in transportation sector whose demand and price are increasing day by day, all the countries around the world are shifting towards Electric Vehicles and Hybrid Vehicles, The transition from IC Engine Vehicles to Electric Vehicles is not that easy there are some barriers which every country has to overcome. One of the major barrier is availability of charging infrastructure for EV's and the cost for charging stations is huge, to reduce the cost and to promote Electric Vehicles in India, this project titled *"Low Cost IoT Based EV Charging Station with Power Bank Vending Mechanism"* is proposed to provide charging facility to EV users at an economical cost. It also has power bank vending mechanism which provides power bank rentals for mobile phone users at public places, which can boost the business of station owner by providing more profits. It designed in such a way that it uses solar power to power up the microcontroller, sensors, servos, and other electronic components. It can be operated through smartphone app and payments can be done through the app itself or person can pay manually by inserting the coin into the coin acceptor. This project can help to provide charging facility at an economical cost by using real-time Database and IoT Technology.

Keywords: EV Charging, Mobile communication system, Climate change, IoT, Smart Vending Mechanisms, Authentication, Web-based services, Payment schemes.

1. INTRODUCTION

Electric vehicles has started to penetrate into the Indian market and there is a need for proper and economical charging infrastructure to charge these EVs, also we found that the need of mobile charging infrastructure at public places is increasing day by day, keeping this in mind we have designed a device which can charge electric vehicles and can also dispense power banks for mobile charging so that the users can charge their mobile phones on the go. This project aims to promote faster adoption of Electric Vehicles in India by providing charging facility at economical cost. It has two Charging modes that is EV, Mobile charging to satisfy the charging requirements of users and can be operated through smartphone as well as manually, The major technologies used in this project are IOT and Machine to machine (M2M) learning which enables it to transfer user information with other charging stations and cloud, so that the user can control the charging process from anywhere in the world. User can use this device with his smartphone by registering and creating account with the help of smartphone App or he can use it by inserting coin manually. Once the user inserts a valid coin the device will charge his vehicle for a predefined period of time. It also has in build power bank vending mechanism for smart phone charging requirement. When the user takes power bank from the charging station the amount of the power bank will be automatically deducted from his account and when he returns back the discharged power bank at any of the available stations nearby, the refund amount will be automatically added to his account.

2. EXPERIMENTAL WORK
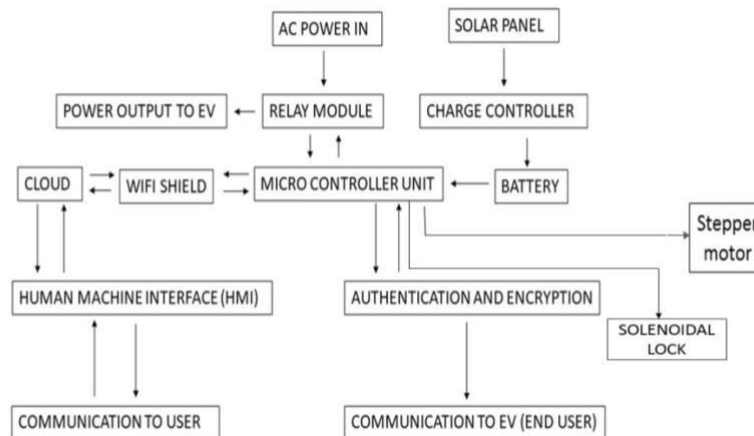
15Watt solar panel is used to decrease operational power of the system by powering up microcontroller and other components such as sensors and stepper motors. The microcontroller is in serial communication with the Wi-Fi module to connect with the internet and access user information such as user ID and balance. With this we can connect multiple charging stations to the same cloud and share data between charging stations and the cloud, hence the charging stations can communicate with each other with the help of cloud. We have developed user friendly android application with which the user can easily create his account and can easily get access to the charging station. If the person operates the charging station with his smartphone then the smartphone will act as Human machine interface, manual control buttons are also provided with coin acceptor so that a person without smartphone can also have access to the EV charging.

The user request and other data will be send to the cloud and the process of authentication will takes place inside the cloud after which the cloud will send the user information along with user request to the microcontroller unit and the microcontroller will operate other electronic components of the charging device based on the user request.

To use the charging station the user has to install smartphone application and create his account, then he has to select EV-Charging option from the application after which he has to enter the time for which he wants to charge his vehicle and once he clicks ok, QR-Scanner will open and he has to scan the QR-code on the charging station, the door of the charging device will automatically open and the user can connect his charger connector, once he closes the door it automatically gets locked and charging process starts for the set period of time and the user can monitor the charging process from anywhere.

3. RESULTS
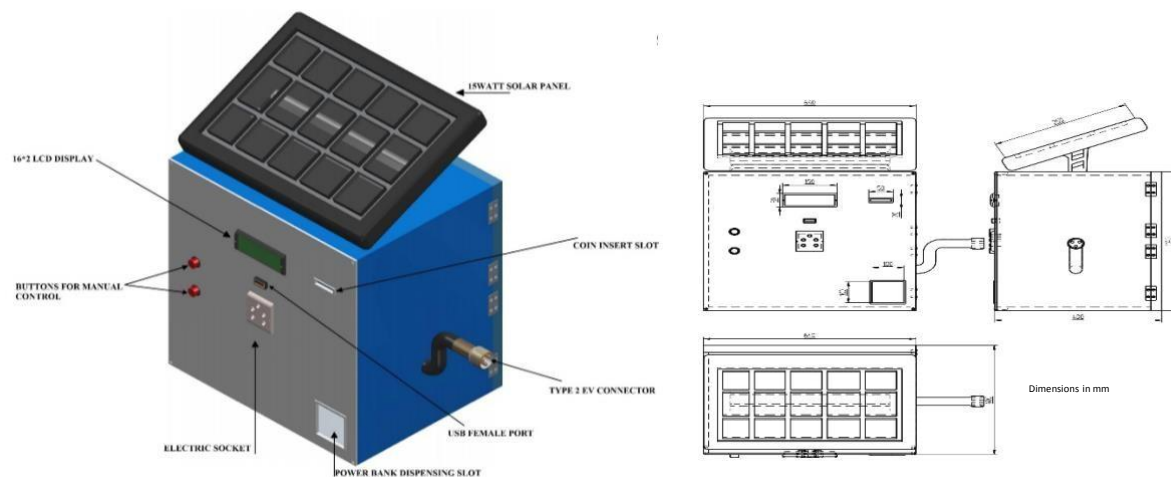
This project aims to promote adoption of Electric Vehicles in India by providing charging facility at economical cost. This charging Station has two Charging modes i:e- EV and Mobile charging to satisfy different charging requirements of user's and can be operated through smartphone as well as manually, as of now EV manufacturers are implementing their own type of charging plugs, so we have designed our station in such a way that the users can use their own charger plug to charge their vehicles. Hence the security of the connector becomes the major problem, to solve this problem we have designed and implemented cloud based locking system to provide security to user's connector. The major technologies used in this project are IOT and Machine to machine (M2M) learning which enables it to transfer user information with other charging stations and cloud, so that the user can control the charging process from anywhere in the world. User can use this station with his smartphone by registering and creating account with the help of smartphone App which we have developed or one can use this station by inserting coin manually. Once the user inserts a valid coin the charging station will charge his vehicle for a predefined period of time. It also has in build power bank vending mechanism for smart phone charging requirement, so that cell phone users can charge their phone on the go. When the user takes power bank from the charging station the amount of the power bank will be automatically deducted from his account and when he returns back the discharged power bank at any of the available stations nearby, the refund amount will be automatically added to his account (Refund amount = Power bank amount - service charge). The power bank and vending machine has been designed in such a way that once the user returns back the power bank into the vending machine, the RFID reader will read the RFID chip present inside the power bank and the machine starts communicating with the cloud to verify whether the power bank ID is present inside the database or not, if it is present the vending machine will accept the power bank and starts charging it automatically.

4. CONCLUSION AND FUTURE SCOPE

Although there are different EV charging stations in the market but still the price factor and the connecter security is major concern, to overcome these problems we have designed and manufactured low cost IoT based EV charging station with power bank vending mechanism. Power bank vending mechanism which is incorporated in the device can provide mobile charging facility at public places which can increase the profit for the owner.

It can be used at shopping malls, residential buildings, public places such as railways stations, parking places etc.

Acknowledgment

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