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IOT Enabled Smart Charging Stations for Electric Vehicles

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Abstract

As we are aware about the mass adoption of EVs on the horizon, the smart electric vehicle charging will become essential for both the charging point network operators, and the National electricity grid. EVs are becoming popular across the globe. As the number of EVs increases, EV charging infrastructure will also be a basic need. This work is to make a smart application to know the different tariff rates of the grid by connecting to the grid. The tariff rates will include both, the power intake rate and also the outgoing power rate. When the user comes to the grid, the application will also display the battery SOC. The main agenda is to optimize low carbon technologies through one connected platform using rule based algorithms, helping to decarbonize both the production and consumption of energy.

Keywords: *Arduino uno, IOT, status of charge, Electric vehicles, ESP8266.*

INTRODUCTION

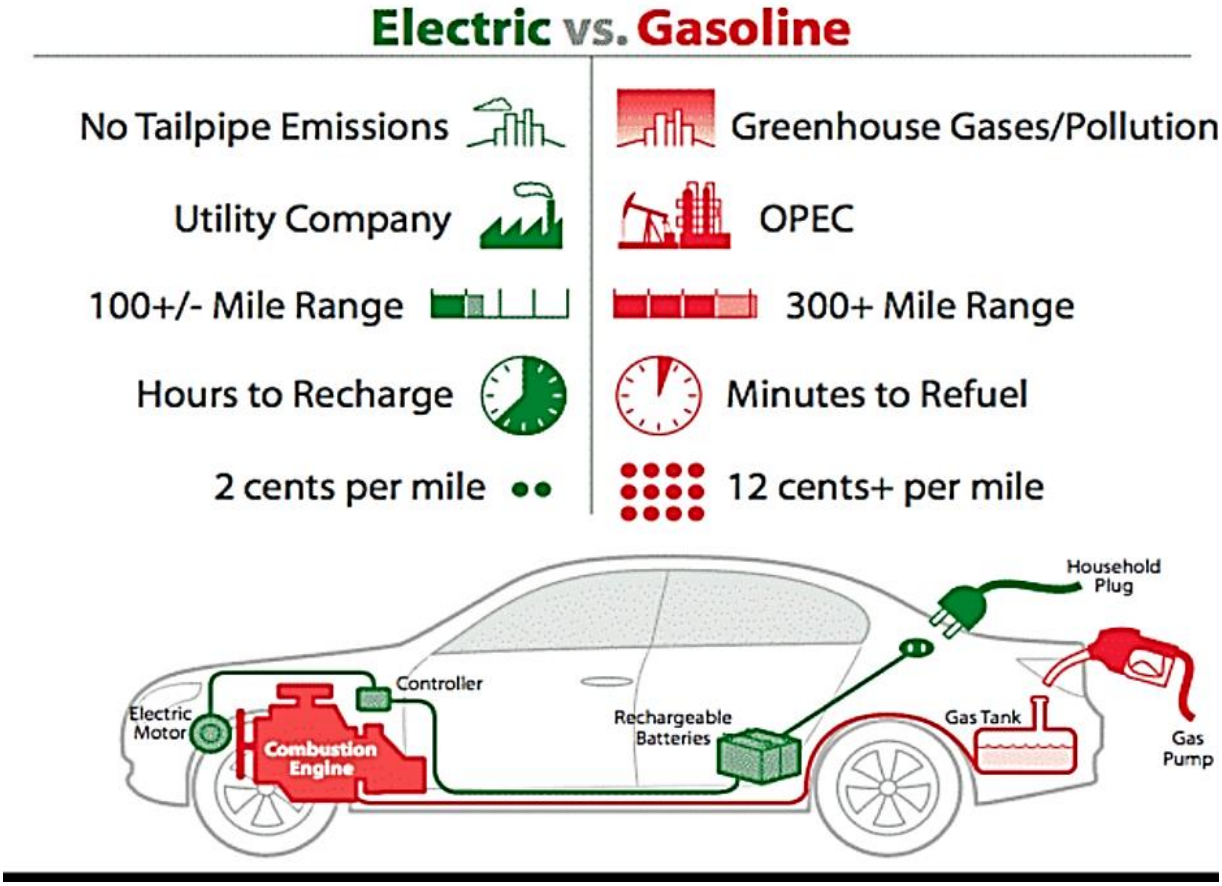
IOT (Internet of Things): It is a network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors and connectivity which enables these things to connect and exchange data.

Smart Charging Stations for Electric Vehicles: It is an element in the infrastructure that supplies electric energy for the recharging of electric vehicles including electric cars [1].

There is a growing need for widely distributed publicly accessible charging stations, some of which support faster charging at higher voltages and currents that are available from residential electric supply. These charging stations can provide range of heavy duty connectors that conform to the variety of electric charging connector standards. Nowadays, vehicles are essential in the day to day life and for industrial use as well. Sufficient effort is being done to withdraw the combustion engines by electric motors [2].

Since battery is a commonly used device for storage of energy, calculation of Status of Charge plays a vital role in the future. A shortage of charging stations may make

EVs less helpful and add to extend nervousness bringing about fewer individuals grasping the utilization of electric vehicles [3-5].



Smart charging will play an instrumental part in the role of future cities, and that charging infrastructure will move away from a 'socket in the street', to an IOT connected device. EV charging infrastructure should serve as a multipurpose asset, from digital advertisement and Wi-Fi to energy balancing, helping to both future proof and increases a charging network commercial viability. A system with IOT will definitely improve the performance of EV charging and looks the impacts. This work is to make a smart application to connect with the grid and to know the different tariff rates of the grid. The tariff rates will have both the rate for power delivery to the grid and tariff rate for taking power from the grid. If the user is having the car battery fully charged, he can deliver some power to the grid and can earn some money. Here we mainly focus on the IoT part of determining the SOC value and sending the data to the IO. The user can view the data in the App. Also, the user can locate the nearby charging station locations using the app. Once the user knows about the status of his car battery [6-8].

METHODOLOGY

Hardware components

Arduino

In this, main processor is microchip ATmega328p microcontroller. The power supply is given by an USB cable. The input voltage of Arduino ranges between 7V to 20V. This Arduino is programmed by using software called Arduino Integrated Development Environment. By default ATmega 328 will be programmed

with a bootloader, which allows running a new code in the Arduino.

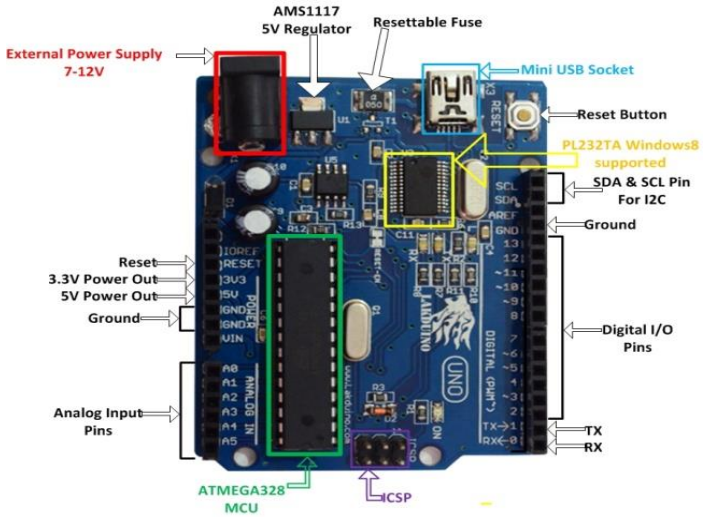


Figure 1: *Arduino uno.*

Required Data

Calculation of Status of charge (SOC):- Status of charge defines the remaining power and time required to charge the battery.

The ideal equation for SOC is given by

Status of charge = Initial SOC –Nominal capacity of battery.

The battery used in this is Lithium- ion battery 12V, 7Ah.

For sensing the current passing through the battery a transducer called LTS25NP is used.

Figure 2: *Li-ion Battery 12V- 7Ah.*

Figure 3: *LTS 25NP.*

This transducer puts an impression on Arduino microcontroller. A code is compiled into the Arduino microcontroller for the calculation of SOC. The computed data will be sent to an ESP 8266 Wi-Fi module as analog signals. Then the ESP 8266 is connected to the cloud by using the cloud IP address through the internet. There after all data can be stored in the cloud.

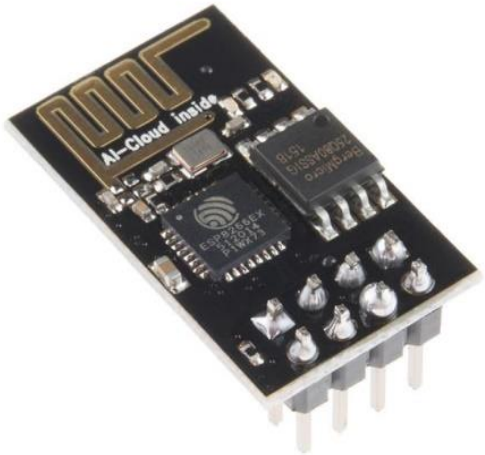


Figure 4: *ESP 8266 Wi-Fi module.*

To access the data from the cloud the required tools are like Adafruit, MQTT. All this tools works on the top of TCP/IP protocol. These tools can be to made run on user's hand held device like smart phones, laptops, tablets etc.

Figure 5: *Ada fruit dash board.*

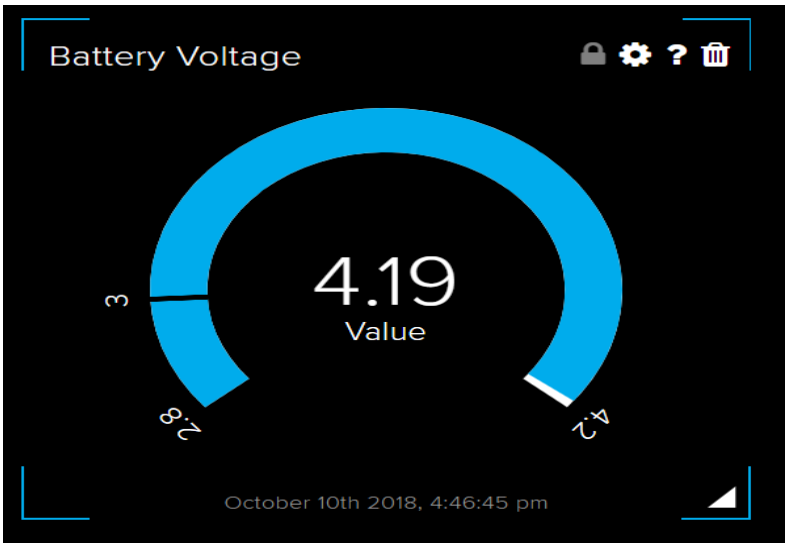


Figure 6: *Ada fruit dash board*

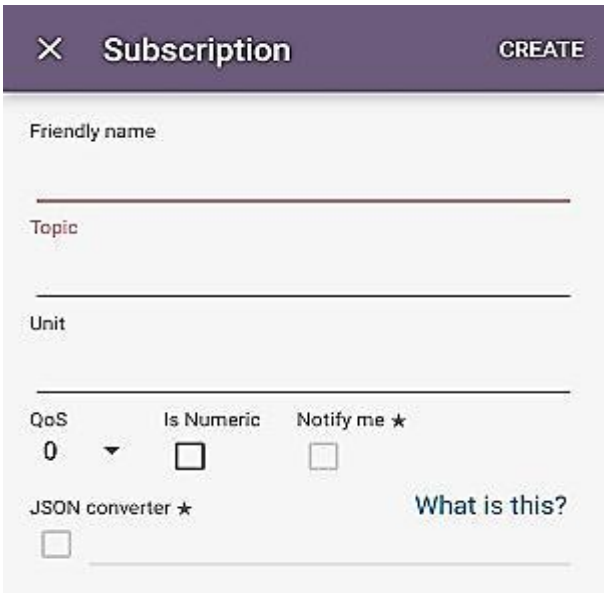
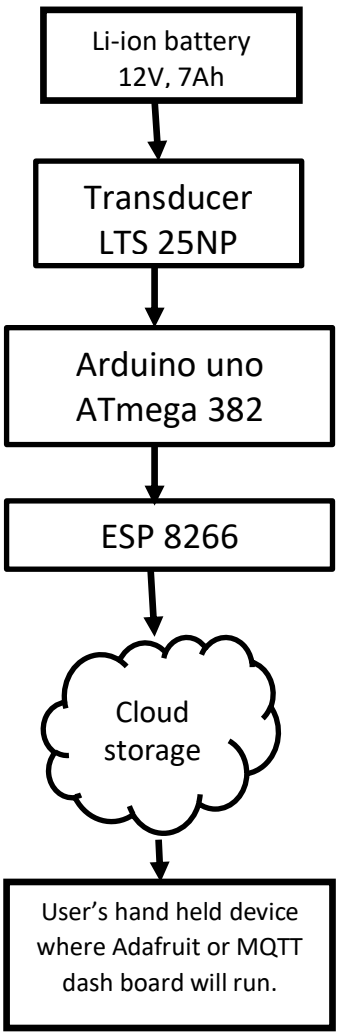


Figure 7: *MQTT dash board*



Data Acquisition Algorithm to Human Interface Flow Chart

RESULT

The status of the battery will be computed by the Arduino uno (microcontroller), then the computed data will be stored in cloud, where the ESP8266 acts as intermediate device between the microcontroller and the network. The stored data can be accessed by the cloud using certain applications like Adafruit, MQTT dash board etc. Hence the user will get to know about his car's battery status and also he can provide excess amount of charge to any other applications, by knowing the status of the battery.

CONCLUSION

The connectivity between the user and the car is based on IOT. A user can decide the power management by analyzing the status of the battery also he can decide, to provide the excess amount of charge to other applications. The main aim of this project is to minimize the difficulty in building charging stations for electric vehicles. By using above mentioned methods, charging stations can be built easily and can be maintained in a well manner for domestic purposes.

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