E-Charge: A IoT Enabled Smart Switch for Electric Vehicle Charging

Bhushan Bhad[1], Ketaki Khengre[2]

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Abstract – *In the technological development, Internet of Things (IoT) is one of the important developments in past few years. Drastic change in hardware technology, networking and recent advancement in cloud storage that are the favorable factor to adapt IoT enabled devices to use in our daily life like safety, healthcare or in manufacturing industry.*

With IoT, now people are moving towards green technology like demand of electric vehicle is increasing day by day. With increasing count of EV's in our society on of the most common problem is where to charge the vehicle.so in this paper a IoT enabled smart plug is developed to charged electric vehicle efficiently and effectively with calculation of consumption of energy by using Mongoose OS or by Arduino IDE and various sensor.

Key Words: IoT, Mongoose OS, Embedded Systems, ESP-32, Arduino IDE

1.INTRODUCTION

Internet of things (IoT) is a network of various sensors and software's. Basically, hardware is controlled by programming the micro-controllers to do work accordingly using other technologies as well. These items have incorporated technology that allows them to interact with internal and external states. When these things sense and communicate, how and where choices are made, as well as who makes them, changes, a certain task is executed.

It includes the devices, sensors, and software required for controlling and monitoring plant and equipment, among other things. On the other hand, information technology (IT) encompasses all of the technologies required for data processing. Computers and the Internet are now reliant on humans for information in traditional methods. The problems include that individuals have limited time and are prone to making mistakes when generating data, resulting in data accuracy difficulties. With recent technological advancements, the Internet is becoming more broadly available. The cost of connecting is reducing, more products are being produced with Wi-Fi capabilities and sensors built in, technology prices are decreasing, and smart-phone adoption is increasing. As a result of these elements, the possibilities for IoT-based applications have expanded to new heights, allowing for more advancements. As a result, there has been a significant surge in IoT applications across a wide range of industries, including healthcare, telecommunications, oil field maintenance, transportation, and so on.

Now let's focus on the emerging EV sector. EVs are the future of automobiles and with use of EV there comes many factors that we need to consider. The main concern here is with respect to the charging of EVs, unless the infrastructure in our country becomes flexible for EV charging with Charging stations at adequate distances the use of EVs has a slow growth. Even if we consider now, we buy a EV and charge only at homes. The necessity for an accurate charging plug becomes a concern and that is also installed in the parking spaces of our societies. EazyCharge a Smart Switch, which is a gadget capable of remotely connecting or detaching your EV charger through the internet, is a perfect solution to this problem. In this situation, the Smart Switch serves as a conduit between the power source and the charging slot.

The goal of this paper is to provide readers an overview of IoT and to help them understand how it can be used to solve their basic problem when it comes to charging the EVs in their local areas without proper charging plugs. The following is how the paper is structured: IoT, Smart Switch hardware components, Esp32 micro-controller, Working of SS, SS software components, and future scope

2. INTERNET OF THINGS (IoT)

However, as technology has progressed, the term has become broader, encompassing a wide range of applications such as healthcare, utilities, transportation, and so on, but the ultimate objective of enabling computer systems understand information without human involvement has remained the same. The inclusion of different embedded devices that support open standards for wireless communication such as Bluetooth, Wi-Fi, and RFID, as well as optimization in sensor nodes and devices, has changed the entire Internet scenario, allowing us to construct a smart environment for our daily lives.

3. HARDWARE COMPONENTS OF SMART SWITCH SS

3.1 Power Supply: The switch is powered by a 230 V AC supply, through an MCB as a protection circuit against the short circuit and the overload conditions.

3.2 AC to DC converter: The 230V AC supply is converted to 12 V dc using an SMPS from Hi-link with following ratings:

- INPUT:100-240V AC, 0.2AOUTPUT: 12V

- DC ,0.42A 5W

Further this 12 V is converted to 5V using a voltage regulator circuit made of LM2596 with following specifications:

- Fixed Output: 5V

- Output Current: Max 3A

- Input Voltage Range: Up to 40V

Further this 5V is converted to 3.3V using a voltage regulator circuit made of AMS1173.3 with following specifications:

- Low Dropout Linear Step Down Regulator

- Max Input Voltage: 15 V

- Output Voltage: 3.3 V

- Max Output Current: 1 A

- Dropout Voltage: 1 V

3.3 Microcontroller: Microcontroller is the heart of any embedded system. Broadly Arduino Nano or Arduino UNO are the basic microcontroller is available. But it doesn't have inbuilt Bluetooth and need to interface external Bluetooth module with it. So ESP32 is a microcontroller which provide BLE (Bluetooth Low Energy).so we go with ESP32 which is having circuitry like Crystal with capacitors, Reset circuitry, and so on. It controls the devices and sensors being interfaced and communicates with the it according to the program being written. It supports Wi-Fi and Bluetooth protocols and thus the plug can be operated by android application through a smartphone by giving signals/commands to the controller. The controller has following specifications:

- Wi-Fi 802.11b/g/n

- Bluetooth v4.2 +EDR,

- Class 1, 2 and 3 Transceiver Module 2.4GHz ~ 2.5GHz Integrated

- 448kB ROM, 536kB SRAM

- Serial Interfaces: GPIO, I²C, I²S, PWM, SDIO, SPI, UART

- Voltage Supply: 2.7V ~ 3.6V

- Operating Temperature :40℃ ~ 85℃

3.4. Current Sensor: The amount of current drawn by the load is sensed by the current sensor and used for further calculating the amount of power consumed in watt in order to generate the bill for charging. The current sensor used is ACS712T ELC-20A with following specifications:

- Ac/DC - current sensor

- 5.0 V, single-supply operation.

- 66 to 185 mV/A output sensitivity

3.5 Relay: A electro mechanical devices used as a switch using microcontroller commands. Here we use HF14FW Relay to turn on and off the SS wirelessly using either Wi-Fi or Bluetooth by sending commands through an android application. The relay used has following specifications:
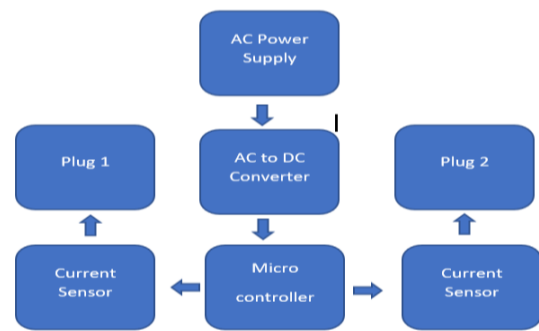
- 16A-250VAC

- 16A-24VDC

- 1HP-240VAC

Fig.1 Block Diagram of Smart switch

4. WORKING PROCEDURE

Step1: Set up the Smart plug at the location you want to charge your vehicle preferably your parking spot in your housing locality, a MCB is connected between the Main AC source and your SS to provide a protection for your charger

Step2: Turn on the mains supply so that AC power is provided to your Smart switch.

Step3: Open the SS application where you will see your Smart switch name visible and you can connect to it either using Wi-Fi, if internet is available at the location or using Bluetooth.

Step4: Once your application is connected to the Switch, you can Plug in your EV charger and click on the start button to start charging.

Step5: You can also set a timer for say 45 min or 60 min so that the switch will get turn off automatically after the timer ends.

Step6: With this there will be a visual panel on your application which will display the units of energy consumed by your EV for charging for that particular amount of time and calculate the amount in terms of Rs and your unit/Rs rate of electric bill measuring.

Step7: Once your EV is charged the app will pop up a notification and you can unplug your Charger from the Switch

3. CONCLUSIONS

Mobile communication technology is constantly developing, and costs are falling, making it possible to integrate mobile technology into home automation systems. In the past, we did not monitor all of our office and home appliances from a single location. We had been manually managing such appliances, which took extra time. This has a drawback in terms of time consumption. Manual power is reduced, costs are reduced, and time is saved. Web technology allows for minimal cost, easy implementation, and low power usage, as well as control. Household and industrial applications, security applications, and lab monitoring systems are all examples of applications.

The real-time connectivity of millions of devices will enable merchants to collect important data and get real-time insights. Supply chain and smart store applications are also important IOT applications in the retail industry. Embedding medical equipment with IoT devices will make it easier to keep track of patients. IoT will also make remote patient monitoring more efficient.

Smart vehicles with IoT connectivity are already on the market. Automobiles, including self-driving vehicles, will control the future. Many large corporations have already invested in and created IoT-connected smart vehicles. We may soon see them on our roadways. According to a research, there will be about 94 million linked automobiles on the road by 2021.

The Internet of Things (IoT) Wearable technology is the way of the future. You can use a smart watch to manage your automobile, such as autonomously parking it and closing or opening the doors. Your wearable gadget may potentially be able to identify threats in your immediate vicinity. Devices that measure our activity and exercise habits are already available. In the not-too-distant future, we may be able to automatically measure our calorie intake and eating patterns. So everything will be simple, except for the fact that making everything simple is difficult. In my upcoming article, I'll go through wearable gadgets in further detail. Here are a few examples of IoT wearable gadgets that are now accessible.

The experimental findings back up the theory, practicality, and dependability of the card she designed, which she tested in a prototype stage before moving on to the commercial stage. As technology advances and internet connection becomes more readily available in every part of the globe, the future of IOT is unquestionably bright. Greater connection is a need for development in today's society, thus the Internet of Things (IoT) has emerged as a critical tool for linking objects.

IoT impacting on our life greatly that we can't imagine. It would make our lives more efficient, easier, and productive. People would be able to turn off the motor or air conditioning in their home or the lights in their automobile while sitting at their desk, for example. IoT will undoubtedly go a long way in terms of being able to connect to all sorts of devices and the simplicity of use that it provides to those who utilize it. We can maintain a close check on things that were previously out of our grasp, such as when we are at work.

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BIOGRAPHIES

Mr. Bhushan Bhad, has completed B.E. degree in Electronics and Telecom. from G. H. Raisoni College of Engineering, Nagpur in 2020.

Ms. Ketaki Khengre, has completed B.E degree in Electronics and Telecom. from Vishwakarma Institute of Technology, Pune in 2021