Power Saving Smart Charger

Prof. Hanamant Sale
Assistant Professor, Department of Information Technology
Bharati Vidyapeeth College of Engineering CBD Belapur, Navi Mumbai

Shravan Shetty
Department Of Information Technology
Bharati Vidyapeeth College of Engineering
CBD Belapur,Navi Mumbai

Kunal Shinde
Department of Information Technology
Bharati Vidyapeeth College of Engineering
CBD Belapur,Navi Mumbai

Abstract — With mobile phones becoming a basic and important part of life in all ways, the recharging of mobile phone batteries has always been a problem. The main objective of this proposal, which presents a Power Saving Charger, is to make the charging of mobile phones independent of their manufacturer and battery make. We propose a device where all the users get to see a clear example of automation. The device uses an Android application for monitoring the battery percentage and to notify the ESP. The ESP will further continue the process as planned and developed and will automatically turn off the switch. The basic plan of this proposal is to save the battery lives of chargers as well as the mobiles. This invention not only is good to save the battery life of a charger, but also focuses on less power wastage.

Keywords- Android Application, NodeMCU ESP8266 module, Power-Saving, Automation, Monitoring.

I. INTRODUCTION

Cell phones, nowadays is one of our primary focus of attention in life playing an important role and becoming a necessity throughout the world. The ability to keep in touch with family, business associates, and access to email are only a few reasons, for the increasing importance of cell phones. Today's technically advanced cell phones are capable of not only receiving and phone calls, but storing data, even can be used for taking pictures. These has only one power source which is rechargeable batteries. A battery stores the charge and then supplies that charge to power up a particular device. Thus the charging of the batteries must be done effectively. In our project, we have studied and implemented a Smart Charger for the mobile devices which will be quite useful to all users. Our aim, behind this invention, is to save the battery lives of the charger as well as mobile by using basic benefits of ESP Module. The technology has been raising and expanding with the days rolling on. Every existing system can still be expanded to make it even more efficient calling it goal system. Most of the common devices are run by batteries. A battery stores the charge and then supplies that charge to power up any particular device. Though batteries are handy to use, their use needs some precaution too. It is also possible that over charging can cause the battery to lose the ability to recharge again. Thus, this device is capable of solving all these problems unlike other chargers.

II. LITERATURE REVIEW

Auto Cut-Off Power Charger[1] [from IoT Based MultiUtility Auto Cut-Off Power Charger (2018)' IRJET paper] introduces a charger in which the charged device is monitored and controlled externally with the help of a relay. When the threshold value is reached, it is automatically detached from the mains Manual control is also possible at any charged level of the battery. Iot gives the advantage to access it from anywhere. The proposed smart electronic device (novel auto cut off power charger[1]), which has sensors, software programmed controllers and network ports which enable to collect connected device's power level and the collected information is used to track the power level of the device.

Navjeet kumar et. al proposes an Iot based automatic charger(2017)[2], that has been designed in to implement a smart charging system that automatically controls its behaviour using the webserver and the phone which is being charged. The device being used is a ESP8266, the Web server which will be stored on the ESP8266 module acts as the IoT platform. As the web server is platform independent, it can be used on any device, like mobiles and laptops, these devices relay commands, and in turn the web server toggles the charger through the ESP8266 module.

Swapnali Patil and Ramesh Patil has projected a Stepper Motor[3] which is controlled using Arduino Uno(2018). They presented the design of automatic PCB drilling machine. It requires an Arduino board, stepper motor and the stepper motor driver module A4988. Arduino uno is based on ATmega 328. The stepper motor is bipolar with maximum power supply of 12V in which electrical energy is converted to mechanical energy. The driver module A4988 is used to control the stepper motor as required.

Putta Sindhuja and M.S. Balamurgan has proposed a Power Monitoring and Control system[4] which enables the client to monitor and control the appliances at home from anywhere availing the IoT features of the designed system thereby reducing the wastage of energy. The main objective behind this work was to ensure that IoT reduces the effort of human by introducing machine to machine interaction. This project[4] was designed to implement smart power monitoring and control system through IoT using cloud data storage.

Dr. Antonio Carlos Bento worked on an experimental and comparative research involving the devices NodeMCU 12e and Arduino UNO (2018)[5]. This comparative study was carried out at year 2017, which focused mainly on the positive and negative points presented by the devices while using a wifi network. The results in this project after analysis proved a point, where Arduino Uno device was demonstrated with little capacity and need to add new devices for communication via WiFi, this way Nodemcu 12e, has almost the same market value, but already has the WiFi feature internally, in addition to has greater capacity and ease of use.

Jagruti P. Gour et. al projected on an idea to change a perception of remote controls for actuating manually operated

robotic arm(2017). A robotic hand is useful for various medical purposes, such as paralysis or for handicapped person. This paper[6] discussed the design of an electronic product known as animatronic hand based on wireless technology using XBee S2 , Arduino UNO board ,servo motor, flex sensor. The servo motor was used as an important part in this animatronic hand. It caused the movement of a robotic finger with reference to which, all five servo motors moved by five flex sensors on a cotton. A wireless communication was thus achieved successfully.

Nathan David et. al presented a model for home remote monitoring system[7] using arduino microcontroller with an OPNET simulated wireless network system(2016). It basically used various cameras and sensors for the Arduino microcontroller to monitor the security of the environment and report the results to a remote system over the internet. The system uses the Arduino-Mega microcontroller which is used to interface the Bluetooth and Wi-Fi shield of the Arduino to make it possible for the microcontroller to provide both technology as media for communication and control using Wi-Fi to remotely monitor the system.

III. METHODOLOGY

We propose a Power Saving Smart Charger which is Wifi module based using NodeMCU ESP8266. The main challenge for our proposal is to turn the switch OFF after the battery percentage reaches its maximum level. The proposed system consists of an application which is responsible for the initiation of the process. Later, the two major parts of the charger i.e. the ESP and the stepper motor, continues the further process. Firstly, the android application which will be developed will be capable of notifying the ESP(with the help of Wifi module enabled at both sides) about the battery percentage, not continuously but only when the battery level reaches to its maximum extent i.e. 100%. The duty of the ESP then, is to ensure that the stepper motor gets started immediately. The stepper motor will be actually in contact with the button on the Switch Board which is used for charging. The stepper motor controlled using the driver module then, will hit the button to turn the switch off.

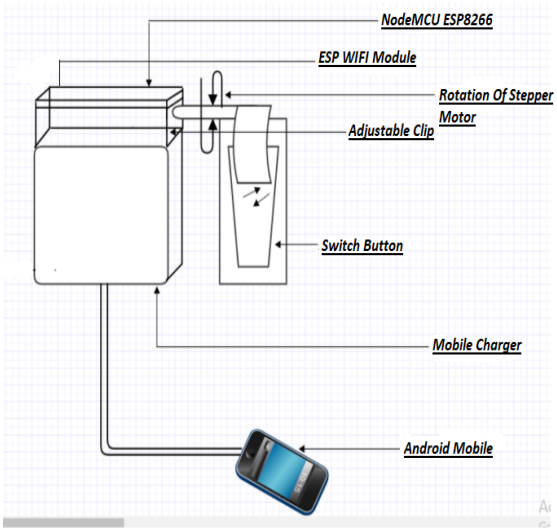

Fig. 1 : **Architecture diagram**

The way of recharging the batteries of mobiles, with the passing days needs to be enhanced. Most of the chargers of any device including cell phones are permanently or temporarily damaged due to extensive charging. This charger is quite smart, which avoids overcharging by a mixture of ideas and major benefits of ESP Wifi Module making it a complete embedded system project. Thus the charger will now help in protecting batteries by charging it till required limit. It is a unique charger which is developed and it will not be restricted to only mobile devices but also places where recharging play role such as laptops, music players, etc. By doing so, it will be flexible for all the devices to avoid any kind of battery problems.

The three main phases involved in implementing this project are mentioned below.

1) **Android Application** - The android application plays an important role in this process. The application is developed using Android studio. It is a basic app for giving a notification or else sending an alert message to the ESP. The application starts its working by scanning the wifi devices nearby. Later on, it connects to the ESP via hotspot for giving it the notification about the battery level percentage by monitoring it[4]. A specific code will be executed by which it will be possible for the application to notify the ESP.

2) **NodeMCU ESP8266** - NodeMCU is nothing but an open source IoT platform with a firmware which runs on ESP8266 wifi module. The ESP8266 is a low-cost WiFi chip with full TCP/IP stack and microcontroller capability[5]. We make use of the ESP to notify the stepper motor to rotate once the battery is 100%.

3) **The Stepper Motor** - The stepper motor is basically controlled by its specific driver module[3]. It receives the notification or a type of signal by the ESP. Ultimately, the stepper motor rotates at a particular degree at that time to turn off the switch.

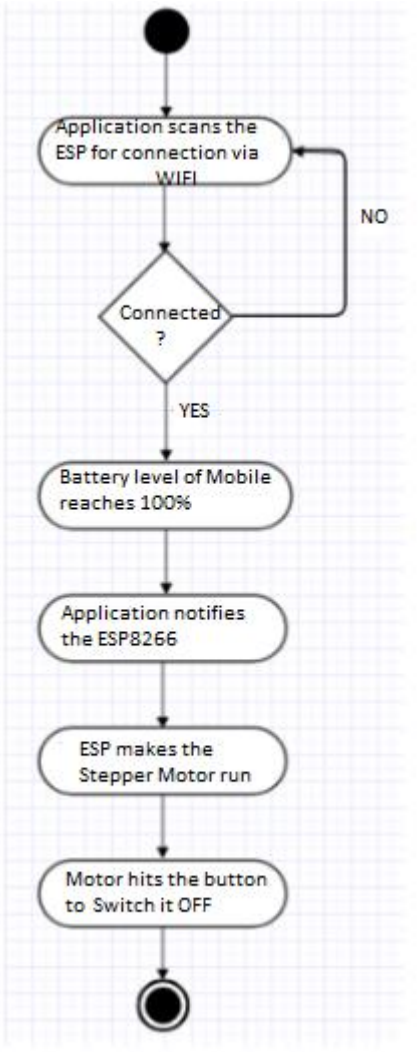

Fig. 2 : Flowchart of the process

The above figure describes the flow of the process in the form of flow graph. The entire process of this device is been explained in the graph step wise. This is called the activity diagram.

IV. EXPERIMENTAL RESULT

This section shows and reports the experimental results of our project implementation. The three phases mentioned in the methodology will be connected to each other. First is the android application developed for connecting to the ESP . Following it is the NodeMCU ESP8266 which will be connected to the stepper motor and its driver modules as given below. The following figure is called a fritzing diagram and it shows the connections between all the components used in the project.

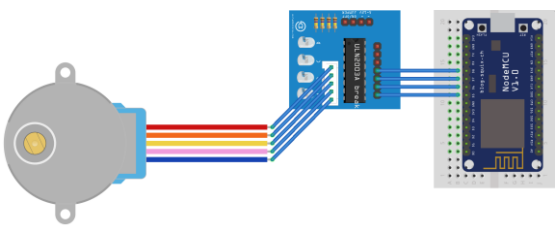

Fig 3 : Connections of Stepper Motor

The adjustable clip introduced is because of the size of different chargers and thus, this clip will help to work on this device on any charger. We first considered Arduino UNO for the project but later got a better board i.e the NodeMCU ESP8266 for good results[5]. The ESP8266 has an in-built wifi module which makes the work easier for the android mobile. An android application, developed to scan nearby wifi devices will be present in the mobile. The application will later detect the ESP and a connection is set up between them. The android application then, monitors the battery percentage. An alert or some kind of notification is given to the ESP by the application once the battery percentage reaches 100%. The ESP8266 with its major benefits, is then capable to make the stepper motor run via the driver module of the motor. This stepper motor plays a major and important role in this project. The stepper motor is responsible to rotate at a particular degree with the help of its driver module as required[6]. This rotation will hit the button and turn the switch OFF and stop the power supply when the battery reaches 100%. The diagram below will give you an idea about the connections we performed for the project.

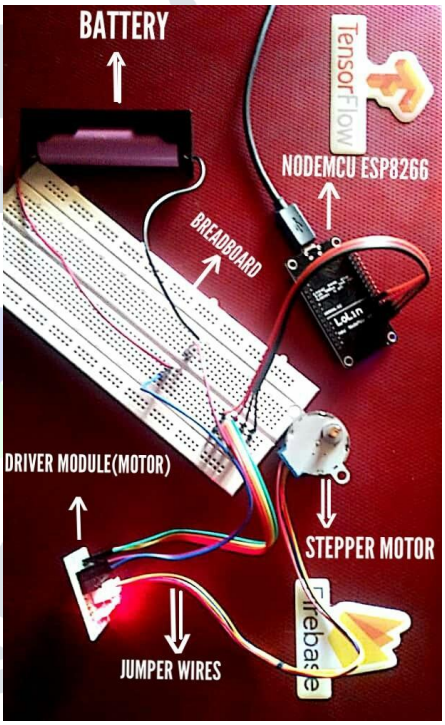

Fig 4 : Component connections

As the connections are once secure, the android application has to play its role for the project implementation. The application has to monitor the battery percent and notify the ESP when its full. The UI of the application developed with the instructions regarding it is shown in the figure below.

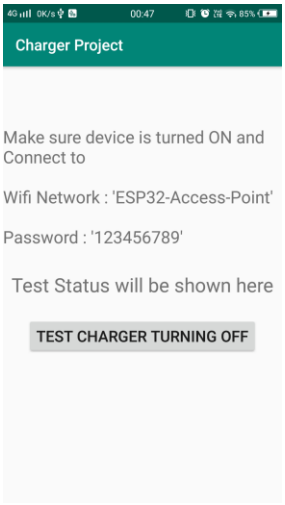

Fig 5 : UI of Application

The above application is developed in Android Studio.The user has to then connect to the wifi network as given.

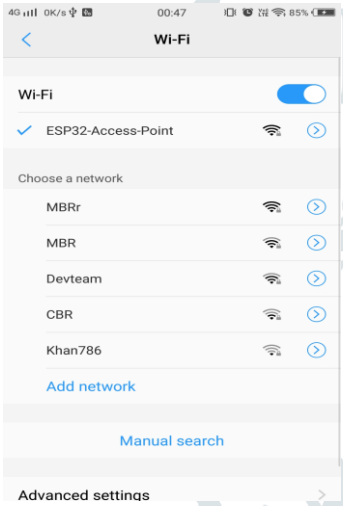

Fig 6 : Connected Wifi Network

Later when the user's mobile is connected to the ESP wifi module, the final step is that the ESP should make the stepper motor run once it gets an alert by the application. This process is carried out by coding of ESP8266[2]. The coding is done in Arduino Software(IDE) 1.8.5[3]. The code written for rotating the stepper motor through ESP is as shown below in the figure.

ESP8266_Final.ino

```
// Load Wi-Fi library
#include <ESP8266WiFi.h>
#include <Stepper.h>

#define STEPS 2038 // the number of steps in one revolution of motor (28BYJ-48)

// Replace with your network credentials
const char* ssid     = "ESP32-Access-Point";
const char* password = "123456789";

// Set web server port number to 80
WiFiServer server(80);

// Variable to store the HTTP request
String header;

Stepper stepper(STEPS, 2, 5, 4, 16);

void setup() {
  Serial.begin(115200);

  // Connect to Wi-Fi network with SSID and password
  Serial.println("Setting AP (Access Point)…");
  // Remove the password parameter, if you want the AP (Access Point) to be open
  WiFi.softAP(ssid, password);

  IPAddress IP = WiFi.softAPIP();
  Serial.println("AP IP address: ");
  Serial.println(IP);
```

Fig 6 : ESP Code

The above code is written so well that the stepper motor rotates at a degree of 180 angle to press the button and turn the switch OFF.

V. CONCLUSION

There are a number of new technologies being introduced nowadays. They are not only improving the lifestyle, but are also spreading awareness of new thinking and ideas in the market. The existing systems of the chargers could not fulfill all the requirements of a user. Thus, this new Smart Charger is introduced which is quite efficient in usage of power and battery. This device helps the charger to automatically turn the switch OFF and stop the wastage of power.This project will be very needy to the mobile users as overcharging causes a lot of problems such as low speed of charging capability, charging slot problems and many more. The proposed system can be clearly useful to many of the mobile users for saving the battery lives of the mobile as well as the charger. This charger will help solve all of the problems leaded by overcharging of the batteries, as it gives a way to monitor the battery percent extent and give an alert when the charging is done.

VI. REFERENCES

[1] R. Shankar, S. Blessy, M. Selva Roja, "IOT Based MultiUtility Auto Cut-OFF Power Charger", International Research Journal of Engineering and Technology(IRJET)" Volume:05,Issue:02, February 2018.

[2] Navjeet Kumar, Dorathy R., Shruthi M., Dr. Anusaya S. "IoT based Smart Charger: An ESP8266 based Automatic Charger" International Journal of Pure and Applied Mathematics Vol.115, No.8, 2017, 565-570.

[3] Swapnali K Patil, Ramesh T Patil "Controlling Stepper Motor Using Arduino UNO" International Research Journal of Engineering and Technology(IRJET), Volume:05, Issue:04| April-2018.

[4] Putta Sindhuja and M.S. Balamurgan "Smart Power Monitoring and Control System through IoT using Cloud Data Storage" Indian Journal of Science and Technology. Vol 8(19), BOI:1017485/ijst/2015/v8i19/76698,August-2015.

[5] Dr. Antonio Carlos Bento, "IoT: NodeMCU 12e X Arduino UNO, Results of an experimental and comparative survey." International Journal of Advance Research in Computer Science and Management Studies, Volume 6, Issue 1, January 2018, ISSN:2321-7782(Online), e-ISJN: A4372-3114, Impact Factor: 7.327

[6] Jagruti P. Gour, Jayswini K. Shende, Karishma K. Kubde, Samiksha K. Kothekar, Prof. Pankaj S. Taklikar, "Animatronic Hand Using Arduino" International Journal of Scientific Research in Science and Technology,(IJSRST) Volume 3, Issue 2 , Print ISSN: 2395-6011, Online ISSN: 2395-602X , February-2017.

[7] Nathan David, Henry Agbo, Greg Ezema, Amalachukwu Abafor "Remote Monitoring of an Arduino Based Home Automation Security System", International Journal of Scientific & Engineering Research, Volume 7, Issue 5, May-2016, ISSN 2229-5518.