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IoT Based Smart Charger: An ESP8266 Based Automatic Charger

Prashant Chavan[1], Vishal Pachpol[2], Amar Barkade[3], Abhishekh Gajbhiye[4], Ganesh Kale[5]

Assistant Professor, Dept. of EE, D.Y.Patil Institute of Engineering & Technology, Pune, Maharashtra, India[1]

UG Student, Dept. of EE, D.Y.Patil Institute of Engineering & Technology, Pune, Maharashtra, India[2-5]

ABSTRACT: The internet of things has many applications; one of those is Smart Power Monitoring and Control Systems. Energy efficient devices can be designed in IoT, which can reduce both, the power consumption and the human effort required to do so. This work 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 Webserver which will be stored on the ESP8266 module acts as the IoT platform. As the webserver 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. This project helps in automatic monitoring ofthe device and sends notifications to the phone, which is necessary if we want to reduce both the energy and time needed to maintain said devices. This system would be capable of turning on and off only when the device is connected and charge only when needed, and can be further improved to monitor other appliances. There are various modules available, which when paired up with the charging circuit will turn the charger into an IoT based device, like ESP8266, Particle Photon, and other Arduino based modules, but ESP8266 is the most cost effective and also has low power consumption

KEYWORDS:IOT, ESP8266, ESP8266 Webserver, Smart Charger.

I.INTRODUCTION

A device that could monitor the power consumption and control it, will help vastly in reducing the wastage of energy. This system would be capable of turning on and off only when the device is connected and charge only when needed, and can be further improved to monitor other appliances. There are various modules available, which when paired up with the charging circuit will turn the charger into an IoT based device, like ESP8266, Particle Photon, and other Arduino based Wi-Fi modules.

II. LITERATURE SURVEY

IoT is widespread and popular nowadays, is prevalent in research, the design includes Wi-Fi module, power supply and remote-control plug

[1]. The remote-control plug is a part of the IoT which connects the mobile phone to other appliances and can be controlled from any place at any-time. The design used in this research has remote plug along with the Wi-Fi and power supply module. The control strategy is depicted with the help of the comfortable design which consists of the 220V – Input and 5V, 6W – Output power supply. This research design contains the STC 15L 204EA as the core control chip to manage the device's electricalrelay functions and the control signals are transmitted in two diverged paths during the connection establishment. Also, the mobile phone can control the plug through remote access by means of TCP port in the same Wi-Fi environment.This work gives an overview of functionality of the ESP8266 Wi-Fi module.

[2].PuttaSindhuja and Balamurugan [2] has projected a home automation system in which the user can be able to control and monitor appliances withthe help of the IoT to minimize the energy usage. The appliances are connected via an Ethernet to a router and uses m-bed microcontroller and sensor-actuator units to control the power utilization. The designed system enables 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 interesting part of the hardware for this system comprises of the Hall effect sensor, Ethernet break outboard, Appliances such as 10W bulb – 12V fan, two channel relay, m-bed microcontroller – LPC 1768 and Ethernet modem. The Relay needs 12v power supply, groove Electricity

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Sensor is employed to measure the energy consumption in each appliance. Xively is software which enables the cloud data storage and its used to analyse the usage.This work gives the direction to be followed while designing systems that analyse the power consumption of devices.

[3].KrupalKachhia Patel et. al. [3] proposes a system that implements MQTT (Message Queuing Telemetry Transport) and TCP in ESP8266 Wi-Fi module to control appliances and interfaces them with proximity, PIR sensors. In his paper, they have described the architecture and implementation of home automation system. To reduce the development cost, this system utilizes the electronic boards. Apart from the low cost, the smartness of the automation system can be justified with the automation scripts that can be customized by the user, even at runtime. The complete system efficiently utilizes the existing network infrastructure with the help of MQTT protocol and TCP protocol.This work helps understanding how the ESP8266 can be interfaces with appliances, and automation of appliances. The four-tier architecture is proposed in this system applied using smart parking, votlDB, vehicle data sets, spark and storm for real time processing which has the Hadoop framework to make it more scalable and efficient

[4]. The execution of architecture has the process of decision making, filtration, preprocessing, aggregation, computing, collection and classification. In this proposed research,the implementation is carried out by means of Hadoop with Storm or S4, Spark, voltDB to process the real-timeIoT data and produce results. The analysis with Hadoop with MapReduce programming is done for future developments and further enhancements. This work gives an overview on creating scalable power monitoring systems.

[5]. Mohammad AbdurRazzaqueet. al proposed in, a Middleware technology for an ultra large scale internet of things, a system for connecting heterogeneous devices like smartphones, TVs, etc. to IoT with an event based, service based and VM based middleware technologies, as it will save traffic and power consumption in IoT devices. The final results portray that the improvement in the entity interconnectivity issues and the reduction in the energy costs of the industrial management systems.This works shows the need for middleware in IoT devices.

[6]. ManarJaradataet. al. [6] have proposed a system which comprises of an IoT based energy management platform that runs a DR algorithm to manage the industrial based tasks. The authors focus on the future of the Internet of Things and smart grid related applications. They also exploit the various applications of the smart power grid domain networks in the different aspects of sensor networks. The meters and sensors for these applications also were discussed with the help of the techniques in the Big Data.This work shows the need for monitoring of energy consumption in appliances of all scales, small or large.

III. SYSTEM ARCHITECTURE

A. HARDWARE REQUIREMENT

i.) ESP8266 Wi-fimodule(as webserver and controller).
ESP8266 is a low power, highly efficient Wi-Fi module that can run on just 3.3v. Its open source and can be programmed with Arduino Uno. The ESP8266 module contains stack for HTML, JAVASCRIPT, XML, CSS, etc. and supports implementation of various API's. ESP8266 can also be used to store cookies and for authentication process. With ESP8266 local Webservers can readily be created and remote implementation can be done by port forwarding using router's static IP.

ii.) Arduino Uno(as a FDTI board).
The Arduino Uno board is used here as a FDTI board in order to program the ESP8266 module.

iii.) MB102 (as a power supply module i.e. voltage regulator).
MB102 is a basic charging circuit is required, that
supports all android devices. The charger should have 3.3V and 5.0 V, a current output less than 750mAh. This device will distribute the input into the ESP8266 module and the phone, separately. The input to the charging module can be 12V or 5V from an external supply. The power supply module has built-in overload protection and voltage regulators, so that makes the smart charger safe to use.

iv.) IRF540 MOSFET (as a switch).
IRF540 is used as a switch in this system, it has the voltage rating of 100V and current rating of 30A, so it can be used with mobiles and laptops interchangeably, which is not possible with relays

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B. SOFTWARE REQUIREMENT

i.) Arduino nightly IDE. Arduino nightly is used here in order to flash firmware onto the ESP8266 module. Here we will also need the ESP8266 libraries and board installed on it.

ii.) ESP8266 Webserve

The ESP8266 module and its variants are all equipped with and support HTML5, JAVASCRIPT, PHP, AJAX, etc. Simple webservers can be created on the ESP8266 module and can be used locally or remotely.

iii.) HTML5 API

Using the HTML5 API for battery, which is supported on almost all devices, we can interface with the device directly and send alerts through the webserver to the ESP8266 module

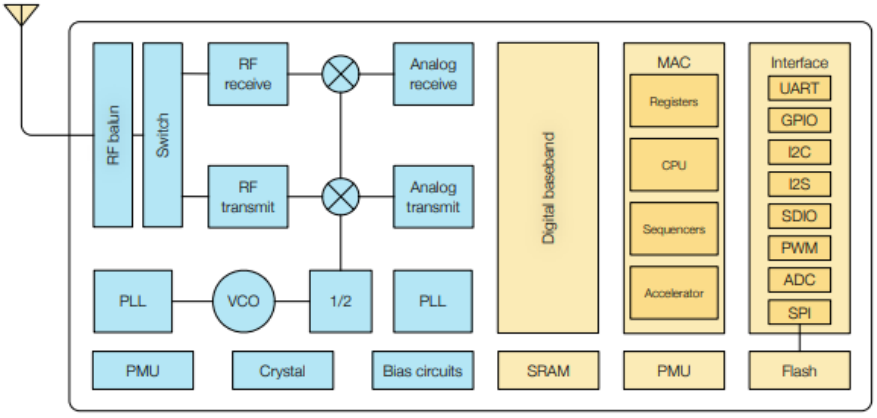
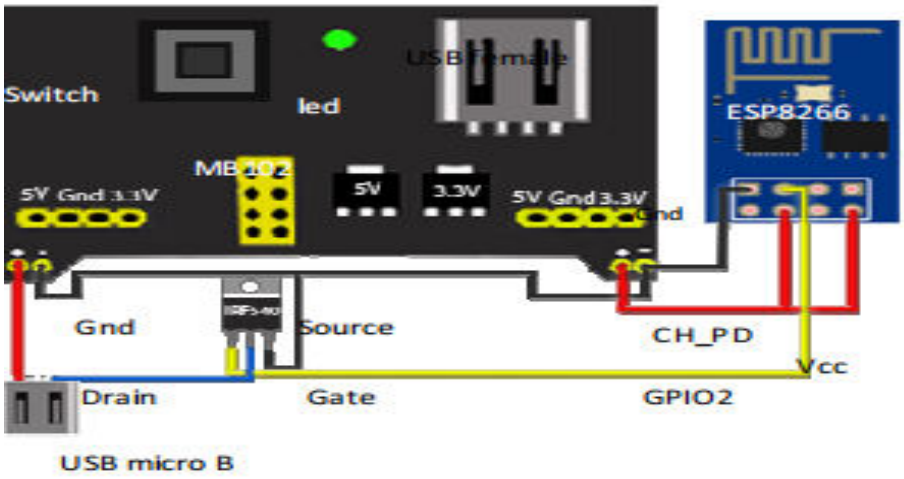


Figure 1. ESP8266 architecture



In the Fig. 2 Circuit Diagram

IV. METHODOLOGY

A) Method 1: Automatic Mode

- **CHARGE_STATUS:** The mobile phone will consist of a preloaded application which will be able to monitor the battery status.
- **POST:** The **CHARGE_STATUS** will send a notification to the ESP8266 module when the CHARGE_STATUS returns 100% or any specified threshold.
- **DEEPSLEEP:** This will be invoked and the module will switch off and the charger will stop charging the mobile.

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B) Method 2: Assist Mode

- **TIMER_VALUE**: The user assigns the time till the phone will get charged, regardless of the **CHARGE_STATUS**.
- **POST:** The **TIMER_VALUE** is entered it will be sent to the ESP8266 module and charging will commence.
- **HANDLE_TIME:** The ESP8266 starts the timer, when the time is over the charger is switched off.

V. RESULT AND DISCUSSION

I n the fig 1 ESP8266 ARCHITECTURE

- **Low-power,highly-integrated Wi-Fi solution**
- **A minimum of 7 externel components**
- **Wide Temperature range: -40^{0}C to +126^{0}C**
- **ESP8266- 8 Mbit flash embedded**

i.) There are various modules available, which when paired up with the charging circuit will turn the charger into an IoT based device, ESP8266 is the most cost effective, has the least power consumption, and the widest operating temperature.
ii.) The module is controlled through the ESP8266 webserver. The ESP8266 module is equipped with and support HTML5, JAVA SCRIPT, PHP, AJAX, etc. Simple webservers can be created on the ESP8266 module and can be used locally or remotely.
iii.) The task of charging is controlled by the device which is being charged i.e. the device that has been plugged in to the charger. It can also be handled through the IoT web platform i.e. the web server.

This system will work with a charging circuit and be controlled through the ESP8266 contThis system will work with a charging circuit and be controlled through the ESP8266 controller, which in turn will be monitored by the mobile which is being charged currently. This system can be implemented easily with any charger and any smartphone. The power supply going through the charger degrades a little, due to the voltage regulator's efficiency, but overall, the voltage and current remains constant. In order to avoid degradation of the current, while charging phones, a secondary supply can be utilized, like in the case of charging laptops. By doing so, the powers supply going to the device remains the same as the actual charging device'sroller, which in turn will be monitored by the mobile which is being charged currently. This system can be implemented easily with any charger and any smartphone. The power supply going through the charger degrades a little, due to the voltage regulator's efficiency, but overall, the voltage and current remains constant. In order to avoid degradation of the current, while charging phones, a secondary supply can be utilized, like in the case of charging laptops. By doing so, the powers supply going to the device remains the same as the actual charging device's.

VI. CONCLUSION

This paper has proposed a system that can automate the charging process of mobiles and laptops. This system would be capable of turning on and off only when the device is connected and charge only when needed, and can be further improved to monitor other appliances Further improvements to the system can be made in order to increase the hardware performance.

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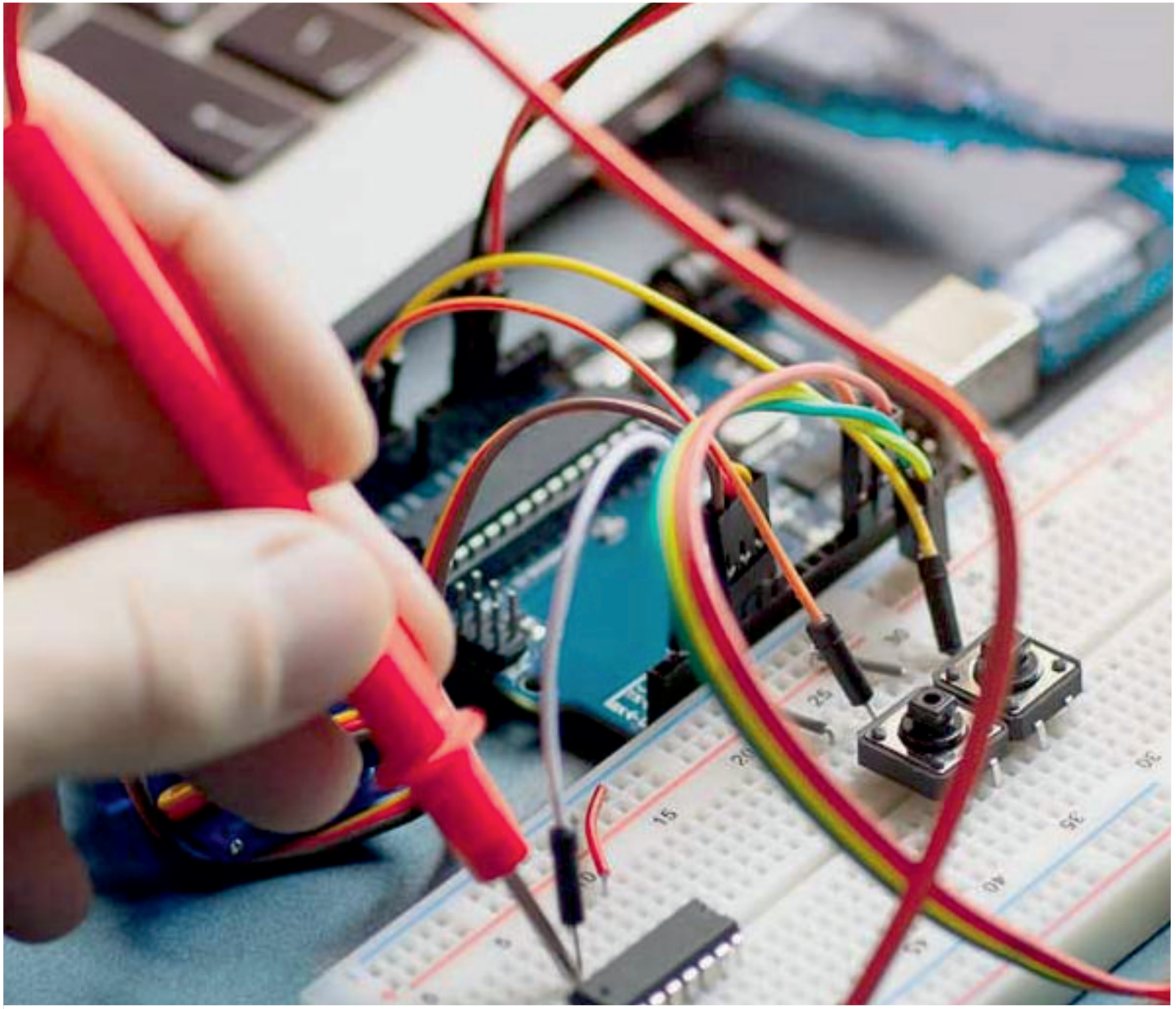

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