Home Automation using ESP8266 Wi-Fi Development Board

Ashwin P Ajith[1], Chaitanya Bachav[2], Dipyaman Paul[3]

[1]Computer Science & Engineering, SRM Institute of Technology, Ramapuram, Chennai, India

[2]Computer Science & Engineering, SRM Institute of Technology, Ramapuram, Chennai, India

[3]Computer Science & Engineering, SRM Institute of Technology, Ramapuram, Chennai, India

Abstract

The fast growing world needs various technologies to improve quality of life. By the virtue of blooming automation industry and wireless connectivity, all the devices within the home can be connected. This improves the comfort, energy efficiency, indoor security, cost savings of the home. Small and constrained embedded devices are used to remotely monitor the conditions within home and control the home appliances. The Internet of Things is a network exchanging the data/information between the devices having Internet connectivity, sensing and computing capabilities. This work uses the ultra low power consumption ESP8266 system on chip board operating 2.4 GHz ISM band for wireless connectivity. The relay circuitry is interfaced to ESP8266 NodeMCU board using the GPIO pins in order to control 220 V supply power outlet, wherein domestic appliances such as lights, fans, air conditioning system, and so on may be controlled remotely. The WLAN SSID & password allow only authorized persons from the home to control such appliances. The Android app has been designed and generated making use of the open source web application to control the domestic appliances using any Android Smart phone.

Keywords - *ESP8266, Home automation Android, Home Automation System*

I. INTRODUCTION

Home automation refers to remotely monitoring the conditions of home and performing the required actuation. Through home automation, household devices such as TV, light bulb, fan, etc. are assigned a unique address and are connected through a common home gateway. These can be remotely accessed and controlled from any PC, mobile or laptop. This can drastically reduce energy wastage and improve the living conditions besides enhancing the indoor security. Owing to the rapid growth in technology, the devices in the recent past are becoming smart. The real world devices are being equipped with intelligence and computing ability so that they can configure themselves accordingly. Sensors connected to embedded devices along with the low power wireless connectivity is facilitates to remotely monitor and control the devices. The Android app has been designed and generated making use of the open source web application to control the domestic appliances using any Android Smart phone. The Android app created provides graphical user interface supports two options to control appliances:

(i) the user can use icons or graphical buttons created for respective home appliances and

(ii) they can use specific voice commands to control those home appliances using Android Smart phone. The main objective of this work is to have a system which is cost effective, robust and also scalable.

II. LITERATURE SURVEY

Ananda Mohan Ghosh et al. [1] has demonstrated a health care system for hospital management to allow relatives and doctors to remotely monitor the health condition of a patient via internet using Arduino Uno connected with E-health sensor shield kit and Phidgets interface kit. But unlike our solution, it does not provide email and SMS alert to an emergency contact list.

P Kumar et al. [2] has proposed a raspberry pi controlled patient monitoring system where heartbeat, respiration, temperature and body movement of the patient is being measured using sensors and displayed on the

screen using the putty software. However, it does not contain the alarm notification for providing prescribed drugs to the patient which has been added in our proposed solution.

Sarfraz Fayaz Khan [3] has proposed a complete and effective healthcare monitoring system using IoT and RFID tags. In this system, for supervising and weighing the health condition of the patient and for increasing the power of IoT, a combination of microcontroller and sensors have been used. But, it does not include medication and precaution according to the patient health condition by controlling the appliances and providing the prescribed medicine which is present in our paper.

Freddy Jimenez et al. [4] have focused on monitoring the health of a patient and sending relevant updates and alerts to doctors, family members and other important people. However, it does not include the appliance control part, which has been added in our project, it only deals with the Monitoring part and informing the relevant people about it.

S. Siva [5] et al. have proposed a solution to monitor patients' health care condition using the smart hospital system. The patients' health condition can be monitored by means of a spark kit. It records the temperature and heart rate of the patient and triggers an alert system if the parameters go out of a certain prescribed range.

Felipe Fernandez et al. [6] tell us about the probable problem which we will be encountering if we actually go ahead to create an IoT based health care system. It also tells us about the reliability of IoT based systems, which is an important concern in health emergencies.

Boyi Xu et al. [7] put forward the challenge of reading and storing data in the IoT platform and ways to solve it. As we know most of the IoT based systems include reading real-time data in regular intervals and health care is one of such cases. Under this scenario due to the different kinds of data and regular input of data it becomes more difficult to interpret and sequentially store the data in proper format. Hence this paper gives us a method to do that.

Danilo F. S. Santos et al. [8] have discussed the use of connected Personal Health Devices (PHD) using which proper data can be retrieved from the actual sensors. This paper actually provides a standard architecture that actually helps in sharing of data between the systems like out mobile phones and cloud databases.

III. SYSTEM ARCHITECTURE

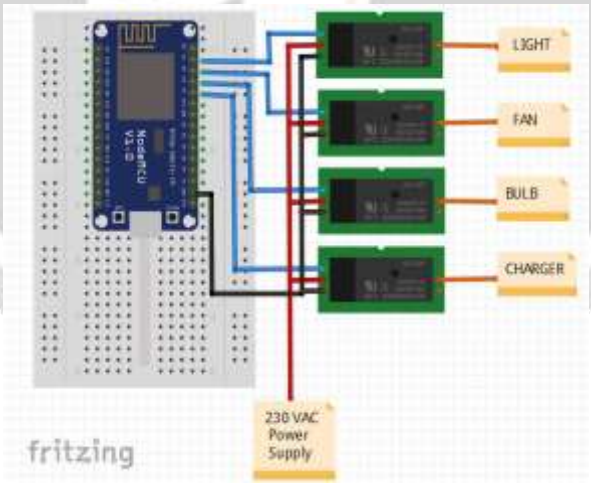

Fig. 1: Circuit Connection of the System

The hardware realization of the proposed system as shown in Fig. 1 contains NodeMCU, the ESP8266 WiFi board, is USB powered and the same is interfaced with various home appliances like light, fan, bulb and charger through the four SPDT relay channels by means of 230V
power supply. The ESP8266 WiFi board acts as web server for the system and it sets number of GPIO pins equal to the number of home appliances. The aim is to
create a simple HTTP server through which the status of GPIO pins of ESP8266 is altered depending upon the request. An example of changing the status of GPIO2 pin of ESP8266 through an HTTP server has the following format:

http://Server_IP/GPIO2/0 .....set the GPIO2 Low

http://Server_IP/GPIO2/1 .....set the GPIO2 High

where Server_IP is the IP address of the ESP8266 WiFi board. Once the NodeMCU is powered up using its USB port it attempts to discover the access point whose SSID and password have been stored already. This access point may be connected to the Internet using either wired or wireless medium or cellular connectivity. The code is uploaded with required libraries [2] to the NodeMCU using the Arduino IDE. Once the ESP8266 finds the matched combination of that particular SSID and Password, it connects to the access point and becomes part of the WLAN. The NodeMCU has already been programmed to act as web server with port address of 80. The Server_IP is displayed in the serial monitor of Arduino IDE which is the local IP of the server. Then, it listens using port 80 and lets the client upload its data. Depending on the data, the status of the GPIO pins of the ESP8266 is modified and in turn the relay connected to the corresponding GPIO pin is controlled. The relay acts as a switch to control 220v AC power to the domestic appliance. Table I provides the URLs used to turn on and off AC power to various appliances.

TABLE I: URL based Domestic appliance control

S.No	URL	Home Appliances	Status
1	http://Server_IP/ GPIO1/0	Light	OFF
2	http://Server_IP/ GPIO1/1	Light	ON
3	http://Server_IP/ GPIO2/0	Fan	OFF
4	http://Server_IP/ GPIO2/1	Fan	ON
5	http://Server_IP/ GPIO3/0	Bulb	OFF
6	http://Server_IP/ GPIO3/1	Bulb	ON
7	http://Server_IP/ GPIO4/0	Charger	OFF
8	http://Server_IP/ GPIO4/1	Charger	ON

Relay Module

A relay module is used to turn on or turn off home appliances using voltage and/or current much more than Arduino could handle. This is also used for providing isolation between the low voltage circuit on Arduino side and the high voltage circuit side controlling home appliances. Relay module is activated by using external 5V power supply, which in turn, controls electrical appliances like fans, lights, ovens etc. In this project 8-channel DC 5V relay module is used. It is equipped with high current relay, AC250V 10A and DC 30V 10 A. In it each relay needs 15-20mA driver current.

Fig. 2-channel Relay Module

IV. CONCLUSION

Home automation market is very auspicious sector which is developing rapidly. The proposed home automation system can be used for both domestic and office environments. The remote control feature using the Android Smart phone assists elderly and persons with disability. The ESP8266 NodeMCU is a low cost device and has ultra low power consumption. A
different relay can be chosen based the load. The design and app development has been demonstrated by using App Inventor to support both GUI button based and voice activated approaches. The automation system is inexpensive, secure easily accessible and also scalable so that the number of devices can be easily customized by making minor modifications. It requires extensive range of developments that can be made in the idea of smart homes. Modelling and execution of home automation system using Wi-FI through android application has been discussed in this paper. The proposed system is practical, economical and simple.

V. FUTURE WORKS

In future home automation systems can make homes even more intelligent. This system can be used for building automation, industrial automation, hospital automation for patients and agricultural automation for farmers. Different sensors can be interfaced with this system such as motion sensors, light sensors, flame sensors, temperature sensors etc to provide safety and control benefits. Automated toggling of devices based on certain situation can also be implemented. Wi-fi and Ethernet based home automation systems can be developed.

VI.ACKNOWLEDGMENT

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