iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4795

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

High Efficient, Low Cost Home Automation System

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Abstract: ***The main objective of this project is to develop a method to automate the daily tasks of a house and access appliances so that time and cost is minimized. The user will be able to control the home appliances remotely using a single click on a webpage. Real time environmental parameters are sensed and posted on the Internet using an API. Devices can be switched on/off based on predefined conditions set by the user. On detection of motion in the house the system will send photos to the cloud. The user will also be able to access his system from anywhere using an interface which shows the real time conditions as well as previous data collected by the sensor. Since the system is automated, there is hardly any chance of a human error.***
Keywords: Home Automation System, IOT, ESP8266, Raspberry Pi, Low Cost.

I. INTRODUCTION

In the computer age of the 21st century, more and more tasks are becoming automated. Automation can make things easier, safer, and often more cost efficient. Home automation is a general term that covers a variety of technological capabilities you can install in your home. Home automation can include controlling aspects of your home remotely through a computer or phone, programming electronic devices to respond automatically to certain conditions or scenarios,
or centralizing the control of a variety of items in your home into a single control center.
Home automation system represents and reports the status of the connected devices in an intuitive, user-friendly interface allowing the user to interact and control various devices with the touch of a few buttons. Some of the major communication technologies used by today's home automation system include Bluetooth, Wi-MAX and Wireless LAN (Wi-Fi), ZigBee, and Global System for Mobile Communication (GSM). Here we will be using a cheap Wi-Fi module called ESP8266. It offers the user complete access control of the appliances through a remote interface.
IOT encapsulates the concept of connecting multiple devices and obtaining data from sensors which is sent to cloud servers for processing and analyzing the data and based on conditions set a trigger can be generated to alert users via push notifications.

II. LITERATURE REVIEW

TABLE I
COMPARATIVE ANALYSIS OF LITERATURE

Sr. No	Author	Working	Feature
1	[1]Pavitra. D , Ranjith Balakrishnam	This project aims at controlling home appliances via Smartphone using Wi-Fi as communication protocol and raspberry pi as server system. An extra feature that enhances the facet of protection from fireplace accidents is its capability of sleuthing the smoke in order that within the event of any fireplace, associates an alerting message and an image is sent to Smartphone.	The devices can be controlled and monitored using web portal or android smart phone Lights ON/OFF, Fan ON/OFF using sensor.
2	[2]Navjot kaur walia , Parul kalru , Deepti Mehrotra	These smart gadgets are using cloud computing which sends and receives signal on the cloud. The data that is of our use can be fetched by matching some key values using the concept of information retrieval. The key objective of this paper is to create a full-fledged application which could let user to operate the lights of their house from any remote location.	Operate the smart light of their house from any remote location.
3	[3]Ravi Kishore Kodali , Kopulwar Shishir Mahesh	It is shown that communication between the low power ESP8266WiFi as client with the clients on smartphones and laptop using an MQTT protocol becomes easier and more reliable. The Wi-Fi enabled ESP8266 board interfaces with DHT11 sensor and LDR sensor to monitor the ambient condition and according to the light intensity level the brightness level of 8*8 Neo-pixel matrix is controlled.	Light Control using sensor. Update on temperature, humidity and light intensity level to users. Control this system using low cost module.

III.PROBLEM DEFINITION

Considering the number of devices that we use in our house, it becomes difficult to control all switches manually. We tend to forget to switch off appliances thereby wasting energy as well as money. Many accidents happen in the home because of poor lighting. Although home security is a priority for everyone, high installation cost or monthly monitoring charges make security systems cost prohibitive for many homeowners. A centralized system is required which gives multi control yet is not costly for the user.

IV.PROPOSED SYSTEM

The proposed system aims for controlling devices using Wi-Fi and logging real time conditions to the cloud.
We have used ESP8266 which is a cheap Wi-Fi module to control the relays which are connected to the appliances. The DHT11 sensor captures the temperature and humidity of the room and log it to Internet using Twitter API. Based on temperature readings, conditions can be decided to send alarms to mobile devices on detection of an event using IFTTT service. On detection of motion, pictures are captured and sent to Dropbox Service using web requests. By using the API of dweet.io, we have created an interface for controlling home devices from anywhere.

V. REQUIREMENT ANALYSIS

A. Software Requirements

1) *Arduino IDE* [4]*:* The Arduino IDE is used to upload programs to the ESP8266. ESP8266 Arduino core comes with libraries to communicate over WiFi using TCP and UDP, set up HTTP, mDNS, SSDP, and DNS servers, do OTA updates, use a file system in flash memory, work with SD cards, servos, SPI and I2C peripherals.
2) *Twitter API:* Twitter API is a service that lets you share a status message on Twitter.
3) *PuTTy* [5]*:* PuTTY is a free implementation of SSH and Telnet for Windows and Unix platforms, along with an xterm terminal emulator.
4) *IFTTT* [6]*:* If This Then That(IFTTT) is a software platform that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services.

B. Hardware Requirements

1) *Relay Module:* Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit.
2) *ESP8266*[7]*:* The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability. It does not come with any built-in code. It is programmed using the Arduino IDE in C language.

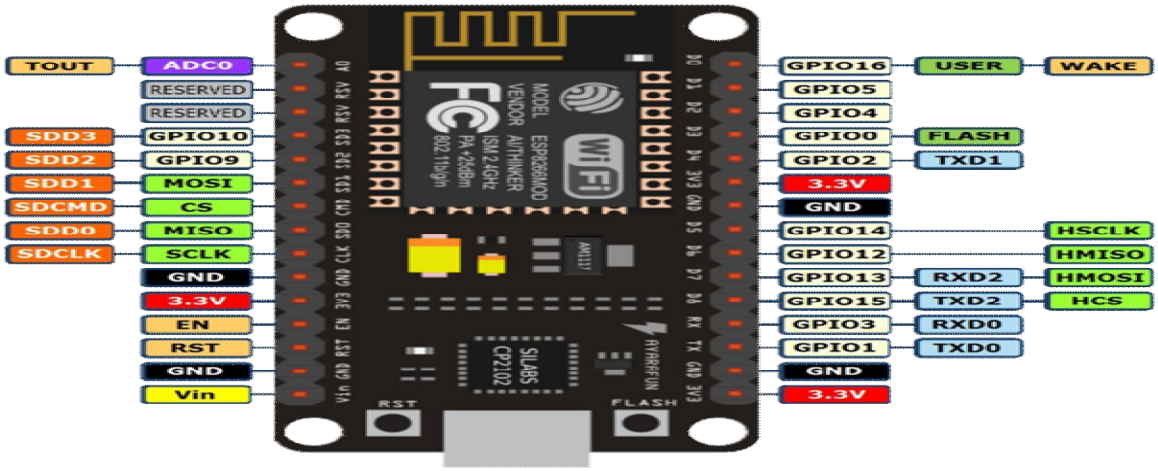

Fig.1 NODEMCU ESP8266

3) *Raspberry Pi:* Raspberry Pi is a small credit card sized computer used to connect multiple ESP devices together and as a hub of your house.
4) *DHT11 Sensor:* DHT11 is a low cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and gives out a digital signal on the data pin.

VI. METHODOLOGY

A. The ESP8266 Module connects to the Internet via the SSID (Service Set Identifier) and Password mentioned in the sketch in Arduino IDE.

B. The ESP8266 is connected to a relay module which is connected to a device which we have to switch on or off.

C. The user can visit the URL (IP address assigned to the ESP8266) to control the device connected to it.

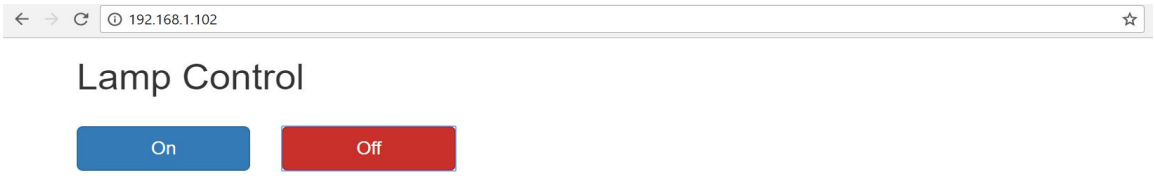

Fig. 1 The webpage for controlling the device

D. The DHT11 sensor is used to sense the temperature and humidity from the surroundings. The ESP is connected to the DHT11 and the user can see the real time humidity and temperature by visiting the URL of the ESP.

E. PuTTy is used to connect to the Raspberry Pi using SSH (Secure Shell). The Raspberry Pi is used to generate a web request using the obtained sensor readings. A user creates an app on Twitter and the Pi sends the web request to the Twitter API using for generating a tweet after specific intervals of time. The temperature and humidity in the house can thus be monitored by the users.

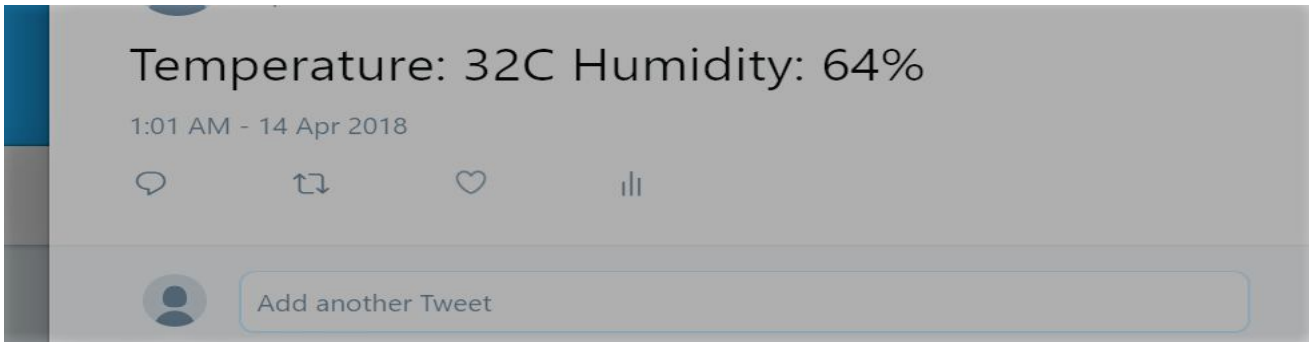

Fig. 3 A sample tweet generated by the system

F. IFTTT service is used to switch on/off devices based on conditions. If the humidity or temperature is more than a threshold value, the service will send a push notification to the subscribed devices to alert the user.

G. Based on humidity and temperature obtained from sensor, a threshold is decided above which the device will be switched on/off automatically. The values are stored in a variable and it is compared with the threshold value in the sketch.

H. The PIR Sensor is connected to the Raspberry Pi to detect motion. Whenever there is motion the D7 pin goes high which means motion is detected and the Web Camera captures a picture which is uploaded to the cloud server.

I. In order to control devices from anywhere we have used APIs from dweet.io and freeboard.io. The API from dweet.io is used to pass on the data from ESP to the Internet and freeboard.io is used to create an intuitive interface. Gauges and sparkline are used to represent temperature and humidity.

VII. CONCLUSION

A prototype for HIGH EFFICIENT LOW COST HOME AUTOMATION system is developed with the help of ESP8266 and data obtained from DHT11 sensor is uploaded to the cloud. we can use this module for continuous monitoring of a room. An individual home

automation system can thus be built using cheap hardware to control devices, display environmental parameters, switch devices based on conditions and control home appliances from anywhere.

VIII. ACKNOWLEDGMENT

We would like to express special thanks of gratitude to our Project Guide and Head of the Department of computer engineering Prof. P.R. Rodge as well as our Project Coordinator Prof. Uttara Gogate who gave us the golden opportunity to do this wonderful project on the topic of Home Automation System, which also helped us in doing a lot of research and we came to know about so many new things. We would Like to Thank CHINMAY ANAOKAR for his technical ASSISTANCE.

We would also like to thank our Principal Dr. J. W. Bakal for providing us the opportunity to implement our project. We are thankful to them. Secondly, we would also like to thank our parents and friends who helped us a lot in finalizing this project within the limited time frame.

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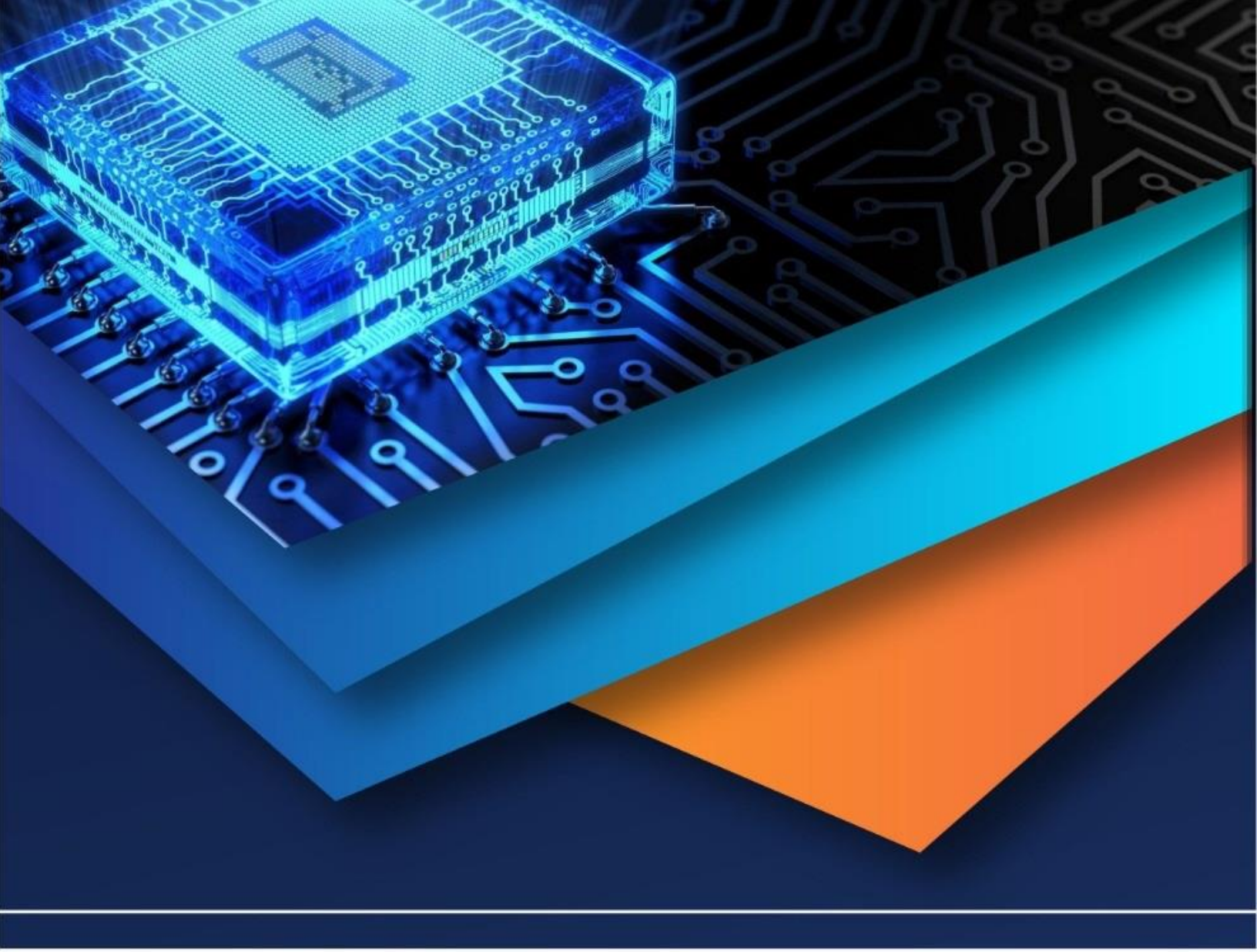

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