

Original Article

Home Automation using HTTP and MQTT Server

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Abstract - The world had moved further from the time when Thomas Edison first introduced the light bulb to the world in the early '80s, which was nothing short of a miracle in those times and changed the daily household for good. Since then, there has been a vast array of advancements in home appliances that have provided a lot of convenience and help for people who use them to make their life easy. But these appliances have always required one thing that is the presence of an operator to control them, to turn them on or to turn them off. Today people are looking at ways and means to improve their lifestyle using the latest technologies which are available. Any new facility or home appliance that promises to enhance their lifestyle is grabbed by the consumers. The more such facilities and appliances are added, the more it becomes inevitable to have easy and convenient methods and means to control and operate these appliances. Conventional wall switches are located in different parts of a house, and this requires manual operations like switching on or off. It gets virtually impossible to keep track of appliances that are running and also to monitor their performance. To overcome this manual system, an idea called Home automation using the Internet of things can be used. In this, various sensors and microcontrollers like Arduinouno, RaspberryPi, NodeMCU are connected through servers like MQTT and HTTP via the Internet.

Keywords - Home Automation, Internet of things, Microcontrollers, Arduino, RaspberryPi, NodeMCU, MQTT, HTTP.

I. INTRODUCTION

Home automation is a topic that is gaining popularity day by day because of its large advantages. One can achieve home automation by simply connecting home appliances electrical devices to the internet or cloud storage [8]. The reason for this surge in demand for network-enabled home automation is reaching the zenith in recent days for its simplicity and comparable affordability. Platforms based on cloud computing help to connect to the things surrounding everyone so that one can find it easy to access anything and everything at any time and place in a user-friendly manner using custom-defined portals. Hence, the cloud [8] acts as a front end to access IOT. Here we are assuming a system that can control devices through a

wireless-based network or cloud-based approach. In the project, we use an IOT based home automation system using HTTP and MQTT servers which aims to develop a home automation system that gives the user complete control over all remotely controllable aspects of their home. The automation system will have the ability to be controlled from a central host PC, the Internet, and also remotely accessed via a pocket PC with an android based application.

This paper focuses on the strategies used for various Home Automation projects. Further Section 2 summarizes the literature survey done by us, and Section 3 demonstrates the design and implementation of the proposed system. In the end, we discuss how we plan to take our proposed work further, and the conclusion is prepared in the last section.

II. LITERATURE SURVEY

The number of papers being published on IOT has certainly increased with time. The paper [1] gives us an idea about how IOT can be used to automate our homes. Another paper[2] and [3]helps us to understand how to create a server that can later be used to control all the devices which are connected in a given network and can be remotely controlled using a trigger. Another paper[4]helped in understanding the various protocols of IOT.In a [5] mentions the security concerns of an IOT network and how we should be careful while implementing such a system, another article [6] shows how we can implement another protocol that was designed to work with IOT[7] and how it can cater to all our security needs and how it provides efficiency in the network bandwidth [9] [10].

III. DESIGN AND IMPLEMENTATION

From the above-given statement, there was a need to provide a solution for the people who are out of reach from their homes or are differently-abled to control the various appliances present in their homes. We needed a way to control devices remotely and display the current status of a given appliance to the user. For this, we used a microcontroller to control the relays which are associated with the various appliances and an array of sensors like an LDR(Light Dependent Resistor) sensor, which we used as a backup emergency light in a case when there is no light in the room, and we used a Fingerprint Sensor(R307) which is used to enhance the security of the home to prevent any unauthorized access and also to make it convenient that the



user doesn't have to carry a key all the time. All these are being controlled by an HTTP (Hypertext Transfer Protocols) server and an MQTT (Message Queuing Telemetry Transport) server, and the garage doors are being controlled by server motors.

Our model uses an HTTP server that is controlled by a webpage using the IP address of the microcontroller. The main advantage of using an HTTP server is getting to develop an easy and user-interactive front-end that will be controlled by the user to toggle the appliances on or off as per their wish. It will also show the current running status of the appliances in the browser window. In our project, we used HTTP to control the appliances connected in the Drawing room and Garages like the garage doors and various lights. The second approach we used was an MQTT server. This protocol is lightweight in that it is often supported by some of the littlest measure and monitoring devices, and it can transmit information over the way, reaching sometimes intermittent networks. Simple MQTT protocol architecture (broker based) has various advantages over HTTP-it is lightweight provides more security as it encrypts the messages being sent. MQTT protocol was designed to work hand in hand with IOT technology. In our project, we used MQTT to control the appliances connected to the Bathroom and Bedroom, such as Lights and LDR. Fig 1 shows the LDR interconnection with the nodemcu, and Fig 2 represents the connection of the DHT11 Module



Fig. 2 DHT11 sensor interconnection

A. System Architecture

The system that we have designed is mainly controlled by the microcontrollers, which receive data from various sensors and, in turn, tell them what to do. Fig 3 represents the system architecture

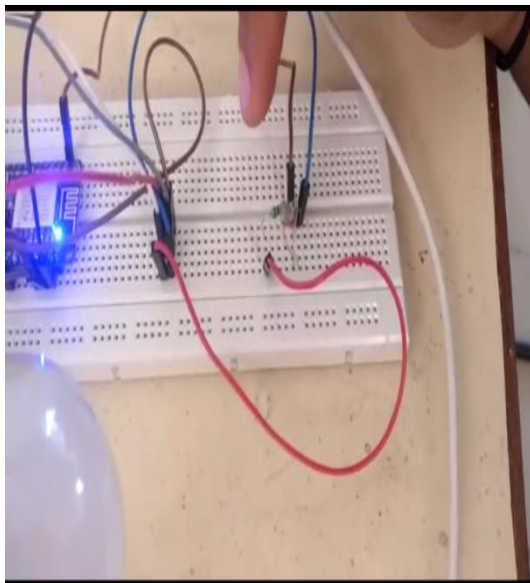


Fig. 1 LDR interconnection with NodeMCU

Complete Layout

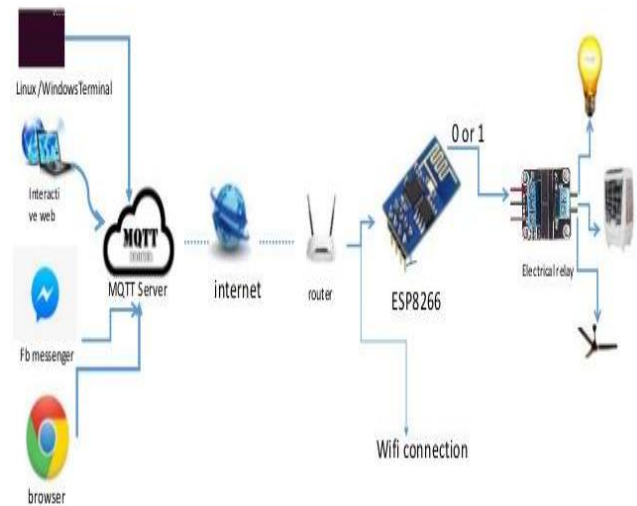


Fig. 3 System Architecture

B. Tools Used

The tools which we have used for our project are Arduino Uno, NodeMCU, RaspberryPi 3 Model B+ and various sensors. Here Fig 4 represents the Arduino IDE, Fig 5. Represents the Arduino board used and various sensors, Fig 6 represents the raspberry pi board used for the mqtt protocol and server, and lastly, Fig 7 represents the NodeMCU which is the main HTTP server and also it controls the relay modules.

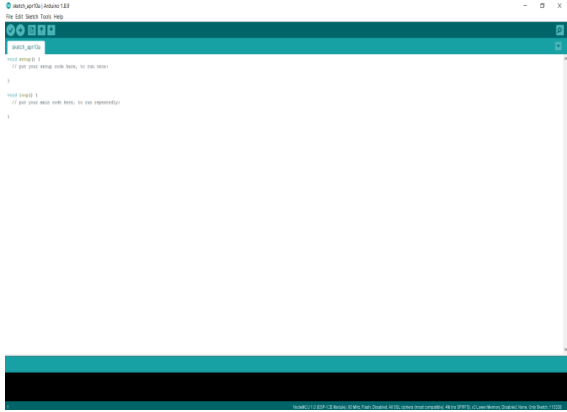


Fig. 4 Arduino IDE



Fig. 5 Arduino and various sensors



Fig. 6 RaspberryPi with camera Module



Fig. 7 NodeMCU

C. System Overview

When the system is turned on by interconnecting all the sensors to the microcontroller, data is retrieved from all sensors, processed in the microcontroller and required output is sent back to the sensors. Below is one of the parts of the system where bulbs can be controlled through an HTTP webpage. Fig 8 shows the working HTML page of the system

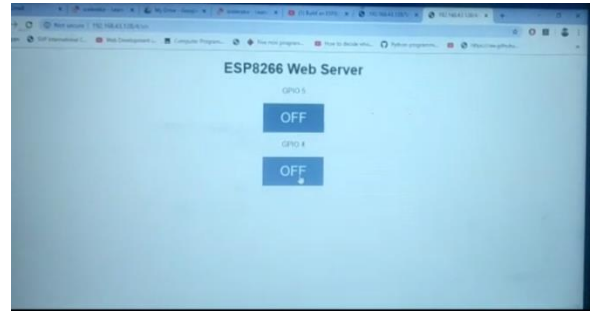


Fig. 8 Webpage having on and off controls for light bulbs.

IV. CONCLUSION

The proposed idea has been successfully implemented, and all of the given objectives have been achieved. We will be able to control the appliances in our home using a mobile app and an HTML page. Some of the many advantages provided by Home automation is controlling appliances remotely, enhancement of security, increasing efficiency as and when a person is not using any device, it will switch off after a given interval and won't be wasting energy, thus reducing the electricity and other kinds of bills. Our project is still in its initial days of development and has a lot of potential for upgrade.

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