

IoT Based Smart Home Automation System using Node MCU

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Abstract - The Internet of Things (IoT) is a latest platform for our technology. Using IOT, we can control our daily routine work such as home application, control, and easy communication systems, improve our digital services. The Internet of Things (IoT) is adding daily contents information wisely to the internet to make communication between objects and people and among themselves. In this paper, we show improved home automation with the help of IoT. In our proposed system, we use the relay, Node MCU which is a network access component. We can control that equipment by using the approach of IOT based system. The home automation system uses the portable device such as mobiles, laptops, tablets as a user interface. They can connect with home automation network through an internet approach like Wi-Fi. The user will move straightly with the system via control interface whereas home apparatus is remotely controlled through mobile application. The home automation system has an additional property that increases the protection capability of home automation system remotely. This modified design system proposed an efficient control of home automation system.

Keywords: IOT, home automation, smart home, relay, response time

I. Introduction

Home automation is also known as an intellectual home system. Numerous people often and often shift from one place to another for their business purpose, personal work, traveling, etc. [1]. So that kind of people leaves their home without checking their household component. That's why they need to exhort and control their things. In this situation, we needed smart home automation. Intellectual home system makes with a network, monitoring instrument and home ingredients [2]. In modern time we use this system for controlling our home automatically. This system raises the alleviation of our home equipment. Equipment that we use in our system is light, door, fan etc. [2]. If the system built in the home, we will control the home things virtually. For controlling the system, we need not to present physically at home. To implement a smart home system, we need to control centrally. To save the information centrally, we employ fog computing in exchange for cloud computing. Fog computing minimizes the bandwidth and low latency, because cloud computing is not stable for numerous IoT use [4]. Though this computing system, we can easily connect between sensors and IoT device. In this paper, we proposed an approach to improve home automation system. At first, we discuss IoT then our proposed system through Cisco and why we use home automation. Finally, we discuss the goals of our works.

IoT Based Home Automation

IoT means a world-wide network of interconnected things that are incomparable. An advanced network of IoT is being created, when a public wants to associate with different objects. IoTs terminology is applied for the enhancement of intelligent houses to increase the surviving formats of life [5]. It proposed leading connectivity among services, apparatus, and systems. It uniquely identifies not only attached computing system but also internally handle existing internet architecture [6]. It gives us strong-level facility at the communication and knowledge. There are three main natures in IoT ecosystems: consumers, governments, and businesses purposes [7]. IoT platforms act as the bridge between the devices, sensors and the data networks. IoT safety and privacy have become the major worry among consumers and businesses [8].

a) Some Advantages of IoT

- Sensor-guided decision analytics.
- Method optimization.
- Momentary control and feedback of difficult
- Autonomous process.
- Real-time calculation of a system.
- Lessened errors in gathering data.

- Reduced cost.
- Raised situational conscious.
- Originate workable systems.
- Saving time.
- Control and automation of any system.
- Easy to communicate with our daily life things.

The fact is that the IoT permits for virtually bondless advantages and connections to accept the position. Most of us can't even imagine and understand the impact of today's issues. Security is a major challenge that is again and again brought up. We have the missions of security and data sharing. IoT is a hot-button matter withal today, so one can barely think how the speech and anxiety will step by step increasing when people are discussing billions of devices being appended [9]. Home automation is made of one or spares computers to manage basic home activities and form deliberately and sometimes remotely [10]. An automated home is also called an intellectual home. For connecting home objects through the Internet, we need a platform that is known as Internet of Things (IoT) [11].

We use IoT because it provides our surrounding objects to append Internet easily. IoT devices that are peer to the Internet will more than triple in 2020.

b) Futures of IoT

- In the next five years almost 6 trillion IoT's objects connected to the Internet.
- Businesses will be the bearer of IoT solutions cause of IoT's behavior and those are cheaper operating costs, raising productivity and prolong to current markets or spread new manufacture oblation.
- The complicated infrastructure of the Internet of Things exuded into individual ecosystem.
- The profuse extensive staving to the benefits and drawbacks of fake cellular and Internet networks.
- The major role of analytics processes, along edge analytics, cloud analytics, fog analytics will perform in building the most of IoT sending.
- The skate privacy challenges submitted by the IoT and that defeated.
- Upcoming IoT's infrastructures are connectivity, security, data storage, system integration, device hardware, and application development.
- In-complex analysis the IOT ecosystem will alternative and in several industries.

II. Introduction Node MCU

NodeMCU V3 is an open-source firmware and development kit that plays a vital role in designing an IoT product using a few script lines. Multiple GPIO pins on the board allow us to connect the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications.

The interface of the module is mainly divided into two parts including both Firmware and Hardware where former runs on the ESP8266 Wi-Fi SoC and later is based on the ESP-12 module. The firmware is based on Lua – A scripting language that is easy to learn, giving a simple programming environment layered with a fast scripting language that connects you with a well-known developer community. And open source firmware gives you the flexibility to edit, modify and rebuiltthe existing module and keep changing the entire interface until you succeed in optimizing the module as per your requirements.

Features:

- Open-source
- Arduino-like hardware
- Status LED
- MicroUSB port
- Reset/Flash buttons
- Interactive and Programmable
- Low cost
- ESP8266 with inbuilt wifi
- USB to UART converter
- GPIO pins
- Arduino-like hardware IO
- Advanced API for hardware IO, which can dramatically reduce the redundant
- work for configuring and manipulating hardware.
- Code like arduino, but interactively in Lua script.

Background and Related Work

The smart house was concepts, not real form. Though home materials were not suspect as smart in the early twentieth century (1901-1920). The first engine-power vacuumcleaner invented in 1901, and the electricity-power vacuum invented in 1907. The ECHO 4 was the fundamental smart machine, but it was not vending in the market in the year of 1966-1967. In the year of

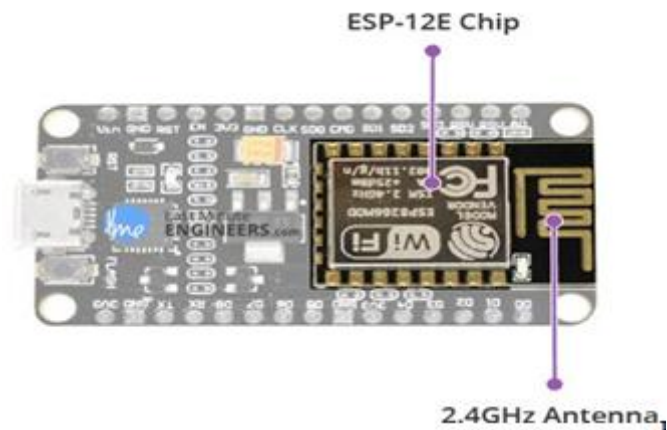


Figure 1:ESP -12E Chip

1990s, this home automation department reached some new experiment and processing. Smart house become exoteric in the early century 2000s, and various terms began to arise [12]. Suddenly in this century, smart homes ripen affordable choice for people [13]. Now we can control home by a remote server or any wireless component such as a laptop, Wi-Fi, mobile phone, tabs, sensing from any sensor [14].

To implement the automation system of functionality and comfortably, we designed a standalone, liberal, melodious and cheap cost home monitoring and controlling system using sensor service. This work is implemented to retire the troubles of existing methods. It bears much resilience, consolation potentiality and security.

This paper proposes a smart home automation system that services the segregation of objects that connected through the motion sensor, fog computing, server and switch connection among things. This system uses a laptop to monitor the home components. The main object of this paper is to operate household components by sensing the motion sensor. When the sensor detects motion, then those components are automatically turned ON/OFF. We can also turn ON/OFF that objects through server if we want. This system is useful from other systems, because when the motion sensor is sensing objects in that time, they are instinctively changed their state. After a lag time sensing, components go back to their previous state. This process happens back and forth.

III. Proposed Methodology

a) System Description

Node MCU -ESP8266

The Internet of Things (IoT) has been a growing field in the world of technology. It has changed the way we work. Physical objects and the digital world are connected now more than ever.

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

ESP8266 has powerful on board processing and storage capabilities that allow it to be integrated with the sensor and other application specific devices with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, and the entire solution, including the front-end module, is designed to occupy minimal PCB area. It can monitor and control things from anywhere in the world.

The development board equips the ESP-12E module containing ESP8266 chip having TensilicaXtensa® 32-bit LX106 RISC microprocessor which operates at 80 to 160 MHz adjustable clock frequency and supports RTOS.

There's also 128 KB RAM and 4MB of Flash memory (for program and data storage) just enough to cope with the large strings that make up web pages, JSON/XML data, and everything we throw at IoT devices nowadays.

The ESP8266 Integrates 802.11b/g/n HT40 Wi-Fi transceiver, so it can not only connect to a Wi-Fi network and interact with the Internet, but it can also set up a network of its own, allowing other devices to connect directly to it. This makes the ESP8266 Node MCU even more versatile.

IV. Power Requirement

As the operating voltage range of ESP8266 is **3V to 3.6V**, the board comes with a LDO voltage regulator to keep the voltage steady at 3.3V. It can reliably supply up to 600mA, which should be more than enough when ESP8266 pulls as much as **80mA during RF transmissions**. The output of the regulator is also

broken out to one of the sides of the board and labeled as 3V3. This pin can be used to supply power to external components.

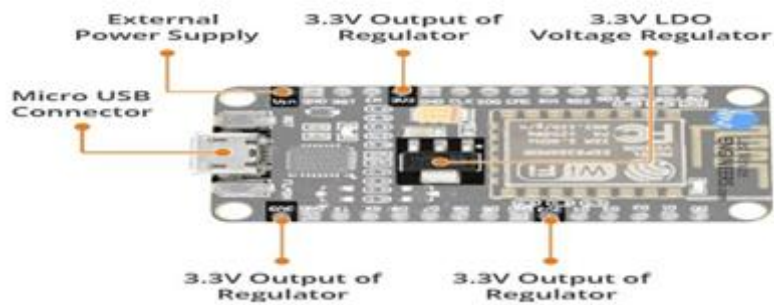


Figure 2:Working of ESP8266

Power to the ESP8266 Node MCU is supplied via the on-board Micro B USB connector. Alternatively, if you have a regulated 5V voltage source, the VIN pin can be used to directly supply the ESP8266 and its peripherals.

ESP8266 Node MCU Pin out

b) Proposed System Functions

The proposed home automation system has the abilities to observe the following objects in users home and monitor the following activities:

- Light ON/OFF
- Fan ON/OFF

V. Analysis Of Proposed Framework

a) Software Design

For implementing the proposed system in virtually here, we will use Blink application. It is very helpful to design IoT components. Here we use mobile, Switch-2960 and other IoT components. Steps that we will do in the simulation are:

First, we connect server, mobile, and several IoT objects through Copper Straight cable. Set server IP address for accessing the components. For controlling devices through mobile also need to configure IP address. Then we need to configure all IoT components uniquely. Download Blink application from play store in mobile and singling up to the blink application, we set a username and password. This password is used for login into the server access. When we go to the App for login to the remote server, then put server IP address into the Blink App, and next ask to input username and password. If we input exact information, then login to the server with login details. Next, turn on the Registration server. Connect all components to the Registration Server. For node MCU ESP 8266 connection we use IoT Custom Cable. Finally, we will join our proposed system. For connecting to the registered server, we go to the IoT accessories configuration then turn on the remote server option and put registration server's IP address, username, and password. Perform that process for all IoT components. If we want to control home automation things through remote mobile then put IP address, username, and password for turn ON/OFF the objects.

b) Security Issues

When motion detected, it will process its work. But sometimes it creates a problem because when any unwanted people such as thief, abductor, and robber enter the room then it obstructs our actual action so that we need to find out home living people. For that, we invent a way to discover original living people [15]. For that purpose, to identify the wanted people we use user's login information. It is feasible because no two people have the similar login information because we use two-way authentication verification system.

c) Future Work

In the 21st century, the communication between social media and computer is splitting aged obstacle and started a new era [17]. Nowadays mobile phone or computer is an important part of our modern life. Mobile phone or computer is not only a material for communication but also tries to give us better control for automated home [18]. There are some existing home automation systems which are built with real instruments of our house. This equipment is monitored through switches. The engine is switched ON/OFF manually when it is necessary. The existing system is not highly protected and waste of electricity. The proposed system is better

and more secure than the existing system. And the system is also imagined networking in our mobile phone to all the things through smart technology [19]. In the proposed system, all the house appliances could be monitored by the owner from a remote area with the favor of user's mobile phone or computer through a network.

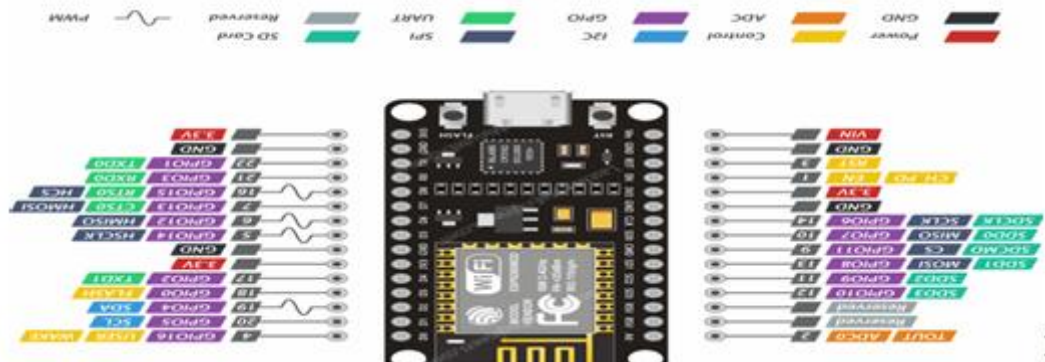


Figure 3: Working of Model Vendor

VI. Results

In this paper, the implemented system's that is connected to all the devices with the sensors and the automated home is controlled by the controller but there is some lacking in the other existing system. The main lacking is in the security area. The security is a little bit weak in that previous process. In our home automation system, there are huge benefits of our system than the other systems. Our system controls all the instruments of our house through mobile phones or computers anywhere from the world. And the control system is simpler than the others. The system we build, there is no security issues because we modify the security system by applying two-way authentication of users in our proposed system. Our system is much secured than the others because here we use unique login details for professed sensor's response which will detect the owner of that home.

VII. Conclusion

The home automation system is one of the most important sectors of the Internet of Things (IoT). In this paper, the home automation using the Internet of Things (IoT) proved that it has been worked favorably by joining simple equipment to it, and the appliances were practically monitored remotely through the internet. As one of the request state in the Internet of Things, the smart house appeals the most effort from the market. The process is preferable for real-time home security controlled and maintaining from fire accidents with quick solution. The system gives us better-secured home and controlled theft issues in our house. The proposed system consult the sensor data like temperature, motion, gas, light sensors, and activates a scheme following the necessity [20]. This process will explore different situation to control the home anytime anywhere. In this process, the sensors can be performed to save data that can examine the process. The modern home system utilizes that the users controlled the central control for all of their materials. In our system, we build a new technology to create an excellent automated home system which is more useful and more secure in our regular advanced life. And the smart house process is monitored with our mobile phones and computers, and it is to handle our busy lifestyle.

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