A Simple Smart Home Based on IOT Using NodeMCU and Blynk

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***Abstract*— IoT or Internet of Things is an upcoming technology that allows us to control hardware devices through the internet. Here we propose to use IoT in order to control home appliances using sensors as well as through blynk application, thus automating modem homes through internet. This system uses three loads to demonstrate as house lighting, fire detection and a fan. Our user friendly interface allows a user to easily control these appliances through the internal. For this system we use a NodeMCU microcontroller. This microcontroller is to get user commands over the internet. Relays are used to control loads. The entire system is powered by a 12 V transformer. After receiving user commands over the internet, microcontroller processes these instructions to operate these loads. Thus the system allows for efficient home automation over internet. The system will control the loads automatically with the help of sensor data.**

Keywords*— *NodeMCU ESP8266, Blynk, DHT11, PIR sensor, Fan etc.

I. INTRODUCTION

The Internet of Things (IoT) is a new, but at the same time an old term. It was already mentioned by Kevin Ashton in 1999, while holding a presentation at Proctor & Gamble. He used the term to link the idea of radio frequency identification (RFID) to the then new topic Internet. Since then the use of this term has blossomed and major companies have predicted an increase in IoT . One prediction is that the number of connected things in the world will have a thirtyfold increase between 2009 and 2020, thus by 2020 there will be 26 billion things that are connected to the Internet. The reason IoT has become so huge depends partly on two things: Moore's law and Koomey's law. Moore's law states that the number of transistors on a chip doubles approximately every two years [5]. This has enabled people to develop more powerful computers on the same sized chip. Intel, a well-known semiconductor chip maker had during 1971, 2300 transistors on a processor and by 2012 their current processors contained 1.4 billion transistors . This is an increase of approximately 610 000 % and it is expect that this trend will continue.

Koomey's law explains that the number of computations per kilowatt-hour roughly doubles every one and a half years . Kevin Ashton states that these two laws have together enabled us to create powerful and energy efficient computers. By turning the graph for Moore's law upside down it can be interpreted as the size of a computer (of a fixed capacity) is halved every two years. Doing the same thing to Koomey's law can be interpreted as the amount of energy needed to perform a computation is dropping at a rapid rate . Combining these interpretations tells us that we can perform the same amount of computations on increasingly a smaller chip, while consuming decreasing amounts of energy ,hence computations are becoming more energy efficient.

The basic concept of IoT is to connect things together, thus enabling these "things" to communicate with each other and enabling people to communicate with them . What these things are varies depending on which context the term is used and the aim of using the thing. The definition of IoT proposed by ITU's Telecommunication Standardization Sector (a United Nations agency which specializes in ICT): "… a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies". Interconnecting the physical world with the virtual world and applying this concept to all things opens up new possibilities in the sense of being able to at any time access anything from

any place. Providing new possibilities will also generate new threats, security risks, and expose vulnerabilities in the unexplored world of interconnected everything. “Things” in the physical world are objects that physically exist and from the perspective of IoT we are able to sense, operate, and connect to these things, while in the virtual world “things” are objects that can be stored, accessed, and processed.

II. OBJECTIVES

- To control and monitor the home appliances: As in this system we can control home appliances from one place and also we can check the room temperature and humidity. It also gives an alert about motion and flame detection.
- To reduce the usage of electricity: Sometimes we may forget to turn off the home appliances as we are controlling home appliances from one place so it will save electricity as time required to turn off the home appliances using android is less hence less will be the usage of electricity.
- To save the time of the user: As this system is multitasking so the time required to control the loads and to monitor motion and fire will be less.
- To save the energy of the user: Sometimes human beings get tired because of their respective works and they will loss some of their energy. As this system works automatically human do not require to apply more efforts.

II. METHODOLOGY

This research is conducted based on the important steps that are done by orienting on the success indicators in connecting the NodeMCU ESP8266 module and other devices so that it can be used to solve multi-objective problems. To achieve these indicators, the stages of this research are as follows:

- Analysis of the problem. Analyze the problems to be studied regarding smart home.
- Analysis of needs .In this case all needs in researching both from journals, literature books, tools, and materials.
- System design. Designing tools to be built using the NodeMCU ESP8266 module, and the sensors used.
- System programming. Make a program using the Arduino IDE and the Blynk android application.
- Testing tools .Testing tools with program codes created and internet connections.
- Making reports and summarizing the results of the experiment. See system responsiveness to commands given to smart home.

To show the temperature value in Celsius degrees and humidity value on the android display, NodeMCU will send sensor output value in voltage to the Blynk application back. Like the ON/OFF process last flowchart, Blynk server will check for internet connection and hotspot name and password, the sensor output value to show the temperature correctly.

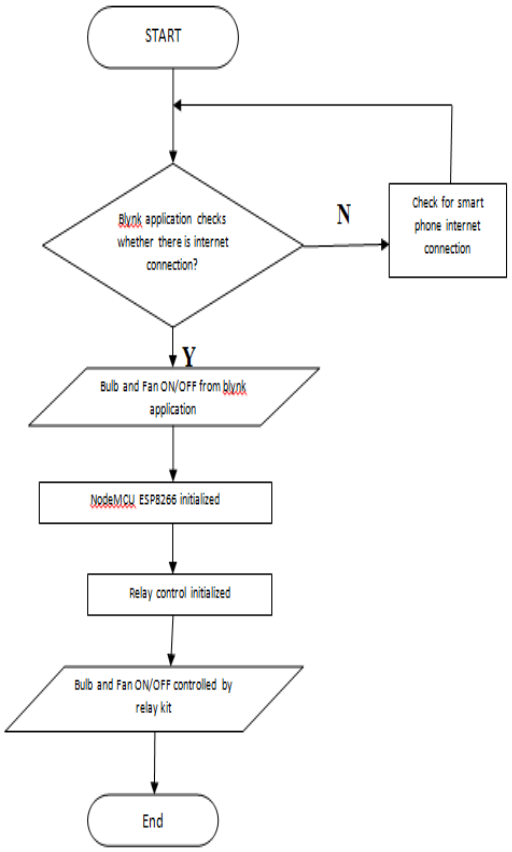

Fig 1.1: Flowchart of Load On/OFF

The temperature and humidity is showed by gauge tool in the Blynk application after setting the input pin and temperature scale as shown in Figure 3.

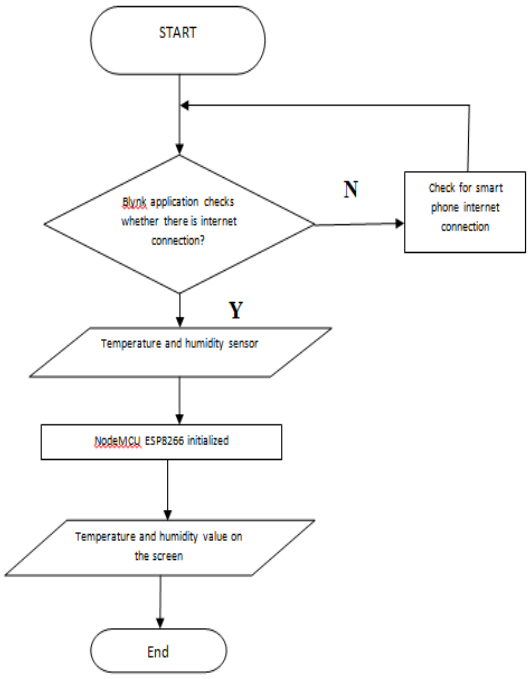

Fig 1.2: Flowchart of Temperature Sensor and humidity sensor

III. BLOCK DIAGRAM

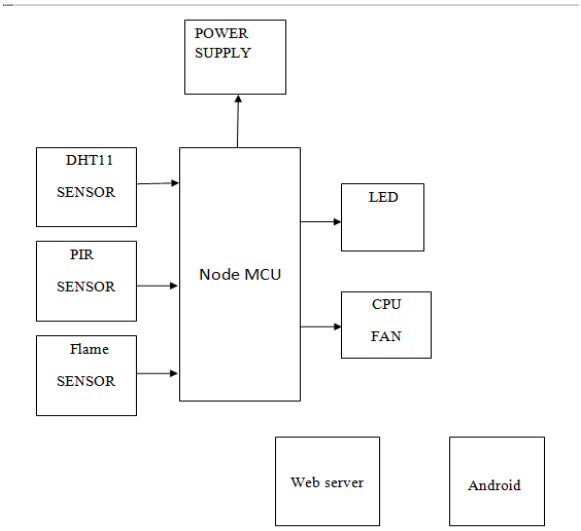

Fig 1.3: Block Diagram of Home Automation

The system is based on NodeMCU board as an internet of things system. The NodeMCU is connected to the internet from the hotspot of the smart phone via WIFI connection as the NodeMCU has ESP8266 circuit to connect with the internet.

NodeMCU to be connected to the hotspot of the smart phone, needs to be identified to the name of hotspot, the password and token code letting the server of Blynk connects them together. You may need the computer once to transfer code from Arduino IDE to the NodeMCU kit to prepare the software part of the project. Figure 4.2.1 shows that the server of Blynk application will process the smartphone-NodeMCU connection. Blynk libraries are ZIP files can be downloaded from Github website to be imported to the Arduino IDE library.

Blynk server will check for internet connection, NodeMCU with android hotspot, the NodeMCU code includes the token code, the name of hotspot and it's password. The information included to the code must be match with the hotspot information to allow ESP8266 connect with the WIFI to be as a channel to exchange commands between smart phone and NodeMCU. Remaining processes are just commands sent from Blynk application to NodeMCU to control loads those are connected to the relay kit as shown in Figure 2. And sensor output value is sent reverse to the Blynk application from NodeMCU kit.

III. RESULT & DISCUSSION

Fig 1.4: OFF CONDITION

Fig 1.5: ON CONDITION

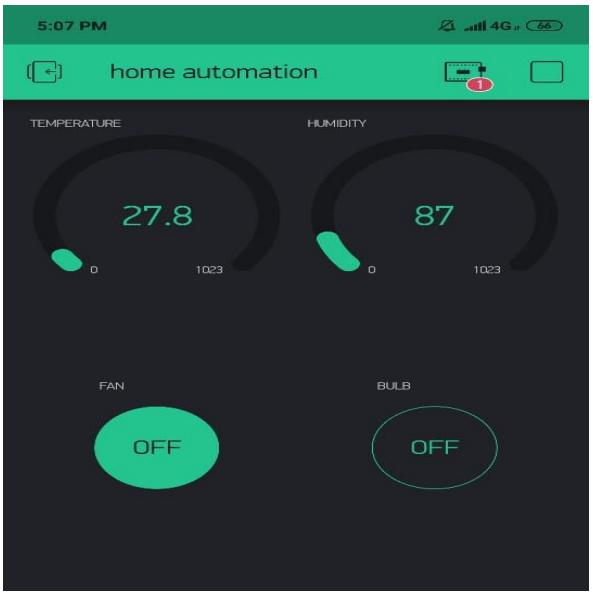

Fig 1.6: Controlling the circuit through blynk app

Light Control and fan control Test Results: The Light Control and fan control Test is done by pressing the ON / OFF button widget on the Blynk application on the respective Android smart phone for lights and fans. This is done after the system is turned on and connected to a Wi-Fi internet connection. If at any time the internet connection is lost or bad signal, then it also affects system performance.

DHT11 Sensor Test: DHT11 Sensor Testing is done by recording the temperature and humidity changes that occur every minute. This is done after the system is turned on and connected to a Wi-Fi internet connection which is shown in figure 8.3. If at any time the internet connection is disconnected or bad signal, then it also affects system performance.

System Analysis: From testing the entire system above, the smart home works according to what is the purpose of this research. Comparison of this research with previous studies, namely this study uses temperature sensor and control buttons, thus increasing the diversity of the smart home system itself. Also used a microcontroller that is different from previous studies that is the NodeMCU ESP8266 module which has advantages compared to other microcontrollers. The smart home has been successfully built with hardware arranged in such a way that it can achieve results that are as expected. In this case the hardware that plays a very important role as the main device is the NodeMCU ESP8266 module. The advantages of using the NodeMCU ESP8266 are more practical than buying various components and then assembling them by yourself.

The Final Hardware Circuit Connection: Using components and materials mentioned above. Figure 8.1 and figure 8.2 shows the project that's used as an (IoT) system controlled by Blynk application is running. Loads used in this project are bulb and fan, they can be changed with other devices by changing bulbs with AC plugs to connect home-use devices or equipment.

IV. CONCLUSION AND FUTURE SCOPE

The project is designed using structured modeling and is able to provide the desired results. It can be successfully implemented as a Real Time system with certain modifications. We achieved our requirements like usage of electrical power and waiting time of user. The Energy Management concept has been successfully achieved in this project.

For project demo concern, we have developed a prototype module. In future, this project can be taken to the product level. To make this project as user friendly and durable, we need to make it compact and cost effective. Going further, most of the units can be embedded along with the controller on a single board with change in technology, thereby reducing the size of the system. We can that we have been save the usage of the electricity and time of the user his/her waiting time.

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