Implementation of IoT for Smart Homes

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Abstract— Internet of Things (IoT) is part of the internet that envisions all objects around us. IoT has a very wide and includes variety of objects like electronics product i.e. smart phones, tablets, digital cameras and sensors. Once all these devices are connected to each other, they enable more and more smart processes and services that support our basic needs, environment and health. Such large number of devices connected to internet provides many kinds of services and they also produce huge amount of data and information. Cloud computing is demand access to a shared pool of configurable resources like computer, networks, servers, storage, applications, services, software. The home automation system uses portable device as user interface, monitoring of temperature and humidity and also controlling home appliances. The main objective is to develop a home automation system using an Node MCU board with an IoT-based device which is capable of controlling appliances and real-time weather monitoring. This device is built using ESP8266 Node MCU. By using that technology is advancing so houses are also getting smarter and faster and also involving remote controlled switches. In order to achieve this, a relay module is interfaced to the Node MCU board at the receiver end while on the transmitter end, a GUI application on the cell phone sends ON/OFF commands to the receiver where loads are connected. Domestic and industrial load can be turned ON/OFF remotely through this technology. The loads are operated by IOT board through Relay Module.ESP8266 Node MCU is a device with a built-in WiFi module and micro controller which can interface with Arduino IDE.

Key words: ESP8266, Computer, Networks, Servers, Storage, Applications, Services, Software

I. INTRODUCTION

The term “Internet of Things” (IoT) was first used in 1999 by British technology pioneer Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors.12 Ashton coined the term to illustrate the power of connecting Radio-Frequency Identification (RFID) tags used in corporate supply chains to the Internet in order to count and track goods without the need for human intervention. Today, the Internet of Things has become a popular term for describing scenarios in which Internet connectivity and computing capability extend to a variety of objects, devices, sensors, and everyday items. Enable networking of everyday objects as widely increase in users of Internet and modifications on the internet working technologies. The term “Internet of Things (IoT)” is about physical items talking to each other, machine-to-machine communications and person-to-computer communications will be extended to “things”. Smart sensor technologies including WSN, Nanotechnology and Miniaturization are the key technologies that drive future IoT. The environment settings like light, air, etc. are interacted by human inside their home and regulate accordingly. To act according to occupy requirements the automation of home settings is termed as intelligent home automation system. In general, intelligent home automation system consists of clusters of sensors, collecting different types of data, regarding the residents and utility consumption at home. To recognize the activities of inhabitants or events, systems with computing capabilities analyze the assimilated data. By reducing the costs and improving the standard of living is effectively done by automate the domestic utilizations. Most of the research activities related to IoT are confined to management of resource constraint devices and different mechanisms of interconnection.

II. OPPORTUNITIES AND CHALLENGES OF IOT

The Internet of Things engages a broad set of ideas that are complex and intertwined from different perspectives. Key concepts that serve as a foundation for exploring the opportunities and challenges of IoT include:

A. IOT

The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.

B. Enabling Technologies

The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. These include Ubiquitous Connectivity, Widespread Ad option of IP-based Networking, Computing Economics, Miniaturization, Advances in Data Analytics, and the Rise of Cloud Computing.

C. Connectivity Models

IoT implementations use different technical communications models, each with its own characteristics. Four common communications models described by the Internet Architecture Board include: Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing. These models highlight the flexibility in the ways that IoT devices can connect and provide value to the user. The system has an embedded key as in case of a steganography. The key is used to increase security, which does not allow any unauthorized users to manipulate or extract data. The embedded object is known as watermark, the watermark embedding medium is termed as the original signal or cover object and the modified object is termed as embedded signal or watermarked data [8].

D. *Transformational Potential*

If the projections and trends towards IoT become reality, it may force a shift in thinking about the implications and issues in a world where the most common interaction with the Internet comes from passive engagement with connected objects rather than active engagement with content. The potential realization of this outcome a "hyper connected world" is testament to the general purpose nature of the Internet architecture itself, which does not place inherent limitations on the applications or services that can make use of the technology.

III. DEVICE-TO-GATEWAY MODEL

In the device-to-gateway model, or more typically, the device-to-application-layer gateway (ALG) model, the IoT device connects through an ALG service as a conduit to reach a cloud service. In simpler terms, this means that there is application software operating on a local gateway device, which acts as an intermediary between the device and the cloud service and provides security and other functionality such as data or protocol translation. The model is shown in Figure 1.

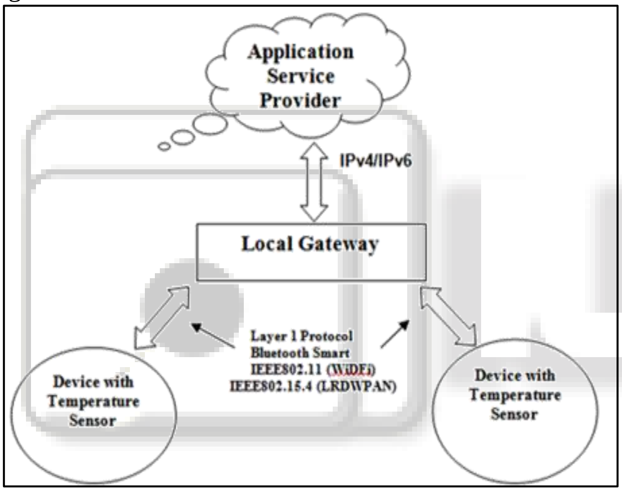

Fig. 1: Device-to-gateway communication model diagram.

Several forms of this model are found in consumer devices. In many cases, the local gateway device is a smart phone running an app to communicate with a device and relay data to a cloud service. This is often the model employed with popular consumer items like personal fitness trackers. These devices do not have the native ability to connect directly to a cloud service, so they frequently rely on smart phone app software to serve as an intermediary gateway to connect the fitness device to the cloud.

IV. PROPOSED APPROACH

A. *Components required*

In proposed approach first discuss about the hardware component, software application and online service

B. *Hardware Components*

- Node MCU ESP8266 12E
- 2 channel 5V Relay Module

Fig. 2: Node MCU ESP8266 12E

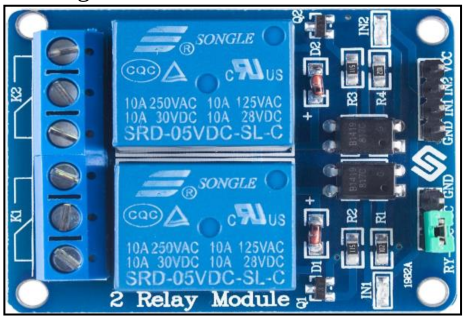

Fig. 3: 2 channel 5V Relay Module

C. *Software Application*

- Arduino IDE 1.8.2 application install in computer (programming for Node MCU)
- Blynk application install in android phone or (tablet for controlling)
- Blynk libraries

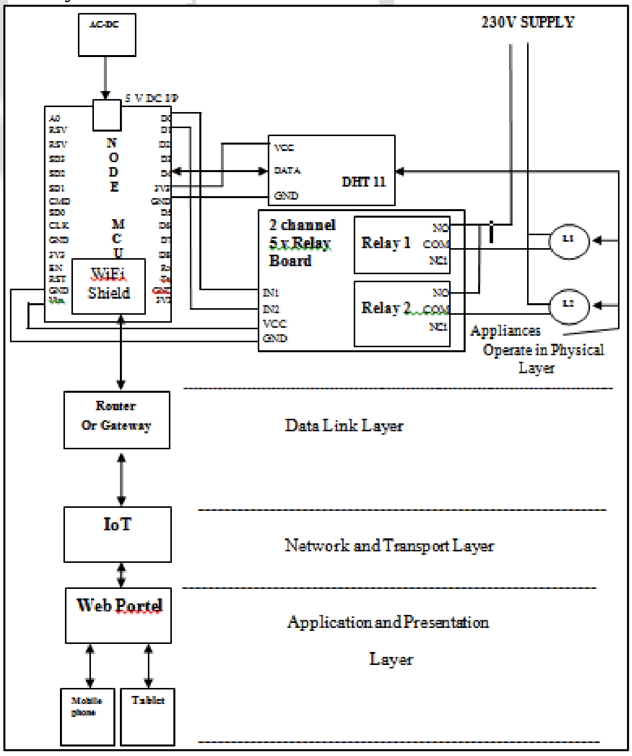

Fig. 4: General block diagram of smart homes circuit through IoT

General IoT architecture of smart home circuit as shown above fig. 4. In this architecture different block present such as Node MCU, DHT 11, Relay section, gateway, web portal, IoT and devices. In this architecture included different layers of network. So in this section working about each block in details.

D. DHT 11

In fig. 4 shoes the image of DHT 11operate. DHT 11 is a humidity and temperature sensor. DHT 11 has 4 terminals as Vcc, GND, NC and Data which connected to the node MCU. Vcc pin require 3.5v to 5v DC supply voltage from node MCU so 3v3 pin connected to the Vcc of DHT11 and GND connected to the GND. DATA pin is connected the D4 pin of node MCU the all connection shown in fig. 4.5.The DHT11 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds. This DF Robot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 32-bit MCU, offering excellent quality, fast response, anti-interference ability and cost-effectiveness. Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The Component is 3-pin single row pin package. It is convenient to connect and special packages can be provided according to users request. This board is a breakout board for the DHT11 sensor and gives a digital output that is proportional to temperature and humidity measured by the sensor. Technology used to produce the DHT11 sensor grants high reliability, excellent long-term stability and very fast response time. Each DHT11 element is accurately calibrated in the laboratory. Calibration coefficient is stored in the internal OTP memory and this value is used by the sensor's internal signal detecting process. The single-wire serial interface makes the integration of this sensor in digital system quick and easy. Sensor physical interfacing is realized through a 0.1" pitch 4-pin connector: +5V, GND and DATA. First two pins are power supply and ground and they are used to power the sensor, the third one is the sensor digital output signal. Its small physical size (1.05"x0.7") and its very light weight (just 0.1oz) make this board an ideal choice to implementing small robots and ambient monitoring systems.

1) Communication Process of DHT11:

The interesting thing in this module is the protocol that uses to transfer data. All the sensor readings are sent using a single wire bus which reduces the cost and extends the distance. In order to send data over a bus you have to describe the way the data will be transferred, so that transmitter and receiver can understand what says each other. This is what a protocol does. It describes the way the data are transmitted. On DHT-11 the 1-wire data bus is pulled up with a resistor to VCC. So if nothing is occurred the voltage on the bus is equal to VCC.

Communication Format can be separated into three stages.

- Request
- Response
- Data Reading

a) Request

To make the DHT-11 to send you the sensor readings you have to send it a request. The request is, to pull down the bus for more than 18ms in order to give DHT time to understand it and then pull it up for 40uS.

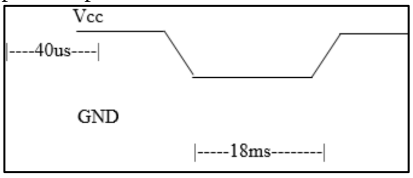

Fig. 5: MCU request

b) Response

What comes after the request is the DHT-11 response. This is an automatic reply from DHT which indicates that DHT received your request. The response is ~54uS low and 80uS high.

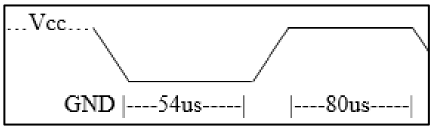

Fig.6 DHT response

In fig 7 shows the output 1and output 2 button is ON in mobile blynk app and in fig .8 shows the YELLOW LED light and RED LED is ON.

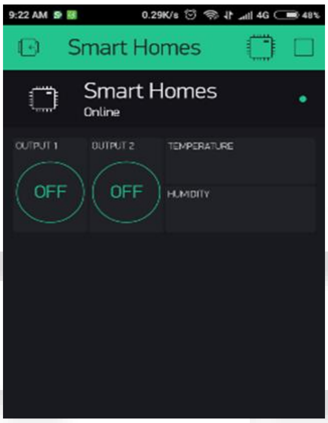

Fig. 7: Output 1

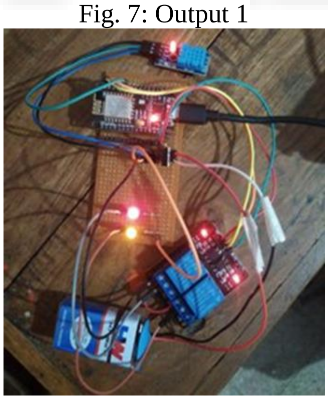

Fig. 8: Output 1

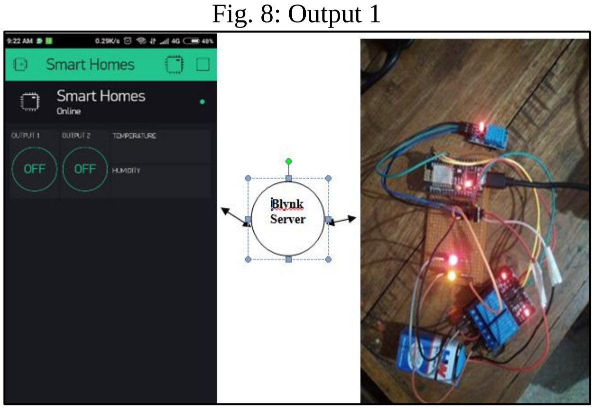

Fig. 9: Output 1 and 2 with blynk server

In this Blynk app the Smart Homes device wasn't online yet means this blynk app is not connect to the node MCU device. Here may be two error possible first is mobile is not connect to the internet or second the node MCU is not power up or router is power off in that house.

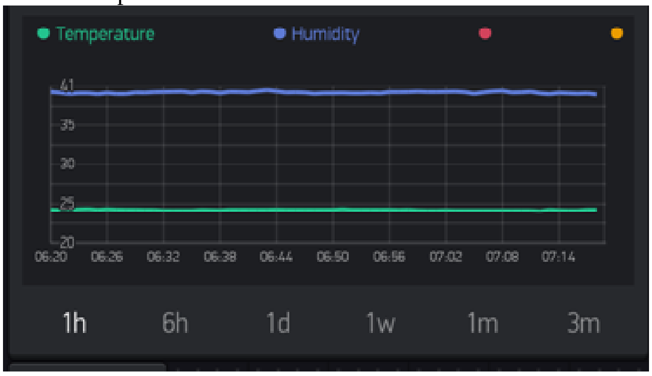

Fig. 10: Forth Result for temperature and humidity monitoring on mobile

V. CONCLUSION

The main aim of proposed scheme monitor the temperature and humidity of homes and control the home appliances using IoT based, as per the result shown. All result is stable and work properly through mobile app from anywhere. Internet of Things home automation has been practically proved that to work adequately by connecting different appliances to it anywhere and system successfully controlled via internet. The designed system not only monitors the sensor data, like temperature, gas, light, motion sensors, but also actuates a process according to the requirement, for example switching on the light when it gets dark. In Gmail a timely manner it also stores the sensor parameters in the cloud. This will help the user to analyze the condition of various parameters in the home anytime anywhere. By using the blynk app on mobile phone and blynk app cloud server its work properly in the proposed architecture and normally connect to the mobile phone to node MCU. It is free open source available. Any Android based Smart phone can be used to access the home equipment remotely through internet.

VI. FUTURE SCOPE

This method can be effectively used in sending hidden text messages over audio signals. With the increasing use of social media applications that allow us to send voice messages, our technique can be collaborated with such applications so as to send secret text messages within the voice message in real time

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