

## **Automation of Temperature and Humidity Monitoring System – Application of IoT**

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**Abstract** - This paper mainly focuses on the aspects of simplifying people's lives by implementing the ways of IOT in daily used home appliances. The major focus of this paper lies in automation of air conditioning using a thermostat and watering of plants without human intervention using a moisture sensor. A DHT11 temperature sensor integrated with internet of things using a Raspberry pi facilitate the above-mentioned implementation of internet of things. The thermostat is used as source of information for the conditioner to adjust the temperature in the room and the moisture sensor acts as a switch to water the plants once the soil moisture content falls below the minimum threshold.

**Keywords:** IoT, DHT11, Humidity Monitoring System, Network,

### **I. INTRODUCTION**

In recent years, there has been a rapid growth in the world of intelligent devices for home automation, such gadgets are designed to reduce the human effort to the minimum. Several technologies have already been introduced for industrial automation. Recently introduced network connectivity solutions such as Ethernet, Wireless LAN, etc. are used in industrial application. There are limitless numbers of additional automation solutions available in already existing techniques for automation. Variety of appliances have been presented with the development of social economy and rapid increase in the needs of the people. However, the problem resides in managing and controlling these appliances to meet the expectations of comfort, health and security at home. To overcome said problem, a smart control-based system has been proposed that governs the temperature and watering system by a remote user. Internet of things (IoT) is an approach to automation consisting of large number of distinct devices which are connected throughout different systems. This sophisticated network of digital devices is connected to a powerful server capable of handling all the requests from multiple fronts at once and is responsible for the processing the data accumulated by these devices. Once the request is processed and the data is sent to these devices, specific actions are defined in these devices based on the response received from the server and these actions are carried out

making it possible to achieve the automation that we have desired for a long time.

There has been a sudden uprising of awareness among people regarding the environment thanks to the efforts of government and other non-profit organisations and one of the major concerns of environment is the decrease in the number of plants on the surface of this planet and lack of proper care towards trees and plants. Using IOT, a system can be designed which allows automation of the watering plants which, as trivial as it may seem, needs considerable amount of time and people are not willing to spend time for this task. Hence the technologies of IOT can be implemented using raspberry pi-a processor and a DHT 11 sensor (temperature and humidity), to automate watering. This system can be used to measure the said temperature and humidity and decide whether a plant needs watering or not and designated devices perform the activity of watering. This system can be implemented in the field of agriculture which helps the farmers for irrigation and sprinkling system which saves a lot of time for farmers.

### **II. LITERATURE SURVEY**

The term Internet of Things was first coined by Kevin Ashton in 1999 in the context of supply chain management [1]. Pascal Von Rickenbach described that any physical system can be controlled easily by using wireless technology compared to manual operation [2]. Internet of Things referred to as IOT is a large network of web-enabled digital

devices whose main purpose is to collect data from their surrounding environment and share this information among other devices which act based on this received information. This process of sharing information among one another is sometimes called as machine-to-machine communication. These devices are built in with wireless technology which enables them to communicate on a regular basis with each other and since their mode of connection is wireless, we can also stay connected to them through internet monitoring them without even being near them. Another advantage of this wireless connection is that this enables us to keep other devices under control and monitoring the condition of the connected devices. "The consolidation of control or monitoring signals from appliances, fittings or basic services is an aim of home automation." by Basil Hamed [3].

One of the best example is Nest thermostat. This Wi-Fi-connected thermostat allows you to remotely adjust the temperature via your mobile device and learns your behavioural patterns to create a temperature-setting schedule. This also allows you to control the temperature in your home without you even being present there physically and before you reach home, the temperature inside your house is exactly to your liking. This also helps you in switch off the air conditioner, which you might have forgotten before leaving. The system can be called as a smart system, which can measure parameters automatically. As per Vasumsetty Uday Aditya user can spread wide variety of sensors within the interested area to monitor all collected data by extending period of time which can enable researcher to study if there is any complex interactions within the environment. [4]. A web server can be embedded into a device, which can be accessed remotely from a web browser. This embedded system can serve the web documents on request by a client from other system. Such type of a web server is called as Embedded Web Server (EWS) which is outlined by Girish Birajdar[5].

All these devices are connected to a cloud service, which allows us to analyse the data these devices have collected in order to further develop these systems and improve the condition to smooth the working, outlined. As per Ms. Padwal S. C., Prof. Manoj Kumar[7]his is especially useful to the corporate business as this allows them to analyse and predict our nature to suggest the kind of services we might need in future . Nevertheless, this also raises the issue of security concerns which out of scope of this paper.

The major concern of discussion in this paper is the way a temperature and a moisture sensor are used to control the temperature inside the living room of a house and the watering of plants automatically. The basic implementation goes this way: the temperature sensor is used to collect the data regarding the temperature in a room and the collected data is sent to the cloud where this data is processed and is sent to the mobile phone of the user. The devices also remember the preferences of the user and set the temperature in the room according to the data gathered from the user. In this way the temperature in the room is

automatically set using a thermostat and cloud. Another implementation is the moisture sensor used for watering plants automatically [7-11].

The main idea is to gather the information about the amount of moisture present in the soil using the moisture sensor and sending this information to the cloud on a regular basis. The cloud keeps processing this data and if it detects any decrease in the level of moisture than the recommended level, it sends an alert to the user. The user then activates the sprinkler, the sprinkler being activated starts watering plants, and hence the watering of plants takes place automatically upon the tap of a button by the remote user. This way the work of setting the temperature and watering plants have been automated reducing the human intervention creating possibilities of investing this time in some other activity. This paper presents the current trends in IoT research propelled by applications and the need for convergence in several interdisciplinary technologies.

### III. LIMITATIONS OF IOT

#### i. Privacy –

This is a great concern when it comes to exchanging valuable information regarding anything. Since everything will be connected, breaching inside the network would be easy by the hackers. By entering into a part of network would reveal everything regarding an individual or organization or both (may be). What if your office colleagues know what medicines you take or where you went last night?

#### ii. Safety –

If a situation comes like a notorious hacker changes your medical prescription and you are supplied expired medicines or those medicinal drugs to which you are allergic to, then there would be a health disaster. Since the consumer, that time would be dependent entirely on the technology there would be least probability that he would bother checking anything. The consumer himself does the verification today manually but no one knows what will happen later.

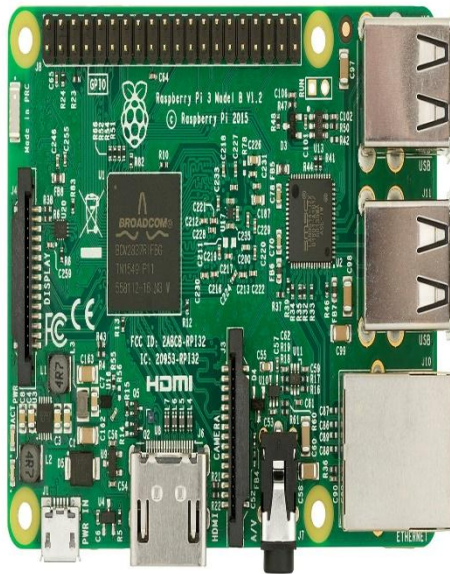
#### iii. Compatibility –

At present, there is no international standard for device compatibility. For example, home based appliances and equipment may be getting problems in connecting with laptops or mobile phones. In addition, Apple devices don't accept the connectivity with any other device. Likewise, different manufacturers need to agree upon this else people will prefer buying only one brand and there would be monopoly.

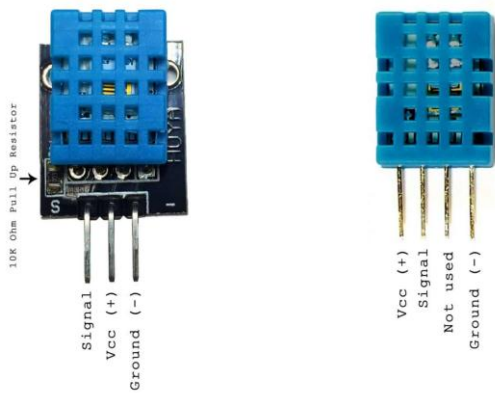
### IV. PROPOSED FRAMEWORK

#### DEVICES USED FOR TEMPERATURE AND HUMIDITY RECORDING:

The devices necessary to create a temperature monitor system are:



- DHT11 Temperature Humidity sensor[8]



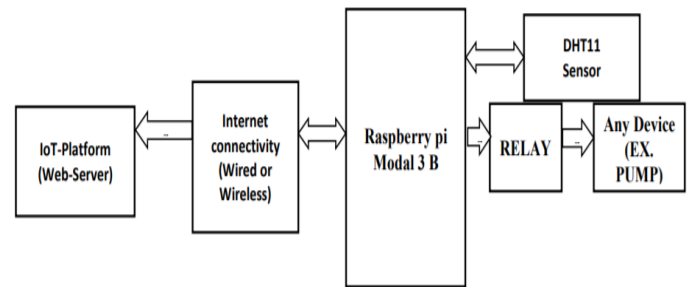
- Raspbian operating system
- Internet connection
- Knowledge on python language

**V. WORKING**

The system consists of a DHT11 sensor, Raspberry pi model with internet connectivity. Sensor analyses outside temperature and humidity and convert the exact information into a digital signal output. The output obtained from the sensor is fed to the Raspberry pi which uses a python program and library to convert information of sensor into numerical values for temperature and humidity. This data is stored in a file over the period of

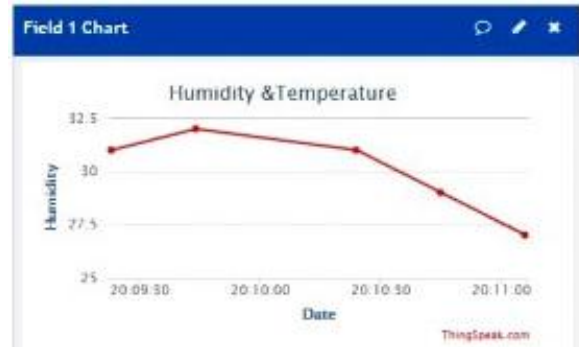
time, which is then placed on internet using IoT. Nowadays lots of free, open data, IOT platform and other services are available on internet, which can also be done by building a web server. IoT cloud service provider named "Thing speak" that has an application programming interface (API) which has the facility to post and review the data from IoT sensor was used. Thing speak facilitates to create a space where all the data obtained from the sensor is displayed with date and time. Finally, user can access this data from anywhere and can control the attached relay.

**VI. FLOW DIAGRAM OF THE PROPOSED MODEL**



**VII. RESULT**

The values of temperature and humidity were recorded during a particular time and were plotted in the server against the time of the day. The resulting graphs plotted are shown below. These graphs depict the time at which the plants need watering and would instruct the device at location according to the user preferences to start watering.





### VIII. CONCLUSION

The process of remote watering without human surveillance is a major step into the future which is only the beginning of automation. Implementing the techniques of IOT to automate daily chore creates a great impact on the user and the amount of time they spend on doing them. This allows us to work cost efficiently and more effectively they make our lives easier and act as a stress reducer. This is still in its early stages of development and there is a lot of potential in the improvement of IOT. These devices are built in a way which facilitates their evolution to match the ever-changing requirements and evolution always includes the potential to growth which makes them even more sophisticated and simple. The usage of this modern technology adds to a safe and comfortable environment for the growth and development of individuals. Introduction of internet connection to these devices will cut the costs as this will

introduce the mobile phones and tablets and will greatly increase the user experience by increasing the comfort levels of the usage.

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SVHN Krishna Kumari has completed her Ph.D from Osmania University in the year 2011, Hyderabad, Telangana, India. Currently she is working as an Associate Professor in K.L.University, Hyderabad. She has published nearly 30 papers in various International Peer reviewed Journals. She is a member of **IAENG, UACEE, CSTA**.



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