IOT Based College Automation for Efficient Energy Consumption

Kapil Kakde[1], Dipali Bachhav[2], Ashwini Borse[3], Kajal Kakad[4], Prof. Jagruti Dandge[5]

Abstract- **These In this era of digitization and automation, the life of human beings is getting simpler as almost everything is automatic, replacing the old manual systems. Nowadays humans have made internet an integral part of their everyday life without which they are helpless. Internet of things (IoT) provides a platform that allows devices to connect, sensed and controlled remotely across a network infrastructure. This paper focuses on home automation using smart phone and computer. The IoT devices controls and monitors the electronic electrical and the mechanical systems used in various types of buildings. The devices connected to the cloud server are controlled by a single admin which facilitate a number of users to which a number of sensor and control nodes are connected. The admin can access and control all the nodes connected to each user but a single user can control only the nodes to which the user itself is connected. This whole system using Internet of Things (IoT) will allow mobile devices and computers to remotely control all the functions and features of home appliances from anywhere around the world using the internet connection. The system designed is economical and can be expanded as it allows connection and controlling of a number of different devices.**

Index Terms- Internet of thing (IoT), home automation, cloud computing, WiFi Module (ESP8266), Arduino IDE

I. INTRODUCTION

THIS document 1.1 what is IoT?

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and is able to transfer data over a network. Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business. IoT has evolved from the convergence of wireless technologies, microelectro mechanical systems (MEMS), microservices and the internet. The convergence has helped tear down the silos between operational technology (OT) and information technology (IT), enabling unstructured machine-generated data to be analyzed for insights to drive improvements.

1.2 Why we use IoT?

Much research in recent years has focused on Internet of Things (IoT) which connects physical objects to network and manages information of the objects. Especially, home domain is the most important field of IoT. Because the research survey [1] reported that the number of connected device will grow to nearly 8 billion devices for the year 2020 excepting mobile phone, and home devices has the biggest portion of them about 3.7 billion. It means they will generate big data such as sensory data, usage information and so on. Home service providers want to develop various and advanced service using the data, but there remains a need for an efficient method that can analyze the data. Previous works have mainly focused communication way, or the specific service of analysis.

E.S.Lee, et al. [2] developed an auto-configuration system structure and protocol for Internet-capable home appliances, which supports the initial configuration and remote maintenance service of the device with only little user effort. HJ.Lee, et al. [3] proposed a three stage conversion process for

interoperability among different middleware of home network that supports not only the conversion of the message format and schema, but also semantic conversion. Shih-Yeh Chen, et al. [4] developed electronic appliance recognition system by building a database mechanism, electronic appliance recognition classification, and waveform recognition. It have been carried out smart meter data analysis but they are accepted only meter data. However, IoT platform needs to accept various kinds of data and manage the data uniformed system. Furthermore, many researches have studied IoT platform in another area. iHome Health-IoT [5] proposed platform seamlessly fuses IoT devices (e.g., wearable sensors and intelligent medicine packages) with in-home healthcare services (e.g., telemedicine) for improved user experience and service e_ciency. It mainly concerned a variety of health IoT device from body to cloud, and their hardware architecture. Andrea Zanella, et al. [6] provided a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT, and presented the technical solutions and bestpractice guidelines adopted in the Padova Smart City project. They collected the temperature, humidity, light, and benzene readings, and just shown the plots. They didnt have analysis part for urban IoT yet. Hong-ming Cai, et al [7] proposed a platform which based on an abstract information model, information encapsulating, composing, discomposing, transferring, tracing, and interacting in Product Lifecycle Management could be carried out.

1.3 Sensors used in IoT

1. Smoke sensor

A smoke sensor is a device that senses smoke (airborne particulates gases) and its level. They have been in use for a long period of time. However, with the development of IoT, they are now even more effective, as they are plugged into a system that immediately notifies the user about any problem that occurs in different industries. Smoke sensors are extensively used by manufacturing industry, HVAC, buildings and accommodation infra to detect fire and gas incidences. This serves to protect people working in dangerous environments, as the whole system is much more effective in comparison to the older ones. Common Type of Smoke Sensors Smoke sensors detect the presence of Smoke, Gases and Flame surrounding their field. It can be detected either optically or by the physical process or by the use of both the methods. Optical smoke Sensor (Photoelectric): Optical smoke sensor used the light scatter principle trigger to occupants.

Ionization smoke Sensor: Ionization smoke sensor works on the principle of ionization, kind of chemistry to detect molecules causing a trigger alarm.

2. Motion Detection Sensors

A motion detector is an electronic device which is used to detect the physical movement (motion) in a given area and it transforms motion into an electric signal; motion of any object or motion of human beings Motion detection plays an important role in the security industry. Businesses utilize these sensors in areas where no movement should be detected at all times, and it is easy to notice any body presence with these sensors installed. These are primarily used for intrusion detection systems, Automatics door control, Boom Barrier, Smart Camera (i.e motion based capture/video recording),Toll plaza, Automatic parking systems, Automated sinks/toilet user, Hand dryers, energy management systems(i.e. Automated lighting, AC, Fan, Appliances control) etc. On the other hand, these sensors can also decipher different types of movements, making them useful in some industries where a customer can communicate with the system by waving a hand or by performing a similar action. For example, someone can wave to a sensor in the retail store to request assistance with making the right purchase decision. Even though their primary use is correlated with the security industry, as the technology advances, the number of possible applications of these sensors is only going to grow. Following are key motion sensor types widely used: Passive Infrared (PIR) : It Detects body heat (infrared energy) and the most widely used motion sensor in home security systems.

3. IR sensors

An infrared sensor is a sensor which is used to sense certain characteristics of its surroundings by either emitting or detecting infrared radiation. It is also capable of measuring the heat being emitted by the objects. They are now used in a variety of IoT projects, especially in Healthcare as they make monitoring of blood ow and blood pressure simple.

They are even used in a wide array of regular smart devices such as smart watches and smartphones as well. Other common use includes Home appliances remote control, Breath analysis, Infrared vision (i.e. visualize heat leaks in electronics, monitor blood flow, art historians to see under layers of paint), wearable electronics, optical communication, non-contact based temperature measurements, Automotive blind-angle detection. Their usage does not end there, they are also a great tool for ensuring high-level security in your home. Also, their application includes environment checks, as they can detect a variety of chemicals and heat leaks. They are going to play an important role in the smart home industry, as they have a wide-range of applications.

4. Humidity sensors

Humidity is the need as the amount of water vapour in an atmosphere of air or other gases. The most commonly used terms are Relative Humidity (RH) These sensors usually follow the use of temperature sensors, as many manufacturing processes require perfect working conditions. Through measuring humidity, you can ensure that the whole process runs smoothly, and when there is any sudden change, action can be taken immediately, as sensors detect the change almost instantaneously. Their applications and use can be found in Industrial residential domain for heating, ventilating, and air conditioning systems control. They can also be found in Automotive, museums, industrial spaces and greenhouses , meteorology stations, Paint and coatings industries, hospitals pharma industries to protect medicines.

1.5 Motivation

First, there are too many remote controls or monitoring terminal for home automation and they are specifically oriented towards the design and development of office automation systems. Also, the access range to remotely control these gadgets are restricted by either length of cables or wireless network coverage in a personal area network. Second, many of the solutions do not provide a user friendly mobile interface to monitor and control electrical appliances at home. Third, most of the existing systems are not affordable and cannot be integrated with an already built home without re-wiring. Fourth, Bluetooth based office automation systems using Android Smart phones (without the Internet controllability) also has several drawbacks. Finally, the existing works were mainly focused on switching and controlling home appliances. Times have changed. Today, people are more agile and interconnected than ever before. Success will come to those who understand and embrace that our behaviors and needs no longer are the same. And thats the essence of the true Smart Office - to use insights about peoples needs in combination with innovative thinking and new technology to support and release the full potential of the workforce. To go the distance, you need a holistic, long-term perspective. Taking a holistic perspective on smart An office is not truly smart until all its parts, from technology to services, fully supports each and every individual that work there. It is the employees who are to be supported in the office and all the parts, from process to services, need to be in place so that the office can fully support the employees in their work. We believe that a Smart Office is: Centered around the people working there. What attracts and motivates them? What do they need to be able to perform at their best, Based on the activities that need to be performed in the office. Where and how are these activities best performed.

-A place designed for flexibility. Flexible in the way that it is accessible and used every day and it is open for changes and innovation over time. -Enabled by technology which efficiently supports the needed ways of planning and performing work. -Enhanced by the services provided both regarding function, convenience and experience. -Sustainable in every possible way balancing both economical, environmental and social aspects.

1.6 Problem Definition

To design and develop the green campus system using the Internet of things which save the energy consumption in college lab. We can also control the devices using android phones.

II. LITERATURE SURVEY

[1]M.poongothai,A.Rajeswari,P.Muthu Subramanian "Design and Implementation of IoT Based Smart Laboratory",

2018 5th International Conference on Industrial Engineering and Application Internet of things (IoT) provides a platform that allows devices to be

connected, sensed and controlled remotely across a network infrastructure. This work aims to develop a smart laboratory system in CIT campus based on IoT and mobile application technologies to monitor the overall activities of the lab including energy consumption and utilization of devices, environmental parameters via sensors, thereby providing a smart environment to CIT with energy efficiency and comfort. IoT smart hardware kits are designed using ESP8266, Arduino UNO, relays, current transformers, Raspberry Pi3 and sensors. The proposed work controls and monitors the devices of the CIT IoT lab using the dashboard developed in Node-RED or ANDROID STUDIO Mobile Application. Devices in laboratory are connected to IoT smart hardware kit. Dashboard and Mobile Application has been developed for interfacing IoT smart hardware kit MQTT broker. Node MCU is also coded to monitor and update the temperature, humidity and light intensity inside laboratory. A database has been created for a prototype switch to view status history. From the results of implementation, it is observed that the appliances in our lab are remotely monitored and controlled, thereby reducing their energy consumption considerably.

[2]Harbor Research, What Exactly Is The "Internet of Things?,March, 2014. Nowadays, much research in recent years has focused on IoT (Internet of Things). The home domain is the most important research area of IoT, because there expected accounts of home smart device for over 40 percent of connected device excepting mobile phone. Furthermore, enormous data is generated by home smart device. There is growing concern, but the previous works didn't address enough to manage and analyze home data. The purpose of this study is to describe and examine to manage the aggregated home IoT data based on SWO (Smart home Web of Objects), and SWO analytics platform. We shows the implementation of SWO analytics platform and a case study using real data from smart metering devices for analysis of appliance usage patterns.

[3]Eun-Seo Lee, Hark-Jin Lee, Kwangil Lee, and Jun-Hee Park, Automating Configuration System and Protocol for Next- Generation Home Appliances, ETRI Journal, vol. 35, no. 6, Dec. 2013, pp. 1094-1104. The implementation of the Smart Home devices necessitates the design of the individual units as well as their co-existence within the home environment. Thus, a Multi physics analysis approach is needed. In this paper, electromagnetic simulation was coupled to thermal and structural simulations to demonstrate the design and tuning of the Smart Home devices in a virtual world. Within the Smart Home, each wireless device has its own antenna module which is designed to ensure that it adheres to specific electrical wireless design constrains. In addition, detailed modeling of the different antennas operating in multiple frequency bands as well as in the diverse thermal and structural environment of the Smart Home was presented. This paper summarizes the antenna module mounted on a smart LED as well as the one mounted on the HVAC system. The ability to control these devices under different environmental scenarios will assist in making the smart home more energy efficient

[6]Geng Yang; Li Xie; Mantysalo, M.; Xiaolin Zhou; Zhibo Pang; Li Da Xu; Kao-Walter, S.; Qiang Chen; Li-rong Zheng, A Health-IoT Platform Based on the Integration of Intelligent Packaging, Unobtrusive Bio-Sensor, and Intelligent Medicine Box, Industrial Informatics, IEEE Transactions on , vol.10, no.4, pp.2180,2191, Nov. 2014. In this paper, an IoT based activity recognition systems based on wearable units was proposed, implemented and deployed successfully for activity detection using consumer home networks. By using information fusion of accelerometers, the activity types generated from activities of daily lives could be gathered seamlessly. Internet of Things (IoT) could ensure continuous gathering of activity data in real-time that results in huge amounts of data, especially if many users are involved. The proposed system achieved a high accuracy of 72% and could be deployed in any consumer-centric daily task monitoring system to examine activities of elderly as well as disabled citizens in smart home.

[7]Zanella, A.; Bui, N.; Castellani, A.; Vangelista, L.; Zorzi, M., Internet of Things for Smart Cities, Internet of Things Journal, IEEE , vol.1, no.1, pp.22,32, Feb. 2014. Nowadays, a secure and comfort house are hard to get. Another problem is the energy. Inside the house, there is often a waste of energy by letting the appliances turned on without being used. By using smart home systems, users can easily monitor and control the device inside the home, improve home security by enabling home locking

systems based on user location, and monitor the energy usage of each devices. The smart home system uses Internet of Things (IoT) technology. IoT technology utilizes the internet to be able to exchange data and communicate. The use of IoT on smart house systems is based on the ease of every user in accessing the internet. By using IoT technology, users can access all devices in the home anytime and anywhere through mobile devices as long as the mobile device is connected to the internet. Therefore, by using a smart home system, users can enjoy the ease in monitoring and controlling the house in real time.

This link will open an HTML web page which will allow the user to interface between the Mobile-Phone/Laptop/PC and the appliances. In addition, the IoT SHS may connect to the home router so that the user can control the appliances with keeping connection with home router. The proposed IoT SHS was designed, programmed, fabricated and tested with excellent results.

[10]Jeu Young Kim; Ji Hyun Lee; Ji-Yeon Son; Jun-Hee Park, Resource relation map based fault diagnosis and fault tolerance methods for home network environments, Network Operations and Management Symposium (APNOMS), 2013 15th Asia-Paci_c , vol., no., pp.1,5, 25- 27 Sept. 2013.This paper presents an approach to incorporate strong security in deploying Internet of Things (IoT) for smart home system, together with due consideration given to user convenience in operating the system. The IoT smart home system runs on conventional wifi network implemented based on the All Joyn framework, using an asymmetric Elliptic Curve Cryptography to perform the authentications during system operation. A wifi gateway is used as the center node of the system to perform the system initial configuration. It is then responsible for authenticating the communication between the IoT devices as well as providing a mean for the user to setup, access and control the system through an Android based mobile device running appropriate application program.

[11]Skubic, M.; Guevara, R.D.; Rantz, M., Automated Health Alerts Using In-Home Sensor Data for Embedded Health Assessment, Translational Engineering in Health and Medicine, IEEE Journal of , vol.3, no., pp.1,11, 2015. The recent technology in home automation provides security, safety and comfortable life at home. That is why in the competitive environment and fast world, home automation technology is required for every person. This purposed home automation technology provides smart monitoring and control of the home appliances as well as door permission system for interaction between the visitor and home/office owner. The control and monitoring the status (ON/OFF of the appliances) have been implemented using multiple ways such as The Internet, electrical switch, and Graphical User Interface (GUI) interface. The system has low-cost design, user-friendly interface, and easy installation in home or multi-purpose building. Using this technology, the consumer can reduce the wastage of electrical power by regular monitoring of home appliances or the proper ON/OFF scheduling of the devices.

[12]Shuai Zhang, Sally I. McClean,Member, IEEE, and BryanW. Scotney, Probabilistic Learning From Incomplete Data for Recognition of Activities of Daily Living in Smart Homes,IEEE TRANSACTIONS ON INFORMA- TION TECHNOLOGY IN BIOMEDICINE, VOL. 16, NO. 3, MAY 2012. In a nutshell, we present an Edge Computing based IoT architecture for home automation services. The functional components of the architecture are explained and prototype evaluation results are outlined. The entire experiment shows that our method is feasible, secure and address the current problems in the Smart Home domain.[11] From experimental result section, it is clear that proposed system given has proved to be a better way of energy and security management. The main idea of this system is to monitor the energy usage and security of the house in a user friendly and a mobile way so that a user can manage the power management as well as security of their house even when not at the house itself.

III. SYSTEM DESIGN

4.1 System Architecture

This system is used for the college campus automation. In this system we are implementing the smart automation using Internet of things. In this system weight sensor and the PIR motion sensor and the MQ-7 sensor is used. The weight sensor is used to detect whether the student is on the chair or not. If he started the system after 10 mins he left the chairs then

system will automatically shutdown the computer. The PIR motion sensor will recognize the whether anyone is in the lab or not. If not then after certain time all the fans and lights in the lab automatically get off. The MQ-7 sensor will detect whether there is any fire or not. If fire is get generated then it will send the alerts to the higher authorities.

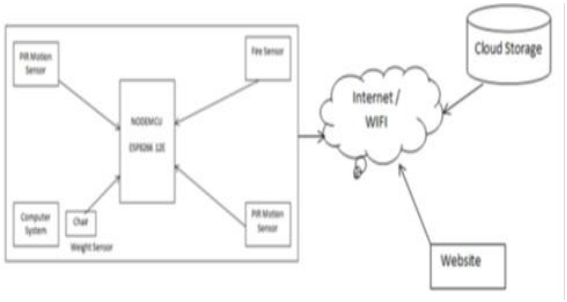


Fig 4.1: System Architecture

IV. MATHEMATICAL MODEL

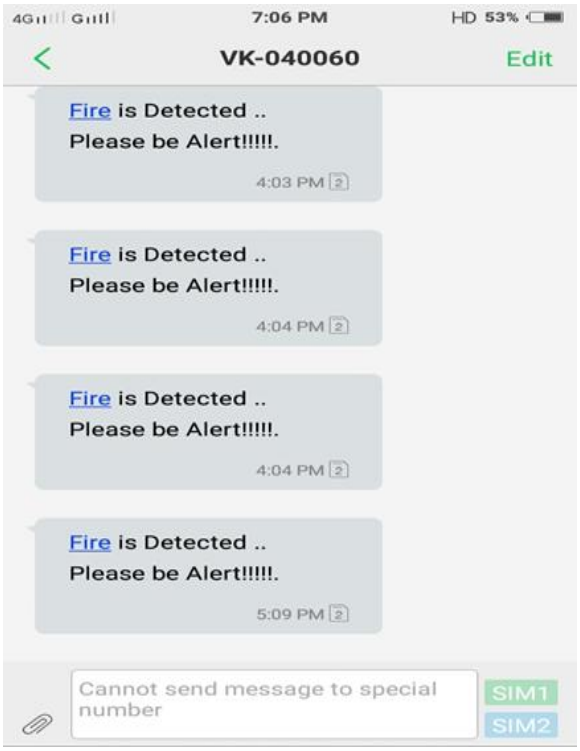
Let S represent from system as a set of components as follows:
S :- F, U, DB, I, O, T, R,M
where,
I:- Input
O:- Output
T:-Time
F:-MQ-7 sensor
U:-Motion Sensor
DB:-Database
R:-Node MCU Pi IDE
M:-Microcontroller
Input:-
I1:- set of input data from MQ-7 Sensor {s1,s2,s3,s4, sn}
I2:- set of input data from Motion Sensor {n1,n2,n3,n4, nn}
I3:- set of input Analog data from Node MCU Pi{a1,a2,a3, an}
Output:-
O1:- set of output data from Transmitter {t1,t2,t3,..tn}
O2:- set of output data from Node MCU {a1,a2,a3..an}
O3:- set of output data from Database{d1,d2,d3.dn}

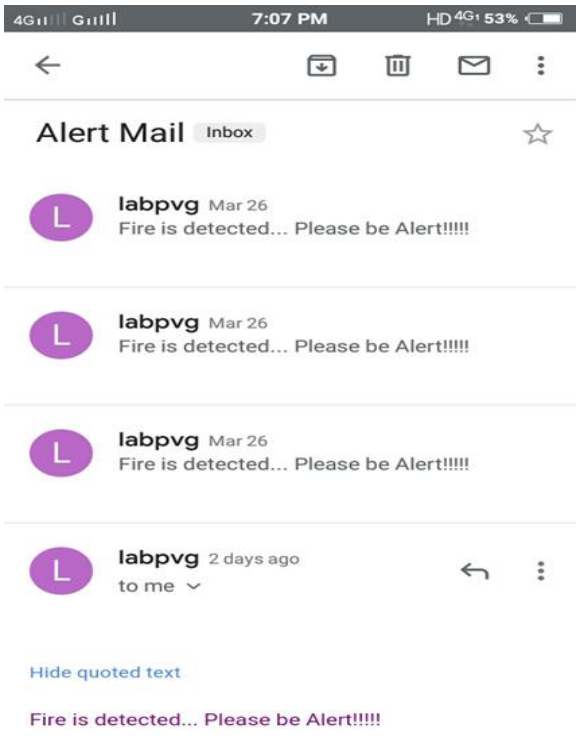
V. CONCLUSION AND FUTURE WORK

A. Conclusion

Internet of things reduces the human intervention by introducing device to device interaction. This work has been designed to implement smart laboratory system using IoT technology for remote energy monitoring and control appliances inside the lab. By employing the proposed system, the total energy consumption can be reduced in our campus. On a whole in a year up to 30 percent of energy can be saved in our campus by implementing smart laboratory system through IoT.

VI. RESULTS





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