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A Review on Smart Campus using IoT

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ABSTRACT: Today is a new era of computing technology i.e. Internet of Things (IoT). IOT can be termed as a "universal global neural network" in the cloud which connects various things. Internet is a revolutionary invention, it has always been transforming itself into some or other new kind of hardware and software which makes it irresistible for anyone. Nowadays the communication is in the form of human-human or human-device. But the future of internet i.e. IoT promises a machine-machine type of communication. The IoT is a system comprising various devices or systems which are intelligently connected which interacts and communicates with other machines, environments, objects and infrastructures. With the areas like business, transportation, medicine, energy, agriculture and others, the Internet of Things also finds a major implication in education. A university campus can be considered as the ideal place for the creation of a smart environment. The aim of the hereby paper is to describe a new concept called Smart University by providing a comprehensive overview of the IoT scenario and reviews its enabling technologies and the sensor networks.

KEYWORDS: Internet of Things, Supersensors, Wireless sensor node, Smart campus

I. INTRODUCTION

The IEEE IoT Initiative provides two definitions based on the complexities of an IoT system. The definition for low complexity systems is as follows:

"An IoT is a network that connects uniquely identifiable "things" to the Internet. The "things" have sensing / actuation and potential programmability capabilities. Through the exploitation of unique identification and sensing, information about the "thing" can be collected and the state of the 'thing' can be changed from anywhere, anytime, by anything." [4]

For large complexity systems, the definition given by the IEEE IoT Initiative is the following:

"Internet of Things envisions a self-configuring, adaptive, complex network that interconnects 'things' to the Internet through the use of standard communication protocols. The interconnected things have physical or virtual representation in the digital world, sensing/actuation capability, a programmability feature and are uniquely identifiable. The representation contains information including the things identity, status, location or any other business, social or privately relevant information. The things offer services, with or without human intervention, through the exploitation of unique identification, data capture and communication, and actuation capability. The service is exploited through the use of intelligent interfaces and is made available anywhere, anytime, and for anything taking security into consideration." [4]

In this digital era, the life of human beings is getting simpler as almost everything is being automatic, replacing the old manual systems. Nowadays internet have become an integral part of humans everyday life without which they are helpless. Internet of things (IoT) provides a platform where devices can be connected, sensed and controlled remotely across a network infrastructure. The IoT devices controls and monitors the electronic, electrical and the mechanical systems. Single admin controls the various devices connected to the cloud server and also facilitates a number of sensors and control nodes. The admin can access and control all the nodes connected to each user but a single user can control only the nodes to which are connected to that particular user. The whole system uses IoT hence the devices connected to internet like mobile or computers can remotely control all the functions and features of the appliances from anywhere. The system designed is economical and scalable as it can be expanded by connecting and controlling of a number of different devices.



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Generally, all universities are connected to internet, and in each there are many similar objects that can be converted into smart objects within meaning of Internet of Things. The university campus may consist of simple common objects like doors, windows, printers, projectors, books, poles, benches etc. or complex objects like buildings, classrooms, laboratories and parking etc. All these objects can be converted into smart objects by attaching sensors, QR tags (texts, links, graphics), RFID, NFC and these objects are given a significant level of intelligence to allow operation of actuators and even decision making. The set of all these smart objects can transform a classical campus, into a Smart Campus.

Several classrooms, staff offices and laboratories etc. have been equipped with super sensors featuring temperature and light monitors. The factors like temperature and light can have significant effects on the productivity of office workers as well as students. Also this helps in reducing power consumption by monitoring the environment condition and controlling the appliances. An IR sensor in each room allows building users to find a meeting room that is currently free. Generally, public meeting rooms should be booked via a shared calendar system.

The main purpose of energy efficient algorithm is to maximize the network lifetime. These algorithms are not just related to maximize the total energy consumption of the route but also to maximize the life time of each node in the network to increase the network lifetime. Energy efficient algorithms can be based on the two metrics: i) Minimizing total transmission energy ii) maximizing network lifetime.

The first metric focuses on the total transmission energy used to send the packets from source to destination by selecting the large number of hops criteria. Second metric focuses on the residual battery energy level of entire network or individual battery energy of a node [1].

II. RELATED WORK

In Kristian Hentschel et al. Here they have outlined the motivation for supersensors, based on inexpensive Raspberry Pi devices attached to off-the-shelf sensors. System uses Python language which is well supported on Raspberry Pi it also provides various libraries for connecting hardware interfaces[1].

Tejas Thaker et al. Here authors considered a cost of a designed Wireless network, here we use Low cost and energy efficient ESP8266 Wi-Fi module for developing a Wireless Sensor Network. ESP8266 module provides high performance, high integration performance[2].

Shohan Dey et al. authors focused on home automation using smart phone and computer. The IoT devices control and monitor the appliances that may be electronic, electrical or mechanical systems. Single admin controls the various devices connected to the cloud server and also facilitates a number of sensors and control nodes[3].

Marian Cata et al. Here the author developed the idea that a university campus may represent the ideal place for the creation of a smart environment. As many universities are connected through internet the implementation of the concept is a practical idea. The concept of smart university is defined like a small world where sensor enabled and networked devices work continuously and in collaboration to make the infrastructure more smart[5].

Cesar Cheuque et al. Here they demonstrated a university project to control the LED devices. The purpose of the project is to give the first approximation of a system using Web technology Raspberry Pi. The system allows inclusion of modules and can be a real alternative in the implementation of a Smart Home[6].

Sheikh Ferdoush et al. Here author described about a wireless sensor network system developed using open source hardware platforms like Arduino and Raspberry Pi. The system is low-cost and highly scalable. The various type and number of sensors can be connected hence it is suitable for wide variety of applications related to environmental monitoring[13].

E. Yoneki et al. authors introduced the RasPiNET, it is a form of a Delay Tolerant Network consisting of Raspberry Pi computers. Each Raspberry Pi is equipped with WiFi communication capability and a battery pack and RasPiNET can operate a data mule communication[15].

S. Banerjee et al. gave a unique design of a secure sensor node prototype. The proposed system communicates over Bluetooth using RC4 encryption algorithm between a mobile phone and their monitoring equipment[16].

R. Szabo et al. They have described a generic framework for smart city applications which is built upon XMPP i.e. Extensible Messaging and Presence Protocol.

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ngand Presence Protocol for mobile participatory sensing[17].

A. Table of Comparison:

Ref. ID	Problem addressed	Methodology/technique used	Merit	Demerit
1	In general, campuses have very large area, so it becomes difficult to manage and track every thing that happens in the campus. Hence fully automated system for monitoring and controlling.	There may be one or two nodes that transmit information received from sensors to the server through a gateway. Also the classroom object can communicate directly to the similar object neighbor.	Energy efficient , Can be accessed from anywhere using data on the cloud	High cost
2	Cost and energy consumption issue of wireless sensor network	ESP8266 based Low cost Wi-Fi based wireless sensor network, the IEEE 802.11n protocol is used for system.	Operating range is more than zigbee and RF Data rate is high	Complexity is more
7	Home automation system using android.	The system is implemented using android platform with including Bluetooth APIs and microcontroller AT89C51	Doesn't use air time Rich features	Range is not that good
8	Integration of home automation system through IoT	Designing a home automation through reading the internet of the client	Can reduce human effort Error probability reduced	May take time and learning Replacing humans is dangerous
9	Internet of Things and Cloud computing can work together can solve the Big Data problems	Used of low sensing system which would effectively create a relay of machines that provide response to each other and require the minimum human interaction	Smarter processing and services Smarter resource sharing	Security concerns Vulnerable to attacks
10	Automating the home appliances via Bluetooth in Smart devices	Automation of the home appliances using Bluetooth in smart phone and its implementation	Readily available Can be implemented at any device and automated	Works in the range of Bluetooth
11	High wastage of energy in home devices due to inefficient managing devices	Wireless sensing element is used for observing parameters such as temperature and weight due do user's presence	Optimizing energy consumption by home appliances while conforming comfort level	Can't be used in mass market



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12	Requirement of cheap and flexible home control system.	Use of microprocessor and microcontroller to control and monitor usage of appliances using smartphone.	Doesn't require PC connectivity and offer complete communication protocol.	Only operates when devices are at remote location.
14	Need of smart and fully automated monitoring condition.	Sensors such as light, temperature, humidity sensor used to provide necessary data to automatically adjust comfort level in a home.	Gives a lot of advantage in the use of IOT in smart home system	High energy consumption.
16	Increase in possible software attacks on privacy and safety of health applications, safety and reliability of the sensor data is an important issue that needs to be addressed in this field	A unique design of a secure sensor node prototype has been proposed and implemented, which communicates over Bluetooth using RC4 encryption algorithm between a mobile phone and their monitoring equipment.	A secure data communication is ensured by encrypting the sensor data using an encryption key the loss of data is prevented	Range is limited to Bluetooth range.
17	Aim was to build services that can be used to draw conclusions regarding the operation of the community, and the derived information can appear as a new service in the community (by using appropriate analytics), thus having a beneficial feedback to its operation.	Traditionally, the implementation of these smart city services require the deployment of some costly sensing and tracking infrastructure. As an alternative, the crowd of inhabitants can be involved in data collection via their mobile devices. This emerging paradigm is called mobile crowd-sensing or participatory sensing	XMPP, as the core of a unifying open architecture for crowd-sourcing XMPP is already established, standardized, freely available, extendible, supports the publish subscribe communication model	Resource dependent Actual implementation may need time

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III. PROPOSED SYSTEM

A. Block Diagram

The block diagram for the Smart Campus system is as follows:

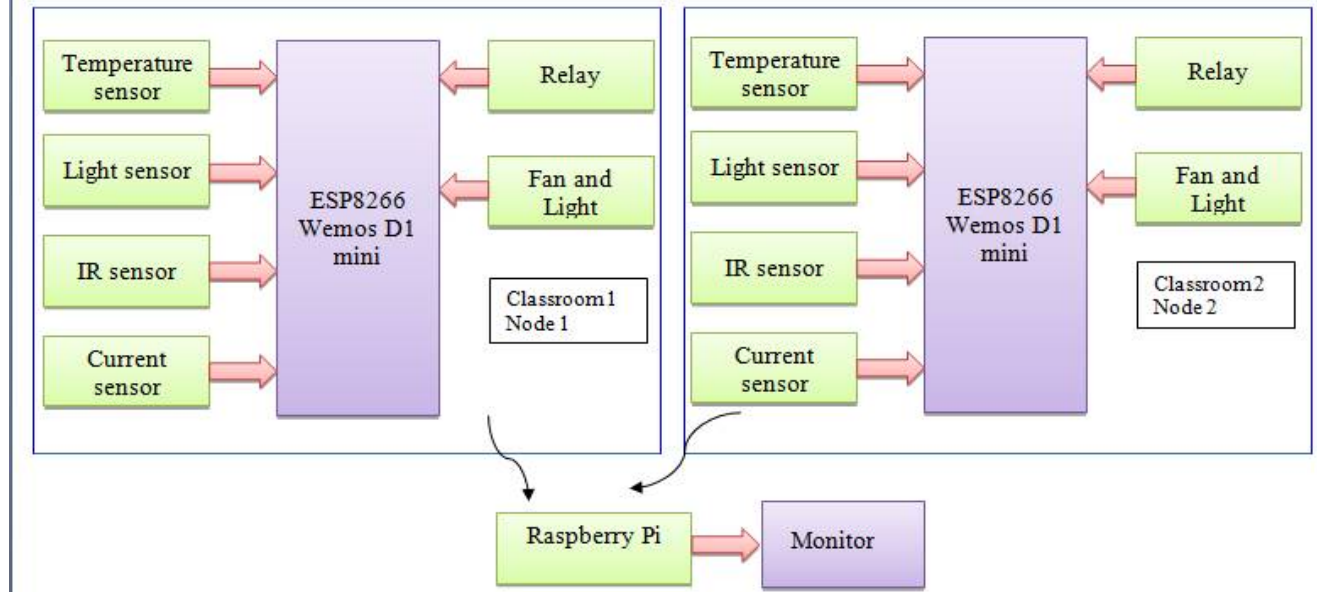


Fig. 1. Block Diagram of Smart Campus

B. Working

The temperature sensor, light sensor and current sensor monitors the temp, light and current resp. The IR sensor is used for monitoring whether any person is present in that room. The data from all the sensors is given to the ESP8266 Wemos D1 mini wi-fi enabled board. This module transmits the information wirelessly to the Raspberry pi available within the range. Raspberry pi credit card microcontroller can store and transfer the data of different sensor. Now the Raspberry pi transfers this data to the main server which can be remotely located, this creates a web based GUI to display all the information. Also by comparing the values of temperature sensor and IR sensor to the threshold value given. If both the values are above threshold system will automatically turn on the fan. Similarly, by comparing the values of LDR and IR sensors with the threshold, if value is greater than threshold then system should turn on the lights. If any of the criteria is not fulfilled it will not turn on the lights or fan. We connect our own applications to proven scalable open source software for a persistent document data store (Mysql), and a performing publish-subscribe system, cache, and queuing system (REDIS). We make use of Protocol Buffers for serializing and parsing transmitted data using the proto3 format to specify message types and service endpoints.

IV. CONCLUSION

These kind of Systems are required in the university campus as the area is very large and number of rooms are also large. And human can make mistakes and forget to switch off the appliances when in no use and in this case, these systems are useful in order to increase the power efficiency. The system can be viewed as a future of artificial intelligence. This is a powerful and dependable system. It fulfills the goal of energy saving and helps in achieving the efficient use of energy resources. Study of various papers gives a better option of wifi enabled processor instead of Bluetooth and zigbee for communication and also to process the sensor data. Hence, due to survey it became possible to make power efficient, cost efficient, fully automated system. This system is taking a step forward towards the goal of increasing the technological advancement and Smart City.



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