iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4560

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Monitoring of Green Campus with IoT

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Abstract: This paper describes the development of green campus using Internet of Things (IoT) technology. IoT is short for Internet of Things refers to the ever-growing network of physical objects that features an IP address for internet connectivity, and the communication that occurs between these objects and other internet-enabled devices and systems. The Internet of Things is the logical next step in the evolution of the internet and is continuation of M2M (machine-to-machine) networks and technologies, building upon and extending technologies in M2M, mobile technologies, RFID and more. IoT stretches further than these roots while encompassing them and became ever more popular due to several factors, including the lower costs of sensors and enabling technologies and networks.
Keywords: IoT; green campus; monitoring statistics; sensor technology; lab management technology.

I. INTRODUCTION

IoT is a network of physical objects with embedded electronics that collect and share data. As the global population grows; the resources on earth are depleted quickly. In order to have a sustainable earth, governments around the world put a lot of efforts to advocate the importance of the reduction of carbon production as well as to emphasize the benefits of reducing the consumption of energy. The proposition has been promoted on campuses of educational institutions as well. Smart campus is a trendy application in the paradigm of the IoT. The concept of constructing a “Smart campus” implies that the institution will adopt advanced ICTs (Information Communication Technologies) to automatically monitor and control every facility on campus. To use the facilities more efficiently and to minimize the energy consumed are believed the most important advantages of building a smart campus. Such efforts are also recognized as constructing a “green campus. ”For instance, narrowband IoT (NB-IoT) is part of LTE Advanced Pro innovations, defined in 3GPP Release 13 and beyond. In this report, we propose taxonomy to categorize the types of sensors used now-a-days in different IoT application domains. To this end we analyzed several IoT-Based Initiatives in order to identify the main IoT application domains and the sensor types currently used in each one of them. Two major ICTs which make the realization of IoT possible are the emergence of cloud computing and the network of wireless sensors. Wireless sensor networks are, particularly, adopted in many urban cities to provide smarter and advanced lives. In order to construct a green campus with the utilization of the Internet of Things, this research reviews the cores of IoT, cloud computing, and wireless sensors network. Thereafter, the definition, the architecture, and the steps for the development of green campus are proposed. This paper also demonstrates our work toward constructing a green campus and the system we have developed. The ultimate goal of this work is the implementation of a cloud-based monitoring system built upon wireless sensor network architecture so that data are gathered and stored on cloud database and the analysis can be carried out periodically.

II. SYSTEM DESIGN

Figure 1 shows the block diagram of our green campus with IoT. In this ESP8266 (01) is used as a server and it works as a router. Clients are connected to ESP8266. There are three modes of clients:

A. Node MCU
B. ESP8266 Version 01
C. ESP8266 12E

Every ESP8266 has an IP address. The server’s IP address is 192.168.4.1. The three clients are connected to ESP8266 and each three client has a web page. Then open a browser and add IP address. Web page will get open; the Client1 is used for digital display. If we type some message in text box then this message will be display on digital display board. Client 2 is used in lab. In this case, we will know what the temperature in lab is, and if the temperature is high then we can turn ON AC through the web page. Client 3 is used for classroom. PIR is used in classroom. If someone enters in classroom then all lights will turn on. But if teacher wants to turn ON/OFF one of the particular light and fan, then first open app and enter IP address and we can turn ON/OFF light and fan through it.

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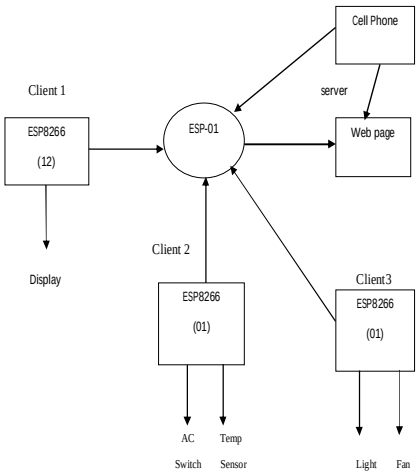

Fig 1: Block diagram of monitoring of green campus with IoT

III. HARDWARE & SOFTWARE REQUIREMENT

A. *ESP8266:* ESP8266 consists of 8 pins, where 4 are in row of 2. The top left pin is GND. The two pins right from the GPIO 2 and 0. The pin on the top right side is the RX pin whereas the lower left pin is TX. These pins are used for communication purpose. CH_PD (chip power-down) and RST (reset) are the middle pins on the bottom. This device works with 3.3V even the Rx and TX pins.

B. *PIR Sensor:* PIR sensors detect and measure incoming infrared energy. The infrared ray is emitted by the heat of the body or any light sources. Depending upon the purpose of the sensor the range of IR filter can be limited to certain level. Most passive infrared sensors can actually detect emissions in the range of 8 to 12 micrometres.

C. *Relays*: Relay are a remote control electrical switch that can be switched using low current to control a high current load. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts.

D. *Dot-matrix*: Dot-matrix display is a display device used to display information on machines, clocks, indicators and many other devices requiring a simple display device of limited resolution.

IV. RESULT

In this project the controlling of Lights, fans are monitor by PIR sensor as well as by voice, the humidity and temperature of AC's is also controlled through it. The receiver connect its PC's via a USB interface and collects all the data which is send by the emitter to it. The data collected which includes the temperature of lab are sent to the server. The changes in the monitoring of lights, fans and temperature of AC's are analysed and updated. The results are updated on web page screen to allow the controlling of system as well as tracking of usage is also done simultaneously. Fig 3 shows our project setup. Fig 4 shows the web page and fig 5 shows the message displayed on the notice board whereas fig 6 shows the controlling of lights in the classroom by PIR sensor and voice.

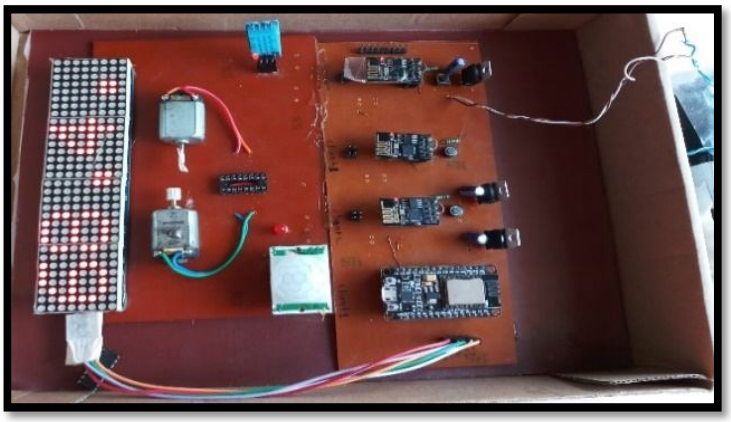

Fig2: Project Setup

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Fig3: Webpage of server

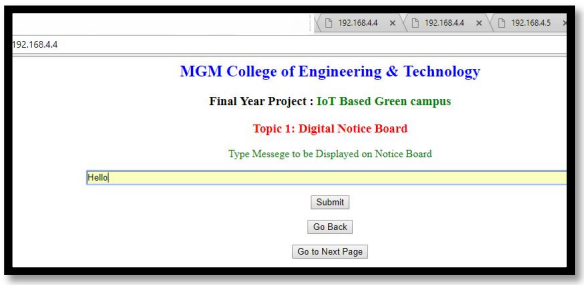

Fig4: Message displayed on notice board

Fig5: The system shows temperature in lab

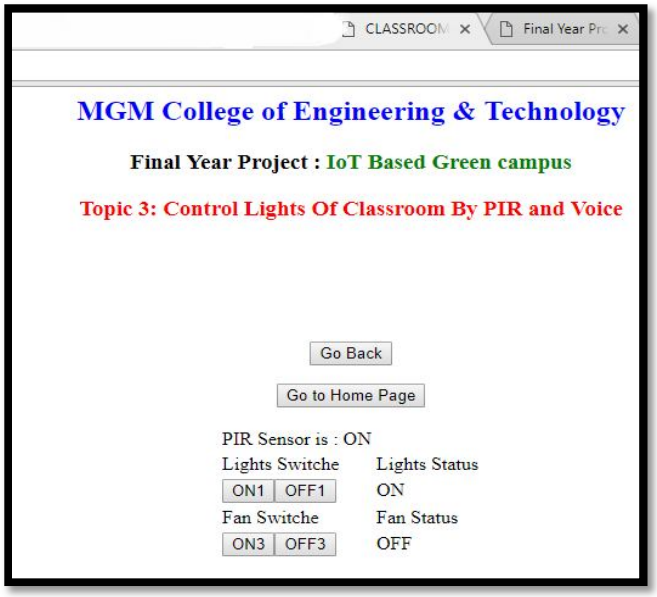

Fig6: Controlling lights of classroom by PIR sensor and voice

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V. CONCLUSION

This project appeals to the responsibilities the colleges should bear in the issues of environmental protection. This project also proposes the steps as well as the methodology of how to empower a green campus by utilizing the advanced technologies smartly. Furthermore, this topic adopts the concept of the "Internet of Things" to monitor the green campus which emphasis the idea of energy saving. The contributions delivered by the system we have developed include the following.

1) The classroom can be managed efficiently.
2) The air conditioners will be turned on only when the temperatures reach a preset level. As a result, this will save energy.
3) The results of the analysis of data will be sent to the operator so that proper actions can be taken in time.
4) The concept we developed allows users to connect to the system with any mobile device in any place.

VI. ACKNOWLEDGEMENT

It is our privilege to express our sincerest regards to our project guide Prof. K. V. Raman (Head of IT Department) who gave us the golden opportunity to do this wonderful project on the topic "MONITORING OF GREEN CAMPUS WITH IoT" for her valuable inputs, guidance, encouragement, whole-hearted cooperation and constructive criticism throughout the duration of our project.
We deeply express our sincere thanks to our Head of Department Dr. I.V. Singh for encouraging and allowing our department premises for the partial fulfilment of the requirements. We also immensely thank our parents and all other family members for their love and constant.

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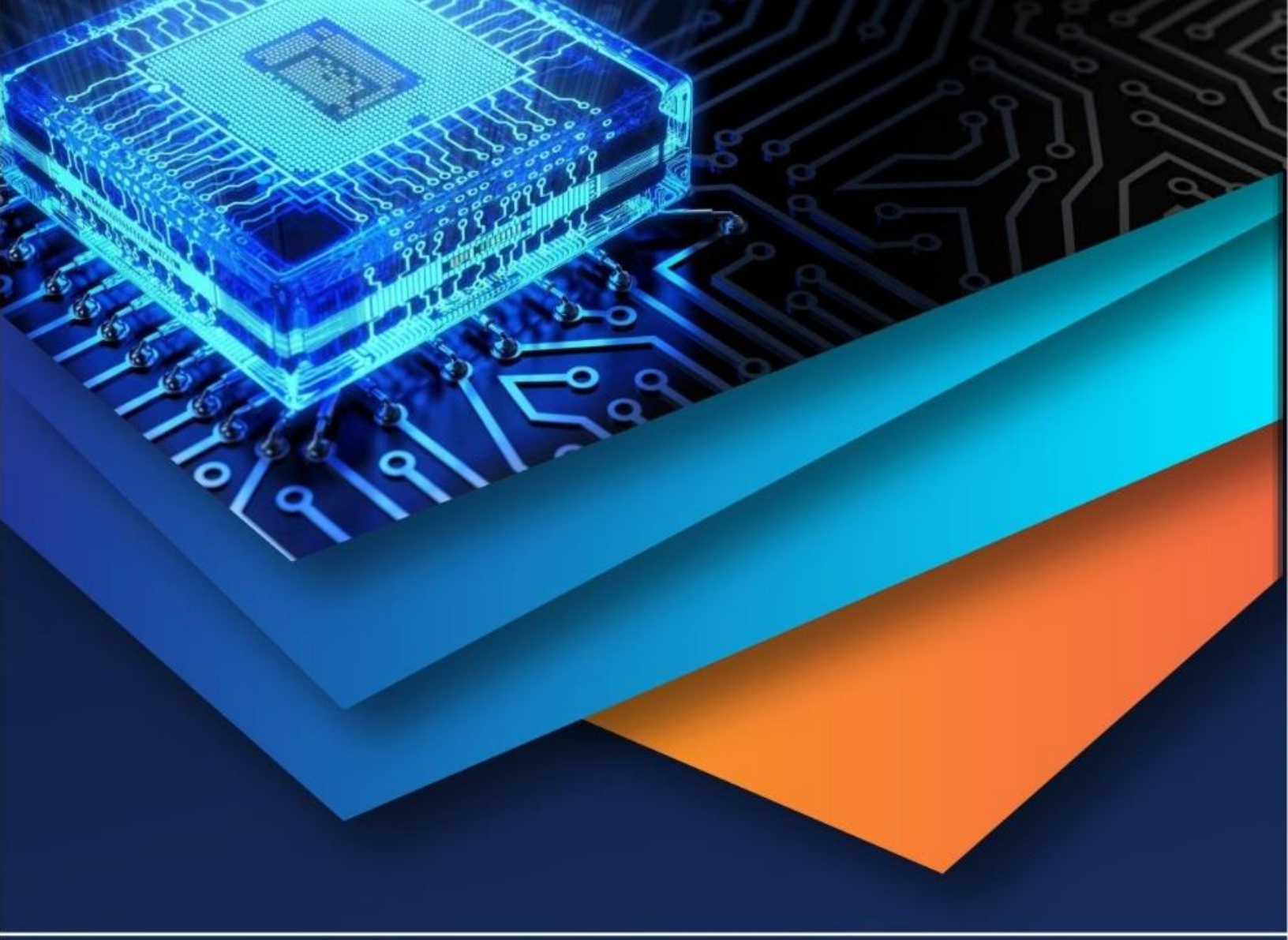

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