WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

IOT Based Energy Saving in E&TC Department

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ABSTRACT—

In order to operate any electrical item, our project offers a low-interaction, cost effective, energy-efficient Internet of Things (IOT) based device controlling system for tube lights, fans, and projectors. The proposed prototype of the "IoT based Energy saving for E & TC Department" is put into use to lessen the amount of electricity that is wasted in the lecture hall in our E & TC department at the Pune Institute of Computer Technology College. By detecting the presence of people in classrooms, this system may manage the operation of electrical devices like fans and tube lights. Our system uses a PIR sensor to detect human presence and can react to environmental factors like temperature, humidity, and light intensity in a human- occupied location. To measure those conditions, PIR sensors are linked to the ESP8266 controller board. Relay module is used to conduct the ON/OFF conditions for sensing people. The ThingSpeak software included in this system uses data from these sensors to update its web application with real-time information on these circumstances. All data is transmitted to the host computer through the internet using a NodeMCU Internet of Things device. Finally, the partially system was tested in college laboratory

Keywords— IOT, ESP8266, PIR, ThingSpeak, Arduino.

I. INTRODUCTION

The main purpose of developing this project is IoT-based automated power-saving system set up to manage electric classroom equipment like lightbulbs and fans. The technology recognizes the location of the person's final destination as they enter the classroom as part of the operation procedure. Then, a fan and light bulb are turned on automatically in the schools' human-occupied areas. The system will keep the classroom's temperature and lighting at a comfortable level when the specific electric gadget is activated.

Since we work in the electronics and telecommunications field, we frequently use the fundamentals in the implementation of contemporary technology. We have chosen the project Energy saving for E & TC Department utilizing IOT from there. The following are the electronic and communication components of our project:

1. NodeMcu ESP8266: Nodemcu is an open-source Internet of Things (IoT) microcontroller that utilizes an Expressif System Wi-Fi module. Its second purpose involves communicating across a Wi-Fi channel using the entire bandwidth to send or receive all of the data. Its 2.4GHz frequency band is crucial for finishing our foundational lessons in communication engineering.
2. PIR (Passive Infrared Sensor): For human detection in our project, we'll use a PIR sensor as an IOT Client. For the purpose of detecting students in the classroom and allowing us to manage electrical equipment like fans and tube lights.
3. Relay module: The MCB will be directly linked to this relay module and the PIR sensor, and we'll use it to control the light by turning it on and off.
4. MCB: The major part of our system, the MCB will control the entire system by identifying people using a PIR sensor, operating lights and fans using a relay module, and turning on and off the electricity in the classrooms.

II. LITERATURE SURVEY

The study of "IoT" was thorough and included multiple relationships and limitations. The basic objective of "IoT" is to make Internet-based communications and the sending and receiving of information conventionally available when used with "electronic sensor" devices. Contrary to software development, the major goal of the IoT is to incorporate organizations, automation, and mechanization; the most commonly recycled sensors with accelerometers are embedded in camps like "MCUS, MPUs" at the beginning of the programmed. According to the initial assessment, software development in general is comparable to the "IoT phase is separated into criteria, specifications, and implementation." This section explains earlier studies that are relevant to our inquiry. Energy utilization principles are the subject of the majority of research conducted today since they offer the best chance of reducing energy use. Other possibilities include creating green universities and using renewable energy sources like solar electricity. Green universities

help with overall university energy needs while reducing environmental pollutants. Walter Simpson asserts that by focusing on the supply side of the energy equation, an aggressive university energy conservation program can reduce university energy use by 30% or more. It entails switching to energy sources and technologies that are clean, renewable, and not carbon-based. The approach includes creating energy regulations for universities, managing the computer explosion, avoiding the problems of electric deregulation, purchasing green power, and applying green building design. This study suggests that one effective strategy to cut university energy use is through technology solutions. Our solution combines the solutions mentioned previously. It is a monitoring system for the classroom as well as an energy- saving solution. Only individuals are accurately identified and the electrical gadgets are automatically controlled in the energy-saving section. The passive infrared sensor (PIR) was employed for this task. It appropriately recognizes the human body. The proposed system was created to use several types of sensors to automatically regulate the conventional manual switching mechanism.

III. PROPOSED METHODOLOGY

In this section, we discuss the overview of our model, through literature reviews we have formulated some of the existing methodologies and designed our system based on the difficulties faced by the existing authors.

A. Block Diagram and Description

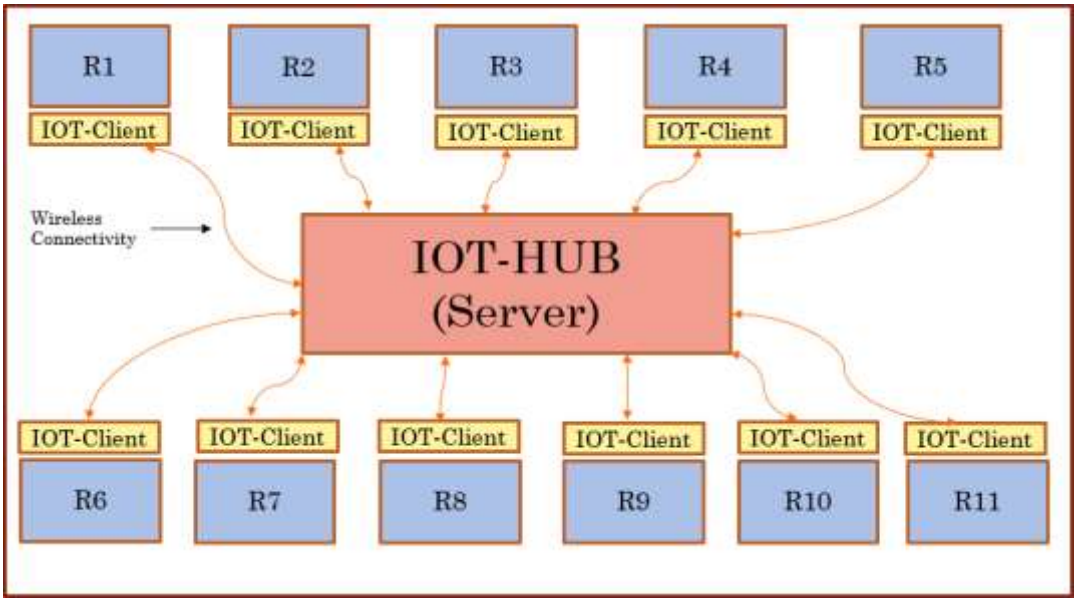

Fig A - Departmental Block diagram

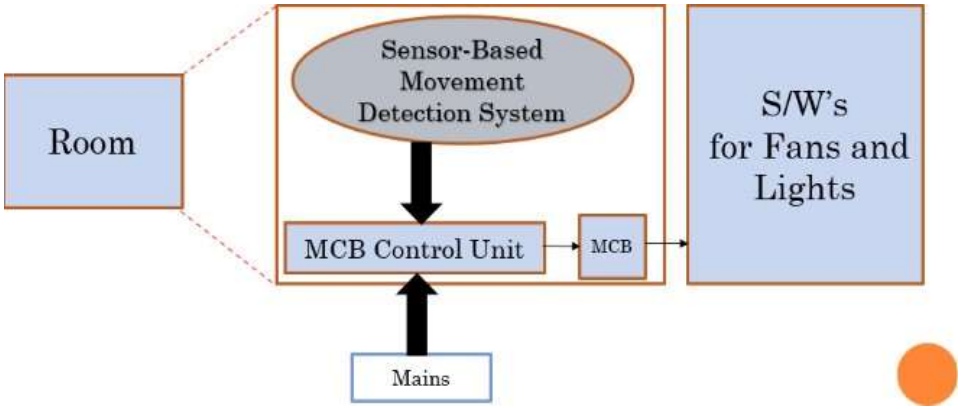

Fig B - Classroom Block diagram

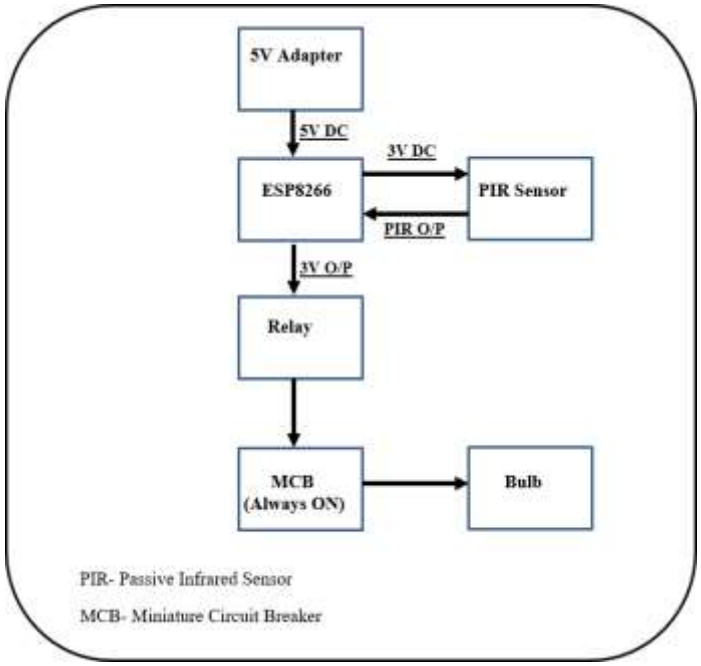

Fig C - Client-Module Test Setup Block Diagram consist of following 4 components:

1) IOT Client

2) IOT Server

3) MCB Control Unit

1) IOT Server-

The controller ESP8266 is used by IoT Server. The ESP8266 controller is used by IoT Server. Espressif has created the ESP8266EX, a highly integrated Wi-Fi SoC solution, in order to satisfy customers' ongoing expectations for reliable performance, a small form factor, and optimal power consumption in the Internet of Things arena. Due to its comprehensive and independent Wi-Fi networking capabilities, the ESP8266EX may function either independently or as a slave to a host MCU. The ESP8266EX starts up right away from the flash when hosting the software. The built-in high-speed cache aids in memory optimization and boosts system performance. Any microcontroller design employing SPI/SDIO or UART interfaces may use the ESP8266EX as a Wi-Fi adapter as well.

Filters, power management modules, an RF balun, a power amplifier, a low noise receive amplifier, and antenna switches are all included in the ESP8266EX. The small PCB size and low need for external circuitry are products of the compact design. The ESP8266EX has Wi-Fi capabilities, an enhanced 32-bit CPU from Tensilica's L106 Diamond series, and on-chip SRAM. It can link to external sensors and other devices using the GPIOs. High-end features like:

1) For energy-saving objectives, quick changeover between sleep and awake modes.
2) Adaptive radio biassing for use at low power.
3) sophisticated signal processing Mechanisms for shared cellular, Bluetooth, DDR, LVDS, and LCD interference reduction, including spur cancellation and RF coexistence.

2) IOT client-

We use PIR Sensor for IOT Client. Motion may be detected using PIR sensors, which are mostly always employed to assess whether a person has entered or left the sensor's field of vision. They are affordable, low-power, simple to operate, lightweight, and durable. Because of reason, they are regularly discovered in gadgets and appliances used in households and companies. PIR, pyroelectric, passive infrared, or IR motion sensors are common names for them. In essence, PIRs are made of pyroelectric sensors, which can detect small quantities of infrared light. This sensor is depicted below as the round metal cylinder with the rectangular crystal in its center. Everything emits some low-level radiation, and the more an object emits, the hotter it is. The sensor of a motion detector really has two sides. This is so that we can notice change or motion rather than an average of IR levels. The two pieces cancel one another out due to how they are wired. Whether one side detects more or less IR radiation than the other will determine whether the output fluctuates high or low.

3) MCB Control unit

PIR Sensor output is essentially the foundation of MCB control unit operation. To turn off the MCB board button, we disconnect main supply from fans and light buttons. When the PIR sensor output is zero (no one is in the classroom), the MCB control unit Disconnect that MCB with all Tube Lights and fans buttons of classroom from main supply and when the PIR sensor output is one (someone is in the classroom), the MCB control unit connect that MCB with all Tube Lights and fans buttons of classroom with main supply.

IV. THINGSPEAK SOFTWARE INFORMATION

A group of "connected devices" that are interconnected constitutes the Internet of Things (IoT). The majority of the time, the gadgets have an inbuilt operating system and a communication interface for the web or other nearby gadgets. One of the crucial elements of a generic IoT system that links the various "things" is an IoT service. An intriguing consequence of the 'things' that make up IoT systems is that they lack the ability to act independently. They ought to be able to link to other "things" at the very least.

Only until the items are connected to a "service," either directly or via other "things," can the whole potential of IoT be realized. The service has capabilities ranging from simple data collection and monitoring to sophisticated data analytics, acting as an unseen manager in such systems. The below diagram shows how an IoT service fits into the wider IoT ecosystem:

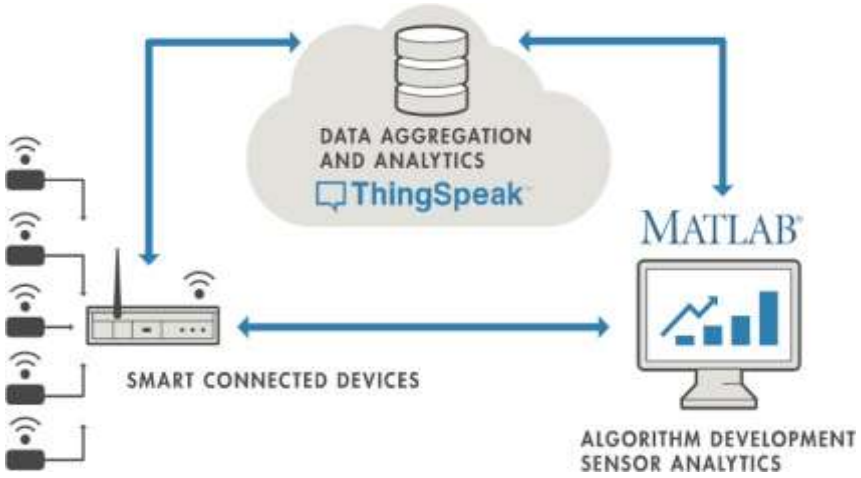

Fig D - ThingSpeak Working model

V. RESULT AND DISCUSSION

Following figure shows installation of classroom setup:

Fig E - Installed system in Classrooms

Fig F - All fans and tube lights of classroom are in OFF state room for checking

Fig. G - After sensing motion all fans and light of classroom are in ON state (I)

Fig. H - After sensing motion all fans and light of classroom are in ON state (II)

After that we purchase energy meter to calculate energy saving. First, we installed energy meter in first floor of E & TC Department without our setup/system to calculate one month energy in Kw/Hr. Following figure shows one month energy in Kw/Hr without our setup/system:

Fig I - Energy meter showing one month energy in kwh without our system/setup.

We installed our two system/setup in two classroom and measured 2 weeks energy in kwh. Energy meter shows 76 kwh energy consumed in 2 weeks. So, in two classrooms 28 kwh energy saved with our system/setup. Hence in one month we considered 56 kwh energy saved in first floor of E&TC department.

VI. CONCLUSIONS AND FUTURE SCOPE

The IoT-based smart classroom promotes a sustainable campus in the learning environment, which increases classroom productivity and effectiveness. The need for power has been expanding, thus there should be rapid effort to put low-cost electricity reduction schemes into place to meet the need. For a sustainable future, these initiatives ought to be in accordance with global energy policies. Therefore, everyone on the college campus needs to effectively manage electricity use.

Since people in the college were being irresponsible, we determined that this automatic system was one of the main causes of electricity waste. This occurred because the electrical equipment cannot be managed without human involvement and the manual switching system is ineffective. As a result, having an automated system rather than a manual switching mechanism is practically required for the college system. So, in order to reduce energy waste, we created this system utilizing an ESP8266 controller as a server and a PIR sensor as an IOT client.

Application-

1) Remote Monitoring and Reduction in Electricity Wastage in Education Institutes.

ACKNOWLEDGMT

We take this opportunity to express our sincere thanks to our guide respected Mr. H. S. Thakar sir for their support and encouragement throughout the completion of this project. We are grateful to him for his constant support.

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