METHOD OF BUILDING A CYBER-PHYSICAL SYSTEM UTILIZING IOT FOR ENERGY MONITORING AND CONTROL OF ELECTRICAL DEVICES

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ABSTRACT:

This work expects to explore, build, test and actualize a low-cost energy monitoring checking and control system using IoT devices. Electrical appliances (e.g., air cooling units and overhead lighting) can be controlled and observed utilizing IoT innovation from wherever on the planet. So as to achieve this objective, a total front-end to back-end system that incorporates a smart device application (iOS stage), a cloud-based database, an Application Programming Interface (API), and an equipment improvement is proposed. A small programmable specialized computing device (e.g., Raspberry Pi) for primer testing. This smart node was picked because of commonality, and its capacities, for example, general useful pins and implicit Wi-Fi chip. The ultimate objective is to watch energy proficiency by observing and controlling cooling appliances and standard overhead lighting units. These keen IoT devices take into account the consumption energy data from every unit to be gathered and put away in a Cloud-based database that can be examined and revealed for energy conservation and analysis.

KEYWORDS: Internet of Things (IoT), Security, Cloud, Electrical

1] INTRODUCTION:

As indicated by specialists, "The IoT is an arrangement of interrelated computing devices, mechanical and computerized machines, items, creatures, or individuals that are furnished with unique identifiers and the capacity to transfer data over a system without expecting human-to-human or human-to computer interaction"[2]. Numerous specialists have been contemplating the idea of IoT, its applications, and security of these applications utilizing IoT [3, 4]. This work means to execute a system in which electrical devices can be safely controlled and observed

utilizing IoT innovation on a universal level (e.g., from wherever on the planet). Likewise, it manages total front-to-back viewpoints including a mobile application, a cloud-based database, the making of an API, and hardware development.The objective is to watch energy waste that may happen during the day by day consumption of energy consumption machines, for example, cooling units and standard overhead lighting units. These smart units are associated with Apple devices set up with iOS applications to control the unit's electrical status and monitor energy consumption, which is recorded in a database for examination. Furthermore, it comprises of use writes about the cooling units alongside patterns in consumption in kWh per unit time.

2] LITERATURE SURVEY:

2.1] A. Zanella, N. Bui, A. Castellani ***et al***

We concentrate explicitly to a urban IoT system that, while as yet being a significant general classification, are described by their particular application area. Urban IoTs, indeed, are intended to help the Smart City vision, which targets exploiting the most exceptional correspondence advancements to help included worth administrations for the organization of the city and for the residents. This paper thus gives an extensive study of the empowering technologies, protocols, and architecture for a urban IoT.

2.2] Chunchi Gu, Hao Zhang ***et al***

We present another sort of energy data collection system which is utilizing WiFi module and current transformer. The entire hardware system can be isolated into four sections. The initial segment is a electricity sensor unit which is the center part of the entire system. The second and the third part are consolidated and cooperating which consist of a microcontroller and a WiFi network module. The fourth part is a small data convertor. These four sections cooperate in the entire procedure. The fundamental software design work is center around the microcontroller. The entire software design work can be separated into three sections which are parameter setting, main working loop and Modbus functions. Here we compose all the program in C. In the result of the test, we can see that the data assortment system can work appropriately and transmit the data to the remote IP address remotely through the Internet switch. With this sort of structure, the data collection system can complete the work regardless of what sort of the power meter is.

2.3] Dae-Man Han ; Jae-Hyun Lim ***et al***

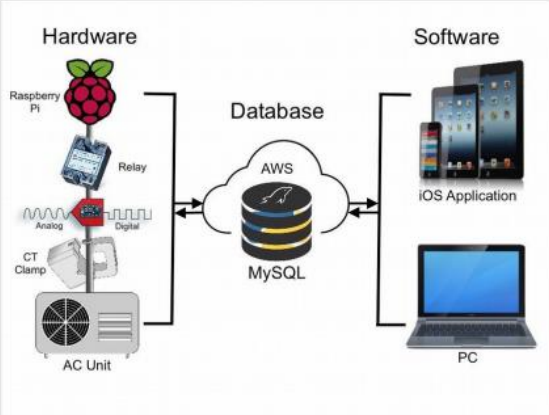
The Smart home energy network has increased across the board considerations because of its flexible integration into everyday life. This next generation green home system transparently unifies different home appliances, smart sensors and wireless communication technologies. The green home energy network gradually forms a complex system to process various tasks. Building up this pattern, we recommend another Smart Home Energy Management System (SHEMS) in view of an IEEE802.15.4 and ZigBee (we call it as a "ZigBee sensor arrange"). The proposed smart home energy the board system separates and assigns various different home network errands to suitable segments. It can incorporate expanded physical detecting data and control different customer home devices, with the help of active sensor systems having both sensor and actuator parts. We build up another routing protocol DMPR (Disjoint Multi Path based Routing) to improve the exhibition of our ZigBee sensor systems.

3] THE INTERNET OF THINGS (IOT) SYSTEM:

The hardware part of this project requires an variety of components that must be tested before requesting and executing into the system. A small programmable specific computing device, the Raspberry Pi v3, was utilized for fundamental testing. The Raspberry Pi v3 was picked because of recognition and its inherent capacities for all parts of the task, including universally useful pins and Wi-Fi abilities. The Raspberry Pi v3 also had an variety of outer connections for checking and control purposes.

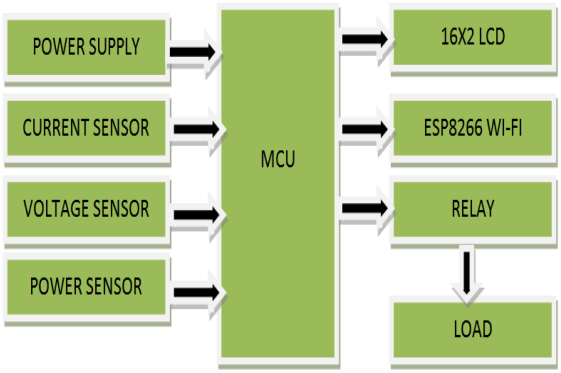
4] ARCHITECTURE:

The smart nodes were intended to speak with the different hardware parts for the expectation of sending energy data in hourly spans to a MySQL relational database example facilitated on Amazon Web Services. When the data is embedded and put away in the database, it would then be able to be perused from the iOS application. Moreover, the iOS application has the usefulness of sending data to the database to change a device's status (e.g., On/Off), which the shrewd hubs would then be able to decipher and react so as to fulfill the request.



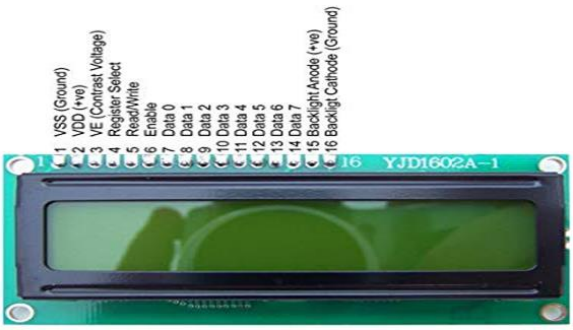
The architecture diagram of the IOT monitoring and control system

5] BLOCK DIAGRAM:



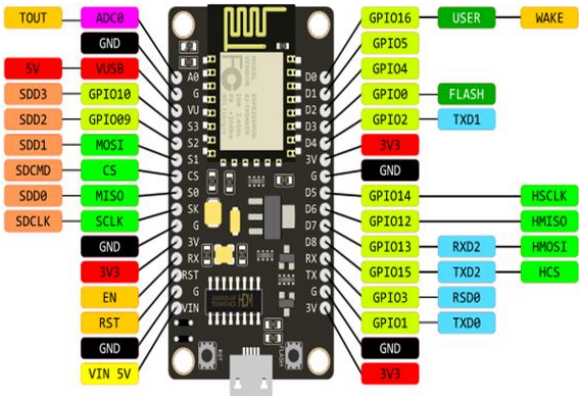
6] PROPOSED METHODOLOGY:

6.1] Liquid Crystal Display



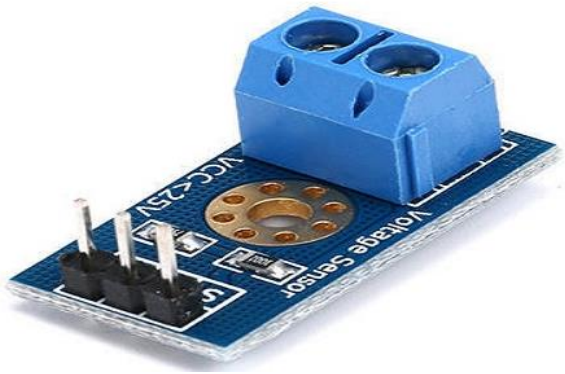
The LCD is used for the purpose of displaying the words which we are given in the program code. This code will be executed on microcontroller chip. By following the instructions in code the LCD display the related words. Below shows the LCD display.

6.2] NODEMCU(Node Micro Controller Unit)



It is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module

6.3] Voltage Sensor



A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage or DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal, etc.

6.4] Current sensor

A current sensor is a device that detects electric current in a wire and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output.

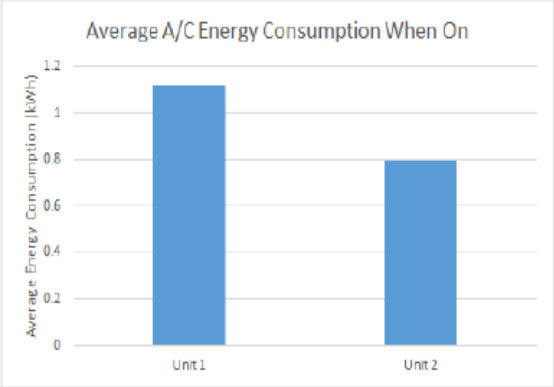
6.1] Cloud Server

The Cloud server manages which is to provide data storage service for the Data Owners. Data owners encrypt their data files and store them in the Server for sharing with data consumers. To access the shared data files, data consumers download encrypted data files of their interest from the Server and then Server will decrypt them.

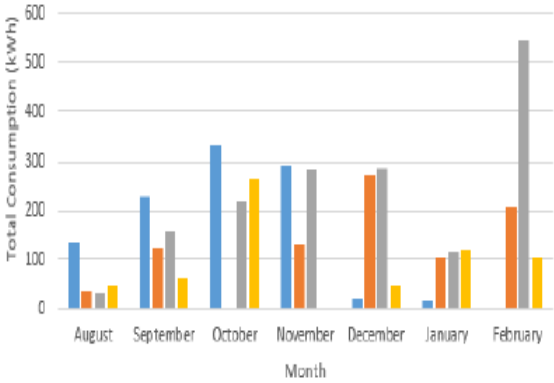
6.2] Android / IOS User

In future we can easily use this application. This application user has to install in a mobile. Before using this application user should register, after registration he should login by using authorized user name and password. After login successful he will do some operations such as searching keyword in the cloud server to data and viewing cloud attackers in the android mobiles.

8] RESULTS:



Average a/c unit energy consumption when the units are on



Total energy consumption for event room units per month

9] CONCLUSION:

A technique for building a cyber physical system using IoT for energy observing and control of electrical devices was introduced and installed at a retreat in Costa Rica, where an example of data examination was also conducted. In February, results show an example of energy consumption in the workplace condition from a period stretch running between 9:00 AM to 5:00 PM. During this time, it could be watched the most energy consumption for the duration of the day was around 12:00 PM (Noon) for Unit 1 and genuinely steady for the duration of the day for Unit 2. This data directly related with the recurrence circulation of the two units indicating how frequently, during any single hour, a unit was accounted for in the 'ON' state.

Because of the lower energy consumption for Unit 2 inside the workplace condition, it was watched Unit 2 had a lower energy sway for each hour when in the 'ON' state.

The hourly storage and ease of access to energy data accomplished through this project support the concept of energy awareness and conservation. As energy data is gathered, more prominent patterns can be derived, therefore giving the consumer the methods wherein to comprehend and intentionally make changes to exorbitant energy use with an end goal to lessen consumption. During the execution in Costa Rica, numerous difficulties were watched and along these lines adjusted to, including low Wi-Fi transmission capacity, dated systems administration advancements, visit power blackouts and low Wi-Fi network go all through the resort. Through a comprehension of these issues, key components and measures were actualized to guarantee the projects life longevity post departure.

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