IOT BASED ELECTRICITY CONSERVATION SYSTEM

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Abstract

The gap between electrical energy supply and demand is continuously increasing despite huge outlay for energy sector since independence in India. This gap between supply and demand of energy can be bridged with the help of proper energy conservation and utilisation with environmental friendly system. The planners have already started appreciating the role new innovative system for significance of energy conservation and utilization in future energy scenario of India. An attempt is made in this research to minimize the consumption of electricity to avoid wastage by creating a micro-controller-IoT based system withPassive Infrared (PIR) sensor, which automatically turns off the lights, fans, AC etc, when there is no body in the room or any working location. This project takes over the task of controlling automatically the electrically operated lights / bulbs in aroom or any other location. When a person enters the room or near the bulbs, the lights are switched on automatically while it is switched off as the last person leaves. A PIR sensor HC-SR501 PIR motion detectors placed near the door and used to detect the presence of human beings. The output from this sensor is sent to the NodeMCU ESP8266, which then controls the room lights via a relay. ACS712 current sensor is added to measure the electricity consumption. A prototype is developed and tested for saving the energy consumption.

Keywords: Electricity conservation System, Node MCU, PIR motion Sensor(HC-SR501), Internet of Thing (IoT)

1. Introduction

The Internet of Things (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. The definition of the Internet of Things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors systems.

Traditional fields of embedded systems, wireless sensor networks, home and building automation systems, and others all contribute to enabling the Internet of Things (IoT). In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering electrical devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, etc.) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers.

Smart electricity utilization is an important part of our life, researcher realize the intelligent device to be builtfor real-time interactive platform to operate between the switch board and consumer from remote usingIoT with motion sensor and Information Technology, which can improve the less power consumption.

As we know IoT with sensing technology can able to effectively enhance the smart power utilization service of the physical world with its overall perception, reliable communication and strong data processing ability to achieve

real-time monitoring of the physical world and intelligent decision-making purposes.

2. Literature Review

KomkritChooruang et al. [1]Here it designs and implements a low-cost IoT energy monitoring system that can be used in many applications, such as electricity billing system, energy management in smart grid and home automation. The design is based on a low-cost PZEM-004T, using non-invasive CT sensors, SD3004 electric energy measurement chip and ESP8266 Wemos D1 mini microcontroller for retrieving data from sensor nodes and sending data to server via internet. The experimental results showed that the developed energy monitoring system can successfully record the voltage, current, active power and accumulative power consumption.

Adelakunet al.[2] Low power consumption is a very good advantage in this energy hungry world. A microcontroller-based Automatic Light Control is designed and constructed to save the usage of electrical energy and to avoid wastage using a room as a study. This project takes over the task of controlling the room light. When a person enters the room, the lights are switched on automatically while it is switched off as the last person leaves. A Passive Infrared sensor is placed near the door and used to detect the presence of human beings. The output from this sensor is sent to the PIC16F84 microcontroller, which then controls the room lights via a relay. A pilot test carried out suggested a saving in the energy consumption.

Fangfang Duan et al.[3] Smart power utilization service is an important part of the grid, and its core to realize the intelligent service for users is to build a real-time interaction platform between the grid enterprises and users, which can improve the stability and reliability of power supply, and provide users with more humanized and multiple intelligence service. IoT technology can able to effectively enhance the smart power utilization service system with its overall perception, reliable communication and strong data processing ability. In this paper, electricity service system based on intelligent networking was studied.

Vignesh Mani et al[4]An IoT based Smart Energy Managementsystem is developed where appliances like Fan and Bulb to start with arecontrolled wirelessly based on humidity and light intensityinformation. These inputs are used towards controlling theappliances intelligently rather than just switching on or off. Inaddition the system also keeps computing throughput the daypower consumption of the appliances which gives the userknowledge on power being consumed over a period of time.These details are updated in Cloud server. This prototype system developed have achieved energy conservation at everyhousehold.

Prithvi Pal Singh et al.[5] This research work reviews the overall electrical network from the generation to transmission and distribution and finally to consumer. It discusses electrical network architecture and energy monitoring points, causes of energy losses and the scope for energy losses reduction. Further load shedding, utility demand energy management system using automation and the role of buildings in energy conservation have been discussed. An overview of energy management devices used in the substation, automation protocols, smart devices, and applicable standards. The importance and need for energy conservation in consumer's house, using IoT devices. IoT devices are also very useful in-home automation and can be used with smart home energy management systems. If we consider the smart home number count in large value, then energy conservation in smart home will make a significant amount of reduction in overall system's energy consumption.

3. Methodology

The implemented framework comprises of the principal square Node MCU and sensors are associated with the node MCU. Node MCU gathers the data from the various sensors; at that point they send information to voice weather. (App)

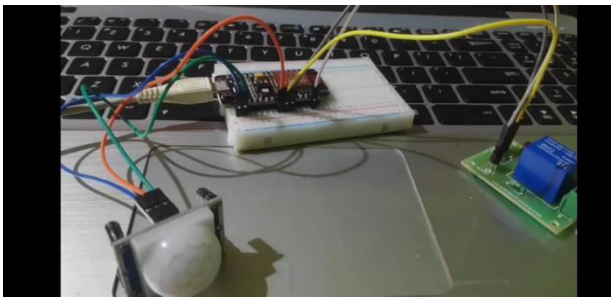

Figure 3.1: Physical System Block Diagram

3.1. Connection of the system

The sensors associated with get the information of the current room atmosphere and the electronic parts utilized in the model are listed below.

3.1.1 Hardware Components

i) Node MCU: NodeMCU ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained WiFi networking solution offering as a bridge from existing micro controller to WiFi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect NodeMCU devkit to your laptop and flash it without any trouble, just like Arduino. It is an open-source firmware and created a pack that causes you to manufacture IoT stuff. It comprises of an ESP8266 Wi-Fi chip.

ii) HC-SR501 (PIR Motion Sensor):HC-SR501 is based on infrared technology, automatic control module, using Germany imported LHI778 probe design, high sensitivity, high reliability, ultra-low-voltage operating mode, widely used in various auto-sensing electrical equipment, especially for battery-powered automatic controlled products.This sensor needs voltage 5V to 20V.The Power Consumption of this sensor is 65mA.. I Lock time is 0.2 sec.The Triggering methods L – disable repeat trigger,and H enable repeat trigger. Sensing rangeof HCSR501 is less than 120 degree, within 7 meters. The temperature should be in between -15degree to +70degree C.

iii) Jumper Cable: Jumpers resemble on/off switches they might be evacuated or added to interchange segment execution choices. A jumper is made of materials that lead power and is sheathed in a non-conductive plastic covering to forestall unplanned short circuits. The jumper's fundamental favorable position is its one-time setup, which makes it less defenseless against debasement or force disappointment than firmware.

iv) Bread Board: A breadboard is an extensively used gadget to structure and test circuits. You don't need to tie wires and portions to make a circuit while using a breadboard. It is easier to mount sections and reuse them. Since parts are not bound you can change your circuit plan whenever with no issue. It involves an assortment of conductive metal catches encased for a situation made of white ABS plastic, where each fasten is ensured with various catches. There are a couple of holes on the plastic box, planned in a particular structure.

v)Relay Module:The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus protects the system from damage.The Single Relay Board can be used to turn lights, fans and other devices on/off while keeping them isolated from your microcontroller. The Single Relay Board allows you to control high-power devices (up to 10 A) via the on-board relay. Control of the relay is provided via a 1 x 3 header – friendly to servo cables and convenient to connect to many development boards.It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field. This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch. The inner section of the relay is shown in the figure below. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flows through the coil produces the magnetic field around it. Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence open the contacts.The pole and throws are the

configurations of the relay, where the pole is the switch, and the throw is the number of connections. The single pole, the single throw is the simplest type of relay which has only one switch and only one possible connection. Similarly, the single pole double throw relay has a one switch and two possible connections.

vi) ACS712: Sensing and controlling current flow is a fundamental requirement in a wide variety of applications including, over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc. This ACS721 current module is based on ACS712 sensor, which can accurately detect AC or DC current. The maximum AC or DC that can be detected can reach 5A, and the present current signal can be read via analog I / O port of Arduino.

3.1.2 Software Components

i) Arduino IDE: The arduino IDE is an open source programming platform that supports C and C++.The Arduino coordinated improvement condition (IDE) is a cross-stage application (for Windows, mac OS, Linux) that is written in the programming language Java. It started from the IDE for the dialects Processing and Wiring. The Arduino IDE underpins the dialects C and C++ utilizing exceptional standards of code organizing. The Arduino IDE supplies a product library from the Wiring venture, which gives numerous regular info and yield techniques. User-written code just requires two fundamental capacities, for beginning the sketch and the fundamental program circle, that are assembled and connected with a program stub main ( ) into an executable cyclic official program with the GNU device chain, additionally included with the IDE dissemination.

ii)BLYNK: Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.Amessage travels to the Blynk Cloud, where it magically finds its way to the hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.

iii) Remote Switch App: This Remote switch app can turn on and off switches from anywhere.

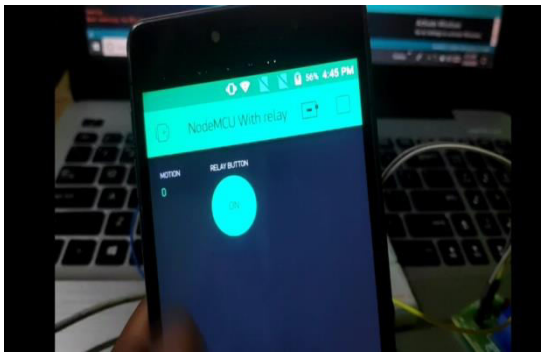

Figure 3.2: Remote Switch App

4. Result

This project takes over the task of controlling the room light. When a person enters the room, the lights are switched on automatically while it is switched off as the last person leaves. A Passive Infrared sensor(pir motion sensor) is placed near the door and used to detect the presence of human beings. The output from this sensor is sent to the NodeMCUmicrocontroller , which then controls the room lights via a relay. And if we need to turn of the light even thoug we are in the room then we can turn on it by mobile phones through the wifi. We can turn on and off the switches from anywhere.This work also shows the consumption of electricity. We will know how much electricity the appliance is using ACS712 current sensor.

5. Conclusions

In this system, a micro-controller is use with pirsensor , a current sensor and some electronic to develop the automated system. The goal of the project is to minimize or conserve the uses of the electricity.. It will help to conserve electricity as we sometimes forget to turn off the switches as in this system the switches will automatically turn off when no movement detects on the room and when its needed we can turn the switches on manually by mobile phones. This system wiil shoe the consumption of electricity when we use light bulbs or various home appliances.

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References

[1]"SMART HOME AUTOMATION USING IOT" Bhavna1 , Dr. Neetu Sharma2 ¹M.Tech. Scholar, Computer Science & Engineering Ganga Institute of Technology and Management Kablana, Jhajjar, Haryana, India ²Associate Professor, Computer Science & Engineering Ganga Institute of Technology and Management Kablana, Jhajjar, Haryana, India. ISSN: 2277-9655 [Bhavna * et al., 7(5): May, 2018] Impact Factor: 5.164 IC™ Value: 3.00 CODEN: IJESS7. ISSN: 2277-9655 [Bhavna * et al., 7(5): May, 2018] Impact Factor: 5.164 IC™ Value: 3.00 CODEN: IJESS7

[2]"Automatic Control and Monitoring of Electrical Energy Consumption Using PIR Sensor Module"AdelakunAdebiyiA.,AdewaleAdeyinkaA. AdemolaAbdulkareem,Olowoleni Joseph O. International Journal of Scientific & Engineering Research, Volume 5, Issue 5, May-2014.

[3]"Research of Smart Power Utilization Service System Based on IoT"FangfangDuan ,Ke Li, b, Bin Li, c, Shihui Yang International Conference on Applied Science and Engineering Innovation (ASEI 2015).

[4]"Design of an IoT Energy Monitoring System"KomkritChooruang(Faculty of Engineering NakhonPhanom University NakhonPhanom, Thailand)KraisonMeekul(Faculty of Engineering NakhonPhanom University NakhonPhanom, Thailand) 2018 Sixteenth International Conference on ICT and Knowledge Engineering.

[5]M.L. Ravi Chandra ; B. Varun Kumar ; B. Suresh Babu"IoT enabled home with smart security"Publisher: IEEE Published in: 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)Date of Conference**:** 1-2 Aug. 2017Date Added to IEEE Xplore: 21 June 2018 ISBN Information:INSPEC Accession Number: 17859173DOI: 10.1109/ICECDS.2017.8389630Publisher: IEEEConference location: Chennai, India

[6]Khirod Chandra Sahoo ,Umesh Chandra Patil, "IoT based intrusion detection system using PIR sensor" Published in: 2017 2nd IEEE International Conference ent Trends in Electronics, Information & Communication Technology (RTEICT)Date ofConference: 19-20 May 2017Date Added to IEEE Xplore: 15 January 2018 ISBN Information:INSPEC

AccessionNumber**:** 17504180DOI: 10.1109/RTEICT.2017.8256877Publisher:IEEEConference Location: Bangalore,India.