ELECTRICAL DEVICE SURVEILLANCE SYSTEM USING IOT

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Abstract:- With every enhancement in Internet in terms of speed and bandwidth, IOT (Internet Of things) is taking the market on a new node and knocking the door with new opportunities of inventions.This paper talks about an energy saving electrical device Surveillance and Control system based on IOT.A large amount of energy is consumed by lighting appliances, so making improved efficiency and quick fault detection is a significant challenge. In this work, two different model approaches is followed depending on the nature of application. For small areas or confined premises zigbee wireless technology is used where all the appliances is connected to a common Wi-Fi network. In the second model like street lamp pole where number of appliances grows only in one direction, wired configuration is used to avoid range issue.

1. INTRODUCTION

IOT is system of related sensors, computing and digital devices spread across the globe over the internet which can communicate amongst them to share and transfer information using unique id which is assigned to each and every device, as UIDs (Unique Identifiers).With the growing of different commercial premises and societies, the focus to automate these premises have increased drastically. Also the growing traffic mess in the cities has pushed everyone towards a better and more reliable electrical control system. A user friendly web application and mobile based surveillance & control system connected to IOT cloud server is used here formore energy conservationand early resolution in case of any fault detection. In this new growing era where smart cities are taking into shape, the effort for optimal energy based traffic signal and light control system has gained pace. So effort has been taken to provide a reliable and user friendly application for easy to use and monitor the electrical devices.

Monitoring and controlling of appliances is one of the important measures to be closely monitored and used in real-time for safety, security and comfort of people. With the advancements in Internet technologies and Wireless Sensor Networks (WSN), a new trend in the era of ubiquity is being realized. Enormous increase in users of Internet and modifications on the Internet working technologies enable networking of everyday objects [1]. Web-enabled systems have offered great promise to consumers. Their benefits are well known. Reduction of operating and maintenance costs due to remote monitoring, diagnostics, debugging, and upgrading firmware. Convenience and safety that comes with the ability to monitor the status of a smart house and to control Internet appliances when away from home. Remote monitoring of residential and industrial properties, notification of emergency services in case of fire, theft, and a leak of liquid or gas. Similar types of Internet-based systems, such as those in, are designed to gather a bulk of data before serving them upon request. In these applications, data are compiled in a central server and are then served to the clients via the internet. Interaction with the embedded unit is also an important issue. In, an embedded PC card placed on the Internet allows limited interaction through commands sent through Transmission Control Protocol/Iinternet protocol (TCP/IP) and User Datagram Protocol (UDP). The paper proposes a Raspberry pi based appliances monitoring and control system through webpage with WI-FI based technology. We have designed and implemented a compact wireless sensor network with internet capability. The system can monitor the status of sensors and send an SMS alert via GSM (Global System for Mobile communications) network automatically to users. The system has the capability to control through internet, when the information update on webserver it is read by the developed algorithm fed into Raspberry pi and then the system responds to the corresponding instruction with high security. The user can directly log in and interact with the embedded device in real time without the need to maintain an additional server. The system is modularly built, allowing different modules to be added. In addition, it is flexible to accommodate a wide range of measurement devices with appropriate interfaces. It has a variety of features such as energy efficient, intelligence, low cost, portability and high performance.

2. LITERATURE REVIEW

Majority of the street lamps have used LDR based control system [6] which turns on the street lights in night and turns off the street lights in day. Street lamp or the on premise light system still consumes lotof electricity when there are few vehicles around or no people in the office, as the new design is better in providing the option to manually monitor and control through mobile or web based portal. Simultaneously, providing feedback of the faulty devices through sensors to the concerned authority to quickly fix the issue may be convenient to the end user.

Automatic electrical appliances control panel based on infrared and Wi-Fi: A framework for electrical energy conservation by E. Adetiba, V. O. Matthews, A. A. Awelewa, I. A. Samuel and J. A. Badejo

Today, proprietary home automation targets very specific applications which operate mostly on a cable based infrastructure. In contrast to that, our implementation builds on a wireless platform for the automatic control of house hold electrical appliances. The nodes gather sensor readings in a home and transmit them to a central automation server. There, the readings are matched against a list of script statements. When there is a match, a specific action is performed. An important property of the system is that the control of all home appliances is done by means of the ubiquitous Infrared and Wi-Fi wireless technologies. This way, the co-operation between manufacturers is not a necessity in order to connect devices to the home automation network.

Energy Efficient Intelligent Street Lighting System Using ZIGBEE and Sensors by Richu Sam Alex, R Narciss Starbell

Solar Photovoltaic panel based street lighting systems are becoming more common these days. But the limitation with these ordinary street light systems is that it lacks intelligent performance. It is very essential to automate the system so that we can conserve energy as well as to maximize the efficiency of the system. In this paper a new method is suggested so as to maximize the efficiency of the street lighting system and to conserve the energy usage by the system with the help of ZIGBEE and sensors. It uses a sensor combination to control and guarantee the desired system parameters. The information is transferred point by point using ZIGBEE transmitters and receivers and is sent to the control terminal used to check the state of the street lamps and hence we can take immediate actions if required.

Smart street lighting control and monitoring system for electrical power saving by using VANET by S. A. E. Mohamed

The huge amount of electrical power of many countries is consumed in lighting the streets. However, vehicles pass with very low rate in specific periods of time and parts of the streets are not occupied by vehicles over time. In this paper, we propose a system that automatically switches off the light for the parts of the streets having no vehicles and turns on the light for these parts once there are some vehicles that are going to come. Logically, this system may save a large amount of the electrical power. In addition, it may increase the lifetime of the lamps and reduce the pollutions. This system automatically controls and monitors the light of the streets. It can light only the parts that have vehicles and help on the maintenance of the lighting equipments. Vehicular Ad-Hoc Networks (VANET) make it possible to propose such system. VANET enables the possibility to know the presence of vehicles, their locations, their directions and their speeds in real time. These quantities are what are needed to develop this system. An advantage of using VANET is that there is no need to use specific network and equipments to design the system, but VANET infrastructure will be used. This de-creases the cost and speed up the deployment of such system. This paper focuses on the proposal of different possible architectures of this system. Results show that the saved energy may reach up to 65% and an increase of the lifetime of the lamps of 53%.A survey on automatic street lightning system on indian streets using Arduino by A. S. Jalan, As we all know that our Indian street lights are not automatic hence by the carelessness of the operatoror say by some other problems, lights are kept continuously ‘ ON’ even there is no need of any street light on the streets.Like in summer days we came to see many times that the lights are switched on even during the day which is the total wastage of electricity. An attempt has been made in this paper to proposed system which is totally automatic and we donot need any manual operator for controlling the lights. Hence to save energy this system can be implemented. This system has a potential to replace India’ s current street lightning system. This system is based on arduino controller, a LDR(Light Dependent Resister) which sense the intensity of the sunlight and gives input to the Arduino. The street lights will be switched ‘ ON’ and ‘ OFF’ based on the intensity of sunlight. A prototype model of Indian streets isprepared and amount of energy saved is calculated Automatic Street Lighting System for Energy Efficiency based on Low Cost Microcontroller by Rohaida Husin, Syed Abdul Mutalib Al Junid, Zulkifli Abd Majid, Zulkifli Othman, Khairul Khaizi Md Shariff, Hadzli Hashim, Mohd Faisal Saari This paper proposes energy efficient of automatic street lighting system based on low cost microcontroller. The main objective is to design energy efficient based controller for controlling the Light Emitting Diode (LED) based street lamp via appropriate lighting levels control. This system is consists of a microcontroller, light sensor, rain sensor, laser sensor and a set of the light emitting diode (LED) module. While, the controlling and managing of the system is based on the number of traffic and five different level of street light brightness has been used for lighting up the street and proportional to the number of traffic. The system was programmed to automatically turn off during the hours of daylight and only operate during the night and heavy raining or bad weather. Several numbers of tests have been conducted to test and validate the proposed prototype in the different environment. As conclusion, around 77%-81% reduction in power consumption can be achieved through this proposed automatic street lighting system for energy efficiency system design.

3.EXISTING SYSTEM

Streetlight monitoring system based on wireless sensor network. The system are often set to run in automatic mode, which control streetlight consistent with Sunrise and Sunset Algorithm and lightweight intensity. Also this system can run in controlled mode. In this mode, we can take the initiative to control street lights. The system is equipped with the high-power relay output and can be widely applied in all places which need timely control like streets, stations, mining, schools, and electricity sectors then on.

In this work describes about the circuit that switches the street light ON detecting the vehicle movement and remains OFF after the fixed time. In this system the street light automatically ON/OFF during the night and the day time. In this system the GSM technology has been used in which the manual switching OFF/ON of the street light using GSM. An automatic garbage level detecting system informing the concerned authorities timely and also classification among the wastes aiding efficient waste management. Traditional lighting systems use timer [1] or manual interaction to turn on and off the lights. But these methods are not energy efficient. The sunlight intensity changes with change in season, during summer the days are longer and during winter the days are shorter. In this case the timer is not very effective as human interaction is required to change the time of the timer.[2] LDRs are also used but they are only used as a switch, it is not dynamic. They don’ t use machine learning algorithms to predict the lighting conditions. In earlier systems no algorithms were used, they were simply an application but in this model, we have added machine learning algorithms. The way that we follow presently[3] for manually monitoring the wastes is very complex process and so much of human effort, time and money goes into it which is not compatible with the present-day technologies. [2] Present Smart waste disposal systems only provide the level of garbage level and alert only the municipal. In the pre-existing system either the filled dustbin location is sent to municipal corporation or indication of filled dustbin is given but this model on the basis of machine learning algorithm will predict the arrival of municipal corporation to collect the garbage. Improper management of waste causes many major problems such as environmental pollution, airborne diseases and has adverse effects on the living conditions of human beings. In order to overcome all these problems, we are proposing the idea of smart waste management system that involves less human interaction in order to maintain a clean environment.

4.PROPOSED SYSTEM

This project aims at designing a system that focus on two major societal issues in India i.e. loss of energy from existing street lighting systems.

4.1 BLOCK DIAGRAM

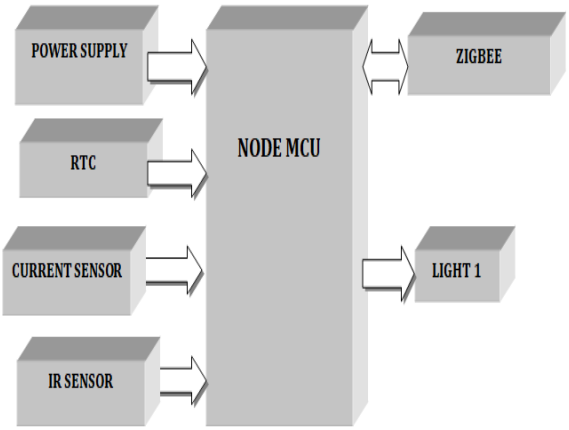


FIG 4.1 TRANSMETER SECTION

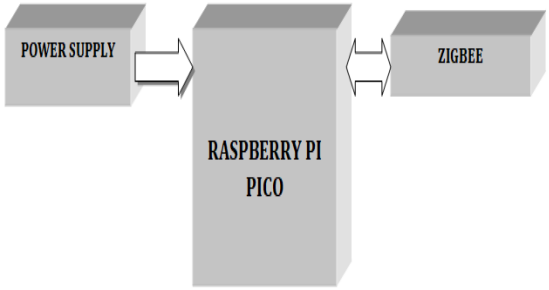


FIG 4.2 RECIVER SECTION

The block diagram of proposed ESP module based surveillance and control system. It consists of street lamps, sensors to detect flow of current, RTC for real time clock to control the on/off of the device and a 5 v power supply converter and node MCU at the slave end (electrical device). Sensors are used to control electrical appliance and send the analog signal of the environment to the system and perform the related task. Master end consists of Raspberry Pico controller connected to Internet connection. The purpose of microcontroller is to take the data from all the street lamps through zigbee connection and convert them into serial communication. The signal is transferred through the sensors to NodeMCU which in turns transmit the signal wirelessly to master control terminal. Master controller detects the signal and perform appropriate task in case there is detection of failure of street lamps. The transmission system comprises of NodeMCU at electrical device end which receives information though sensors attached to the device. At the other end, master controller (Raspberry Pi) which receives information wirelessly and send the data to a central monitoring system. Web application presents the graphical representation of the received data from the electrical devices.This is the case of traffic street lamps [11] which grow in number in one direction. So this is different from the on premise as here we have challenge of communication range. As wireless connection range (router or Node MCU) is in meters, so it is not possible to use in cases where zigbee connection is require in Kilometers. Moreover, to make the system reliable wired connection is used to connect Master Controller Raspberry Pico to the street lamp device. This Pi is turn is connected to Cloud server and web application. It acts like brain for the whole device control and monitoring system. Raspberry Pico receives and transmits signals to and fro slave nodes over wireless connection. At the same time it sends the feedback to a central monitoring application for visual display of the status of different electrical devices.Each lamp controller is connected to master controller to send and receive information about the status of the device. Based on the current sensor detector which is connected to electrical device, signal is send to the Master controller about the working status of the device. If any signal is send from the master to the slave then the relevant action is performed based on the data received. Web application is used to display the status of the electrical device in a user friendly way. User can also send signal from this web application to the device so that it can be controlled remotely. This application can communicate with the master controller via HTTP protocol.

4.2 HARDWARE COMPONENTS

NODEMCU CONTROLLER

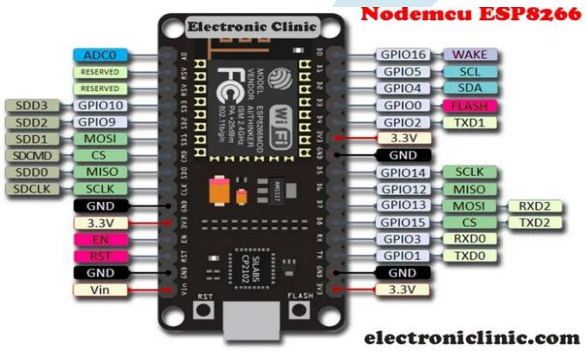
NodeMCU is a low-cost open source IoT platform.[4][5] It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module.[6][7] Later, support for the ESP32 32-bit MCU was added

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).[8] The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.

Both the firmware and prototyping board designs are open source.[8]

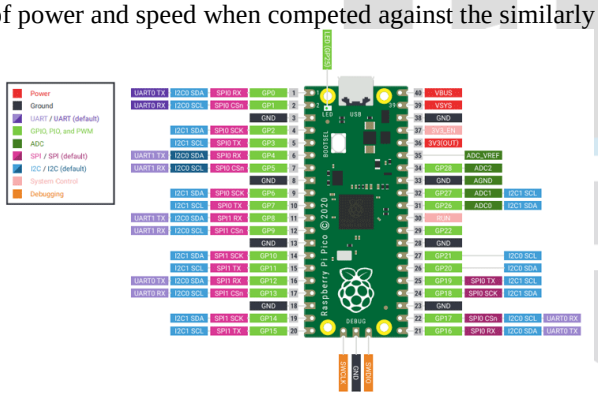
The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson[9] and SPIFFS.[10] Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications.



RASPBERRY PI PICO CONTROLLER

Raspberry Pi foundation, i.e. the Pi Pico. If not, then allow me to introduce you the microcontroller board, YES, you read it right, A Microcontroller!!! Pi Pico is the first microcontroller from the manufacturers of Raspberry Pi, based on the Raspberry Pi' s RP2040 microcontroller chip and working on ARM' s Dual-core cortex M0+ architecture. It works at frequencies up to 133MHz and albeit looking powerless when compared to the other members of the Pi family it has a lot to offer. Unlike the other Pi boards which are basically a Linux based single board computer, Pico is a budget friendly microcontroller with 264kB multi-bank high-performance SRAM, 16 kb of on-chip cache, and 2MB of flash storage. It is actually an amazing board considering how affordable this board it is competing directly against the likes of established Arduino boards, blowing them out of water in terms of power and speed when competed against the similarly priced modules.



(IR) INFRARED TECHNOLOGY

Technically known as "infrared radiation", infrared light is part of the electromagnetic spectrum located just below the red portion of normal visible light – the opposite end to ultraviolet. Although invisible, infrared follows the same principles as regular light and can be reflected or pass through transparent objects, such as glass. Infrared remote controls use this invisible light as a form of communications between themselves and home theater equipment, all of which have infrared receivers positioned on the front. Essentially, each time you press a button on a remote, a small infrared diode at the front of the remote beams out pulses of light at high speed to all of your equipment. When the equipment recognizes the signal as its own, it responds to the command.

ZIGBEE

ZigBee is the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2006 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology is intended to be simpler and cheaper than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

RTC (Real Time Clock)

A RTC is a computer clock (most often in the form of an integrated circuit) that keeps track of the current time. Although the term often refers to the devices in personal computers, servers and embedded systems, RTCs are present in almost any electronic device which needs to keep accurate time.

CURRENT SENSOR MODULE

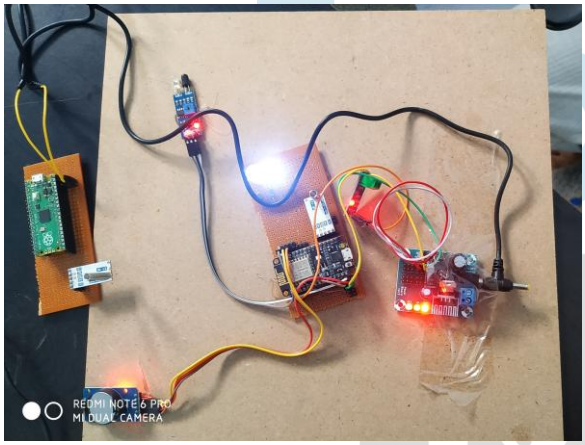
The **ACS712 Module** uses the famous **ACS712 IC** to **measure current** using the Hall Effect principle. The module gets its name from the IC (ACS712) used in the module, so for you final products use the IC directly instead of the module.

These ACS712 module can measure current AC or DC current ranging from +5A to -5A, +20A to -20A and +30A to -30A. You have to select the right range for your project since you have to trade off accuracy for higher range modules. This modules outputs Analog voltage (0-5V) based on the current flowing through the wire; hence it is very easy to interface this module with any microcontroller.

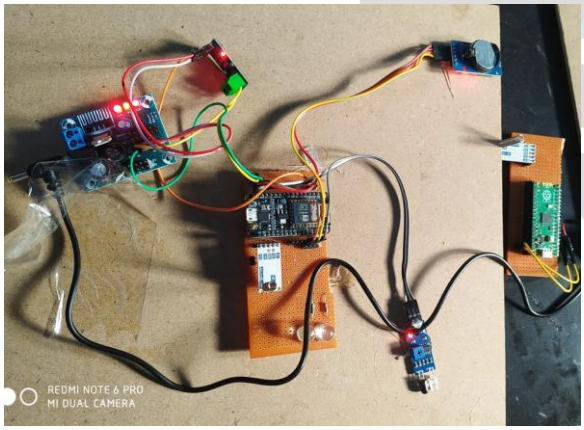
LED(LIGHT EMITTING DIODE)

A light-emitting diode (LED) is a semiconductor diode that emits light when an electrical current is applied in the forward direction of the device, as in the simple LED circuit. The effect is a form of electroluminescence. where incoherent and narrow-spectrum light is emitted from the p-n junction..

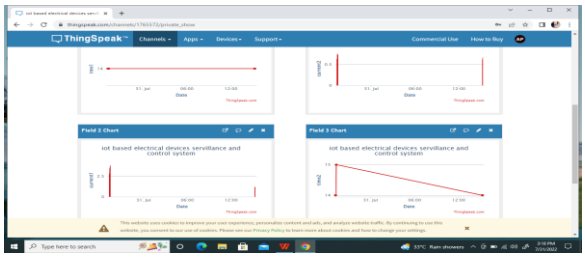
5.RESULTS



Here the Fig shows the street light is on based on RTC clock



Here the Fig shows the street light is off based on RTC clock



Here the graph is plotted between time and current. It shows the energy consumption for a user at a time. Power consumed by the street light can be shown

6. CONCLUSION

This IOT based device surveillance and control system is exclusively used to keep surveillance on the electrical devices working condition and also to control the on/off functionality from a central remote location. The designed system works efficiently for both indoor and outdoor lighting. On the one hand it improves efficiency of the system by sending alert signal in case of any defect and on the other hand it drastically reduces the electric energy consumption by providing central control over the appliances. The graphical App based mobile controlling gives a user friendly and easily accessible platform to the user. This system can be installed as energy efficient system to control street lamp that requires a lot of energy and needs manual intervene.

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