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Energy Saving Solution using IoT

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Abstract: ***Now a days the home environment is introduced with a network enabled digital technology. This type of home automation increases the connectivity of smart equipment within the room. With the continuity of home automation, we have designed a circuit which will track the person in the living room by using image processing. Previous research of human tracking was done depending on IR and PIR sensors. IR sensor has a dead zone between 0 - 4 CM that means no object detection closer than 4 CM.PIR sensors are insensitive to slow motion or the body in standing mode. But image processing doesn't have distance criteria based on the camera we use to cover wider range instead of zone like a PIR sensor and overall detection range is comparable to that of a PIR sensor. So in this research we have used image processing for easy exact human position tracking that rotates a fan independently to direct air flow to whatever position a person moves to in the room and working of light. In addition the fan can be turned ON or OFF based on human tracking to save electricity towards smart home user experience.***

I. INTRODUCTION

A lot of people in the world are without electricity and modern lighting. This problem is more severe in rural areas or in cities. The rural electrification varies widely from country to country. Our country frequently suffers from unreliable and intermittent electricity supply. In some places, people get electricity only few hours a day. Without adequate electricity, it becomes challenging for adults towards concentrating on their professional work orstudies. Rural communities of course needs a reliable and sustainable solution for lighting towards providing a brighter future. The country has made significant progress towards the augmentation of its power infrastructure. Moreover, poor quality of power supply and frequent power cuts and shortages impose a heavy burden on India's fast growing trade and industry. So current scenario insist towards highly efficient and effective usageof any form of power like College ,Universities and Publicplaces where we use power for our teaching in class room and daily usage. It is common practice that most of us leave the rooms with Air conditioner, Fan and lighting on even if no members are present. In some cases we see only few members sitting in one corner of the room entire fan, light and aircon is running. All these amounts tounnecessary wastage of power contributing to country energy resource Lot of research been conducted on smart lighting system, where automated lighting system with visitor counters been implemented. This system is used in controlling the lights and fans in a room and keeps track of number of persons / visitors entered or exit from the room. Researchers also have employed vacancy sensor that replaced the standard wall switches. In our country, manual switches are still frequently used to turn on and off electrical fans, particularly in rooms. People are consequently become so busy that they neglect to turn off switches when leaving a room. Rapid global warming necessitates the development of new technology to accommodate the fluctuating temperatures. The concern ofmodern technology is the requirement for automatic systems. This mechanism serves two purposes. Controlling the fan's speed in accordance with temperature and turning it on and offin response to human detection. When the temperature appearsto reach 270 C and a person enters the room, the fan will come on automatically according to temperature utilizing the LM35.When a person leaves the room, the fan will be turned off. A LED screen will show information about the temperature and speed. The room temperature will be detected via a temperature sensor (LM35). Using the PWM approach, the fan's speed is adjusted based on the ambient temperature. People entering or leaving the room are detected using PIR sensors. PIR sensors can detect motion and are virtually always used to determine whether a person has entered or exited a room..

In recent days the consumption of electric power is tremendously increasing. In such condition it is the usage of electric power efficiently is the responsibility of every citizen of our country. Energy saved is energy generated. Resources to generate electric power either are limited or have side effects. There are many devices invented to use the electric power efficiently. But there are hardly any to be used in our everyday life. Hence a system is suggested to analyse the power usage in a Gathering Hall/Auditorium by deploying a visitor counter and automatic fan control system.

The main goal of this project is to save the electricity from being wasted when not necessary by automatically switching ON of the appliances that are required based on the number of people present in the hall, instead of blindly switching on all the appliances and also switching them off as and when the peoplemove out of the hall, again based on the count of people leaving the hall.

II. BACKGROUND AND RELATED WORK

According to [1], This system was created to help and support older and differently abled people who may experience trouble using the manual system. The IoT vision includes a number of building structures that combine and involve multi- and inter-disciplinary activities from thecommercial and technical domains. This system aims to operate embedded devices and appliances in the home for a reasonable cost, with simple installation and a user-friendly interface. The system's main concept is to use a variety of sensors and control systems to monitor the appliances and give services based on the demands of the user. It allows users to remotely operate household equipment including lights, fans, air conditioners, televisions, and more by pressing a mobile key. With the use of a touch, the idea of remotely operating the appliances is realised. Input smart phone along with Android Operating System.

According to [2], The proposed system principally monitors and control some of the environmental parameters such as light intensity by LDR, room temperature and gas levels by MQ2 Sensor. This proposed system also monitor the status of Appliances and send an SMS alert via GSM network automatically to a concerned authority and the status will also update in Embedded Web Server. We can also control the devices i.e ON or OFF the by using web server links. If the conditions get abnormal and find a wide application areas where physical presence is not possible all the time. The Wi- Fi and Raspberry pi are used in the implementation of sensor module.

This system offers a complete low cost, powerful and user friendly way of real time monitoring and control of industry or Home.

According to [3], In this project, we use Arduino to designand create a control system for a home automation system that can be accessed by a Wi-Fi module or a Web server. This project deals with the automated control of various home appliances, including lighting. The user will speak with Arduino online via a Wi-Fi network. Because of this system's lower cost, more home appliances are possible. Forus, it's more secure. We can operate hardware through the internet thanks to a new technology called IOT, or the Internet of Things. Here, we suggested using IOT to automate the modern home by using the internet to control home appliances. This system uses three loads to representa fan and lighting fixture for a dwelling. A smart home is one that has heating, cooling, and electronic systems that can be managed online or by a smartphone. Whether you are inside or outside of your home, your electronic gadgets can be controlled by a home automation system that is internet-based.

According to [4], Smart home security has become absolutely pre-eminent in daily life of household andindustrial works. Home security is something that is applicable to all of us and involves the hardware and a personal security practice. The hardware would be the doors, alarms, lock systems and different type of sensors like PIR sensor, Temperature sensor, fire sensor to detect unfavourable condition. In case of personal security practice involving doors locking, activating alarms, closing the windows and many other daily life tasks are performed to prevent a burglary. In the present time a lot of unsolicited deactivates like theft are increasing continuously so there is need to modify the functionality of existing security systems. Apart from unauthorized entry, fire and LPG leakage in the house etc. are the problems faced by the society which needs equal attention. The Internet of Things (IoT) is a physical network of devices, structures, cars, and other items that are equipped with electronics, software, sensors, and network connectivity. This technology enables these devices and objects to gather and share data. An anti-theft system is any tool or technique intended to stop or discourage unlawful theft .the taking of something deemed valuable. Both machine to machine and human to machine communication should increase as a result of the Internet of Things. This project suggests an IoT-based security system to stop theft in homes, banks, and other establishments. This project's main goal is to minimise human labour. Security system automation has long been a key component. The project's goal was to create and put in place a security system. System that allows control via a handheld mobile phone thanks to theInternet of Things.

According to [5], The IoT paradigm's "smart house" concept integrates home automation. The Internet can be used to connect household items and gadgets, allowing users to monitor and control them from a distance.

These include light switches that respond to voice commands or smartphone apps to turn on and off, thermostats that change the indoor temperature and produce energy usage reports, or smart irrigation systems that start at a specific time of day on a personalised monthly schedule to reduce water waste. Smart home solutions have become very popular in the last years.

One of the greatest advantages of home automation systems is their easy management and control using different devices, including smartphones, laptops and desktops, tablets, smart watches, or voice assistants. Home automation systems offer a series of benefits; they add safety through appliance and lighting control, secure the home through automated door locks, increase awareness through security cameras, increase convenience through temperature adjustment, save precious time, give control, and save money.

According to [6], This system can provide an alert if anyone intrudes. Different types of control systems use different types Studies on home automation systems such as Bluetooth, GSM,Internet, and speech-controlled wireless interactive home lifetime automation system. Machine to Machine Chain System using Global System for Mobile Communication. The Bluetooth concept is suitable for controlling home appliances. Although these systems do not work remotely. A Java-based home automation process has been described in Introduced ZigBee-based system Details.

The most popular home automation system in the international market is the Internet- based home automation system . Installation cost is reduced and the system is increased Flexibility through wireless-based home automation and monitoring systems. The homeowner's lifestyle is according to the internet Things can observe, guide,and manage home situations.

According to [7], Both academics and professionals have worked very hard to advance the idea. Son et al., for instance, proposed a resource-aware management system for smart home management that represents the home context using a domain-object hierarchical model. Technically, they used the Simple Object Success Protocol (SOAP) and Web Services Description Language (WSDL) to allow mobile devices to access home information remotely. Han et al. suggested a new Smart Home Energy Management System (SHEMS) based on IEEE802.15.4 and ZigBee for effective energy management. To lower overall energy costs, they created a SHEMS-based multi-sensing and light control application. Wu et al. presenteda framework to describe the link between services, places, and users in order to satisfy the human-centric interaction need ofa smart home with regard to the "home nature" of a smart home in servicing its users. They created the framework and two ubiquitous applications called Media Follow Me (MFM) and Ubiquitous Skype. Alam et al. introduced an approach termed sequence prediction using enhanced episode discovery to forecast user behaviour (SPEED).

According to [8], This approach is implemented to control various home appliances with ARM9processor.This will also provide safer physical control to the user compare to the conventional high voltage switches. The Bluetooth connection in the system is established by Bluetooth module that directly receives /transmits commands from/to ARM9.Mainly, it is used to control home devices from a central control point. The communication between the devices is wireless. The system is secured for access from outside through an SSL algorithm protected server. SSL algorithm to help create a more secure and scalable future. SSL means secure sockets layer it is a computer networking protocol for securing connectionsbetween network application such as internet.

According to [9], The smart home should be contained withmany machine driven sensors and customized systems for secure life elegance. The security issues are having different types and which increases day by day in our regular life . However, the attacks exist with many associations of techniques and interrupt in the smart home management system. When important information about something is exchanged, information privacy is a crucial concern. As long as there isn't a robust firewall in place, hackers can easily access the network that is linked to sensors and smart home systems. The context attentive and privacy categories include the recognition and identifying category. The distinguishing characteristics change with mental ability and relate to energyuse. Privacy can be a general concept that refers to how values, time periods, and age groups vary.

According to [9], A smart home system integrates various electrical appliances in a home. It provides monitoring and controlling the home devices automatically according to the user's need. After performing literature survey and studying other existing works, we proposed a technique that gives us better understanding of environmental conditions within the home with less human interaction. In this system we have overcome certain drawbacks like complexity, highcompetition with vendors, incompatible standards and higher costs. And also providing a user-friendly interface on the host side so that the devices are easily monitored and controlled. Furthermore, the overall system should be swift enough to realize the true power of wireless technology. Our system not only just monitor and control devices but also detects problem in any device automatically. By using these system we can actually manage to make low cost and energy efficient homes

III. LITERATURE REVIVE

Table 1 Relevant studies on advantages and disadvantages of Smart Appliances

Related Studies	Advantages	Disadvantages	Methodology
[1	• The mobility of theapplication makes to be available to the user independent o the user's location. • It eliminates the need for manual wor and makes a remote device to tak control of the appliances. • This system provides authentication o usersthat increases the security	• Sensor data may not beaccurate . • Requires constant and good interne connection for datatransmission. • Slower transmit cycles. • Lack of security encryption. • Creating a globally scalable network i difficult with anMQTT	• This system enables to control the applianceswith the help of a mobile application which is easilyportable and reliable. Iteliminates the need formanual work and makes aremote device to take control of the appliances. It alsoprovides special functionslike customizable timing,temperature offset, and speed for an appliance making it more efficient and convenientfor the users.

[2	• With an IoT system, you can contro your appliances remotely using smartphone or other device, regardles of where you are. • It can help you monitor and optimize th performance of your appliances, whic can lead to energy savings and reduce operating costs. This is done b increasingefficiency.	• As with any system that is connected t the internet, there is a risk of hackin and data breaches. It is important t ensure that the system issecure and tha sensitive data is properly protected. • Implementing an IoT system can b expensive, especially if you need t purchase new appliances that ar compatiblewith the system.	• Remote Monitoring and Control: Thi involves using sensors and other devices t collect data from appliancesand transmit it t a central server or cloud-based platform From there, the datacan be analyzed and use to remotely control the appliance.
[3	• Controlled electrical fixtures such as lights andair conditioners • Simplified garden or lawnmanagement • Controlled smart homeappliances • Enhanced safety andsecurity at home	• Not suitable for advancedapplication • Requires stable internetconnection • Needs constant power supply. In case of power cutdown the module as to be connected to internet again manually. .	• The arduino controller is programmed such that the fan and light ar control basedon the data send by the mobil phone to the arduino through a Wi-F interfacing model.
[4]	• Arduino boards are availableat low cost • It is not only limited to Windows it is also available across multiple platforms likeLinux and macOS. • PIRS include low false alarmrates when compared to microwave and ultrasonic sensors.	• Arduino has limited scope inthe robotic world and cannot be used in industria scale projects. • Limited Support for Programmin Languages • Less Memory Storage Capacity.	• The Arduino Uno connects tothe Wi-Fi through serial software. When theconnection is established itwill start reading theparameters of sensors.
[5]	• Very accurate • Affordable • No special maintenancenecessary • ESP8266 chips and RaspberryPi boards Both choices are cost effective, small.	• Time consuming • Relatively slow response time	• using qToggle system avery basic core API, allowingfor a more flexible networkdesign It is aimed to be acomplete smart homeprototype, with a lot offunctionalities-automation, control, monitoring, andsecurity. •
[6]	• It ensures home security • Low power consumption • Motion Detection • Secures the home throughthe web control	• Not able to run Windows Operatin system • Overheating as the board doesn't com with any heat-sinks pre-applied or an cooling fan.	• In the proposed system temperature an motion willbe monitored and stored in cloud If it exceeds cooler will automatically turne ON baes on light.
[7]	• Managing all of your homedevices from one place. • Flexibility for new devicesand appliances • Maximizing home security. • Remote control of homefunctions. • Increased energy efficiency.	• Installation cost • Internet dependency • Privacy concern • Complicated user interfaces.	• This approach utilizes microcontroller-enabled sensors for measuring homeconditions, microcontroller-enabled actuators formonitoring home appliances in the front end. It utilizesPaaS (Platform as a Service)and SaaS (Software as a Service) in Cloud computingfor processing data at the backend.
[8]	• With smart home automation, you ca control your home's systems and device remotely using a smartphone app or voic assistant. This makes it easier to manag your home and perform tasks lik adjusting the thermostat or turning off th lights fromanywhere. .	• These devices have security flaws an can be hacked. Some companies tha make these products don't have stron backgrounds in security. • The systems can be costly.	• Through a server protected by the SS algorithm, the system is secured agains access from the outside. Users must create login and password in order to access th website. GHAS uses mobile phones to contro home appliances. It features a built-in SM feature andmodem for home automation.

[9	• Increased convenience: Smart hom devices can be controlled remotely usin a smartphone or voice assistant, making easy to adjust the temperature, turn of lights, or lock doors when you're not a home. • Improved energy efficiency: Smar thermostats and smart lighting system can learn your schedule and adjust th temperature and lighting in your hom accordingly, helping you save on energ costs.	• The interoperability allowsinformatio associated properties modified betwee the various ensorial module i smart home environment's row. • Still there is a challenge taskis that th absence of proper ro communication between the connecte devices which is in smart hom environment. • At consistent operation of variou integrated devices, there may be dela assimilation interruption with any ne devices.	• The smart meter is one of the equipment tha registers a digital signal with Central Proces unit (CPU). The communication devices wi be shaped and records by smart meter. • In essence of smart home were primaril conceptualized and later developed t mechanically address the daily necessities o aged andusers with disabilities. • It is suggested that potency of smart homes i anticipated tobe climaxed whereas utilizingne approaches.
[10	• Improved efficiency: can be programme to turn on and off based on the occupanc of a room, as well as the temperaturean humidity levels. This can help to reduc energy consumption and save o electricity costs. • Enhanced comfort: can be controlle remotely through a smartphone app o voice assistant • Improved safety: can be programmed t turn off automatically if they detect a obstacle in their path, such as a person o pet. This can help to prevent accident and injuries.	• Cost: Smart electrical fans with thes features may be more expensive tha traditional fans, which could be deterrent for some consumers. • Dependence on internetconnectivity: I the smart fan is unable to connect t the internet, it may not be able t function as intended, which could b frustrating for users. • Data privacy concerns: Some peopl may be concerned about the amount o data that is collected and transmitte by IoT devices, including sma appliances.	• Detection of motion is stored in the server. I the parametersexceed the threshold level, the any electrical appliances will turn on and o automatically. • If any electrical appliances are left on in a hurry it can beseen. This can be turned offremotely through simply typing the IP address of the web server.

IV. CONCLUSION

In conclusion, it is the privilege of every person to utilise smart electrical appliances systems that will automaticallywarn users when a switch is ON or OFF and have the ability to significantly increase the efficiency of how we use electricity. When a need is sensed, switches are monitored and automatically turned on. In some instances, we notice only a few people seated in one corner of the room while the fan, light, and air conditioner are all functioning. All of these amount to wasteful energy waste that depletes the nation's energy supply. Several studies have been done on automated lighting systems with visitor counters, which are used in smart lighting systems. Overall, using smart electrical appliance technologies could significantly increase savings. By automatically turning on the appliances that are essential based on the amount of people present in the hall, you can save electricity from being wasted when it's not necessary.

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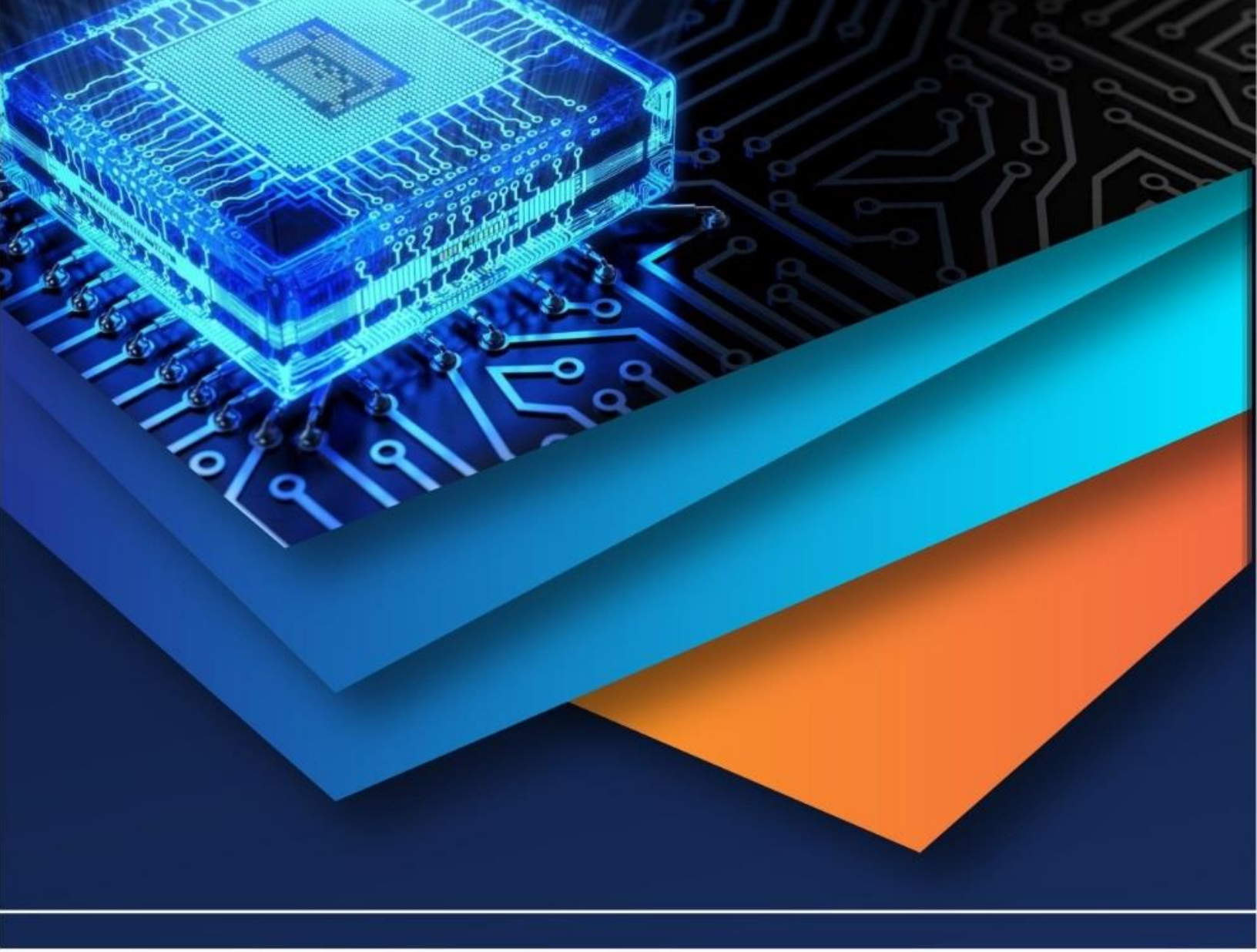

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