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Smart Energy Utilization On Demand Using Image Processing

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ABSTRACT

Life without electricity can never be imagined in this world, so it's every human duty to save electricity. But due to the busy schedule existing in present, often many of us forget to switch off lights and fans which increase wastage of electricity. Often we find lights and fans in the monitoring region(MR) is where we perform the operation to detect the motion of the object, will be on though the MR is empty which increases the electricity bill. This is the major issue in most of the educational institutions. Over the past decade, there has been significant advancement and innovations in the field of consumer electronics by using new technologies we can automate the control of main power supply provided to the MR which significantly reduces the power consumption. Automation provides some sort of automatic control to the electrical appliances present in the building. Proposed work demonstrates detection of motion of objects as a parameter to decide whether to switch on/off the power supply.

Keywords: Background subtraction, Image Processing, Raspberry Pi ,Relay ,Monitoring region.

I. INTRODUCTION

A Lighting control system is a network based lighting control solution that incorporates communication between various system inputs and outputs related to lighting control with the use of one or more central computing devices. It provides the right amount of light where and when it is needed. They are employed to maximize the energy savings from the lighting system and energy conservation programs. Lighting control system are often referred to as Smart Lighting. Smart lighting is a lighting technology designed for energy efficiency. It is to accurately detect object and take a proper decision of turning on/off of light, which is going to be completely automatic. Here we are using image processing technique to detect the motion and based on the result whether to turn on/off the power supply to the monitoring region(MR).Image processing is a method to convert an image into digital form and perform some operations in order to get an enhanced image. In which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Although there are a lot of products available in the market which will turn on/off lights based on the presence or absence of an object respectively. We are using image processing technique to detect the motion and based on the result whether to turn on/off the power supply in the monitoring region .When the raspberry pi boots up the passive infrared sensor(PIR) starts executing and starts detecting the motion of objects by comparing the reference image and the current image captured by the camera. If there is any motion detected then the PIR sensor sends raspberry pi a message that there is

an object present in the MR and it has to turn on the initialized GPIO pin which in turn triggers the relay and turns on the main power supply. If there is no motion detected then the GPIO pin is not turned on and so is the main power supply provided to the MR. The objective is to control the switching of power supply in Monitoring region(MR) and helps in using power supply efficiently. Design a smart automated device which controls the switching of Power supply in the MR based on presence/absence of an object.

EXISTING SYSTEM

The existing systems are operated manually. Infrared sensors can keep count of a number of objects entering /leaving the monitoring region.

a. It is a tedious job to switch on/off the light every time when an object enter/leave the monitoring region.
b. Infrared sensors are unable to detect if the monitoring region is occupied or not.
c. Infrared radiations are harmful.
d. Switchboards have to be replaced with new ones, but we use the existing switchboards and CCTV cameras, which are pre installed in most of the educational institutions.

PROPOSED SYSTEM

Control the switching of power supply in the MR. When an object is present in the MR the mains automatically switches ON. When no object is present in the MR, then mains gets switched OFF. Using electromagnetic switch at the output that triggers switching ON/OFF of the main power supply. Implementing this system using Raspberry pi. When the raspberry pi boots up the Passive infrared sensor(PIR)starts executing and detecting the motion of objects by comparing the reference image and the current image captured by the camera. If there is any motion detected then the PIR sensor sends raspberry pi a message that there is an object present in the MR and it has to turn on the initialized GPIO pin which in turn triggers the relay and turns on the main power supply. If there is no motion detected then the GPIO pin is not turned on and so is the main power supply provided to the MR.

There is no need to switch main supply on/off manually. The CCTV camera is used in almost all campuses, so there is no need to install new cameras. The device is going to be completely automatic without need of any human intervention at any stage thereby reducing the manpower. The device will be easy to handle with less maintenance. The use of Raspberry pi helps in multitasking since it is a processor and can be accessed remotely.

II. LITERATURE SURVEY

[1]"**Automatic Control of Power Supply in Classroom using Image Processing**" **by Darshan Ganiger, Kishor A Patil, [10 February 2017] ,**International Conference on Recent Advances in Electronics and Communication.

Although there are a lot of products available in the market which will turn lights on/off based on the presence or absence of an object but requires a big infrastructure.

[2] **"Automatic Lighting and Control System for Classroom" By Suresh S, H N S Anusha, J Rajath etal, SRM University, [06 April 2017],** ICT in Business Industry and Government(ICTBIG)

Most of the colleges and universities use the traditional lighting system where we have a switch to control the lighting. So, accordingly here automatic lighting and control is developed using Arduino for the efficient use of energy in class room.

[3] **"Internet of Things Enabled Smart Switch" by Vishwateja Mudian Reddy, Naresh Vinay etal Manipal, India, [21 July 2016],**Wireless and Optical Communications Networks(WOCN), 2016 Thirteenth International Conference.

Analog switches are mounted on the walls. To operate them the user needs to physically press the switch to turn on/off any appliance. The current

work makes use of a web app and a cloud to control the operation of the switches.

[4] **"Automated Energy Saving and Safety System" by Md. Kamrul Majumdar, Himel Biswas, Md. Haider Ali Shaim ,[10 April 2014],** Electrical Engineering and Information and Communication Technology(ICEEICT),2014 International Conference.

This paper reports on a system that can save electricity. Many times we leave the room without switching off lights and fans. In this work they have presented a system in which energy will be saved based on number of people entering in or leaving out of the room.

[5] "Energy Conservation using Automatic Lighting System using FPGA"

by Payal Rodi,Leena Chandrakar, S Saylee, Ginde Sivanantham.[27 Nov 2015], Green Engineering and technologies(IC-GET),2015 online international conference.

This paper proposes efficient use of solar energy for automatic street lighting system using micro controller. The main objective is to make street lighting system free from manual operation so that there would not be any unnecessary usage of light.

III. METHODS AND MATERIALS

System architecture

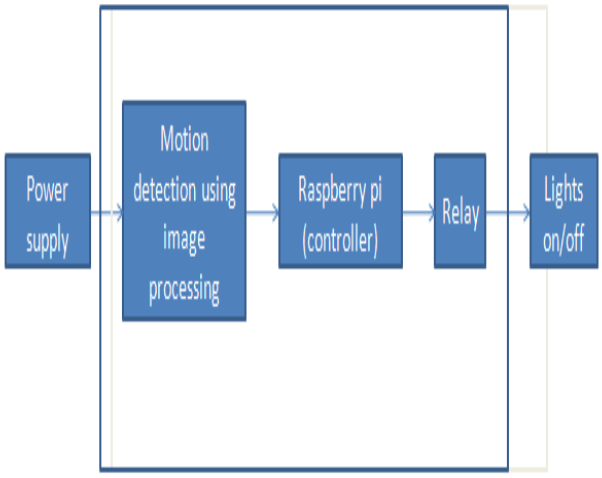

Figure 1. Block diagram of automatic control of power supply.

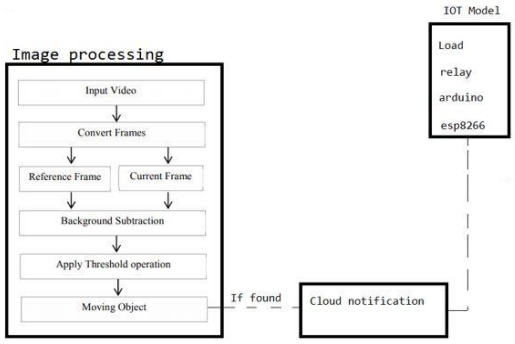

Figure 2. System architecture of automatic control of power supply

From the system architecture the process is divided into five modules

1.Cameramodule:a device for capturing a photogra hic image or recording a video,using film. Here the input video will be recorded in the camera and then it will be converted into frames.

2. **Image Processing Module**: is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image.The frames from the camera is compared with the reference frame and the current frame then

background subtraction is applied(frame difference algorithm).

3. **Cloud Notification Module**: is an information technology that enables ubiquitous access to shared pools of configurable system resources and higher-level services that can store and rapidly work with minimal management effort, often over the internet. After the background subtraction threshold operation will be applied where if the motion of the object is detected within the threshold range then the notification will be sent to the cloud.

4.**IOT Module**: is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, a ctuators, and connectivity which enables these objects to connect and exchange data. The Passive Infrared Sensor (PIR) is fixed along with the Raspberry pi where it is an additional feature which is a sensor that measures IR light radiating from objects in its field of view which is used to detect the motion of the object.

5.**Hardware Design Module**: are the physical parts or components of a computer, such as the monitor, keyboard, computer data storage, graphic card, sound card and motherboard. By contrast, software are the instructions that can be stored and ran by hardware. The hardware components used such as raspberry pi, electromagnetic switch(relay), arduino micro control and GPIO(general purpose input output) ESP8266,When motion is also detected in the PIR sensor then the bulb will glow(load).

Design

1. Raspberry pi:

The Raspberry Pi is neither a microcontroller nor a microprocessor. It is a small computer, which uses keyboard and mouse as input devices and displays on the monitor. It is a low cost, portable, small-sized computer, which has a large number of peripherals, and it has the network for communication. It is a small device that uses programming languages like Scratch, Python, and C++. Python and IDLE 3 are preloaded in Raspberry Pi. Python is the official programming language of the Raspberry Pi .

Figure 3. Raspberry pi

2. PIR Sensor

A passive infrared sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. It is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms andautomaticallyactivated lighting syste ms. They are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".

Figure 4. PIR Sensor

3. Image Processing

Background subtraction is a method in image processing which helps in detecting the motion of objects. The basic principle of this method is that it compares two images or frames and gives out the difference between them at the pixel level, images considered in image

processing are normally in the form of a matrix(i.e. rows * columns). In Background subtraction method one image or frame is considered as a reference image (i.e. as a background image). This method subtracts two images that is reference image and the image captured from the current frame of the video (i.e. difference image = background image – current frame image).

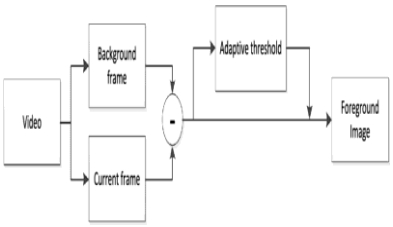

Figure 5. Background subtraction

IV. RESULTS AND DISCUSSIONS

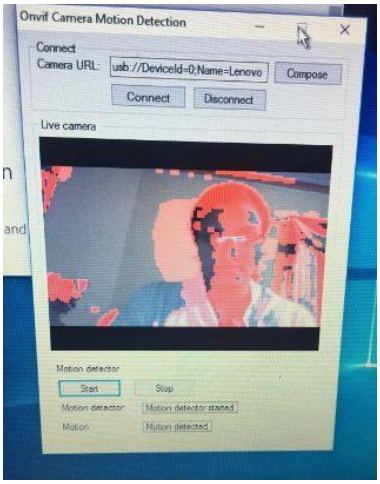

Figure 6. When image is captured from the camera then Motion will be detected in image processing module through camera to perform operation.

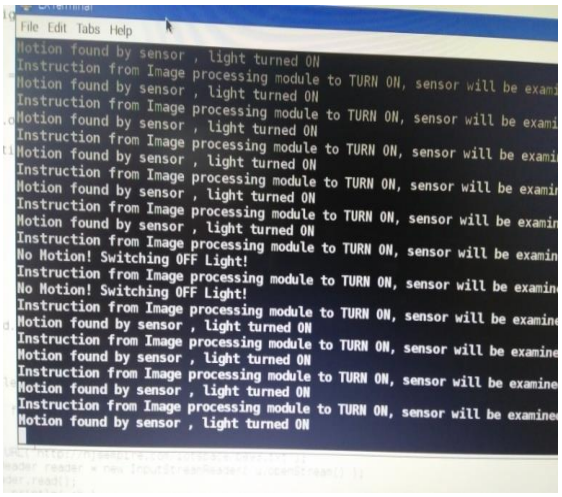

Figure 7. When motion is detected from the sensor, it gives instruction to led to turn on.

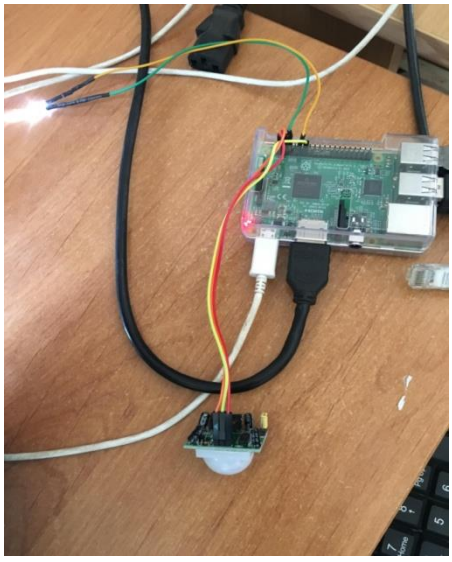

Figure 8. Led is turned on when motion is detected from the sensor.

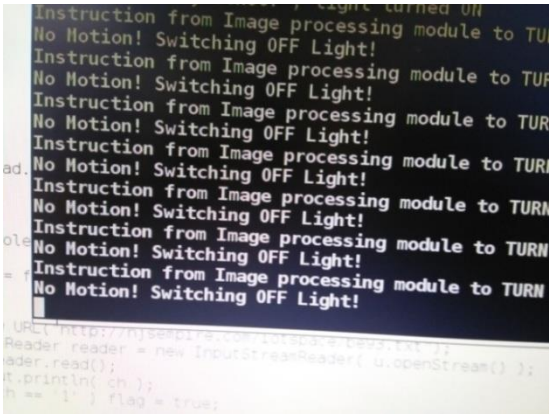

Figure 9. When no motion is detected from the sensor, it gives instruction to led to turn off.

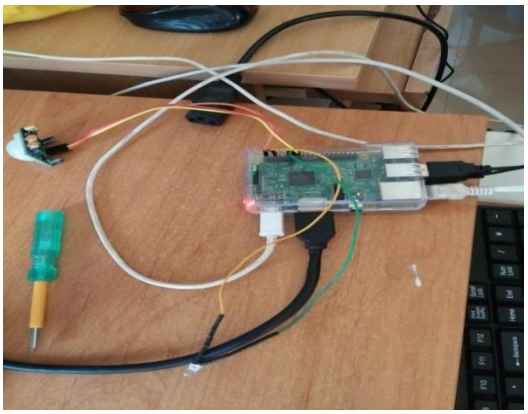

Figure 10. Led is turned off when no motion is detected from the sensor.

V. CONCLUSION

The proposed methodology can be implemented in real time and is reliable in automatic controlling of lights without any human intervention, using image processing technique like frame subtraction . A visual representation can also be captured for security purposes and stored in the cloud and viewed from the remote control.

VI. REFERENCES

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