

RESEARCH ARTICLE



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## ENERGY OPTIMIZATION OF SMART SENSOR SYSTEM USING OPEN IOT PROTOCOL STACK

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### ABSTRACT

Light technology is advancing step by step from incandescent, compact fluorescent and induction lamps to LEDs. The ultimate is to make these lightings an energy efficient by automatic optimization of lights whenever not required. LEDs are extremely energy efficient and consumes less power than incandescent bulbs. This paper highlights innovative ideas in which we can reduce the power consumption maximum up to 60%. The "Smart meeting room" is brimming with automatic light control system with dimming features, different light scenes selection and live energy monitoring in a single dashboard. Dimming capability of lights allows them to save more than half of its energy. Enabling different scene selection makes it possible to witness a smart lighting technology. The optimized energy can be monitored live on the dashboard and is stored in database. Screening of energy optimization makes it more wonderful if it can be done. This light control system reduces energy consumption through its dimming feature and allows room not to be in absolute darkness. The innovative idea of different SCENE selection makes light technology a fascinating work. In this paper energy optimization of lighting devices using open IOT protocol stack is presented. Dimming can be done through various technology. Here PWM technique is used which is capable of saving up to 80% -90% of light energy. This paper presents consumption of light energy system with raspberry pi as controller, sensor data is stored in cloud, web page act as dashboard which shows different scenes options, current light status, and energy utilized.

Keywords: Raspberry pi, PIR sensor, PWM, node red, T K inker, IBM Blue mix

### I. INTRODUCTION

Energy optimization is extremely valuable nowadays and it turns out to be all the more great when it can be screen. Saving energy doesn't have to leave your room in dark. This light control system reduces energy consumption through its dimming feature and allows room not to be in complete darkness. The innovative idea of different SCENE selection makes light technology a fascinating work. It makes normal meeting room in an advanced

meeting room. Proposed technology can be used in the applications such as Commercial lighting, Decorative lighting, Street lighting, and automotive lighting. In this paper energy optimization of lighting devices using open IOT protocol stack is presented. Dimming can be done through various technologies. One of the methods is using TRIAC, which shows the failure that can be caused by insufficient current to charge the capacitor in the dimmer switch [1], another system is by integrating microchip, power

converter, sensors and thermistor to implement a smart LED light system [2].

**II. METHODOLOGY**

The target of this venture is to beat the issue of energy crisis. This project consists of two main parts. First is hardware part and the other is software part. Block diagram of overall system is shown below-

- PIR sensor is the basic most component of the whole system. It sense the presence of human body in its specific range. As soon as it detects any human being present in room it sends a high signal to raspberry pi controller.

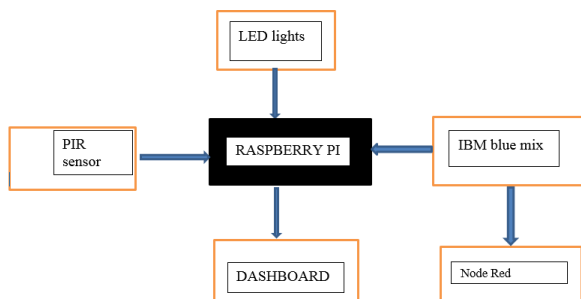


Fig 1. Block diagram of the system

- Raspberry pi being the master controller then accepts the signal from PIR sensors and starts processing according to it.
- Raspberry pi being programmed already works according to the work flow chart.
- As a beginning of a system as soon as PIR sensor senses human body at its first entry, raspberry pi process and glows all lights with 40% of its total brightness.
- There are different mode selection is there. According to the mode selected by the person, respective lights glow accordingly.
- Raspberry pi is programmed in python programming language.
- Raspberry pi is connected to IBM Blue mix account. The data is saved to Blue mix account. It is a to and fro communication system.
- Once a particular mode is selected by the person, that command is processed and lights glow accordingly.
- The main feature in this system is that once the meeting room is empty, PIR sensor

detects no presence of human being, the glowing lights first gets dim which means brightness is reduced and gradually switch off.

- This system is controlled and monitor through a dashboard. Dashboard consists of all the mode option.

In our Project there are 4 modes sets for workplaces meeting rooms to be specific Meeting, Presentation, Front light and Back light. There is specific capacity is set for specific mode.



Fig. 2 lighting modes

The meeting room is consists of 4 lights in each corner and 1 light in center of meeting room. The particular function of particular mode is given as follows:

- 1] Presentation Mode: Glow center light with 30% brightness.
- 2] Welcome Mode: Glow all light with 40% brightness.
- 3] Small meeting Mode: Glow front two lights with 80 Intensity and center light with 70% intensity.
- 4] Group Discussion: Glow 4 lights with 70% and center light with 100% intensity
- 5] OFF mode: Switch off all the lights.

A. Connection of raspberry pi with LEDs and PIR sensors: The below figure is hardware setup of raspberry pi with LED lights and PIR sensor.

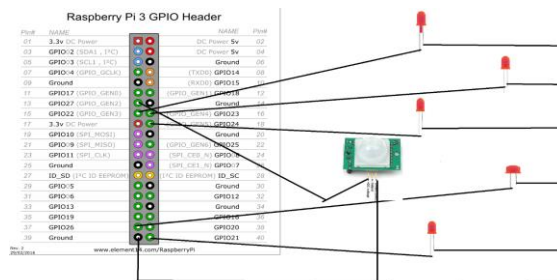


Fig 3: Connection of raspberry Pi

B. Software Architecture: Raspberry pi is added to IBM Blue mix cloud service account. Node Red concept is used here. It's a programming tool connecting together hardware devices, Application programming interface (APIs) and other online services. It gives a flow editor which is browser based which makes it more user friendly as it mug together flows by utilizing wide ranged nodes in palette.

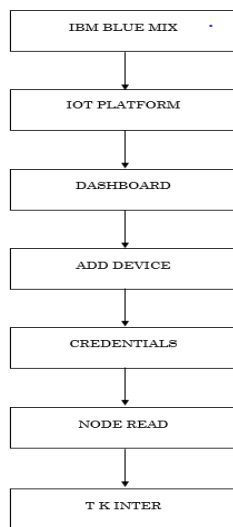


Fig 4: software work flow chart

T K inter python makes it easy for developing a graphical user interface. T k inter gives a more powerful interface to the GUI toolkit.

**III. RESULT AND DISCUSSION**

Following are the outcomes that we have here. At whatever point a person goes into or leaves the room, sensor senses the presence and accordingly the intensity of light is increased and decreased. Respective mode is ON or OFF, as per the requirement.



Fig 5: hardware setup of project

Further monitoring and controlling is done through display dashboard in which different scene selection options are there. This dashboard is made through T k inter python GUI. T k inter is the standard GUI library for Python. Python when joined with T k inter gives a quick and simple approach to make GUI applications. T k inter gives a capable object-oriented interface to the T k GUI toolbox. The dashboard design looks like the below web page.



Fig.6: Dashboard of the system

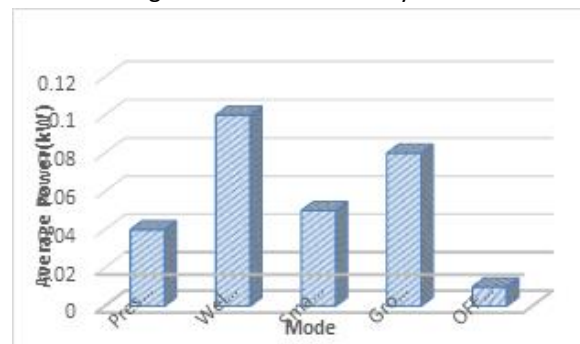


Fig.7 Graph of Avg. consumption Vs Environment.

Table 1. Specific mode and its working

Scene	LED and its working
Presentation mode	LED 1, indicates only lights near projector will glow
Welcome scene	LED 2, means all lights will glow with 40% of brightness
Small meeting	LED 3, means only few lights will glow
Group discussion	LED 4, indicates 70% lights will glow
OFF mode	LED 5, all lights can manually off

The amount of energy saved by the system is shown in above graph. PWM dimming technology can save up to 80% of light energy.

**IV. CONCLUSION**

Light energy can be optimized by reducing its intensity. The better way to reduce the intensity is by Pulse width modulation method. This thesis work

presents energy optimization of a smart meeting room with PWM dimming technology. For maintaining sufficient light in a LED light system PWM adjusts its luminous flux intensity of LED lights. From results it is shown that PWM provides efficient dimming capabilities to LED lights. Experiments done indicates that PWM saves 90% of light energy.

Considers on energy optimization have demonstrated that it is at a phase of hindrance because of advance innovative development. Such a system to enhance energy optimization as well as a comfortable living can be accomplished by room mechanization method. Since the innovations are developing step by step there will be best in class automation strategies which can enhance current way of life and can spare more energy will catch our market. By doing this venture we arrived at the conclusion that despite the fact that we have built up a little piece of automation in a solitary room, it can be developed utilizing more segments with the end goal that it could be introduced in greater rooms.

#### V. FUTURE SCOPE

By using internet services more development can be done such as creating a dashboard through a web server or an html page, creating web APIs.

#### VI. ACKNOWLEDGMENT

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