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# Smart Energy efficient lighting in Green Buildings based on power control.

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**Abstract-** GreenBuildingisaimportantresearchareainIOT. The energy efficiency in green buildings is vital for global sustainability. However many factors affect energy consumption by the device and most of the green buildings are not really green due to static energy supply and centralizedcontrolondevices.Hereweproposeadesignusing LEDandCFLtomakeuseofpowersupplytoincreaseenergy efficiency and distributed clustering of devices for smart automaticcontrol.

## I.INTRODUCTION

Green Building is a important research area in IOT. The energy efficiency in green buildings is vital for global sustainability. According to general survey lighting in smart building is responsible for more carbon di oxide emission than other equipment, most of the currently available green building uses location based control over the system to attain power efficiency but the test bed fails under multiple subjects [1], [6], and [7]. In some green buildings centralized control of devices are used to implement the dynamic power policy [2], [5]. Many green buildingsalsouseseliminationofDCtoACandACtoDC conversionswherelotofpowerislostoverconversion[3]. This work focusses on green building lighting tominimize the carbon di oxide emission and increase the power efficiency by using a design based on LED and CFL .The key aspects of the workare.

1) **Powercontrol:** Through microcontrollers power to the devices are controlled depending on the surrounding conditions measured with the helpof sensors
2) **Data gathering:** Through serial monitoring, data from micro controllers are stored in MySQL database
3) **Future Prediction:** The data stored in database are processed to attain the power consumption Pattern for gathering information such as future device failnure, quality of the product and rate of product productionetc.,

The result shows that due to changes in systemdesign using LED and CFL used to dynamic power control rather than florescent devices and static power control thecarbon di oxide emission is decreased and increases power efficiencyeffectively.

## II. POWERCONTROL

HighpowerLEDandCFLareusedtoproducebrightwhite light instead of commercial CFL bulbs. As LED and CFL are sensitive to small voltage changes a driver circuit is used to regulate voltage.Room lighting intensity are measured using Light Dependent Resister (LDR) to adjust the Compact Fluorescent light (CFL) brightness automatically Pulse Width Modulation (PWM) signal is used to control the CFL brightness by dynamic changing thepowersupply.Sensorsareusedheretomeasuredevice temperature and CFLintensity.

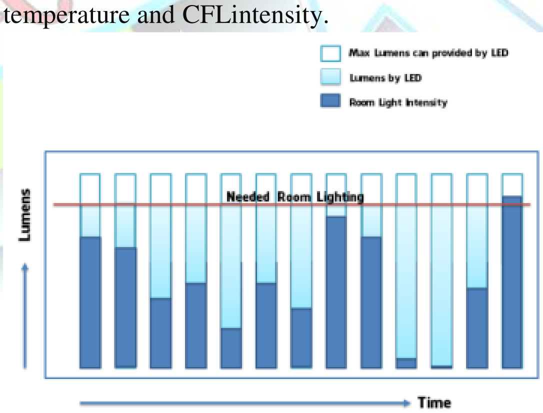


Fig 1. Dynamic Control

Here figure.1 shows that the variation of power supplyofthedeviceisinverselyproportionaltothechange in surrounding light intensity. As the environmental light intensityincreasesthepowersupplydecreasesdynamically intime.

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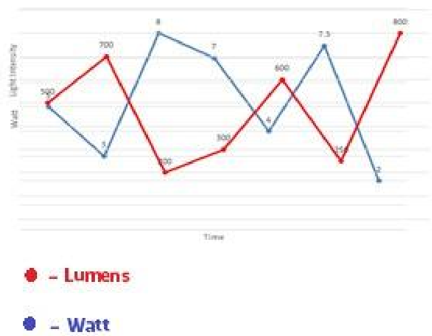


Fig 2. Correlation among Power vs. Lumens over time

This system design using dynamic power control ofLEDandCFLprovidebetterlightingcomparedtostatic power control and it improves power efficiency by 45%. Power needed is controlled depending on the surrounding conditionssuchasclimaticchangeandstructuraldesignof thebuilding.

## III. DATAGATHERING

Table 1. Model Database

| Device ID | Watt | V-Out | Temperature | Status | Life Time | Date | Place |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 900 | 26 | Alive | 1600 h | 17-2-16 | Delhi |
| 2 | 4 | 1200 | 29 | Alive | 1800 h | 18-2-16 | Andhra |
| 3 | 5 | 200 | 25 | Dead | 2100 h | 19-2-16 | TamilNadu |
| 1 | 3 | 600 | 25 | Warning | 1700 h | 17-2-16 | Delhi |
| 2 | 4 | 1200 | 27 | Alive | 1900 h | 18-2-16 | Andhra |
| 3 | 5 | 0 | 20 | Dead | 2120 h | 19-2-16 | TamilNadu |
| 1 | 3 | 150 | 24 | Dead | 1800 h | 17-2-16 | Delhi |
| ... | ... | ... | ... | ... | ... | ... | ... |

For gathering data, a test bed is designed to provide the same environment of green building which allows sunlight pass inside the building to increase the power efficiency. Here a set of LDR and temperature sensors are connected with the microcontroller to observe the surrounding environment. Data obtained through sensors are stored in database for future processing.

The data is gathered for different seasons to predict the effect of temperature and humidity over the newly designed system. This will help to improve the system design depending on the surrounding conditions. It is observed that each season and also small changes in surrounding environment greatly affect the system power policy, so it is not possible to provide a static or location based power policy in this design. The collected data is stored in the cloud. Administrator can track the device status regularly through the stored data. Manufacturer can make use of this data to predict LED failures before it occurs and increase product production depend on device failure rate.

## IV. Future Prediction

Here in future prediction module, the stored data is mined to attain details about the probability of failure of LEDs. This helps to measure product quality manufactured on certain factory at certain date. Objectives of this module are,

1. To identify future device failure before itoccurs.
2. To calculate product quality of certain batch of devices.
3. To predict Increase in product production rate early
4. To identify Need of change in product design depend onenvironment

**To Identify Future device failure:**

As CFL can't consume all the power supplied to it and some power will flow through the CFL to the other end of the circuit until the circuit is closed we can observe the status of the CFL as Alive or Failure

LetthepowerflowtotheotherendbeV-Out,then for given power supply X the V-Out will be Y toZ

If V-Out is greater than Zero and Smaller than Y

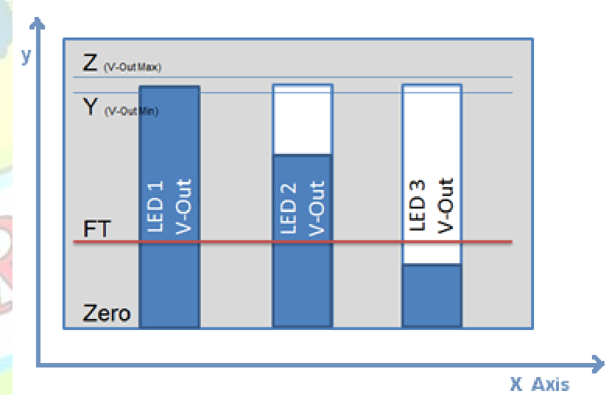


Fig 4. Model Chart

**V-Outthreshold:**

The V-Out threshold is used to identify the status of the LEDsuchthatitisdeadoralive.Thisthresholdwillchange dynamicallywithrespecttosuppliedvoltageasthevoltage increases.

**To improve product quality and service by manufacturer:**

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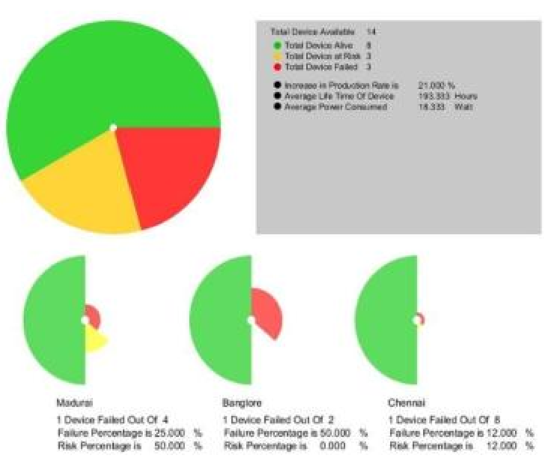
Table 2.ManufacturerDatabase

| Device ID | Manufacturing Date | Place | … |
|---|---|---|---|
| 1 | 17-2-16 | Delhi | … |
| 2 | 18-2-16 | Andhra | … |
| 3 | 19-2-16 | TamilNadu | … |
| 4 | 17-2-16 | Delhi | … |
| 5 | 18-2-16 | Andhra | … |
| 6 | 19-2-16 | TamilNadu | … |

By tracking device ID manufacturer is able to gather possible failure detail about the product made on particular date and place. Then devices can be monitored dynamically for possible failure detection and to predict lifetimeofthedevices.Eventhedatagatheredwillbeused to change the device design based on the surrounding environment as the environmental conditions has a great impact on the deviceperformance.

**To predict Increase in product production rate early**

Hereprocessingtoolisusedtofetchanddrawthe data stored in database then details such as failure device to the total device installed are calculated and number of devices failed from a particular manufacturing plant were identified to predict the percentage of increase in product rate before customer place theorder




Here all the devices are also dynamically monitored to predict the overall device failure andaverage power consumption and average lifetime of all installed devices so that mass monitoring of devices isachieved

**ToidentifyNeedofchangeinproductdesigndependon environment**

By analyzing the surrounding conditions such as temperatureofthedevicethatfailedwecanabletoidentify the changes need to be done in the particularenvironment orareathatthedeviceisinstalledtoincreasethedevicelife time.

## V. FutureWork

Data will be mined to obtain patterns abouteffect oftemperatureandclimaticchangesinpowerconsumption overthesystem.DetailsabouteffectoftimeovertheLEDs can also be gathered. Following extensions could bedone.

1. By observing effect of temperature over the system, power policy could be created for differentseasoning
2. The patterns are used to improve the system performancebyalteringthephysicalcomponents
3. Life time of the device are calculated depend on various factors such as power consumption,time etc.

## VI. CONCLUSION

In this paper, a new design is proposed and implemented to increase the power efficiency of a green building based on the environmental factors. Thus carbon di oxide emission is minimized.

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