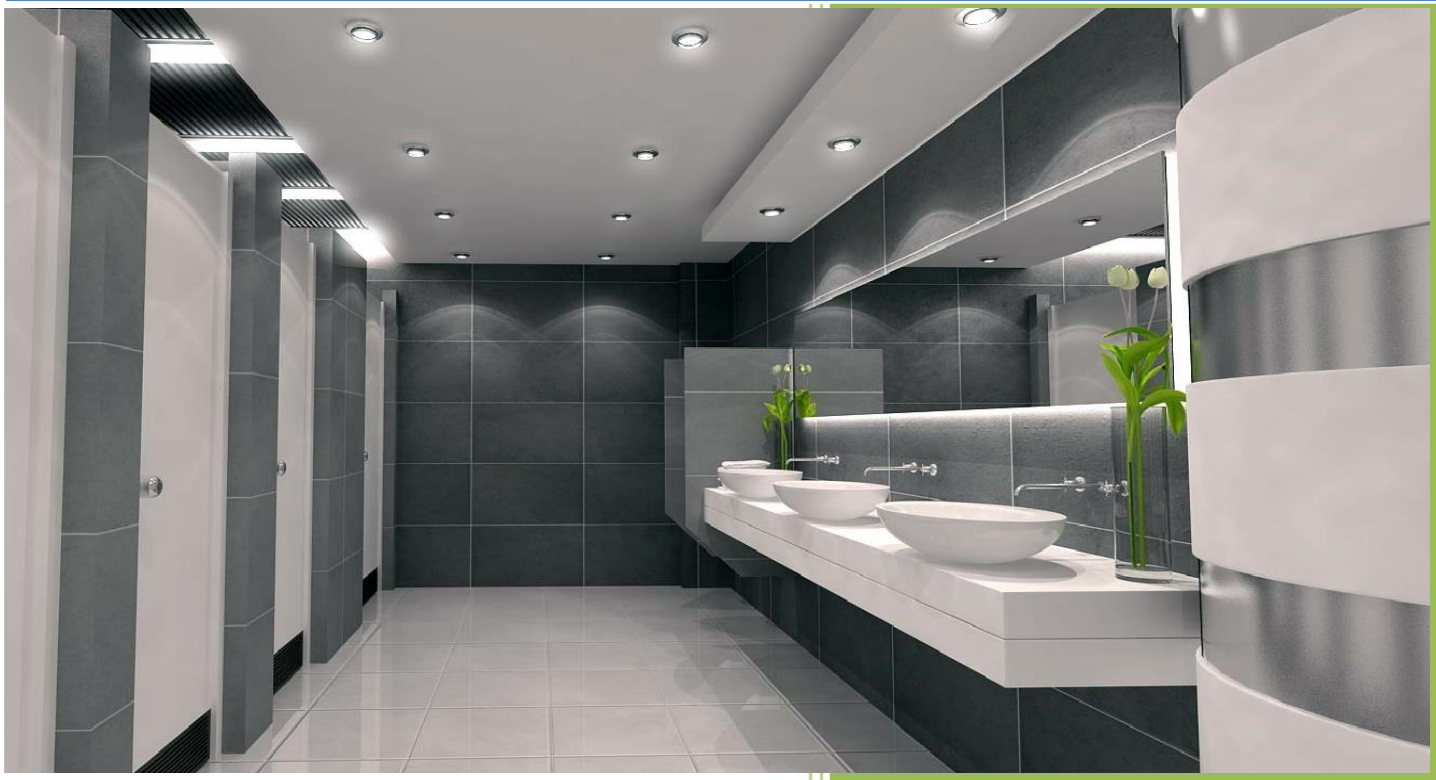
Year 2017

WASHROOM AUTOMATION PROJECT



A Project By

Vaibhav Thakur & Group

"WASHROOM AUTOMATION USING SENSOS FOR ENERGY CONSERVATION"

A Project Report

Submitted By

VAIBHAV RAJARAM THAKUR

Supportive Team Members

1. SHUBHAM VAIBHAV VAIDYA

2. PRASAD BALKRUSHNA SHINDE

3. SANKET RAJKUMAR VHAVAL

4. MAZHAR ASIF SURVE

Under the Guidance of

Prof. P.V. OAK

Prof. S. C. MUNGHATE

Supportive Technical Staff

Mr. N.V. GAMARE

Mr. P. A. PATIL

Mr. K.Y. DEOLKAR

Mrs. M. M. KOKAJE

INDEX

1. Abstract

Everyone fantasies a home where all the appliances and devices work on their own without having the need for a user to intervene. This is a small step towards achieving that. Wouldn't it be great when you no longer have to use a switch to turn ON a lamp when you walk into a room , or better yet when you forget to turn it OFF , it automatically turns OFF by itself when you leave the room ?

Using this product of some very simple components and microcontroller you will be able to make the lamps, fans or other appliances in your room activated automatically when you normally walk into the room.

2. Introduction

There are two circuits: sensor module and controller module. PIR sensor module is used here to detect the Human body movement, whenever there is any body movement the voltage at output pin changes. Basically it detects the change in Heat, and produce output whenever such detection occurs.

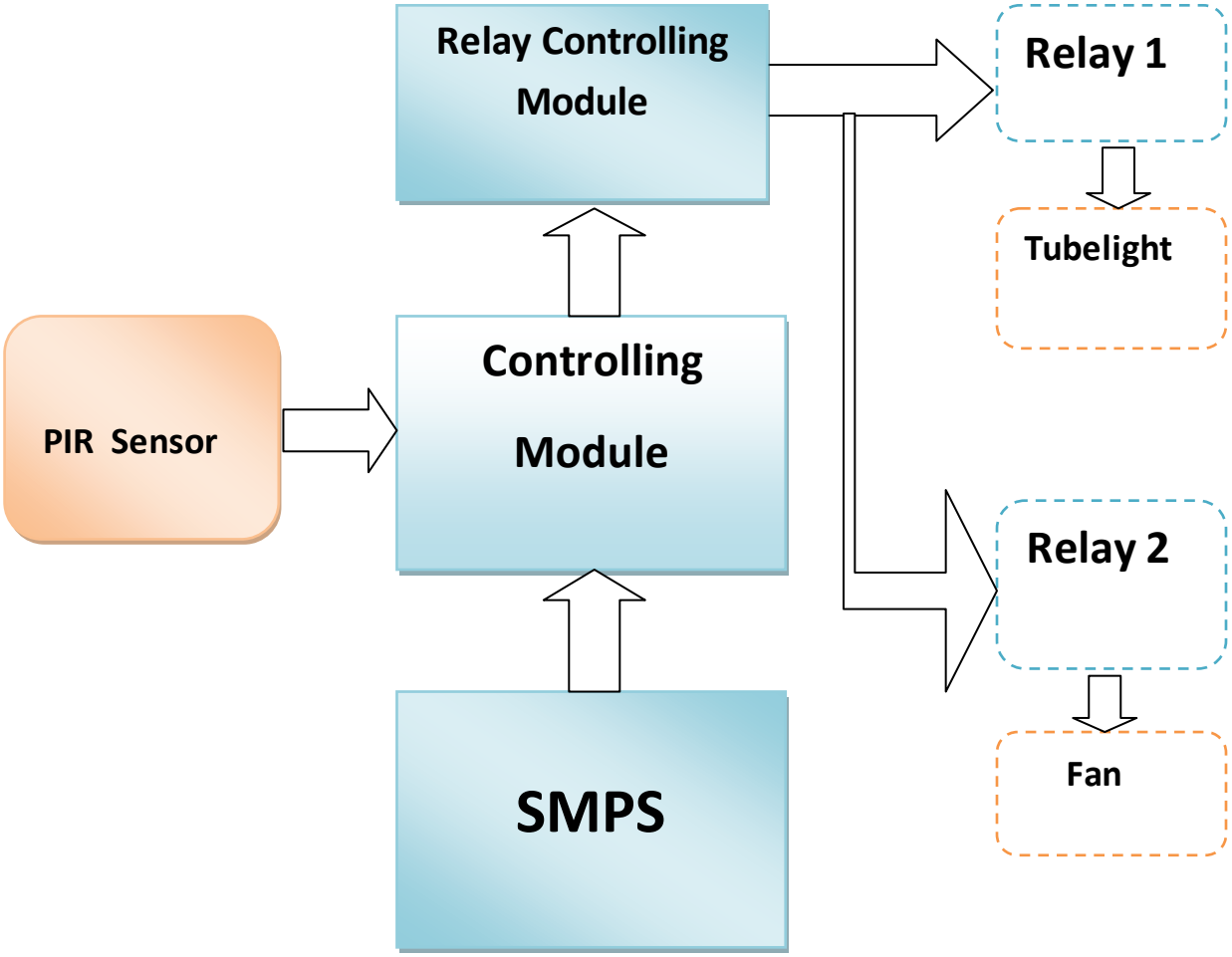
In controller module Relay is an electromagnetic switch, which is controlled by small current, and used to switch ON and OFF relatively much larger current. By applying small current we can switch ON the relay which allow much larger current to flow.

3. Objectives

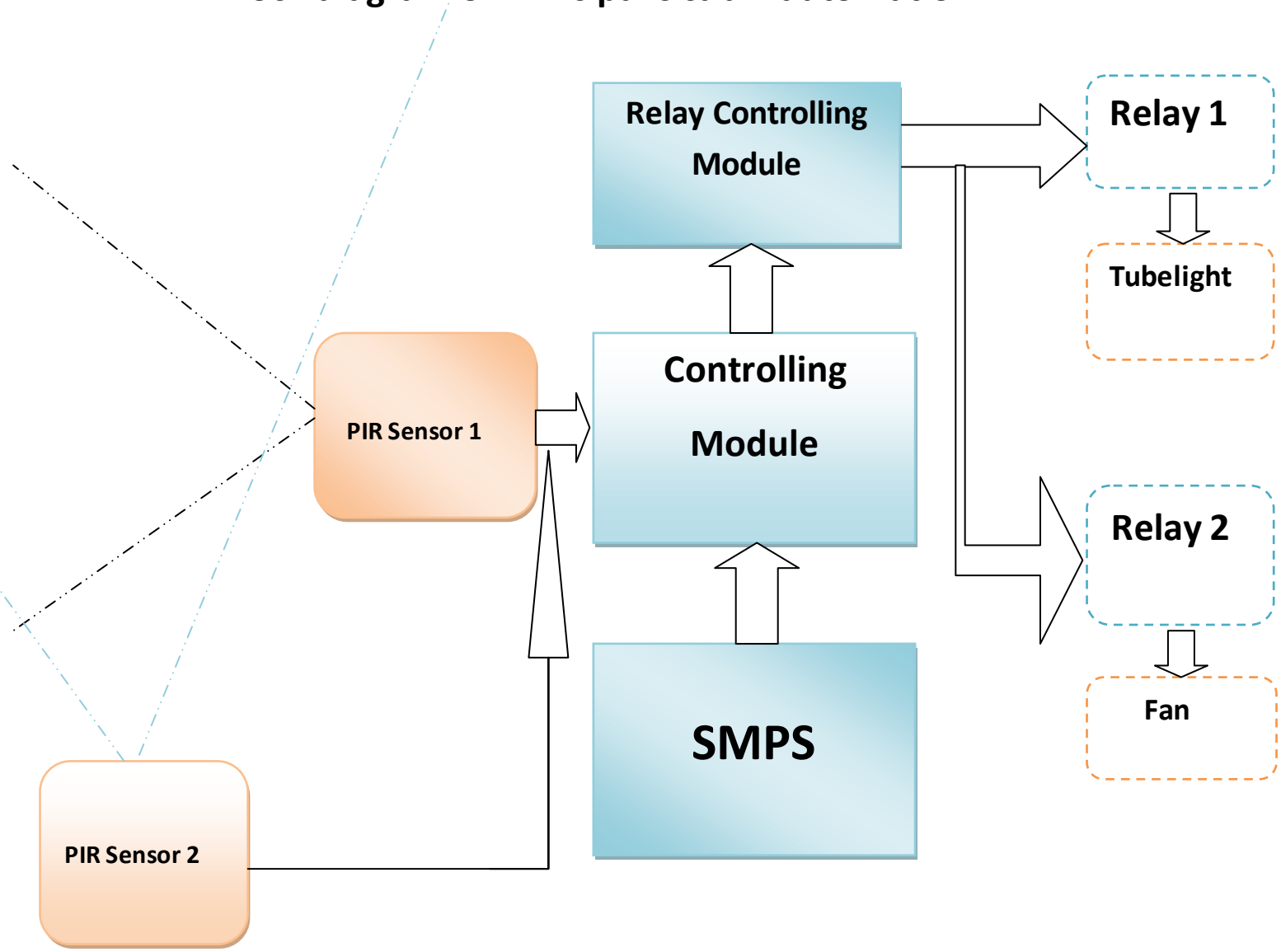
- ✓ **The main advantage of this project is energy conservation.**
- ✓ **The lights will automatically turn off when there is no buddy in room.**
- ✓ **To reduce Human efforts.**
- ✓ **Low cost implementation.**
- ✓ **This system will also get operated manually.**

4. Block Diagram

4.1 Block diagram of Washroom Automation:

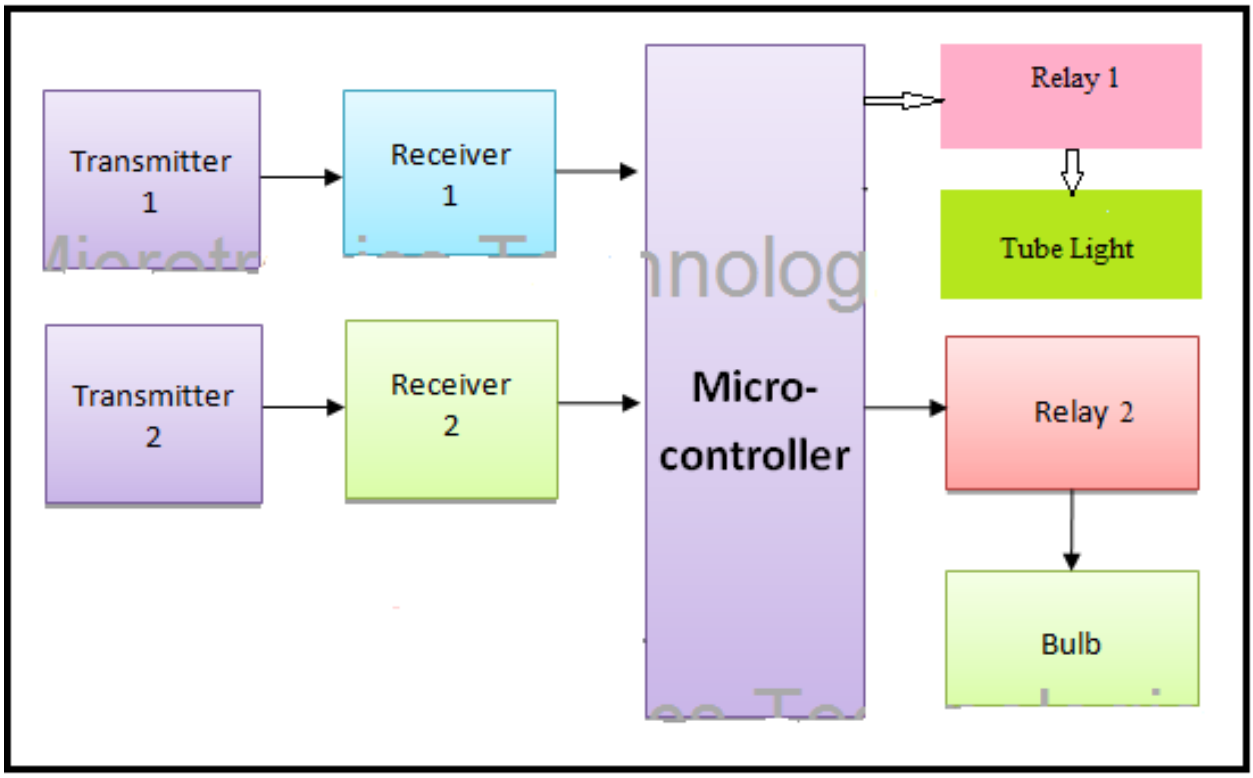


4.2 Block diagram of Principal's cabin automation:



In Principal's cabin we built the logic of two sensors. Because there was one error obtained of movement of person. Sometimes sensor could not detect the vertical movement. So we built the logic of two sensors one was at one for horizontal movement and one for vertical movement and it works successfully.

4.3 Block diagram of HOD's cabin automation



- **In Hod's cabin, there are 2 transmitters and 2 receivers placed In front of each other at door.**
- **When any person enters or leaves the room, sensors will detect the persons who enters or leaves the room and Microcontroller will increment or decrement the counter according to the signal passed from sensor.**
- **Once the count is non-zero, the room light is turned on using relay.**

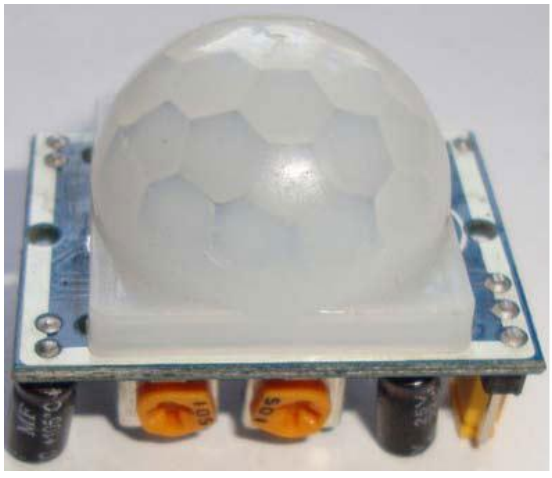
5. Components

This '**Automatic Roomlight Circuit**' switch on the room lights automatically when someone enters in the and gets off after some time. There are two important components in this circuit, first is '**PIR Sensor** (Passive Infrared Sensor)' and second is controller and relay module.

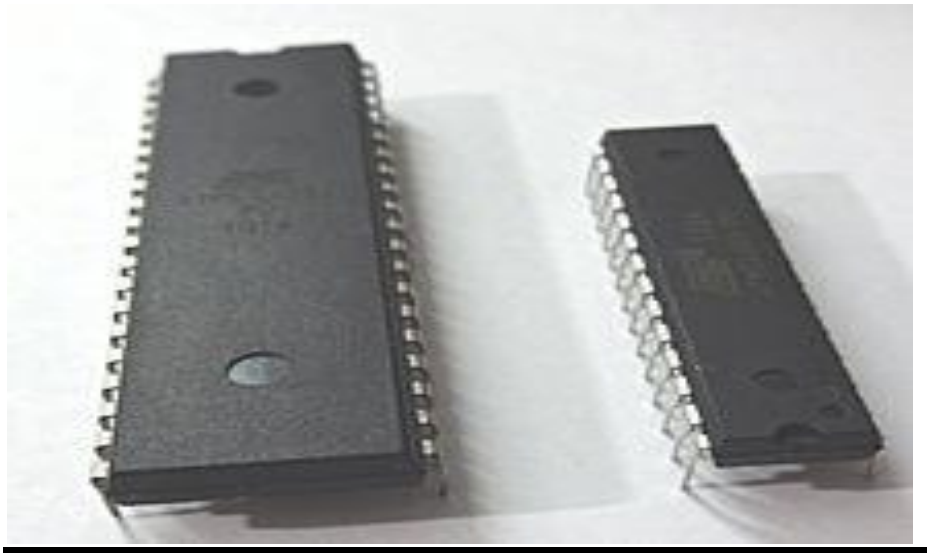
5.1 PIR Sensor :

PIR sensor is used here to detect the human body movement, whenever there is any body movement, the voltage at output pin changes. Basically it detects the change in heat, and produce output whenever such detection occurs.

The sensor is passive because, instead of emitting a beam of light or microwave energy that must be interrupted by a passing person in order to "sense" that person, the PIR is simply sensitive to the infrared energy emitted by every living thing. When an intruder walks into the detector's field of vision, the detector "sees" a sharp increase in infrared energy.



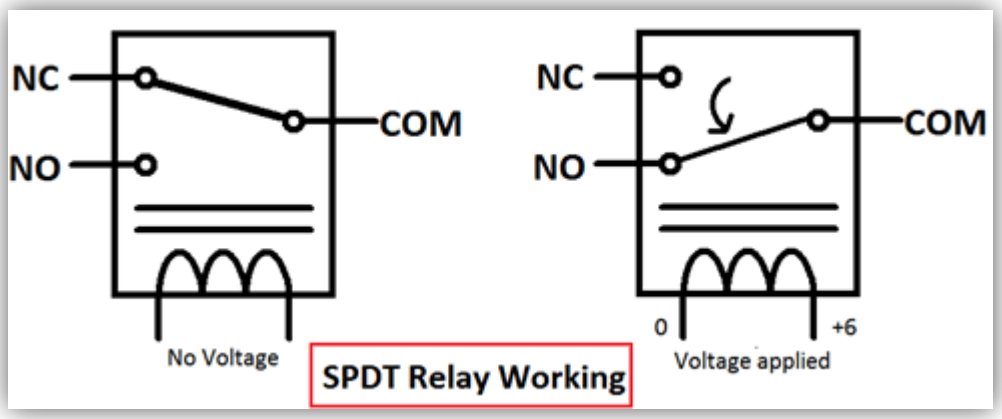
5.2 Controller:



Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems.

5.3 Relay :

Relay is an electromagnetic switch, which is controlled by small current, and used to switch ON and OFF relatively much larger current. Means by applying small current, we can switch ON the relay which allows much larger current to flow. Relay is the good example of controlling the AC (alternate current) devices, using a much smaller DC current. Commonly used relay is **Single Pole Double Throw (SPDT)** relay; it has five terminals as below:



When there is no voltage applied to the coil, COM (common) is connected to NC (normally closed contact). When there is some voltage applied to the coil, the electromagnetic field produced. Which attract the Armature (lever connected to spring), and COM and NO (normally open contact) gets connected, which allow larger current to flow. Relays are available in many ratings, here we used 6V operating voltage relay, which allow 7A-250VAC current to flow.

Relay is configured by using a small **Driver circuit** which consist a Transistor, Diode and a resistor. Transistor is used to amplify the current so that full current (from the DC source – 9v battery) can flow through coil to fully energies it. Resistor is used to provide biasing to transistor. And Diode is used to prevent reverse current flow, when the transistor is switched OFF. Every Inductor coil produces equal and opposite EMF when switched OFF suddenly, this may cause permanent damage to components, so Diode must be used to prevent reverse current.

6. Working

This automatic Room light circuit can be easily explained. Whenever PIR sensor detects any body movement, its OUTPUT pin becomes HIGH, which applies the triggering voltage to the base of the transistor, transistor get ON, and current started flowing through the coil. Coil in Relay gets energies and create electromagnetic field, which attracts the lever and COM and NO get connected. This allows a much larger current (220v AC) to flow, which turns ON the BULB.

7. Evaluation Report:

7.1 ENERGY SAVING : (1 KwH=1 UNIT)

We have connected energy meter to check the actual usage/utilization of electricity. We have made the comparison between normal and our automated setup.

- **Normal Mode Readings:**

DAY	STARTING TIME	ENDING TIME	STARTING READING ON ENERGY METER (IN KwH)	ENDING READING ON ENERGY METER (IN KwH)	POWER CONSUMED (in KwH)
DAY 1	10.00 AM	5.00 PM	0.6	1.72	1.12
DAY 2	10.00 AM	5.00 PM	1.72	2.89	1.17
DAY 3	10.00 AM	5.00 PM	2.89	4.23	1.34
DAY 4	10.00 AM	5.00 PM	4.23	5.55	1.32
DAY 5	10.00 AM	5.00 PM	5.55	6.23	0.68
DAY 6 (SUNDAY)	10.00 AM	5.00 PM	6.23	6.24	0.01
DAY 7	10.00 AM	5.00 PM	6.24	7.45	1.21
DAY 8	10.00 AM	5.00 PM	7.45	8.38	0.93
Average Reading Per Day					1.1

(Note : 1.In first week, we had put the energy meter in washroom and get the readings. In next week we implemented our Product and get the energy meter readings. And we connect only single 60W blub as a load.

2. Initial reading of energy meter before putting was 0.6Kwh)

In 2nd week, we implemented our product in washroom and connected the energy meter to it and get the readings for 1 week.

- **Automated Mode readings:**

DAY	STARTING TIME	ENDING TIME	STARTING READING ON ENERGY METER (IN KwH)	ENDING READING ON ENERGY METER (IN KwH)	POWER CONSUMPTION (IN KwH)
DAY 1	10.00 AM	5.00 PM	8.40	8.52	0.12
DAY 2	10.00 AM	5.00 PM	8.52	8.60	0.08
DAY 3	10.00 AM	5.00 PM	8.60	8.74	0.14
DAY 4	10.00 AM	5.00 PM	8.74	8.82	0.08
DAY 5 (SUNDAY)	10.00 AM	5.00 PM	8.82	8.83	0.01
DAY 6	10.00 AM	5.00 PM	8.89	9.02	0.13
DAY 7	10.00 AM	5.00 PM	9.02	9.13	0.11
DAY 8	10.00 AM	5.00 PM	9.13	9.26	0.13
AVREAGE READING PER DAY					0.14

❖ **Calculations of energy saving:**

- **Initial reading of meter : 0.6 KwH**
- **Last day reading of meter in normal mode : 8.38 KwH**
- **Average reading of meter in normal mode : 1.1 KwH**

- **Initial reading of meter : 8.40 KwH**
- **Last day reading of meter in Automated mode : 9.26 KwH**
- **Average reading of meter in Automated mode: 0.14 KwH**

7.2 Cost Effectiveness

7.2.1 According To The Monthly Billing Of College

- **The cost of per unit : Rs. 10**

  (The cost of 1 unit of electricity for household purpose is Rs.7 the cost of 1 unit of electricity for commertial purpose is Rs.10)
- **According to calculations,the monthly reading of energy meter : 25 KwH**
- **The total electricity cost for per washroom unit per month is : Rs. 250**

- **Total washrooms in whole college: 22**
- **Total monthly bill of all washrooms are: Rs. 5500**
- **Total yearly bill amount of all washrooms : 5500*12 = Rs. 66000**
- **Monthly bill amount of each washroom is = *Rs. 250***
- **Yearly bill amount of each washroom is = *Rs. 3000***

7.2.2 After Implementation Of Our Automation Project:

- **The cost of per unit : Rs. 10**
- **According to calculations,The monthly reading of energy meter : 4.8 KwH**
- **The total electricity cost for per washroom unit per month is : Rs. 48**
- **Total washrooms in whole college: 22**
- **Total monthly bill of all washrooms are: Rs. 1056**
- **Total yearly bill amount of all washrooms : 1056*12 = Rs. 12672**
- **Monthly bill amount of each washroom is = Rs. 35**
- **Yearly bill amount of each washroom is = Rs. 576**

Comparison and discussion :

- **Normally Total yearly bill amount of all washrooms : 5500*12 = Rs. 66000 .**

When our Washroom Automation project will be implemented , then

- **The Monthly bill amount of each washroom will be:**

  4.8 KwH * Rs. 10 = Rs. 48

- **The Monthly bill amount of all washrooms will be:**

  Rs. 48 * 22 Washrooms = Rs. 1056

- **The Yearly elctricity bill amount of all washrooms became :**

  1056*12 = Rs. 12672

THE COLLEGE CAN SAVE NEARLY ABOUT RS. 54000 /YEAR IN ELECTICITY BILL..

** We have considered the usage of washroom (Energy consumption) as per our infrastructure i.e. 2 washrooms on each floor.

The project automatically makes ON/OFF of the tubelights. So there is no need to put switches to ON/OFF the appliances.

8 Cost Of Our Product

AUTOMATIC ROOM LIGHT CONTROLLER PRODUCT QUATATION

Component	Price
Sensor Module And Controller M0dule	1100
Relay Module	400
Dc Power Supply Module	250
Miscellenious	750
Total	**2500**

(Note-This Is Consedered For Only 1 Room)

For 22 washrooms and 18 Labs, total expenditure is

2500*40 = Rs. 100000

Security Alarm for Important locations:

Following labs have costly equipments which needs higher security. The sensor based auto alarm system will be useful in our important labs. If implemented, it will save the energy & give more security.

Department	Lab Name	Cost Of Equipments In the Lab(in Rs.)
1. Department Of Electronics & Telecommunicatio n Engineering	1.Advance Communication Lab	10,95,873/-
	2.Telecommunication & Networking Lab includes VNA costing approx 13 lakhs	29,99,918/-
2. Department Of Computer Engineering	1.Software Engineering Lab	3,66,392/-
	2.Database Lab	3,90,814/-
3. Department Of IT Engineering	1.Computer Graphics Lab	10,39,934/-
	2.Computer Programming Lab	7,58,089/-
4. Department Of Mechanical Engineering	1.Measurment & Metrology Lab , Mechatronics Lab	9,77,000/-
	2.Fluid Mechanics Lab	10,76,000/-
	3.HOD Cabin	1,50,000/-
5. Department Of Chemical Engineering	1.Computational Fluid Dynamics	35,00,000/-
	2.Chemical Reaction Engineering Lab	17,00,000/-
	3.Mass Transfer Lab	10,00,000/-

1. Department Of Civil Engineering	1.Concrete & Technology Lab; Building material & Construction Lab	1,91,560/-
	2.Surveying Engineering lab	16,26,086/-
2. Department Of First Year	1.Physics Lab	7,73,754/-
	2.BEE Lab	5,16,153/-
3. Server Room	1.Server Room includes server, firewall, NAS costing	10,00,000/-
	2.UPS Room includes UPS-03 with battery bank, CISCO switches, DVR,EPABX costing	14,00,000/-

Checked by:

HOD, EXTC Department

HOD, Computer Department

HOD, IT Department

HOD, Mechanical Department

HOD, Chemical Department

HOD, Civil Department

Department Of First Year

System Admin

Outcome

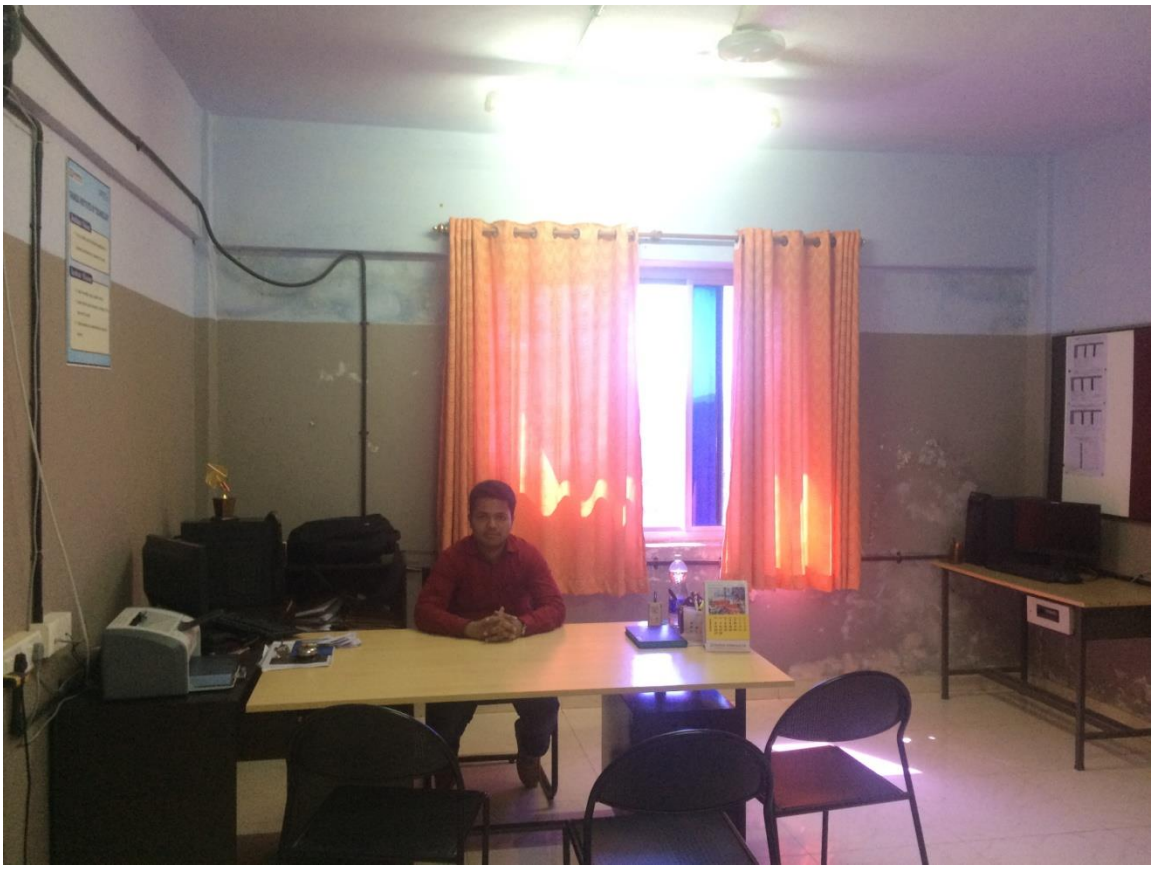
The costs for components used in normal automation systems are high in market due to which their installation and maintenance cost also increases. The components used in our project are regularly used and available in cheap price. So their maintenance and installation is easy and less costly. The billing during without automation is if Rs. 1,00,000 then after installation of this automation system the billing will be reduced to Rs. 20,000 i.e its 1/5th of normal billing. As compararing both the results of analysis, we found that after implementing the 'Washroom Automation Product' , the college will save upto Rs. 60000 in electricity bill per year. In analysis, we have connected only single 60W blub as a load. Additional electrical equipments of washrooms like tubelight,exhaust fan etc. can also be automated using our poduct. The energy conservation will also increase and college will save upto *Rs.1,20,000/- per annum.*

The total cost of whole Project will be recovered in average 6 months.

9 Our Work Places

We have implemented this project in some places as follows

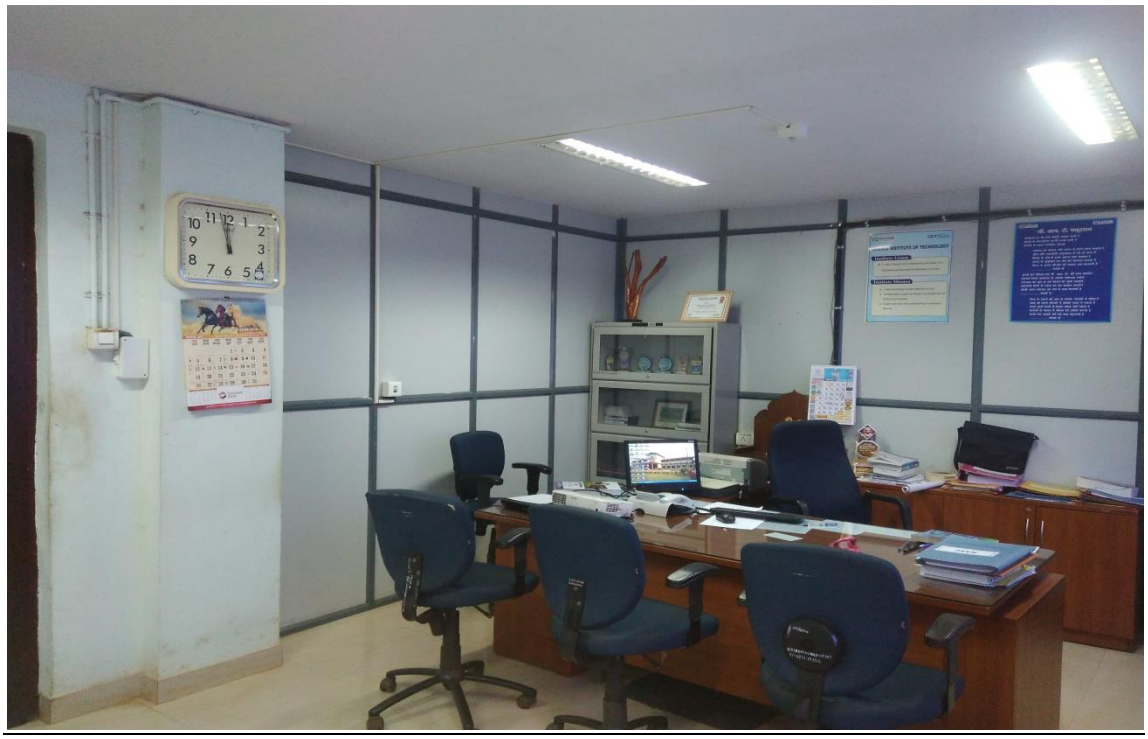
11.1 Head of Department(HOD's) Cabin, Extc Department :




SHARDA INSTITUTE OF TECHNOLOGY
Institute Mission


0003
PLEASE
SWITCH OFF WHEN NOT REQUIRED

11.2 Principal's Cabin, Gharda Institute Of Technology :



11.3 Washroom, ExTC Depratment :

11 Conclusion

The final outcome of home automation reduction of cost to great extent. After using the our product, there is great diffrence in billing and usage of units due to which energy will be saved. So, our product is cost effective, energy saving which is indirectly helping our national wealth.

12 Team Efforts


GHARDA INSTITUTE OF TECHNOLOGY
Institute Mission

13. Our Team

Vaibhav Rajaram Thakur, Team leader and idea builder

Formarly student of B.E Electronics & Telecommunication Engineering in Gharda Institute of Technology, Khed.

- ***Supportive team members:***

Shubham Vaibhav Vaidya, Team member (BE E&TC, GIT, Lavel)

Prasad Balkrushna Shinde, Team member (BE E&TC, GIT, Lavel)

Sanket Rajkumar Vhaval, Team member (TE E&TC, GIT, Lavel)

Mazhar Asif Surve, Team member (TE E&TC, GIT, Lavel)

- ***Project guides :***

Prof. Pratik V. Oak, Project guide

Prof. Sandeep C. Munghate, Project guide

Technical supportive staff

Mr. Nitin V. Gamare, Technical staff member

Mr. Pravin A. Patil, Technical staff member

Mr. Khemraj Y. Deolkar, Technical staff member

Mrs. Manasi M. Kokaje, Technical staff member