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# **Smart Light Intensity Management System**

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Abstract - In recent times with the increase in overall consumption of electricity all over the globe most of the energy is being wasted unnecessarily. Most of the time the lights are left on while nobody is present in the room for hours unknowingly. Some of the lighting systems have come with Remote system towards controlling the lighting similar to air conditioner which is being used in homes. But still there is a challenge towards leaving the lights unattended when person is not in the room. The goal of the project is to design a smart lighting system for homes with the aim of energy saving and autonomous operation. So accordingly, we here in this research have developed Automatic lighting and control it using Arduino for the efficient use of energy in the room. In addition to relay control, we have also provided mobility and remote command execution to system using Android mobile App to control lighting based on voice command. This system is designed to switch the room lights on when a person enters in and leaves out of his room and also depending on the external lights. The objective of this system is to save the energy consumption as well as to automatically control the room lights by turning off all the lighting appliances when nobody is present in the room.

Key Words: Arduino, LED, LDR, PIR etc.

# **1. INTRODUCTION**

There exists a wide diversity of home electronics with incompatible remote controls. The motivation of this work is hence to develop a platform, either on a smart phone or a tablet, for interoperability among these remote controls, such that the real time monitoring on home energy use can be achieved, and the brightness as well as the lighting modes of a smart LED lighting system can be switched. In a conventional lighting system, a light source can be merely switched on/off manually, while, instead in a smart one, various pre-set lighting modes are preloaded into the lighting system, either wired or wireless, to meet the user's specific needs.

The smart lighting system employs techniques to control the lights automatically or semi-automatically and to adjust the light intensities based on occupant's visual comfort.

The smart lighting system may also comprise of heterogeneous lights and can be controlled using the same unified controlling system. Harnessing daylight makes a lighting system more energy-efficient. The main goal of a smart lighting system is to achieve energy efficiency without sacrificing the visual comfort of the occupants. A smart lighting system considers several parameters, including natural daylight available in the building, user preferences, user movement, and occupancy in the home to control illuminance.

#### 2. IMPLEMENTATION

This system makes use of two sensors as PIR sensors and LDR sensors and a microcontroller such as Arduino Uno or Nano and a WI-FI module to control the lights from a long distance using a mobile or a computer. These appliances will be connected to the relays which are controlled by the Arduino. The WI-FI module and Arduino together acts as a Web Server and we will send control commands through a Web Browser like Google Chrome or Mozilla Firefox.



**Fig -1**: Data flow diagram

The additional sensors can make the lights turned on or off upon detecting a human presence in the room by programming the Arduino.

#### 2.1 ARDUINO UNO

[1]**Arduino UNO** is a microcontroller based board on the ATmega328p. It has 14 digital input and output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It can easily be connected to a computer by a USB cable.



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Fig 2. Arduino UNO

## **2.2 WI-FI MODULE**

[2] **ESP8266** is a self-contained SoC with an integrated TCP/IP stack that allows you to access a Wi-Fi network for any microcontroller with UART. It can be both a Wi-Fi access point and a Wi-Fi client. It is pre-programmed with AT commands, so a microcontroller can be easily accessed and configured.





Fig 4. PIR Sensor

## 2.4 LDR SENSOR

Light dependent resistors (LDR) are light sensitive devices that are most frequently used to indicate the presence or absence of light or to measure the intensity of light. As light sensors, light-dependent resistors are most often used. They are often used when the presence and absence of light is detected or the light intensity is measured. Depending on the exterior lighting, this system uses LDR sensors to control the room lights.



Fig 3. WI-FI Module

# **2.3 PIR SENSOR**

The [3] **PIR** sensor detects changes in the amount of infrared radiation that affects it, which varies according to the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human, passes in front of the background, such as a wall, the temperature rises from room temperature to body temperature at that point in the field of view of the sensor and then returns back. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage and thus, detection is triggered. Depending on an individual's presence, this system uses PIR sensors to control lights.

Fig 5. Light Dependent Resistor

## **3. LITERATURE SURVEY**

We have been studying various existing smart lighting systems and found a couple of them working towards achieving a similar objective as ours. We found out the common obstacle in developing a smart lighting system is the expensive cost of the components needed. Most of the systems are found using the less expensive Arduino UNO over the Raspberry Pi which on the other hand has the ability to control more devices but isn't economically preferable. Our project aims at smaller household lighting systems and hence incorporating a Raspberry Pi would not be suitable.

In [4] Implementation of Automatic Room Light Controller with Visitor Counter Design using 8051 Microcontroller (E.Shilpa1, Bushra Begum 2 et al.) the system uses sensors which are connected to each other via Infrared. When visitors cross the infrared bar, the microcontroller increments the counter and likewise reduces the counter if person goes in opposite direction. It also uses a 7 Segment display to show the count.

Another system for [2] Automatic room light intensity detection and control using microprocessor and light sensors (Ying-Wen Bai ; Yi-Te Ku) also employs similar approach at controlling the lights in the room. A home light control module will be installed wherever needed. The module consists of four parts namely : PIR sensor, RF Module, Microprocessor and the Light Control circuit.

## 4. RESULTS

When the individual enters the room, the sensors will sense the movement and the Arduino will turn on the lights. And once no activity is sensed, lights will be turned off. Depending on the outdoor lightings, the room lights will be turned on or off.

Users can alternatively use the app with a login to control the lights with the Wi-Fi module. With the use of Wi-Fi module, it is possible to control lights from the local network.



Fig 6. User Interface of the Android application

# **5. CONCLUSIONS**

With the help of rapidly developing internet and communication technologies today's home also have strong computation and communication abilities. An IOT-based intelligent home is emerging as an important part of the world's smart and intelligent cities. The aim of this system is to improve the standard of living and to save energy and resources. This intelligent home system plays an important role in society's development. The system proposed can be implemented in accordance with user requirements.

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