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AUTOMATION OF LAB

Gayatri Khadgi*1, Gousiya Khan*2, Gungun Tembhurne*3, Abhishek Raut*4, Tushar Gaikwad*5 Student of Electronics & Telecommunication Engineering
GUIDE : **Dr. Tirupati Goskula** Associate Professor ,, Dept. of Electronics & Telecommunication, ACET, Nagpur Maharashtra, India

Rashtrasant Tukadoji Maharaj Nagpur University (RTMNU) Nagpur Maharashtra, India.

Abstract— Lab automation for fans and lights is a revolutionary technology that allows users to control and manage their fans and lights remotely using smart devices such as smartphones or voice assistants. By integrating wireless communication and smart switches, users can easily turn on/off, adjust settings, and create automation rules for their fans and lights. This not only provides convenience but also promotes energy efficiency by allowing users to schedule operations and optimize energy consumption. With lab automation, users can transform their living spaces into smart, personalized environments that enhance comfort and control.

Keywords: Smart building, Energy Conservation , PIR Sensor , ESP 32 , Relay Module

I. INTRODUCTION

We are automating the workshop lab, in which we chose one side of the same, having 8 Lights and 2 Fans. This is the Switchboard of Lab of Side 1, here we have considered S as Switch- which is further numbered from S1 to S8, similarly F1 and F2 as Fans and L as Light.

Here, we can see, by S1, F1 is being switched on, by S2, L1 and L3 are being switched on, by S3 L2 and L4 are being switched on, by S4, F2 is being switched on, by S5, L5 and L7 are being switched on and lastly by S6, L6 and L8 are being switched on. Remaining two switches, S7 and S8 are considered as sockets.

When a person will enter into the workshop lab the electrical appliances should Switch ON automatically and when he/she leaves the workshop lab the electrical appliances should Switch OFF automatically. Besides this if we don't need automation in some selected appliances then there should be provision for that.

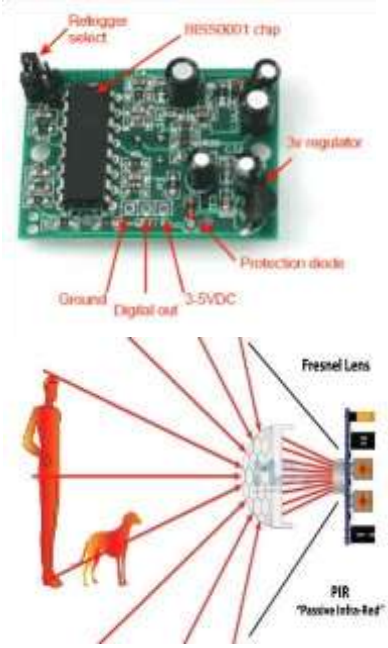
I.I. PIR SENSOR

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIRbased motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

PIR sensors detect general movement and detect such activities, but do not give information on who or what moved. For that purpose, an imaging IR sensor is required. PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".

The PIR sensor has two slots that detect infrared radiation. When a person, enters the sensor's range, the radiation pattern changes, and the sensor detects this change. This triggers an output signal that can be used to activate lights, alarms, or other devices.

PIR sensors are commonly used in security systems, automatic lighting systems, and even in wildlife monitoring.

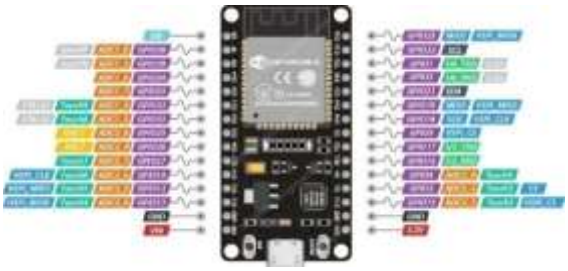


I.II. ESP 32 CONTROLLER (ESP 32 DEV KIT V1

The ESP32 is dual core microcontroller with integrated wifi and bluetooth connectivity , In this we have used ESP32

DEV kit v1 it is built on the ESP-32 module , a new miniature high-performance Wi-Fi + BT + BLE chip from Espressif, designed for a wide range of applications, from micro-power network sensors to the most complex applications, such as encoding, streaming music and MP3 encoding.

WifiEspNow is as arduino library for ESP-NOW ,a connectionless Wifi communication Wifi communication protocol difined by Espressif. In this controller there are 36 pins of IC, And the frequency range of this controller is 240Mhz



In this controller we have used GPIO PINS , it is responsible to control or read the state of a specific pin in digital word in simple words GPIO is to communicate to the CPU the ON/OFF signal received from the switches.

I.III. RELAY MODULE

The eight-channel relay module contains eight 5V relays and the associated switching and isolating components, which makes interfacing with a microcontroller or sensor easy with minimum components and connections. Each relay on the board has the same circuit, and the input ground is common to all eight channels. Operating Voltage : 5V DC

Operating Current : 70 mA

Max AC load current : 10A at 250VAC

Max DC load current : 10A at 30V DC

Operating time : 10msec

Release time : 5msec

A Relay is an electromechanical device that can be used to make or break an electrical connection. It consists of a flexible moving mechanical part which can be controlled electronically through an electromagnet, basically, a relay is just like a mechanical switch but you can control it with an electronic signal instead of manually turning it on or off. Again this working principle of relay fits only for the electromechanical relay.

II. LITERATURE REVIEW

Lab automation for fans and lights is a popular topic. While I don't have access to specific literature at the moment, I can give you a general overview of the benefits and technologies involved.

Lab automation for fans and lights allows you to control and manage these appliances remotely, making your lab more convenient and energy-efficient. Here are a few key points:

1. Convenience: With lab automation, you can control your fans and lights through your smartphone or voice commands. This means you can easily turn them on or off, adjust their speed or brightness, and even set schedules or create scenes to automate their behavior.

2. Energy Efficiency: Lab automation systems often include features like occupancy sensors and smart algorithms that optimize energy usage. For example, lights can automatically turn off when no one is in the room, and fans can adjust their speed based on temperature or occupancy, saving energy and reducing utility bills.

3. Integration and Compatibility: Lab automation systems can integrate with various technologies and protocols, such as Wi-Fi, Zigbee, or Z-Wave, allowing you to control your fans and lights alongside other smart devices in your home, like thermostats, security systems, or voice assistants.

4. Customization and Personalization: Lab automation systems offer flexibility in terms of customization. You can create personalized settings, scenes, or routines tailored to your preferences and lifestyle. For example, you can set up a "Good Morning" scene that gradually turns on lights and starts the fan at a specific time to wake you up gently.

5. Remote Access and Monitoring: With Lab automation, you can control your fans and lights even when you're away from lab. This means you can remotely turn them on or off, providing security and peace of mind. Some systems also offer monitoring capabilities, allowing you to track energy usage or receive notifications for unusual activity.

When conducting a literature review, it's best to explore academic databases, research papers, and technical articles related to lab automation, Internet of Things (IoT), and smart lab. Look for studies that discuss the effectiveness, energy savings, user experience, and challenges of implementing lab automation systems for fans and lights.

III. METHODOLOGY

When it comes to the methodology for lab automation of fans and lights, there are a few common approaches you can consider:

1. Wireless Communication: One of the key aspects of lab automation is the wireless communication between devices. You can use technologies like Wi-Fi, Zigbee, or ZWave to establish communication between your fan/light and the control system. This allows you to send commands and receive status updates wirelessly.

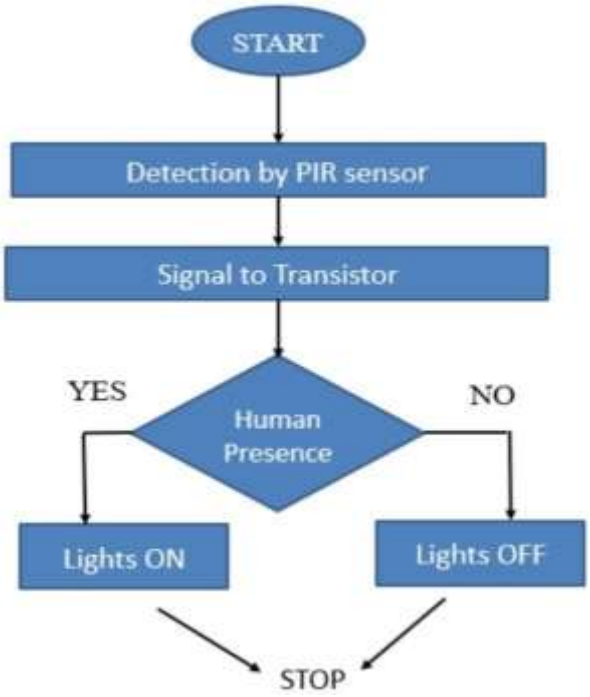
2. Control Hub or Gateway: A central control hub or gateway acts as the brain of your lab automation system. It connects to your lab network and communicates with all the smart devices, including your fans and lights. You can control and manage these devices through a smartphone app or a web interface provided by the control hub.

3. Smart Switches or Modules: To automate your existing fans and lights, you can replace traditional switches with smart switches or install smart modules behind them. These devices enable wireless control and can be integrated with the control hub. They often support features like scheduling, dimming, and remote access.

4. Voice Control Integration: If you want to add voice control to your lab automation setup, you can integrate voice assistants like Amazon Alexa or Google Assistant. These assistants can be connected to your control hub, allowing you to control your fans and lights using voice commands.

5. Programming and Automation Rules: Most lab automation systems provide programming or automation capabilities. You can create rules or scenarios that define the behavior of your fans and lights based on specific conditions. For example, you can set a rule to turn off the lights and reduce fan speed when no one is in the room for a certain period of time.

When implementing the methodology, it's important to consider factors such as compatibility, reliability, and security. Make sure the devices you choose are compatible with your chosen communication technology and control hub. Also, pay attention to security measures, such as using strong passwords and keeping your software/firmware up to date.



FLOW CHART

IV. CONCLUSION

Lab automation for fans and lights offers convenience, energy efficiency, and enhanced control over your living space. By implementing wireless communication, a control hub or gateway, smart switches or modules, voice control integration, and automation rules, you can create a seamless and personalized lab automation system. With just a few taps on your smartphone or a voice command, you can effortlessly control your fans and lights, making your home smarter and more comfortable.

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