IOT AND SENSOR INTEGRATED HOME AUTOMATION AND SURVEILLANCE USING RASPBERRY PI PICO W

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ABSTRACT

In today's rapidly advancing technological landscape, automation and smart systems are revolutionizing the way we monitor and control our surroundings. Smart home automation integrates Internet of Things (IoT), sensor-based technology, and Wi-Fi networking to enhance security, efficiency, and convenience. This project aims to develop an intelligent area monitoring system that provides real-time surveillance, automated control, and remote access, making everyday operations more seamless and secure With the increasing demand for smart monitoring solutions, this project offers a reliable and scalable approach to automating security, environmental control, and home automation systems. By leveraging IoT-enabled devices, sensor-driven automation, and wireless connectivity**,** the system ensures optimal performance, energy efficiency, and user-friendly operation. The proposed system utilizes IoT Mode for cloud-based remote access, Sensor Mode for real-time environmental detection, and Wi-Fi Network for seamless data transmission and multi-device connectivity. These technologies work together to create an innovative automated area monitoring system that enhances safety, responsiveness, and ease of use. This report outlines the project's objectives, applications, and key technologies, demonstrating its significance in smart automation, security enhancement, and intelligent monitoring solutions**.**

Keywords

Home Automation and Surveillance, Raspberry PI Pico W, Thonny IDE, MQTT Dash, Micro Python.

1. INTRODUCTION

A smart home is a specialized home where appliances can be controlled automatically and remotely. A smart home is called "intelligent", because its computer systems can monitor many aspects of daily life [1] . The home automation concept is a promising and cost-effective way of non-invasively improving home care for the elderly and disabled, allowing for greater independence, helping to maintain good health and preventing social isolation [2]. Smart home consists of home appliances, sensors, actuators and data processors and analysers. [3]. This paper suggests a home automation and security monitoring system based on Raspberry PI. The main objective of this paper is that it presents an easy to implement, flexible and scalable solution to create a smart home environment with security..

2. MAIN SECTION- I

2.1 EXISTING SYSTEM

This paper shows a project based on two main parts. First part is security surveillance in which when a person presses the doorbell then his/her image detected by camera and checking with store data then if it found a known person which match by stored data, the door automatically opens and if unknown person found then automatically is detect the person in home by PIR sensor and if no one found in home then it sends mail to home owner. This part consists of PIR sensor, bell button, DC motor, camera, personal computer, buzzer, LCD display, serial communication module. The second part of the system is home automation based on raspberry pi. Which is for monitoring, tracking and analysing a home and controlling the appliances. It consist of raspberry pi3, GAS sensor, PIR sensor, temperature sensor and other all sensors, ADC module, LCD display and home appliances. In this system the PIR sensor is used for detect any person in the home if any person detected in the home by this sensor the automation system is activate and by detecting temperature by temperature sensor the fan automatic switch on or off and by detecting light intensity the bulbs automatic switch on or off. The gas sensor used to detect smoke if any smoke is detected in the home the alarm automatically turned on and also it sends a message to the home owner. The LCD display is used to display this all-system work with readings. In this way the home automation system works.

The Conclusion part of the existing system:

Homes nowadays have different features oriented to different users of the environment which makes the home automated. Current trends in home automation include automatic lighting, automatic temperature adjustment, energy management, mobile or email notifications, streaming media, remote video surveillance, and more. [9]. Home automation systems with security are also perfectly useful in residential settings for the elderly or disabled, where they aim to support autonomous living. [10]. And, like most technology, smart home technology gets better with age. It gets smarter, less expensive, and easier to use every year. Smart home system can provide human a kind of easy, orderly and effective life style, and should be the development trend for future habitat.

3. MAIN SECTION- II

3.1 PROPOSED METHODOLOGY

The proposed part of the system is home automation based on raspberry pi, which is for monitoring, tracking and analysing a home and controlling the appliances. it consist of raspberry pi pico w, LDR sensor, LDR sensor, temperature sensor and other all sensors, I2c module, LCD display and home appliances. In this system the Microwave sensor is used for detect any person in the home if any person detected in the home by this sensor the automation system is activate and by detecting temperature by temperature sensor the fan automatic switch on or off and by detecting light intensity the bulbs automatic switch on or off. The LCD display is used to display this all-system work with readings. In this way the home automation system works.

SENSOR MODE:

This mode enables fully automated operation, relying on sensor inputs to determine the appropriate actions for controlling the fan and light. The system dynamically adjusts to environmental conditions without requiring user intervention.

Motion Detection Using PIR Sensor:

- The **Microwave sensor** continuously monitors for movement in the room.
- If motion is detected, the system proceeds to check temperature and light levels before activating any appliances.

Temperature-Based Fan Control:

- The **DHT11 temperature and humidity sensor** is used to measure the room temperature.
- If the temperature exceeds a predefined threshold (e.g., **28°C**), the Raspberry Pi Pico triggers the relay to turn the **fan ON**.
- If the temperature drops below the threshold or no motion is detected for a specific duration, the fan is turned **OFF** automatically.

Light Control Based on Ambient Light Conditions:

- The **LDR (Light Dependent Resistor) sensor** detects ambient light levels.
- If the room is too dark, the system activates the **relay to turn the light ON**.
- If there is sufficient natural light, the system keeps the light **OFF**, conserving energy.

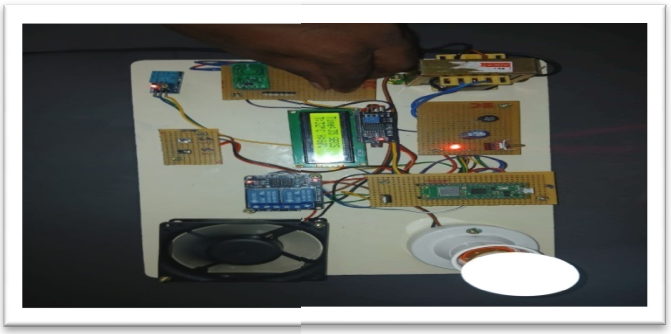

Fig 1:Result of Sensor Mode

MOBILE IoT MODE:

In this mode, the user has full control over the fan and light through a mobile application, allowing for remote operation. The connection between the mobile device and the Raspberry Pi Pico is established via **Wi-Fi** (either built-in or using an external module), enabling seamless communication.

- **System Setup:**
  - The Raspberry Pi Pico is connected to the mobile application over Wi-Fi or another IoT communication protocol.
  - The mobile application provides a simple user interface for sending commands to the Pico.
- **Fan and Light Control:**
  - The user sends commands through the mobile app, which are transmitted to the Raspberry Pi Pico.
  - The Pico receives the command and activates the corresponding relay to **turn the fan or light ON/OFF**.
- **Real-Time Status Feedback:**
  - An **LCD display** on the system provides visual feedback, showing the current state of the fan and light.
  - The user receives confirmation through the mobile app when an action is executed.

Fig 2: Result of IOT Mode

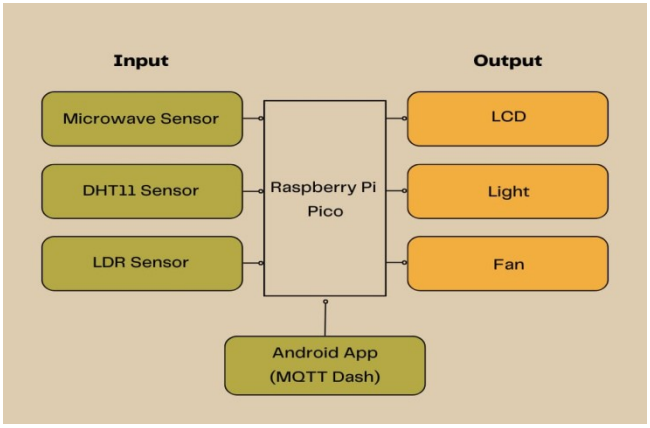

Fig 3: Block diagram of Proposed system

3.2 SYSTEM IMPLEMENTATION

(i) Hardware Requirement:

- Power supply
- Raspberry Pi Pico W
- LDR Sensor
- DHT 11 sensor
- Microwave Sensor
- LCD Display
- I2c module

(ii) Software Requirement:

- Thonny IDE
- Micro Python

SOFTWARE RESULT:

▪ When the system operates in Mobile IoT Mode, the user controls the fan and light manually through a mobile application connected via Wi-Fi or another IoT protocol. Here's how it works:

▪ Setup: The Raspberry Pi Pico connects to the mobile app over Wi-Fi (or an external module if the Pico lacks built-in Wi-Fi capability).

▪ Fan and Light Control: Through the app, the user sends commands that the Pico receives. When a command is received, the Pico activates the respective relay to control the fan or light.

▪ Feedback Loop: The LCD shows the current status, confirming the on/off state of the fan and light based on the user's commands, providing immediate visual feedback.

▪ The IoT mode empowers users with remote control, adding convenience for scenarios where the sensors may not be needed or the user prefers to adjust conditions manually.

Fig 4: MQTT Dash Application result

This project's successful outcome ensures to the way we live, making homes more convenient, efficient, and secure. With advancements in IoT, and homeowners can now control lighting and temperature. These systems not temperature only enhance comfort but also improve energy efficiency, reducing costs and environmental impact.

4. Conclusion

This project is developed to make a smart home automation system using microcontroller, sensor module. Their main requirements was a system that could be operated using by an app, voice control to operate the appliances from anywhere. The differently-abled, old peoples will be the most beneficiary of this system as they can operate the appliances independently. The system requires a Wi- Fi or an internet connection to function and in the absence of internet connection, Bluetooth connection is been used to function the operation efficiently. So, we proposed this system which to be highly energy saving and reliable and make people feel more comfortable and satisfied. Now everyone can utilize this technology to operate the appliances. The home automation system has been experimentally proven to work satisfied by connecting sample appliances to it and the application were successfully controlled from a wireless mobile device. We learned many skills such as soldering wiring the circuit and other tools that we use for this project and was able to work together as a team during this project. The Bluetooth client was successfully tested on a multitude of different mobile phones from different manufacturers, thus proving its portability and wide compatibly. Thus a low- cost home automation system was successfully designed. Implement and tested.

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