IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SMART ROOM- A GESTURE CONTROLLED TECHNOLOGY

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Abstract

Switches and infrared remote controls are frequently used to operate electrical appliances and devices today. The moment has come to swap out the current control system for a new one. This new system's primary goal is to let users operate electronics with finger and gesture movements. Automating the use and control of household equipment is known as home automation. Lighting, climate, entertainment systems, and appliances can all be managed by an automation system in the home. In this, we suggested using hand gestures to automate home applications and also handle system papers. For those who are physically unable of reaching the switches or who are physically handicapped, this system may also be the ideal option. Due to its practicality and simplicity, gesture-based home automation is growing in popularity. In this project, we suggest a Raspberry Pi Pico microcontroller, Flex Sensor, accelerometer sensor, relay module, MP3 module, and GSM module for a gesture-based home automation system. The Raspberry Pi Pico receives data from the Flex Sensor and Accelerometer Sensor, which detect hand gestures and motions, respectively. The Raspberry Pi Pico deciphers the information and sends instructions to the relay module to control other devices like lights or motors or to the MP3 module to change the level of an audio output. The GSM module can also be used to remotely activate or deactivate a phone using hand gestures.

Keywords: Raspberry Pi Pico, Flex Sensors, Accelerometer Sensor, Relay Modules, GSM Module, MP3 Player are some of the keywords.

Introduction

The Internet of Things (IoT) is the interconnection of physical objects, such as furniture, cars (also known as "connected devices" and "smart devices"), buildings, and other items, which are outfitted with electronics, software, sensors, actuators, and network connectivity to enable data collection and exchange. The Internet of Things (IoT) was referred to as "the infrastructure of the information society" by the Global Standards Initiative on Internet of Things (IoT-GSI) in 2013. The function of automation in modern life and the world economy is becoming more and more important. Engineers work to construct complicated systems for a continuously expanding range of applications and human activities by fusing automated technologies with mathematical and organisational skills.

Since the late 1970s, there has been talk of home automation. But as technology has advanced and smart services have become more accessible, people's expectations for how well a traditional house can be transformed into a smart home have changed significantly. These expectations have affected how people view home automation systems as well as what a home should be able to do and how services should be offered and accessed in a smart home.

Literature Survey

1.J. Chen, Y. Wang, and Y. Xie's article "A Review of Smart Home Applications Based on the Internet of Things" is the first. With a focus on Internet of Things (IoT) technology, this article offers an overview of the fundamental ideas and uses of smart home systems. The writers go over the numerous elements and characteristics of smart home systems, as well as the advantages and disadvantages of putting such systems into practise.

2. X. Li, W. Li, and X. Li, "Smart Homes for Elderly Healthcare—Recent Advances and Research Challenges" This study looks at how smart houses might help older patients receive better treatment. In order to fully realise the potential of smart home healthcare applications, the authors explore the numerous sensors and devices that can be incorporated into a smart home system to monitor and manage health issues. They also identify the major research hurdles that must be overcome.

3. R. Sterritt, R. Curran, and M. Gardiner's "A Survey of Smart Home Automation Systems and Technologies" The numerous smart home automation systems and technologies that are currently on the market are thoroughly reviewed in this study. The authors offer a critical assessment of the state of the art in smart home automation by examining the salient characteristics and capabilities of each system, as well as

their advantages and disadvantages.

4. S. Karthikeyan, R. Selvakumar, and N. Nithya's "Design and Implementation of a Smart Home Automation System Using Raspberry Pi" In this work, the design and implementation of a Raspberry Pi-based smart home automation system are discussed. The writers go over the system's numerous hardware and software components as well as design concerns and difficulties associated with creating a dependable and expandable smart home system.

5. T. K. Das and J. R. Jang's "An Overview of Smart Home Security and Privacy" - The security and privacy concerns relating to smart home systems are examined in this research. The authors go over the numerous hazards that smart homes are exposed to as well as the technical and policy-based remedies that may be applied to reduce these dangers and guarantee the security and privacy of smart home users.

Existing System

The hardware of the current system has been modified by the removal of the RF transmitter and RF receiver portions, which results in the entire circuit being linked with a single PIC microcontroller. Additionally, a Bluetooth HC05 hardware module was included, allowing the system to accept voice instructions for controlling home appliances. The bluetooth module and MEMS sensor are connected to the pic microcontroller in the current arrangement. When particular movements are done, the MEMS accelerometer generates analogue values.

The microcontroller's ADC receives these analogue values. These analogue values are converted into numerical values by the PIC microcontroller. A code is written for the microcontroller using the Pic C compiler. As a result, the generated numbers are compared to the threshold values that have been set in advance and written in code that is loaded into the microcontroller. The relevant home appliances are managed based on the comparison. Serial communication is used to link the microcontroller and bluetooth hc05. The hc05 transforms speech instructions into text before comparing them. The proper home appliance is run if comparison is successful.

Flow Chart for Bluetooth Module: (voice based operation)

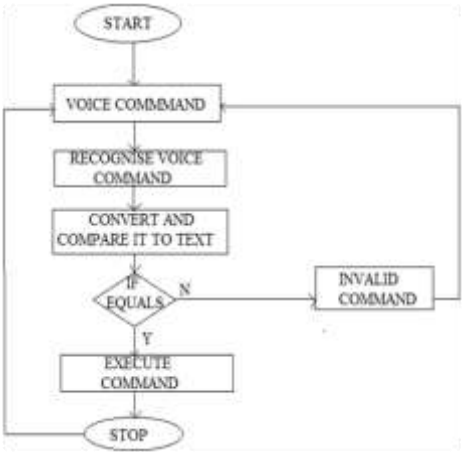

Fig 1: Flow chart -I of the existing system

Flow Chart for MEMS (Gesture based operation)

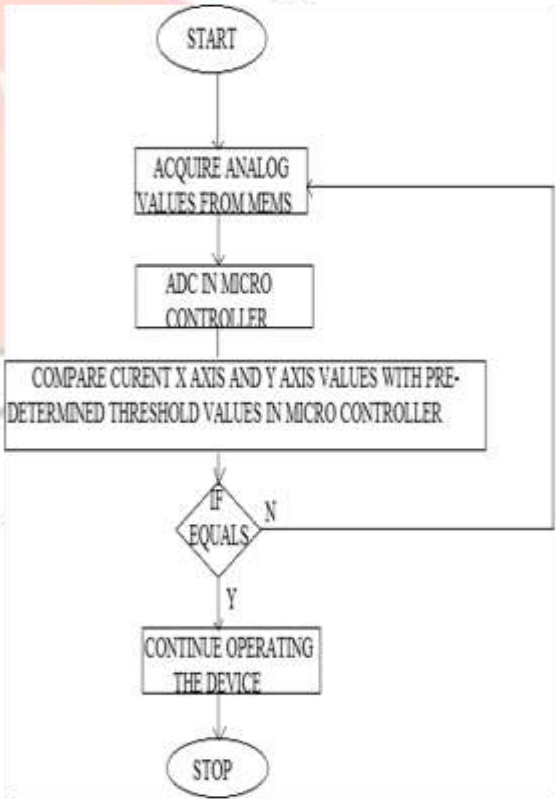

Fig 2: flow chart -II of the existing system

Proposed System

In the proposed system, we used gesture-based home automation using a Flex Sensor and an accelerometer sensor, coupled with a Raspberry Pi Pico, relay module, MP3 module, and GSM module, which can be used to control an MP3 player's volume and turn on and off a phone.

Hand gestures can be recognised using the Flex Sensor and the accelerometer sensor. The accelerometer sensor detects movement and position, while the flex sensor gauges the amount of bending. The Raspberry Pi Pico, which may be used to link these sensors, can evaluate the sensor data and decide what should be done.

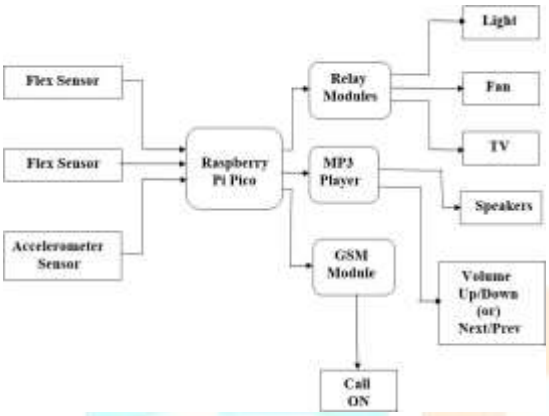

Fig 3: Block diagram of proposed system

A) Flex sensor

A sensor known as a flex sensor monitors changes in a material's bending or angle. It comprises of a tiny strip of conductive material, like carbon, that is attached to a flexible substance, like plastic or rubber. The resistance of the conductive material changes as the sensor bends or flexes, and this change in resistance can be measured and utilised to establish the degree of bending. Flex sensors have several uses, including in robotics, medical technology, and electronic instruments.

Fig 4: Flex Sensor

B)Accelerometer Sensor

A sensor called an accelerometer monitors acceleration, as well as changes in velocity and direction of movement. It is frequently used in applications like motion detection, vibration analysis, and tilt sensing since it can detect both linear and rotational acceleration. An accelerometer sensor works on the fundamental premise that it has a mass inside suspended by springs, and that as the sensor is moved or accelerated, the mass moves in relation to the sensor body. Piezoelectric materials, which produce an electrical signal proportional to the acceleration, are used to measure this movement.

Fig 5: Accelerometer Sensor

Relay modules are electronic parts that let you use low-voltage or low-current signals to control high-voltage or high-current circuits. Electrical devices like motors, lights, and appliances can be turned on and off using automation and control systems. One or more relays, which are essentially switches that are actuated by an electrical signal, make up a relay module. Depending on the arrangement, the relay shifts from its ordinarily open (NO) position to its usually closed (NC) position when the signal is received.

Fig 6: Relay Module

D)GSM Module

The GSM module would need to be attached to a microcontroller or single-board computer, such a Raspberry Pi, and configured to recognise particular hand motions in order to enable gesture control for making phone calls. The GSM module would then receive a command from the microcontroller to begin a phone call to the specified number. Making a fist, pointing with your index finger, or waving your hand in a certain direction are a few typical gestures that can be used to start a phone conversation. You might, for instance, programme the system to call your home security company when you make a fist or to call a relative when you point with your index finger.

Fig 7: GSM module

E)MP3 Player

A portable electronic device called an MP3 player is used to play digital music files in the MP3 format. It usually features a compact design, a rechargeable battery within, and a headphone jack for playing music or other audio files. As a replacement for portable CD players and cassette tape players, MP3 players gained popularity in the early 2000s. Due to the growing use of smartphones, which can also play digital audio files and provide further capabilities like

C)Relay Module

internet connectivity and app capability, they are becoming less common. Nevertheless, because to its simplicity, longer battery life, and superior sound quality, some consumers continue to favour specialised MP3 players.

Fig 8: MP3 Player

F)Raspberry Pi Pico

The Raspberry Pi Foundation initially introduced the Raspberry Pi Pico in January 2021. The board was created to be a high-performance, low-cost microcontroller board that could be utilised for a variety of projects.

The RP2040 microcontroller chip, which was also created by the Raspberry Pi Foundation, serves as the foundation for the Pico. Dual-core ARM Cortex-M0+ microcontroller with 264KB RAM and 2MB flash memory is the RP2040.

Fig 9: Raspberry Pi Pico

The Raspberry Pi Foundation's prior emphasis on single-board computers has changed with the introduction of the Pico. The Pico, however, was created as a result of the foundation recognising a need for a low-cost microcontroller board that could be utilised for a variety of projects.

C/C++, MicroPython, and CircuitPython are just a few of the programming languages and development tools that are compatible with the Pico. The built-in support for SPI, I2C, UART, ADC, and PWM allowed it to be used with a variety of sensors and actuators.

Thonny Software

Thonny is a Python programming language integrated development environment (IDE). It is intended to be a lightweight, user-friendly IDE that makes learning and writing Python code simple for novices. Aivar Annamaa, an

Estonian computer science instructor, developed Thonny to make programming easier for his students to learn.

Thonny has features like an interactive Python shell for testing code snippets, a code editor with syntax highlighting, code completion, and error highlighting. Additionally, it has a debugger that enables programmers to inspect variables, set breakpoints, and step through their code line by line.

MicroPython with Thonny IDE

The Python programming language has an integrated development environment (IDE) called Thonny. It is intended to be a lightweight, user-friendly IDE that makes it simple for beginners to understand and write Python code. Thonny was developed by Estonian computer science instructor Aivar Annamaa to make learning programming easier for his students.

A code editor with syntax highlighting, code completion, and error highlighting, as well as an interactive Python shell for testing code snippets, are features that Thonny offers. A debugger is also included, enabling programmers to step through their code line by line, check variables, and set breakpoints.

Micropython with Raspberry Pi Pico

The Raspberry Pi Pico, a low-cost microcontroller board created by the Raspberry Pi Foundation, is frequently programmed using MicroPython. The Pico is intended to be used with MicroPython, and the official Pico SDK has MicroPython firmware.

You must first download and install the Pico SDK, which contains all the tools and libraries required for MicroPython programming on the Pico, in order to begin using it. The SDK is available for download from the Raspberry Pi website.

Final Output

Fig 10:Final output

Conclusion

In conclusion, gesture-based home automation employing a relay module, MP3 module, GSM module, flex sensor, and accelerometer sensor with the Raspberry Pi Pico offers an original and effective solution to manage many parts of a home. Hands-free volume control and other features are made possible by gesture recognition technology with the use of flex and accelerometer sensors, making it simpler and more accessible for those with disabilities or mobility challenges. The relay module provides for the control of numerous electrical items in the home, whereas the MP3 module is used for audio control. The Raspberry Pi Pico acts as the central processing unit, and the GSM module offers remote access and control.

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