International Scientific Journal of Engineering and Management
Volume: 03 Issue: 05 | May – 2024
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata
ISSN: 2583-6129
DOI: 10.55041/ISJEM01615

GESTURE CONTROLLED SMART GLOVE WITH WEB APPLICATION

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Abstract *This paper presents a gesture-controlled smart glove system integrated with a web application for interactive user interface and control. The glove utilizes an array of sensors, such as accelerometers, gyroscopes, and flex sensors, to detect hand movements and gestures with high precision. These sensors capture real-time data, which is processed by an embedded microcontroller unit (MCU) onboard the glove.*

The processed data is then transmitted wirelessly to a web application via Bluetooth or Wi-Fi connectivity. The web application, accessible through a browser on any device, provides a user-friendly interface for controlling various applications and devices remotely. Users can customize gesture mappings to specific actions, enabling seamless interaction with IoT devices, virtual reality environments, and computer applications.

The system's architecture emphasizes modularity and scalability, allowing for easy integration of additional sensors or functionalities. Moreover, the web application employs responsive design principles, ensuring compatibility with different screen sizes and devices.

In conclusion, the proposed gesture-controlled smart glove system offers a versatile and intuitive interface for interacting with digital environments. Its integration with a web application enhances accessibility and usability, making it suitable for a wide range of applications, including gaming, rehabilitation, and virtual control interfaces.

***Key Words*: MCU, Flex sensors, Web Application, Gesture Control, IOT**

1. INTRODUCTION

Communication is fundamental to human interaction, yet for individuals with speech impairments, expressing themselves can be challenging. Traditional assistive technologies, such as speech synthesizers or text-based communication devices, have limitations and may not adequately address the diverse needs of this population. To bridge this gap, we propose a novel solution: a gesture-controlled smart glove tailored specifically for speech-impaired individuals.

The gesture-controlled smart glove serves as an intuitive and non-verbal communication tool, enabling users to convey their thoughts and emotions through hand gestures and movements. By harnessing the natural language of gestures, this technology offers a more expressive and versatile means of communication, empowering individuals to engage more fully in social interactions and daily activities.

The design of the smart glove is centered around user accessibility and ease of use. It features an array of sensors strategically placed on the glove to detect a wide range of hand movements and gestures with precision and accuracy. The sensor proposed here is flex sensors, which capture real-time data about the user's hand positions and motions.

One of the key advantages of the gesture-controlled smart glove is its adaptability to individual user preferences and needs. Through a user-friendly interface, users can customize gesture mappings to correspond with specific phrases, words, or actions. This customization empowers users to personalize their communication experience, ensuring that the technology aligns with their unique communication styles and capabilities.

Furthermore, the smart glove is designed to be portable and discreet, allowing users to wear it comfortably in various social settings without drawing unnecessary attention. Its wireless connectivity enables seamless integration with smartphones or tablets, providing additional flexibility and functionality.

In summary, the gesture-controlled smart glove represents a significant advancement in assistive technology for speech-impaired individuals. By harnessing the power of gestures, this innovative device offers a new avenue for communication and social interaction, enhancing the quality of life for users and fostering greater inclusion and accessibility in society.

2. THE METHODOLOGY

The development of the gesture-controlled smart glove for speech-impaired individuals involves several key steps. Firstly, we identify the specific gestures and hand movements commonly used by the target user group through surveys and interviews with speech therapists and individuals with speech impairments

Next, we design and prototype the smart glove using a combination of off-the-shelf sensors and custom-built hardware components. The glove incorporates flex sensors to accurately detect and interpret hand gestures in real-time.

Once the hardware is developed, we implement the gesture recognition algorithm, utilizing machine learning techniques to classify and map hand gestures to predefined actions or phrases. This algorithm is trained using a dataset

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of recorded gestures performed by individuals with speech impairments.

Finally, we integrate the gesture-controlled smart glove with a user-friendly interface, allowing users to customize gesture mappings and interact with the device seamlessly. Usability testing and feedback sessions with the target user group are conducted to refine and optimize the system's performance and user experience.

2.1 GSM

A GSM module is a hardware component used to enable communication via GSM networks in electronic devices. These modules are typically small, integrated circuits that incorporate a GSM modem, which allows devices to connect to mobile networks and communicate wirelessly. They often include additional features such as SIM card slots for authentication, interfaces for connecting external antennas, and UART (Universal Asynchronous Receiver-Transmitter) ports for interfacing with microcontrollers or other devices.

Fig. 1 GSM Module

2.2 NodeMCU

The NodeMCU is an open-source firmware and development kit that helps build IoT (Internet of Things) applications. It is based on the ESP8266 Wi-Fi module and combines the capabilities of a microcontroller with Wi-Fi connectivity. Here are some key features and aspects of the NodeMCU

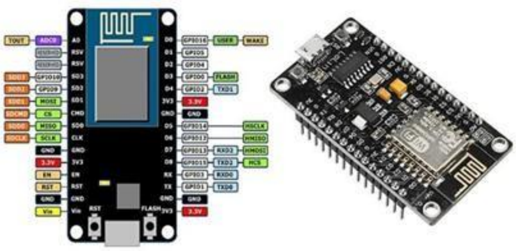

Fig. 2 NodeMCU

2.3 ARDUINO NANO

The Arduino Nano is a compact and versatile microcontroller board designed for easy prototyping and DIY electronics projects. It features the ATmega328P microcontroller chip, the same chip used in the popular Arduino Uno board. Despite its small size, the Arduino Nano offers a wide range of features and capabilities

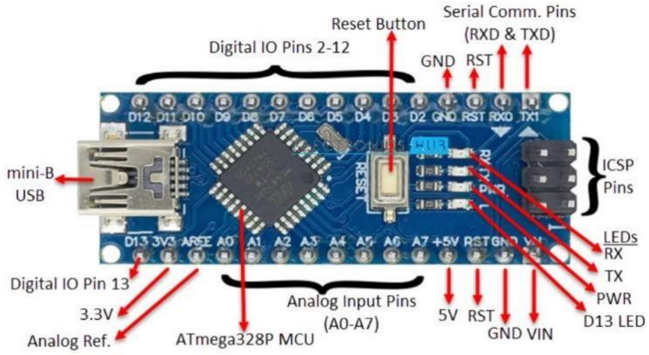

Fig. 3 Arduino Nano

3. EXISTING SYSTEM

3. 1Webcam And Image Processing

It is done Using computer vision techniques, such as Open CV. It employs a deep learning model, often based on convolutional neural networks (CNNs), which are trained on datasets of sign language gestures and their corresponding translations.

3.2 Machine Learning In PC

Uses a Machine Learning (ML) algorithm to translate sign language into spoken English. The input packets are sent serially to a user's PC to be run in conjunction with a Python script. The user creates data sets of information for each gesture that should eventually be translated, and the algorithm trains over these datasets to predict later at runtime what a user is signing

3.3 DISADVANTAGES

- Requires high-end computers
- Expensive
- May not be as accurate as other systems since the lighting can change from each side and could affect the stored data making it difficult to obtain the required output.

4. PROPOSED SYSTEM

The proposed system aims to develop a gesture-controlled smart glow system using flex sensors, a GSM module, and a web application interface. This innovative system will allow users to interact with their environment and control smart lighting using hand gestures, while also providing remote access and monitoring capabilities.

Key components of the system include:

4.1 Flex Sensors: Flex sensors will be attached to gloves or wearable bands worn by the user. These sensors will detect hand gestures and movements, translating them into electrical signals that represent specific commands.

4.2 Gesture Recognition: The system will utilize signal processing techniques to interpret the electrical signals from the flex sensors and recognize predefined hand

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gestures in real-time. Each gesture will correspond to a specific command for controlling the smart glow system.

4.3 Smart Glow Integration: The recognized gestures will trigger actions within the smart glow system, such as adjusting the color, brightness, or pattern of smart LED lights. This integration will create an immersive and interactive lighting experience based on user gestures.

4.4 GSM Module: A GSM module will be incorporated into the system to enable remote access and control via text messages or a web application. This feature will allow users to control the smart glow system from anywhere with cellular network coverage, enhancing convenience and flexibility.

4.5 Web Application Interface: Users will interact with the system through a web application accessible from any device with internet connectivity. The interface will provide visual feedback on recognized gestures, status updates, and remote control options for managing the smart glow system.

4.6 Security and Privacy: The system will implement encryption and authentication mechanisms to ensure secure communication between the web application and the smart glow system, protecting user privacy and preventing unauthorized access.
Overall, this proposed system offers a seamless and versatile solution for gesture-controlled smart glow, combining wearable sensors, remote connectivity, and a user-friendly web interface for enhanced user experience and accessibility.

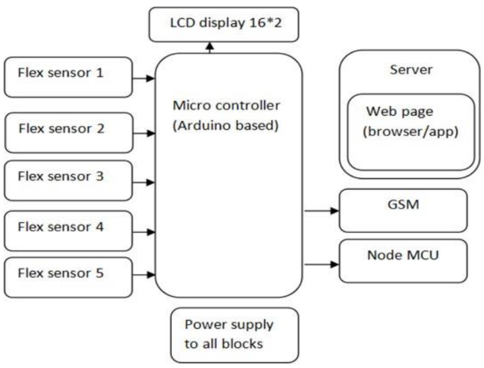

Fig. 4 Block Diagram

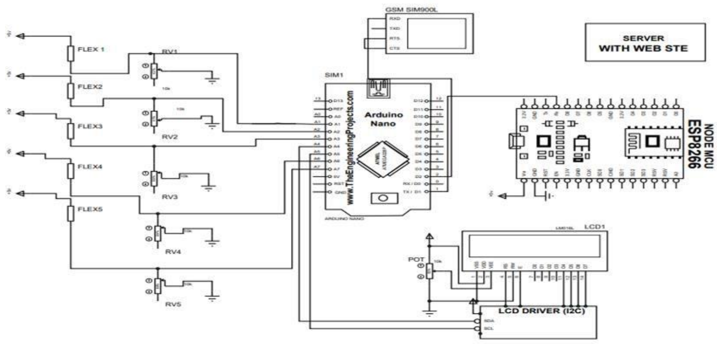

Fig. 5 Circuit Diagram

5. RESULT

The gesture control smart gloves system, integrating flex sensors, a GSM module, and a web application, enables precise gesture recognition for controlling smart devices. Flex sensors translate hand movements into commands, while the GSM module allows remote control via text or web interface. The user-friendly web app provides visual feedback and customization options. Robust security ensures privacy and prevents unauthorized access. Overall, the system offers seamless interaction with smart devices through intuitive gestures, enhancing convenience and accessibility.

Fig. 6 Final Result

6. CONCLUSION

In conclusion, the gesture control smart gloves system represents a significant advancement in human-computer interaction, enabling users to control smart devices with simple hand gestures. By integrating flex sensors, a GSM module, and a user-friendly web application interface, the system provides precise gesture recognition, remote access, and customization options. With robust security measures in place, users can confidently interact with their smart devices from anywhere. This innovative solution not only enhances convenience and accessibility but also showcases the potential of wearable technology in shaping the future of connected environments.

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