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ESP32-Based Smart Gloves for Message Transmission via Hand Gestures Using Telegram Application

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ABSTRACT

This research aims to develop an ESP32-based Smart Gloves system that facilitates message transmission via hand gestures, integrating Telegram as a communication platform. The system utilizes an MPU9250 motion sensor embedded in the glove to detect hand gesture patterns, which are then processed by the ESP32 microcontroller to convert these gestures into text messages. The translated messages are sent in real-time through the Telegram application to the intended recipient. This process offers a solution for users with verbal communication limitations, such as stroke patients, enabling them to communicate easily and effectively. Testing results demonstrate that the system can accurately convert hand gestures into text messages and transmit them via Telegram promptly.

Keywords: Smart Gloves, MPU9250, Microcontroller, Telegram, Hand Gestures

1. INTRODUCTION

Communication could be an essential requirement for each person, counting patients with physical inabilities who battle with talking. This condition is frequently found in patients who have endured strokes, loss of motion, or particular wounds that prevent them from verbally communicating their needs. Such communication boundaries can decrease the quality of life for patients and prevent quick reactions from restorative faculty or family individuals.

With the headway of Web of Things (IoT)-based innovation, openings have risen to create frameworks that encourage quiet communication. One innovation that can be actualized may be a sensor-based shrewd glove able to identify hand signals to naturally send messages through applications like Wire. This framework gives a commonsense arrangement to overcome real-time communication boundaries, in this way quickening the conveyance of understanding needs.

This venture aims to plan a savvy glove prepared with an MPU9250 sensor to detect patient hand gestures. The hand signal information will be prepared utilizing ESP32 as the most microcontroller and after that sent to the Wire application as a communication medium. Hence, this framework can offer assistance to patients to pass on messages or demands without requiring verbal capacities.

2. METHODS

The flow chart of this research is given by Figure 1. The strategy of ESP32-based Savvy Gloves venture utilizes the R&D show with the ADDIE approach (Investigation, Plan, Improvement, Execution, Assessment). The examination stage includes recognizing client needs, such as real-time sign dialect interpretation, and framework details that incorporate the MPU9250 sensor, ESP32, and Wire application for message transmission.

The plan stage incorporates framework engineering plan, interfacing fundamental components, equipment choice, and information communication stream plan from the glove to the application. The improvement stage includes making an introductory model by introducing the sensor on the glove, programming the ESP32 to distinguish signal designs, and conducting starting framework testing. Usage includes testing the model in real-world conditions to assess its execution, such as motion location accuracy and reaction time. Within the assessment stage, a test comes about and client input is analyzed to distinguish inadequacies and change zones. Corrections are made based on the investigation that comes about to refine the device. This approach points to creating a utilitarian shrewd glove that underpins comprehensive communication for patients with talking troubles.

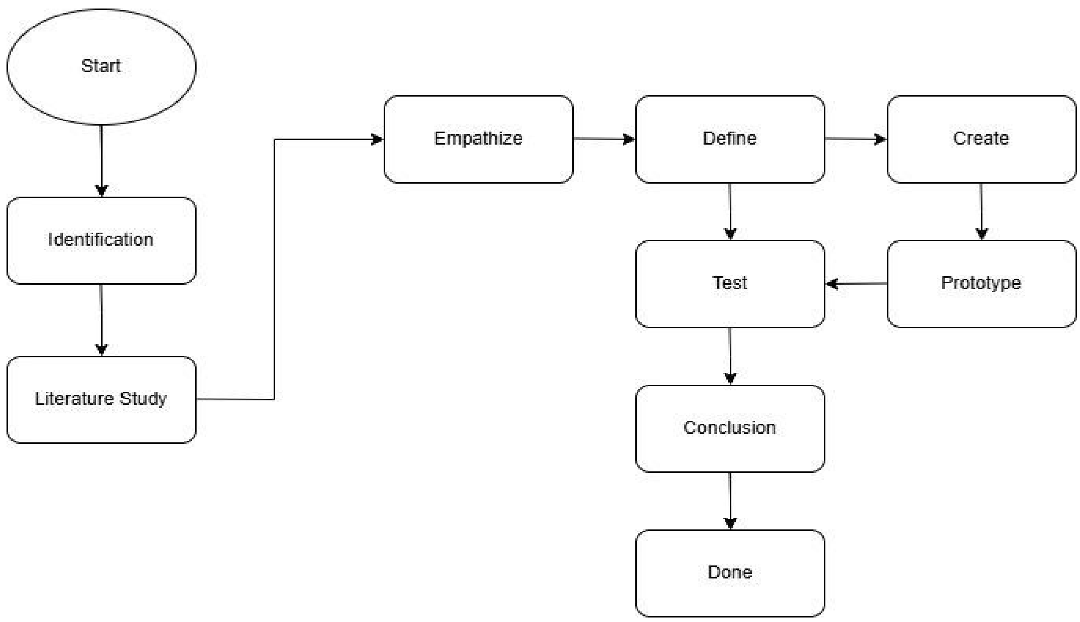

Figure 1. Flow chart

2.1 Tools and Component

The tools and component are shown in Table 1. ESP32-based framework has been broadly created for different IoT applications, counting gesture-based message transmission utilizing shrewd gloves. This extension leverages sensor innovation and IoT communication to help physically debilitated patients in consequently transmitting messages through the Wire application. The framework coordinates components such as the MPU9250 sensor for identifying hand gestures, NodeMCU ESP32 as the most information processor, and Wire application as the communication medium. All components work together to make a viable and easy-to-use framework for patients in existence.

Table 1. Tools and Component

No.	Component Name	Function
1.	NodeMCU ESP32	Main microcontroller & Wi-Fi module for data processing and message transmission
2.	MPU9250 Sensor	Detects orientation, acceleration, and hand movements with precision
3.	Telegram Application	IoT-based real-time messaging medium
4.	Gloves	Physical medium for placing sensors and reading hand movements
5.	Breadboard	To integrate components during development
6.	Jumper Wires	Connects components to ensure stable connectivity

2.2 System Workflow

The system workflow flowchart is listed in Figure 2. The framework workflow starts with the control supply giving power to all components. The MPU9250 sensor, introduced on the glove, identifies the user's hand introduction, increasing speed, and development designs. The hand signal information is at that point sent to the NodeMCU ESP32 microcontroller, which has the capacity as the control center to handle the information into content messages. Hence, NodeMCU ESP32 employs Wi-Fi to send the content messages in real-time by means of the Wire application to the aiming beneficiary. This framework is outlined to bolster patients with discourse restrictions, empowering them to communicate messages rapidly and effortlessly through hand signals.

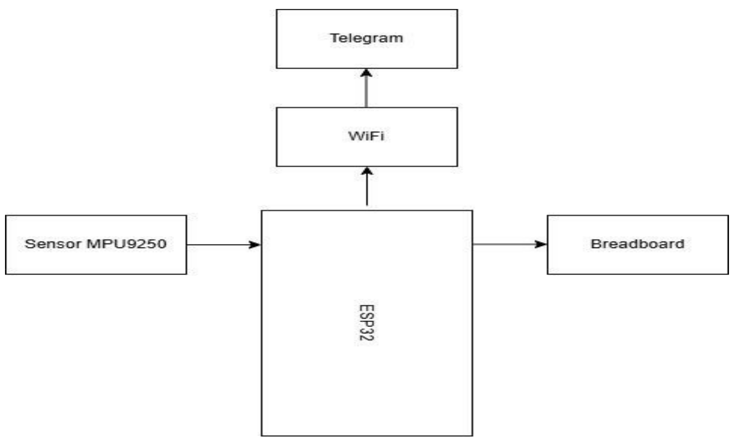

Figure 2. System Workflow Flowchart

3. RESULTS AND DISCUSSION

3.1 Results

The proposed glove is described in Figure 3. The MPU9250 sensor with the NodeMCU ESP32 forms a shrewd glove to perused quiet hand signals and consequently send messages to the Wire application as a communication medium. The framework works with particular signal designs, where each identified hand development compares to a specific message.

As illustrated in Figure 4, when the primary sensor is bowed, the ESP32 forms the signal information and sends a message to Wire expressing, "Going for a walk in a wheelchair". For developments including the moment sensor, the framework sends a message reflecting the patient's requirements, such as, "I have to utilize the restroom."

In the event that both sensors are bowed at the same time, the transmitted message changes into, "Check on me, I am feeling unwell," demonstrating the patient's condition. With this design, the shrewd glove helps the patients to specify their needs particularly and rapidly.

Figure 4. Proposed Device

Figure 3. Displayed Message Results

3.2 Discussions

The ESP32-based Keen Gloves framework incorporate a little screen or sound-related a scaled down speaker to supply quick affirmation to the client with respect to the message sent. Further testing with different hand signal design should ensure the framework to recognize a broader extent of developments. Furthermore, optimizing control utilization is profoundly suggested so that the gadget can be utilized for longer periods, particularly for patients requiring serious utilization. The framework might be extended by integrating it with other communication stages, such as WhatsApp or SMS, to extend adaptability and openness for more clients. The ergonomic advancement of the gloves ought to be prioritized, utilizing lightweight, adaptable, and comfortable materials for day-by-day wear including extra sensors, such as body temperature or heart rate sensors which may upgrade the device's usefulness by checking the patient's condition more comprehensively. With these advancements, Savvy Gloves might end up a more comprehensive, successful, and profitable communication help.

4. CONCLUSION

The conclusion of this extend is that the ESP32-based Shrewd Gloves framework has been effectively created as an imaginative arrangement to help patients with discourse confinements in communication. The framework coordinates the MPU9250 sensor to distinguish hand signals and the NodeMCU ESP32 as the information processor, which at that point changes over these signals into content messages sent through the Wire application. Testing appears to show that the framework works with adequate exactness and conveys messages in genuine time, empowering quick and viable communication. This capability upgrades patients' quality of life, bolsters comprehensive communication, and encourages quicker reactions from therapeutic work force or caregivers.

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