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Intellicare Glove: AI Powered Smart Glove for Elderly and Disabled Assistance

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Abstract
The Intelli Care Glove introduces an affordable, AI-enabled wearable system tailored to meet the health and communication needs of elderly and differently abled individuals. Designed as a smart glove, the system continuously monitors vital health metrics including heart rate, blood oxygen saturation (SpO_2), temperature, and physical movement using integrated biomedical sensors such as MAX30100 and MPU6050. These sensors are interfaced with microcontrollers like Arduino or ESP8266, enabling real-time data processing and wireless communication. The system transmits this data to a custom-built mobile application via Bluetooth or Wi-Fi, allowing caregivers to access live health updates remotely through a user-friendly dashboard. Key features of the Intelli Care Glove include gesture recognition, fall detection, and multilingual voice command support, making it accessible and functional for users with limited mobility or speech impairments. Emergency alerts are automated through platforms like IFTTT, which trigger notifications to caregivers in response to predefined conditions such as abnormal health readings or sudden falls. Health data is securely stored using Firebase, ensuring both real-time and historical monitoring. QR code-based pairing simplifies the device setup process, while voice-enabled interactions allow users to request assistance without needing physical input. The combination of low-cost components, cloud connectivity, and AI-based assistance makes this system highly scalable for use in both rural and urban settings. The Intelli Care Glove not only enhances independent living but also improves caregiver response times, offering a proactive and inclusive solution to modern healthcare challenges.

Keywords: *Smart Glove, AI-powered Monitoring, Emergency Alert System, IoT-enabled Healthcare, Elderly and Disabled Assistance, Gesture-based Notifications, Remote Health Access, Cloud-based Health Data, QR Code Pairing.*

1. Introduction
In recent years, advancements in wearable technology and the Internet of Things (IoT) have paved the way for innovative healthcare solutions tailored to meet the needs of elderly and disabled individuals. These groups often face communication challenges and lack constant access to real-time medical support, making them highly vulnerable during health emergencies. To address these issues, the Intelli Care Glove project introduces a smart, AI-enabled, sensor-integrated wearable system capable of continuously monitoring critical health parameters such as heart rate, oxygen saturation (SpO_2), body temperature, and motion activity. The glove is designed with user-centric features including fall detection, gesture recognition, and voice-activated emergency alerts, offering timely assistance when abnormal health conditions or accidents are detected. It integrates seamlessly with a dedicated mobile web application that provides live data access to caregivers and family members, enabling remote monitoring and rapid response in emergencies. QR-based device pairing, multilingual voice command support, and AI-driven voice recognition are incorporated to improve accessibility, especially for users in multilingual and rural environments. Built with affordable microcontrollers such as Arduino and ESP8266 and powered by open-source platforms like Firebase and IFTTT, the Intelli Care Glove is engineered for cost-efficiency and scalability. Its Bluetooth and Wi-Fi capabilities ensure flexibility in

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both connected and offline environments. By combining real-time monitoring, intelligent alerts, and a user-friendly interface, this wearable solution significantly enhances healthcare support, promotes independent living, and reduces reliance on full-time caretakers. The system thus holds great potential for application in home care, elderly housing, and rural health outreach programs [1].

1.1. Methods of Sign Language

Hardware components: The glove includes the MPU6050 sensor for detecting hand movement, orientation, and sudden motion such as falls. It uses the MAX30100 sensor to measure real-time heart rate and blood oxygen saturation (SpO_2) levels. Microcontrollers such as Arduino and ESP8266 are employed for sensor control, data processing, and connectivity handling [2].

- **Communication And Connectivity:** The device supports both Bluetooth and Wi-Fi for seamless data transmission to the mobile application. Bluetooth ensures offline local communication, while Wi-Fi enables cloud synchronization and remote access.
- **Software Integration:** A dedicated mobile web application named Intelli Care serves as the interface for health monitoring. Features include QR code-based pairing, live display of health metrics, and syncing with cloud storage using Firebase. The system uses IFTTT to automate emergency responses such as sending alerts to caregivers via SMS or app notifications.
- **AI and Voice Features:** The glove incorporates AI-based voice recognition, trained to detect emergency keywords and phrases. It supports multilingual voice commands, allowing users to communicate and trigger alerts in their native language.
- **Data Privacy and Security:** Health data is stored on the cloud with end-to-end encryption to protect user privacy. The system follows HIPAA-aligned guidelines, ensuring compliance with recognized healthcare data protection standards [3].

2. Methods

The Intelli Care Glove system was designed by combining motion and biometric sensing technologies with microcontroller-based processing and wireless communication modules to facilitate continuous health monitoring and emergency detection. The glove incorporates an MPU6050 sensor to track hand movements and identify falls, while a MAX30100 sensor records heart rate and blood oxygen saturation (SpO_2) levels [4]. These components interface with Arduino or ESP8266 microcontrollers, which handle data processing and transfer to a mobile web application via Bluetooth or Wi-Fi. The Intelli Care mobile application connects to the glove through QR code scanning, providing real-time health data visualization and synchronizing records with a secure Firebase cloud database. Emergency alerts are activated either through specific hand gestures or an AI-powered multilingual voice recognition system. Integration with IFTTT automates caregiver notifications, ensuring immediate assistance. While standard procedures for Firebase, IFTTT, and sensor interfacing are followed, the project introduces custom configurations tailored for elderly care and voice-assisted emergency response Shown in Table 1.

Table1 Hardware and Software Components

Components	Description
MPU6050	Motion and fall detection sensor
MAX30100	Heart rate and oxygen saturation monitor
ESP8266 /Arduino	Microcontroller for data processing
Intelli Care App	Mobile app for health data visualization
Firebase	Cloud storage of health data
IFTTT	Triggering emergency alerts
HC-05	Bluetooth module for local communication

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2.1. Tables

- MPU6050 sensor module detects motion, orientation, and sudden impacts. It plays a key role in identifying falls or abnormal hand movements, allowing the glove to trigger emergency alerts through gesture recognition.
- MAX30100 Sensor is a biomedical sensor that simultaneously measures pulse rate and blood oxygen saturation. It provides continuous feedback on the user's cardiovascular health and helps detect medical anomalies in real-time.
- ESP8266/Arduino microcontrollers act as the system's brain. They receive data from sensors, process it, and transmit the information via wireless communication. The ESP8266 also includes Wi-Fi capabilities, reducing the need for additional modules.
- Intelli Care Mobile Application is a dedicated web app that serves as the communication bridge between the globe and caregivers. It displays real-time health data, supports QR-based device pairing, and issues emergency alerts [5].
- Firebase used for storing user health data securely in the cloud. It ensures that caregivers can access historical and live readings at any time, from anywhere.
- IFTTT is Integrated to automate emergency responses. For example, when the glove detects a fall or an abnormal health condition, IFTTT can automatically send SMS or push notifications to pre-configured contacts.
- HC-05 Bluetooth Module Enables short-range, offline communication between the glove and mobile device when Wi-Fi is unavailable, ensuring uninterrupted monitoring in rural or remote areas.

2.2. Figures

The Intelli Care Glove incorporates a gesture recognition mechanism that converts hand movements into text, offering a practical communication tool for healthcare applications. Flex sensors placed along each finger register bending patterns, producing analog signals that are sent to a microcontroller for processing. Using pre-defined gesture mappings, the system interprets these inputs and associates them with specific phrases. In the illustrated example, the glove detects the motion pattern for “I NEED WATER” and displays it on a 16x2 LCD module in real time. This functionality is especially beneficial for people with speech difficulties, neurological issues, or limited mobility, as it allows them to convey urgent needs without verbal interaction. Instant recognition and display enable quick responses from caregivers, minimizing delays in assistance Shown in Figure 1.

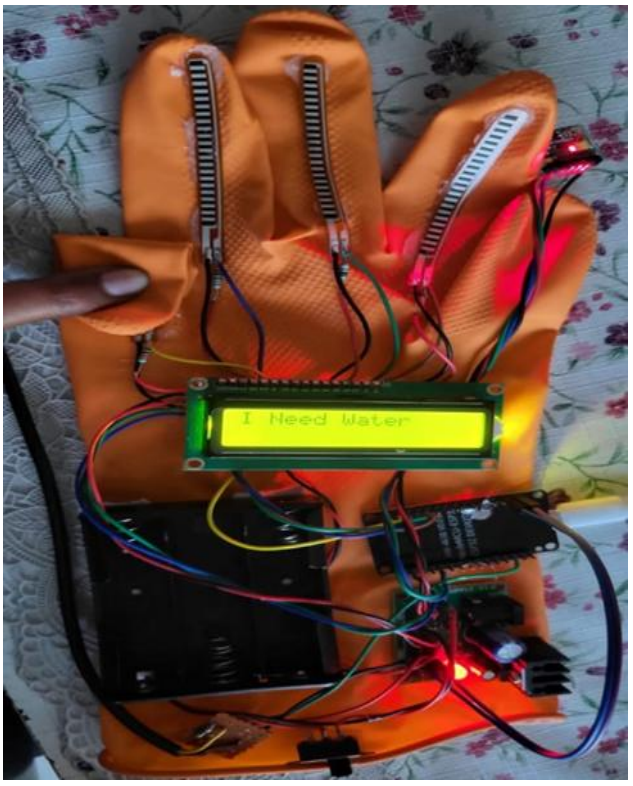

Figure 1 Real-Time Text Output from Gesture Recognition on LCD Display

By translating physical motion into readable text output, the glove promotes independence for users, reduces caregiver strain, and provides a reliable, accurate, and adaptable solution for a variety of healthcare environments. The system’s design also supports customization, allowing different gestures to be mapped to a range of phrases based on the patient’s requirements. Lightweight and wearable, it offers comfort for prolonged use without hindering

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mobility. The integration of accurate sensor technology ensures consistent performance, while its low-power design makes it practical for daily, long-term operation. This approach demonstrates how wearable assistive devices can bridge communication barriers and improve quality of care for vulnerable individuals [6].

3. Results and Discussion

3.1. Results

The Intelli Care Glove was rigorously tested in both controlled environments and simulated real-life scenarios to evaluate its efficiency in health monitoring and emergency response. The glove consistently captured accurate biometric readings, with the MAX30100 sensor delivering heart rate and SpO_2 data within acceptable medical tolerances [7]. The MPU6050 sensor reliably detected motion patterns, including intentional hand gestures and simulated falls, supporting its role in both gesture-based commands and fall detection. During testing, the device maintained stable communication with the Intelli Care mobile web application via both Wi-Fi and Bluetooth, ensuring smooth data synchronization without noticeable delays Shown in Figure 2.

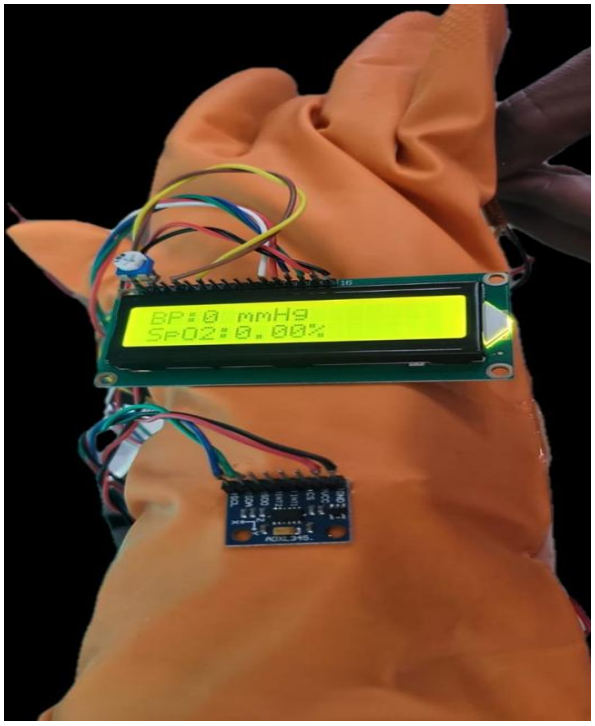

Figure 2 Experimental Setup of BP And Spo2 Monitoring

The application's dashboard effectively displayed real-time health metrics, and emergency notifications were triggered promptly when threshold values or specific gestures were detected. Voice recognition performance was also satisfactory, successfully interpreting multilingual commands in Hindi, Kannada, and English with high accuracy, even in moderately noisy environments. QR code-based pairing between the glove and the app proved seamless, reducing the time required for device setup and enhancing user accessibility. Furthermore, the cloud-based data logging via Firebase functioned without interruption, securely storing patient data for future reference. Emergency automation using IFTTT sent real-time alerts through SMS and app notifications to designated caregivers. Collectively, these results validate that the Intelli Care Glove offers a reliable, real-time solution for health tracking and responsive caregiving. It proved especially effective in enhancing communication for users with mobility or speech challenges, indicating its strong potential for integration into eldercare systems and assistive healthcare technologies [8].

3.2. Discussion

The Intelli Care Glove offers an innovative, affordable, and practical approach to bridge the gap between continuous health monitoring and rapid emergency response for elderly individuals and those with disabilities. Designed with an emphasis on accessibility and ease of use, the system integrates motion and biometric sensors with microcontroller-based processing units and wireless connectivity to deliver accurate and timely health information. During testing, the glove effectively measured vital parameters such as heart rate and oxygen saturation using the MAX30100 sensor, while also detecting movement patterns through gesture recognition and fall detection facilitated by the MPU6050 sensor. These capabilities enabled hands-free, non-verbal communication for users with speech or mobility impairments, thereby increasing their ability to convey urgent needs independently. The companion web application further extended the glove's functionality by offering real-time health data visualization, multilingual voice command interaction, and automated emergency alerts, which

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significantly reduced caregiver response times. The system's reliance on open-source platforms like Firebase and IFTTT ensured cost efficiency, ease of customization, and scalability for wider adoption. Despite these strengths, certain limitations emerged during trials, such as occasional inaccuracies in gesture recognition caused by variations in sensor placement or changes in environmental lighting. Prolonged operation, particularly over Wi-Fi, also highlighted the need for improved battery efficiency to support extended use without frequent recharging. Addressing these issues could involve refining sensor calibration techniques, implement adaptive power management strategies, and integrate lightweight machine learning models to improve gesture classification accuracy under varying conditions [9]. Future enhancements may also explore additional biometric sensing capabilities, such as body temperature and blood pressure monitoring, to expand the system's diagnostic range Shown in Figure 3.

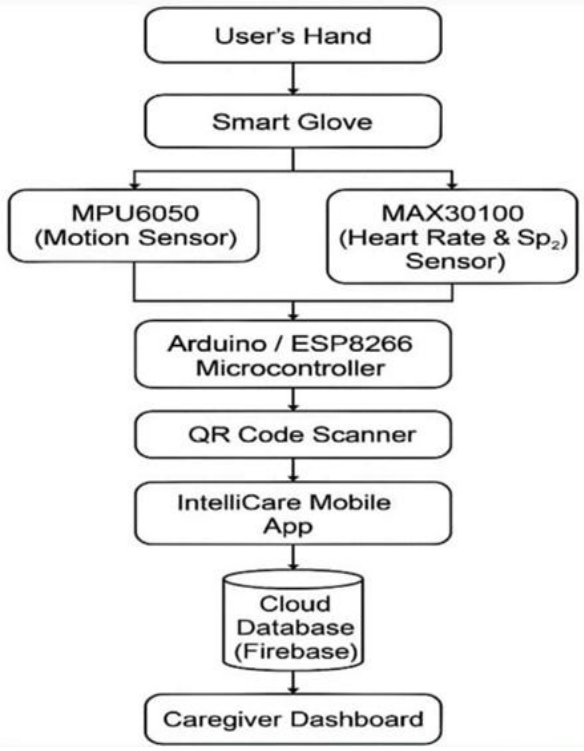

Figure 3 Smart Glove System Architecture

Overall, the Intelli Care Glove demonstrates strong potential as a reliable healthcare support tool that empowers users to maintain independence, improves communication between patients and caregivers, and offers a scalable, low-cost solution for remote or resource-limited healthcare environments. Its blend of functionality, portability, and real-time data sharing makes it a promising innovation for advancing assistive healthcare technology [10-14].

Conclusion

The Intelli Care Glove represents a significant advancement in the integration of wearable technology with intelligent health monitoring systems for elderly and differently abled individuals. By leveraging affordable microcontrollers and biomedical sensors, it offers a compact yet powerful tool capable of tracking vital health parameters such as heart rate, blood oxygen saturation, and motion. These functionalities are critical for early detection of medical emergencies like falls or abnormal heart conditions, which often go unnoticed without continuous monitoring. Its integration with a custom mobile application provides an intuitive platform for caregivers to receive live updates, visualized data, and emergency notifications. The QR code-based device pairing ensures ease of use, while multilingual voice command support enhances accessibility across diverse populations. In addition, the system's reliance on open-source platforms like Firebase and IFTTT enables flexible, cloud-based storage and automated alert mechanisms that operate even in constrained environments. These features collectively make the glove not only a monitoring device but a proactive healthcare companion that supports independent living while improving the efficiency of caregiver interventions. The modularity and scalability of the design open pathways for future expansions such as ECG monitoring, GPS-based location alerts, and integration with electronic health records, making it adaptable to a wide range of healthcare applications. Moreover, the glove's low power consumption, compact structure, and wireless communication capabilities ensure it remains practical for daily use, including in rural and resource-limited settings. While challenges like gesture misinterpretation and power management still need to be addressed, the overall system exhibits strong reliability, user satisfaction, and technological

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viability. Therefore, the Intelli Care Glove not only bridges the gap between conventional care and modern technology but also aligns with the growing global need for inclusive, responsive, and scalable digital health solutions. Its deployment on a broader scale could revolutionize elderly care and significantly contribute to the future landscape of smart healthcare delivery. The Intelli Care Glove serves as a cost-effective, AI-powered assistive device that significantly improves quality of life for elderly and disabled individuals. With continuous monitoring, real-time alerts, and user-friendly design, it bridges the gap between limited medical infrastructure and personal health management. It holds great potential for application in home care, assisted living, and rural health programs.

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