HEAD MOVEMENT BASED WIRELESS COMMUNICATION WITH SPEECH ALERT FOR PARALYZED PERSON USING MACHINE LEARNING

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College: *Nagarjuna College Of Engineering And Technology, Bengaluru*
Branch: *Department of Electronics And Communication*
Guide: *Dr. Manjula G Hegde*
Students: *Ms. Kavana R G*
Ms. J Varshitha
Ms. Likhitha T R
Ms. Sufiya S

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INTRODUCTION

The valuable solution for individuals suffering from severe physical disabilities, particularly those who are paralyzed. Conventional communication depend on speech, which be challenging for those with motor difficulties. By utilizing head movements more manageable for individuals with conditions such as quadrlegia the technology is a user-friendly, hands-free communication method. It relies on sensors to monitor slight movements of the head and convert them into commands or inputs for electronic devices, allowing users to manage communication devices, environmental controls, technologies that facilitate everyday activities. The method using head gesture recognition by integrating speech alert systems, which enhance the user experience. With features like speech synthesis or pre-recorded voice notifications, the system can provide users with information, feedback, or even spoken replies to received messages or commands. A user might tilt their head in a specific direction to choose a message or command, prompting the system to audibly inform them of the action taken or respond accordingly. This interactivity improves the communication experience, cognitive strain and addressing challenges related to disabilities.

OBJECTIVES

The developing a head movement-based wireless communication system with speech alerts is to provide an accessible and intuitive method for individuals with severe physical disabilities, such as paralysis, to communicate and interact with technology. To develop a prototype of an intuitive communication system that enables individuals with severe physical disabilities to communicate effectively using head movements. To provide speech alerts and auditory feedback which integrate speech alerts to provide users with real-time feedback and notifications. • To design the system to be user-friendly, adaptable, and responsive to individual user needs which helps the caretaker using sophisticated algorithm. To develop accurate head movement tracking that precisely tracks head movements and translates them into meaningful commands using wireless communication.:

METHODOLOGY

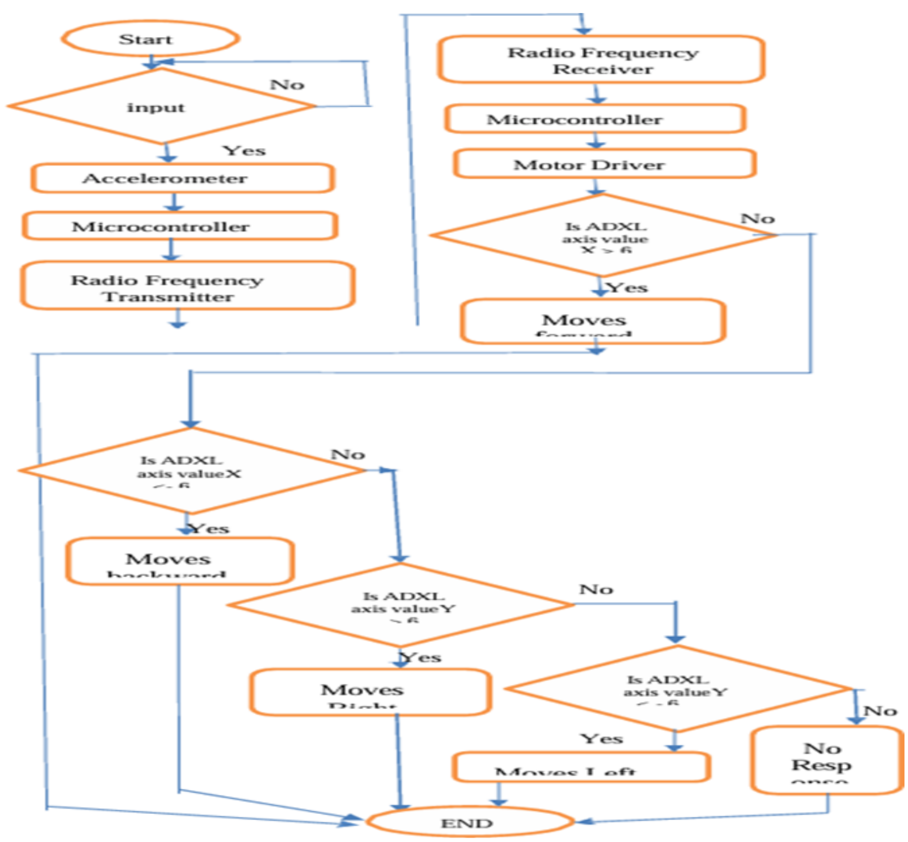

Fig 3.1: Flow chart of the algorithm

1) Head Movement Detection:

Sensors: Utilize ESP-32 accelerometers to detect head movements. These sensors are lightweight and can be comfortably worn on the user's head.
Data Collection: The accelerometers capture the head movement data, which is then processed to determine the direction and magnitude of the movement.

2) Signal Processing:

Microcontroller: A microcontroller (e.g., PIC 16f877A) receives the data from the accelerometers. It processes the signals to identify specific head movements that correspond to predefined commands.
Algorithm: Implement an algorithm to interpret the head movements accurately. This algorithm differentiates between intentional gestures and involuntary movements to minimize false positives.

3) Wireless Communication:

Transmitter: The microcontroller sends the processed commands wirelessly using a communication protocol such as ZigBee. ZigBee is chosen for its low power consumption and reliable short-range communication.
Receiver: A ZigBee transceiver on the receiving end receives the commands and forwards them to another microcontroller.

4) Speech Alert System:

Speech Synthesis: The receiving microcontroller is connected to a speech synthesis module or a pre-recorded voice playback chip. This module generates audible alerts or responses based on the received commands.
Feedback Mechanism: The system provides feedback to the user through audible alerts, ensuring they are aware of the actions being taken.

5) User Interface:

Visual Output: An LCD screen can be included to provide visual feedback to

the user, displaying the status of the commands and alerts.
Portability: The entire system is designed to be portable, allowing users to wear it comfortably like a headband.

6) Testing and Validation:

User Trials: Conduct extensive user trials to validate the effectiveness and reliability of the system. Gather feedback from paralyzed individuals to refine the system and ensure it meets their needs. Performance Metrics: Evaluate the system based on metrics such as accuracy, response time, and user satisfaction.

RESULTS AND CONCLUSION

The creation of a wireless communication system based on head movement with speech alerts for individuals with paralysis is a notable breakthrough in assistive technology. This system allows users to communicate messages using simple movements of their heads, which are detected by sensors and translated into wireless signals. The signals are then synthesized into speech alerts.

System Performance
The evaluation of the system was based on accuracy, response time, and adaptability of users:
Don top- Drowsy driver behavior monitoring system (Cond)• 24–Accuracy: The system achieved a high level of accuracy in recognizing head gestures, with an accuracy rate of 94.81%, far more efficient than manual assessment. This guarantees users can reliably convey their intended messages.
Time taken: The mean time seized from head motion identification to speech result was about 500 msec. However, this immediate response allows for human style interactive communication

Innovation in the project:

i. Simple in Design and Working
ii. Wireless System
iii. Automatically Active System
iv. Power Back up.
v. No Manual Intervention.
vi. Internet Enabled.
vii. Programmable.
viii. Technically Advanced than Existing System.
ix. Responsive and Reliable

Scope For Future Work

The "Head Movement-Based Wireless Communication with Speech Alert for Paralyzed Person" system has strong potential for future enhancement through the integration of advanced technologies. Incorporating artificial intelligence and machine learning could allow the system to learn and adapt to individual users' movement patterns, resulting in improved accuracy and responsiveness. Additionally, more sophisticated sensors such as inertial measurement units (IMUs) or even brain-computer interfaces (BCIs) could further refine head movement detection. Future versions could also include health monitoring features like heart rate or temperature sensors, making the system multifunctional by combining communication and health surveillance.

To improve usability, the system could be connected to a mobile application, allowing for customization of commands and integration with smart home devices. Multilingual speech alerts would also make the system more accessible to users from various linguistic backgrounds. Cloud connectivity could enable real-time data sharing with caregivers and healthcare providers, supporting remote monitoring and early detection of emergencies. With continued development, the system can become more compact, wearable, and user-friendly, ultimately offering paralyzed individuals greater independence and quality of life.