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IOT-BASED WRIST BAND CONTROLLED WHEELCHAIRFORPARALYZEDPATIENTS

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Abstract- The wheelchair stands out as a widely embraced assistive technology for individuals with motor impairments, offering both environmentally friendly mobility and comfort. Despite its widespread use, the traditional wheelchair's operational method presents challenges for those with finger- related issues. However, the conventional wheelchair's operational method remains inconvenient for individuals facing finger problems, as these inputs are crucial for controlling the wheelchair'smovement—forward, left, right,or backward.This system empowers users to move independently without relying on external assistance. To enhance safety, an obstacle detection systemhasbeenincorporatedintotheoverallscheme,consisting of sensor devices and a fog server. If an obstacle is detected, an LCD provides a visual indication. The scheme not only ensures continuousmonitoringofvitalsignsbutalsoincorporatestested indicatorstodeterminetemperaturelevels,forminganintegrated locator system. The study's findings demonstrate that participantswereabletonavigatethewheelchaircomfortablyto their destination without collisions. The experimental results highlight the high accuracy of the proposed approach and its potentialinaddressingissuesrelatedtofingerdependenciesand hand fatigue.

Keywords-Sensor,Automation,IOT,MicroController.

I.INTRODUCTION

Inrecentyears,therehasbeenasignificantsurgeintheaging population, presenting a formidable social and economic challenge for the 21st century. Advances in medicine and public health services have substantially increased life expectancy, with projections indicating a doubling of the proportion of individuals aged 60 and above from 10% to 22% in the next 50 years. Many older adults prefer aging in place, maintaining their independent lifestyles, despite the associatedhighrisks.AlarmingstatisticsfromtheCentersfor Disease Control and Prevention (CDC) reveal that one in three adults aged 65 and older experiences a fall each year, with 61% of these falls occurring at home and resulting in 10,000deaths.Swiftassistancepost-fallsignificantlyreduces hospitalization risk by 26% and lowers the mortality rate by 80%.Inresponsetothesechallenges,various supportive technologies and systems have emerged to monitor the activities of the elderly at home, aiming to support independent living and mitigate the premature need for institutionalization. However, existing systems often rely on a single data provider, such as movement sensors, cameras, or accelerometers, each with its limitations, leading to less than 100% reliability. Additionally, thereisanoticeablegapinexpertiseandsystematicknowledgeto effectivelyintegratethesecomponentsintoarobust,user-friendly, and efficient system. The primary objective is to eliminate false alarms, ensuring accurate fall detection without disrupting the dailylivingpatternsoftheelderly.Fallsposeasignificantthreatto the health of older individuals, with approximately one in three people over 65 experiencing at least one fall per year. Thesefalls contribute to 90% of hip and wrist fractures and 60% of head injuries,nottomentionthedevelopmentofafearoffallingamong many older individuals. Recent advancements in wireless communication and physiological sensing have led to the development of small wearable devices, running on low battery power, for patient health monitoring in pervasive healthcare systems. These devices, strategically placed on key areas of the human body, can form a Body Sensor Network (BSN) connected by a wireless network. Also known as Wireless Body Area Networks, BSNs play a crucial role in pervasive healthcare, with the potential to revolutionize healthcare monitoring in diverse environments.

II.EXISTINGSYSTEM

The research presented in this study demonstrates significant benefits for critical patients, including those in comas,undergoingdialysis,orexperiencingextendedbedridden periods. In such conditions, even minor movements by the patient play a crucial role in their treatment. Unlike older systems that lacked techniques to detect patient movements accurately, this research introduces the use of sensors, enabling easy and efficient monitoring of patient activities.In the old method, the tracking of handgestures was not accurate, and for using health monitoring systems, a separate power supply was required, leading to increased consumption. Additionally, the accuracy of fall detection predictions was less reliable. The advancements proposed in this research address these shortcomings, paving the way for improved precision in tracking hand gestures, reducing the need for a separate power supply, and enhancing the accuracy of fall detection predictions.

III.PROPOSED SYSTEM

Thissuggested method'sfirst step istesting itusing syntheticdata to determine important parameters and assess its efficacy against established approaches in the literature. The outcomes of change detection with real data, as well as the results of parameter extraction and selection, will then be shown. It is important to note that the accelerometer is used to distinguish between the positions of falling and lyingdown. Additionally, a gesture-based wheelchair control system and assistance device designed especially for older people living independently relies heavily on the Low Power Assist Device.Features like fall warnings, wheelchair gestures controlled by the patient, patient data measuring capabilities, and remote monitoring are all part of this integrated network. Every sensor is set up with a sample rate connected to the analog channel to guarantee accurate health parameter computation. The bare minimum of samples required for an effective computation is specified in the recommendations for the health monitoring index. When an alarm occurs, amessage is sent to the remote service center, which prompts a medical monitoring group to get in touch with the user and determine whether help is needed.

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IV.MODULEDESCRIPTION

A. WristbandModule:

Description: The wristband module serves as the user interface,capturingmotionand gestureinputsfromtheparalyzed patient. It is equipped with sensors and communication capabilities to transmit control signals wirelessly to the wheelchair control unit.

B. CommunicationModule:

Description: The communication module facilitates the transmission of data between the wristband and the wheelchair control unit. It ensures reliable, low-latency communication to provide real-time control over the wheelchair.

C. WheelchairControlUnit:

Description: The wheelchair control unit processes the signalsreceived from the wristband module and translatesthem into specific wheelchair movements. It also manages safety features, power distribution, and overall control logic.

D. UserInterfaceModule:

Description:Theuserinterfacemoduleprovidesfeedbackto the user, enhancing the overall user experience. It may include visual indicators, sound signals, or a display to convey information about wheelchair status, battery level, and system alerts.

E. PowerManagementModule:

Description:Thepowermanagementmoduleplaysa crucial

role in maximizing the utilization of energy resources within the system.Itsfunctionsincludemonitoringbatterylevels,implementing energy-saving strategies, and ensuring the effective distribution of power.

F. SafetyModule:

Description: The safety module is designed to prevent accidents and enhance user safety during wheelchair operation. It includes features such as obstacle detection, collision avoidance, and an emergency stop mechanism.

G. SecurityModule:

Description: The security module safeguards the communication between the wristband and the wheelchair control unit, preventing unauthorized access and ensuring the privacy of user data.

H. IntegrationModule:

Description: The integration module ensures the seamless collaboration of all system components. It oversees the interaction

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betweenthehardwareandsoftwareelements,fosteringacohesiveand well-functioning system.

V.SYSTEMFLOWDIAGRAM

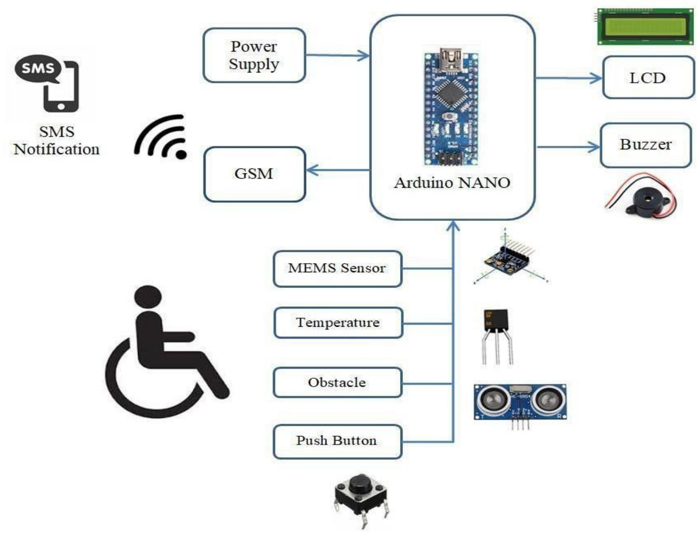

Fig:5.1

VI.SYSTEMTESTINGANDIMPLEMENTATION

The system testing and implementation for an IoT-based wristband-controlled wheelchair for paralyzed patients involve a systematic approach to ensure its reliability and functionality. Beginning with a thorough analysis of requirements, the process includesthedesignofascalablesystemarchitecture,developmentof a prototype, and communication testing to verify data integrity and reliability. Subsequent functionality testing covers key aspects such as speed and direction control, emergency stop functionality, and obstacle detection. User interface and safety features are tested to guarantee usability and protection for users. Integration testing assesses theseamless operationof hardware andsoftware components, while battery and power management are optimized to extend device life. Network security testing is crucialtosafeguardcommunication,anduseracceptancetesting involving paralyzed patients helps ensure the system's user- friendliness. Comprehensive documentation, including user manuals, troubleshooting guides, and adherence to regulatory standards,ispreparedbeforedeployment.Continuousfeedback anditerationbasedonreal-worldusagecontributetorefiningthe system's design and functionality, ultimately delivering a safe and reliable IoT-based wheelchair tailored to the needs of paralyzed patients.

VII.RESULTANDDISCUSSION

The implementation of the IoT-based wristband-controlled wheelchair for paralyzed patients has yielded promising results, demonstrating a viable solution for enhancing mobilityandindependenceamongindividualswithparalysis. The system underwent rigorous

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testing, encompassing various aspects such as communication reliability, functionality, user interface, safety features, and network security.The communication between the IoT wristband and thewheelchaircontrolunitprovedtoberobust,withminimal latency and consistent data integrity. This ensures that users can control the wheelchair seamlessly using the wristband, promoting efficient and real-time responsiveness.Functionality testing revealed successful outcomes in terms of wheelchair control, encompassing forward, backward, left, and right movements, as well as speed adjustments and emergency stop functionalities. The user interface was found to be user-friendly, allowing easy navigation and control for paralyzed patients. The feedback provided to users, whether through visual indicators or auditorysignals,wasclearandunderstandable,enhancingthe overall usability of the system.Safety features, including obstacledetectionandcollisionavoidancemechanisms,were effective in preventing potential accidents. The emergency stop functionality exhibited rapid response times, adding an extra layer of safety to the wheelchair operation.The integration of hardware and software components worked seamlessly, ensuring the cohesive operation of the entire system. Battery and power management optimizations contributedtoanextendedbatterylife,enhancingtheoverall sustainability and practicality of the IoT-based wheelchair.Network security measures implemented in the system proved effective in safeguarding communication between the wristband and the wheelchair control unit. This is crucial for maintaining the privacy and security of users, preventing unauthorized access or interference.User acceptance testing involving paralyzed patients provided valuable insights into the system's practicality and user- friendliness in real-world scenarios.

VIII.CONCLUSION

This study describes a low-cost gesture-operated smart wheelchair system designed to improve safety and enable pleasant wheelchair travel for those with severe impairments. Obstacle detection, fall detection, and an emergency messaging system are important safety features.Humantrialswereusedinthefirmwaredevelopmentprocess toincludebothgenuineADXLsandsimulatedfallsintotheprototype. Thedatasetsthatweregatheredweresplitbetweentrainingandtesting the fall classifier. In light of the fact that pressure is a major power- hungry component of the fall detection system, future research will look at better energy-efficient ways to gather and interpret pressure data. Fix-point computations will also improve coding efficiency by replacing floating-point calculations. Notably, rather than utilizing an older dataset, the reviewed fall detection system was created and evaluated using datasets from young volunteers.

IX. FUTUREWORK

Explore the integration of additional safety features into the wheelchair and wristband system. This could include fall detection sensors, collision avoidance technology, andreal-

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time monitoring of vital signs such as heart rate and blood pressure. Enable seamless integration with smart home systems to allow paralyzed patients greater independence and control over their environment. This could involve voice-activated commands to control lights, temperature, and other home appliances directly from the wristband.

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