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Wheel Chair Control System Wireless Control Using Accelerometer

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Abstract: *The Wheelchair Control System using Wireless Accelerometer is an innovative project designed to assist physically challenged individuals in achieving greater mobility and independence. This system utilizes an accelerometer sensor to detect the tilt and orientation of the user's hand or head movements, which are translated into directional commands for controlling the wheelchair wirelessly. The accelerometer senses motion along multiple axes and transmits corresponding signals via a wireless module, such as Bluetooth or RF, to a microcontroller-based receiver circuit attached to the wheelchair. The microcontroller then drives the motors to move the wheelchair forward, backward, left, or right according to the user's gestures. This hands-free control mechanism eliminates the need for manual joystick operation, making it especially useful for users with limited hand or arm movement. The system offers advantages such as ease of use, low power consumption, and cost-effectiveness. Furthermore, safety features like emergency stop functionality and obstacle detection can be integrated to enhance user security. The proposed wireless accelerometer-controlled wheelchair thus provides a practical, smart, and affordable mobility solution for differently-abled individuals, enabling them to navigate their surroundings with minimal physical effort.*

Keywords: Wheelchair, Accelerometer, Wireless control, Microcontroller, Gesture recognition, Mobility assistance etc

I. INTRODUCTION

The Wheelchair Control System using Wireless Accelerometer is a modern assistive technology designed to improve the mobility and independence of physically disabled or elderly individuals. Traditional wheelchairs are typically operated manually or through a joystick, which can be challenging for users with limited hand or arm movement. To overcome these limitations, this project introduces a gesture-based wireless control system that allows the user to control the wheelchair simply by tilting an accelerometer sensor attached to their hand, head, or another convenient body part. An accelerometer is a motion-detecting sensor that measures acceleration and tilt in multiple directions (X, Y, and Z axes). The detected gestures are processed by a microcontroller, which interprets the movement direction and transmits commands wirelessly via Bluetooth or RF communication to the motor driver circuit of the wheelchair. Based on these signals, the wheelchair moves forward, backward, left, or right accordingly.

This system provides a hands-free, user-friendly, and efficient control mechanism, enhancing the comfort and autonomy of the user. It also eliminates the physical strain associated with traditional control methods. Additionally, the system can be expanded with features such as obstacle detection, speed control, and emergency stop functions for improved safety and functionality. Overall, the wireless accelerometer-controlled wheelchair represents a significant step toward intelligent and adaptive assistive devices, promoting inclusive technology that empowers differently able individuals to move confidently and independently in their daily lives.

Home automation is the way of the future, not just a luxury. A person who has lost their physical mobility is said to be physically paralysed. Different types of paralysis exist. They have monoplegia, which affects only one arm or leg. Paraplegia affects both legs, quadriplegia affects both arms and legs, and hemiplegia affects one arm and one leg on the

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same side of the body. Even for basic tasks like eating, dressing, and washing, a physically disabled person would seek out assistance from others. When there is no guardian to take care of such a person, things get even worse. How would someone like that operate the household appliances? And there are more questions like that. Many would respond that they would engage someone whose job it is to look after such individuals, but this is not a dependable solution. How much each item would matter to a new person. Thus, we wish to create a system in which a People who are paralyzed are frequently able to use voice commands and basic hand gestures to operate equipment. The user can operate powered equipment like fans and lights with gestures by wearing a MEMS accelerometer on their hand.

OBJECTIVE

- Wheelchair is the best assistive device used by elder and disabled people.
- The driving and controlling of traditional wheelchair are much harder task.
- Our point is to construct a moo fetched and capable wheel chair which makes a difference the incapacitated individuals to travel without depending on others.
- We want to give the disabled person the sense of freedom where they can go on their own.

II. LITERATURE REVIEW

Chuchart Pintavirooj et al. (2022) This project presents a smart wheelchair using eye-tracking technology designed for individuals with locomotor disabilities. It can be added to any electric wheelchair and consists of four modules: image processing, wheelchair control, SMS manager, and appliance control. A webcam on eyeglasses captures eye movements, which are processed by a Raspberry Pi using OpenCV to determine eye direction. These signals are then sent wirelessly to control the wheelchair's movement. Additionally, eye motion can be used to operate appliances and send messages via smartphone.

Shraddha Khadilkar et. al. (2022) This paper presents a smart wheelchair controlled via smartphone for physically challenged individuals. It enables voice and gesture-based control of wheelchair movement using Android functions, while also allowing users to access SMS, email, and news. The system employs eight sensors for detecting infrared signals, temperature, smoke, and light. It consists of three main units voice recognition, gesture recognition, and motor control integrated through an Android phone, AVR microcontroller, and sensors to provide efficient and interactive wheelchair operation.

K. Kiran Kumar et. al. (2023) To develop a smart wheelchair for blind and disabled persons. Methods and Analysis: The wheelchairs being used patients are not user friendly. In modern days, it is difficult for a person to attend a patient throughout the day. The proposed wheelchair can be self-manoeuvred easily by the patient using hand or head gestures. Apart from it, the wheelchair is aided by a voice guided indoor positioning system. Findings: We incorporated an IOT service device so that the status of the patient is regularly updated on a web server. This smart wheelchair is connected to the cell-phone of the guardian as well as the social media profile of the patient so that the patient can get help as soon as there's a mishap. Improvement: The wheelchair has ability to detect obstacles across the path of the patient and it can divert its path from the obstacle so as to avoid collision.

Haroon Khwaja Mobeen et. al. (2023) This paper describes an automated smart wheelchair controlled via an Android smartphone using hand gestures, voice commands, and phone tilts. The system employs an Arduino controller with a HC-05 Bluetooth module (smartphone as master, Arduino as slave) to manage motor drivers. Users can control wheelchair movement forward, backward, left, right, and stop through recorded voice commands or by tilting the phone using its gyroscope. The design focuses on voice accuracy and wheelchair velocity, with IR sensors for obstacle detection and emergency stopping, making it a reliable mobility aid for disabled users.

Siddhi Chokshi et al. (2024) This paper presents a basic but successful strategy for actualizing hand motion acknowledgment that gives a stage for individuals with physical disabilities.Using these signals, the wheelchair can be worked in an productive way that's typical and helpful not at all like a machine. The wheelchair comprises of an accelerometer sensor that faculties the hand developments and sends the yield to the microcontroller. Depending on the signals recognized by the accelerometer, the wheelchair will move in forward, in reverse, right and cleared out

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bearings. Impediments can be identified utilizing ultrasonic sensor, sparing the client from hazard. In case of any crisis the client can fair press the button given which sends the caution messages to the doctors/relatives with the assistance of GSM module.

G. Bhaskar Phani Ram et al. (2020) This paper proposes a low-cost system for controlling home appliances using voice and hand gestures to assist physically challenged individuals such as those with paralysis or Parkinson's disease. The system employs a MEMS accelerometer sensor to detect hand movements and a Bluetooth module (HC-05) to receive voice commands, both processed by a PIC16F877A micro-controller. The PIC controller handles gesture recognition and speech processing, enabling users to independently operate various home electronic devices through rehabilitation engineering technology.

III. EXISTING SYSTEM

This report proposes a model for Hand Gesture Controlled and Voice assisted Wheelchair, which is able to control some of the overall disadvantages of the other strategies commonly used by providing a gesture controlled wheel chair. This gives the client freedom and a mental advantage of being autonomous. To maintain a strategic distance from physical hardship, a client can utilize the accelerometer to the protect as with the slight bend often hand the client gets the capacity and flexibility to turn the wheelchair into the specified direction. Also, the obstacle sensor detects the obstacle, turns on the buzzer and stops the wheelchair because change of direction may be dangerous. The user can then give another alternate direction to move. During an emergency, the user presses the button placed on the wheelchair and the GSM module sends the recorded alert message to the relative/doctor Some existing automated systems use wired controls, voice commands, or button-based interfaces. However, these systems have several limitations:

- Limited Accessibility: Users with restricted hand or arm movement find joystick or button control difficult to operate.
- Wired Dependency: Wired control systems restrict the range of movement and can cause inconvenience due to tangled or damaged cables.
- High Cost: Advanced systems with complex electronic interfaces and sensors are often expensive, making them unaffordable for many users.
- Low Adaptability: Many existing systems cannot adapt to different users' needs or preferences, reducing their usability and comfort.
- Delayed Response: Some systems suffer from signal lag or lack of smooth control, leading to unstable or jerky motion.

Because of these limitations, there is a growing need for a wireless, intuitive, and reliable control mechanism that provides smoother and more natural operation. The introduction of an accelerometer-based wireless control system addresses these shortcomings by offering a gesture-driven, easy-to-use, and cost-effective solution for physically challenged individuals

IV. PROPOSED METHOD

In proposed framework we are getting to screen the elderly individuals controlling wheelchair by utilizing hand signal and voice commands. Conjointly screen debilitated individuals controlling wheelchair and the working of cautions framework to their caretakers. The system consists of major components like ATMEGA328 with 32K Flash memory, accelerometer Sensor, 2 DC Motors and 12V DC supply, Relays, ADC, Crystal oscillator, LED circuitry etc

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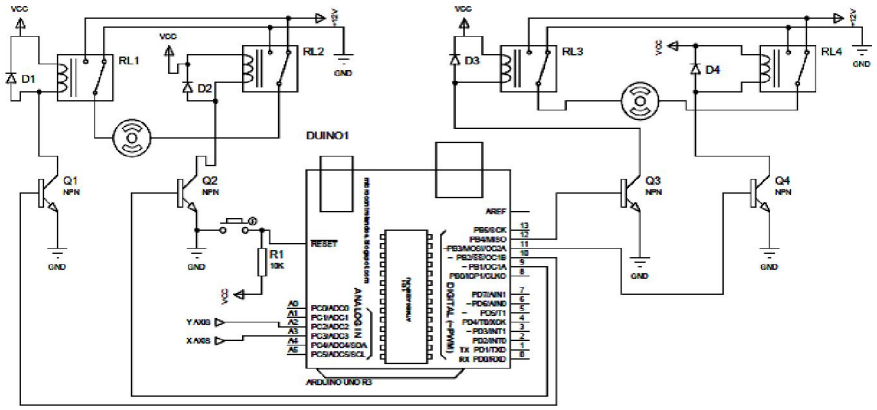
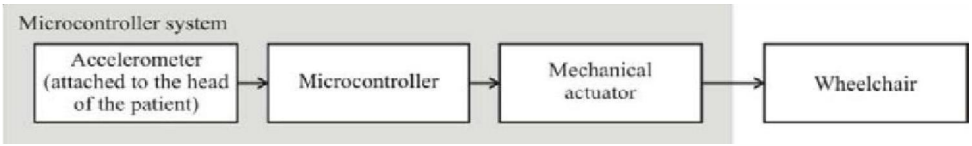
CIRCUIT DIAGRAM:



BLOCK DIAGRAM:



ACCELEROMETER:

An accelerometer is an integrated device that measures proper acceleration, the acceleration experienced relative to freefall. Single- and multiaxis models are available to detect magnitude and direction of the acceleration as a vector quantity, and can be used to sense orientation, acceleration, vibration shock, and falling. Micro machined accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.

It is a capable of measuring how fast the speed of object is changing. It generates analog voltage as the output which is used as an input to the control system. The accelerometer used in this automated system is ADXL335. It is a three axis accelerometer, which senses the tilt in two directions only. The supply voltage ranges from 2 to 3.6v

ADVANTAGES:

- User Friendly
- Efficient and Low Cost Design
- Fast Response
- Low Power Consumption
- Helpful for the paralysis stroke people who don't have much stamina in the hands.
- Reduces the human activity.
- Reduces the physical strain.
- Easy to operate with least movement required.

V. CONCLUSION

Accelerometers have a secure place in the movement of equipment based on actions done. The system can be made free from challenges and will be cost effective in the near future. Calibration though at times is problem but with more introspection and research better calibration and performance can be achieved. The system developed by us despite calibration errors and problems still is able achieve accuracy of 88-95%, further improvements can used to achieve an accuracy of 95-99%. The system proves a very competitive performance computationally and in terms of recognition accuracy. Interesting topic to research is the problem of tilting. As mentioned earlier, tilting of the remote can lead to

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erroneous recognition if not taken into account. Therefore, in our proposed system, subjects were requested to hold the remote in a natural way while performing the gestures and to avoid any tilting of the remote as much as possible. However, this way of holding the remote can result in some inconvenience to users of the system. Consequently, a system which is immune to tilting of the accelerometer is definitely a desirable one.

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