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GYROSCOPE CONTROLLED WHEEL CHAIR FOR DISABLED PATIENTS

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Abstract:

Utilizing useful, cutting-edge and reasonably priced equipment should improve the quality of life for patients and handicaps with physical disabilities. The physically impaired patients with an easily maneuverable wheelchair who had endured losing their extremities as a result of an accident, ageing, or illness. Due to losing both of their arms and legs, these individuals are unable to utilize an electric wheelchair with joystick or a manual wheelchair. The way this wheelchair moves is controlled by head movements. In the direction of the head, the wheelchair will move.

Keyword: MPU-6050, ATmega328p, l298n, Ultrasonic sensor

1. INTRODUCTION

The physically impaired patients with an easily maneuverable wheelchair who had endured losing their extremities as a result of an accident, ageing, or illness. Due to their disability, some people are unable to utilize manual wheelchairs or electric wheelchairs with joysticks. This wheelchair's movements are managed by head movements through a gyroscope sensor (MPU-6050). Additionally, an ATmega328p microcontroller is employed, and it is designed to cause the wheelchair to move in response to the patient's head moving in the same manner. The wheelchair will go ahead when the user tilts their head forward, to the left when they tilt their head to the left, and so on. Ultrasonic sensors are used in an obstacle detection system. This technique produced excellent results and will make using this wheelchair safer than using a normal wheelchair. It will contribute to improving their quality of life and reducing their reliance

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on others. This wheelchair is affordable, easy to use, and pleasant for those who are physically challenged.

The automation of today's technologies has reduced the necessity for human intervention. These automated systems are very accurate and dependable with less manual procedures. Patients with disabilities who struggle to use manual wheelchairs might benefit greatly from smart wheelchairs. Patients who had losing their hands cannot use the manual wheelchair or motorized wheelchair with joysticks. Such individuals require pricey, very complex medical equipment. As a result, a microcontroller-based technology that allows the wheelchair to move based on head motion is introduced.

The wheelchair described in the system uses a head motion and gyroscope sensor connected to a DC motor to assist people who are physically impaired. The gyroscope sensor is a micro-electro-mechanical sensor (MEMS) sensor that successfully converted head motions into data that a computer could understand. The patient will be assisted in using the wheelchair safely by the obstacle detection system, which makes use of ultrasonic sensors. It is a wheeled chair that has DC motors in the wheels so that patients may use it automatically. In comparison to manual wheelchairs, it is simpler. Rechargeable batteries can be used to power the DC motors.

II. OBJECTIVE

- The ultimate goal of gyroscope-controlled wheel chair is to provide physically disabled patients (with loss of both hands and legs) an easily controllable wheel chair.
- The range of application for gyroscope-controlled wheel chair is very wide since there are many patients with no legs and hand.
- This project also concerns the military personnel's who lost their body part during war

III. LITERATURE REVIEW

Human-computer interaction is the main topic of the study article "Hand Gesture Recognition: A Literature Review" [2]. It is an analysis of current hand gesture recognition technology. Crucial concerns at hand the problems of gesture systems are given to gesture recognition systems. Reviewing contemporary postures' techniques a technique for recognizing gestures was

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also shown. There are significant issues with the orientation histogram approach used here, such as the possibility that comparable movements might be different. Additionally, the suggested method might provide comparable orientation histograms for other gestures. Even though the dominant item in the photograph is not the hand motion, the strategy was successful in achieving it.

The Sensor-Based Gesture Control Wheelchair, described in a research article [3] published in IEEE, operates on the idea of gesture detection utilizing infrared sensors. In this technique, IR sensors are utilized to recognize basic movements that may be used to steer the motorized wheelchair in any direction. A gesture pad with IR sensors, an MCU, and a power management circuit is constructed for gesture detection and identification in the proposed prototype system, and a controller for controlling motors is implemented. The biggest issue with IR is that it loses sensitivity in daylight, which makes it difficult to execute subsequent programs. Additionally, employing IR sensors to identify precise motions is challenging.

We are employing an accelerometer that is affixed to the user's head in the form of a head set so that we can alter the direction of the wheelchair by just moving the user's head, or more specifically, by moving their head just a little bit in a different way.

IV. BLOCK DIAGRAM

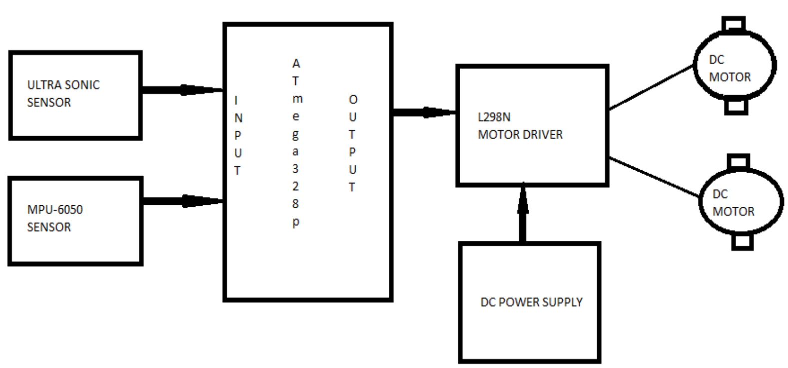

Fig. 1 Block Diagram of basic control system for a gyroscope-controlled Wheel Chair

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Fig.1 illustrates the block diagram of basic control system for a gyroscope-controlled wheelchair, using an ATmega328P microcontroller as the central processing unit. Here's a detailed description of each block in the diagram:

- ATmega328p

  Atmega328p is a microcontroller which is used to perform various tasks like input and output control. It has 32 kilo bytes of programmable read while write functionality. It has total 23 general purpose input and output pins. In this project we are using it to control the entire system. All the sensors and output devices are interfaced with this microcontroller.

- Ultrasonic Sensor

  An ultrasonic sensor is a piece of technology that converts the sound that is reflected back into an electrical signal after using ultrasonic sound waves to measure the distance to a target item. Audible sound travels at a faster rate than ultrasonic waves do (i.e. the sound that humans can hear). An ultrasonic sensor primarily consists of the transmitter (which produces sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

- MPU-6050

  A comprehensive 6-axis motion tracking device is the MPU6050 sensor module. In a compact size, it includes a 3-axis gyroscope, 3-axis accelerometer, and a digital motion processor. Additionally, it incorporates an on-chip temperature sensor as an extra function. In order to connect with the microcontrollers, it features an I2C bus interface. To interface with other sensor devices like a 3-axis magnetometer, a pressure sensor, etc., it features an auxiliary I2C bus. A full 9-axis Motion Fusion output may be provided by MPU6050 if a 3-axis Magnetometer is attached to an additional I2C connection.

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- L298N Motor Driver

  The L298N Motor Driver Module is a high power motor driver module that may be used to power DC and Stepper Motors. This module is composed of an L298 motor driver IC and a 78M05 5V regulator. The L298N Module may control two DC motors with speed and direction control or up to four DC motors.

- DC Power Supply

  The DC power supply is an apparatus that converts the AC power supply of the outlet into a reliable Direct Current (DC) and provides it to the device. To run electrical circuits or test electronic gadgets, it serves as a power source.

- DC Motor

  A DC motor is an electrical device that converts electrical energy into mechanical energy. The electrical energy used in a DC motor, direct current, is transformed into mechanical rotation.

V. DESIGN AND WORKING

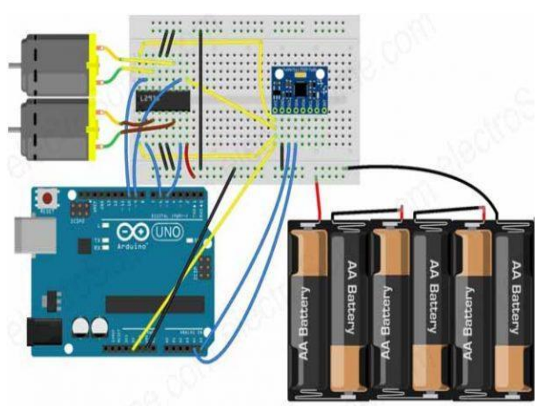

Fig 2. Basic setup of gyroscope-controlled wheelchair

The Gyroscope Controlled Wheelchair starts when the patient sits on the wheelchair and place his/her head on wheel chair. The wheelchair will not start until and unless you place your head to the head locator at certain distance. This is done for better patient experience and total control over wheelchair. In the head locator there is an ultrasonic sensor (mpu-6050) which detects the

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position and distance of head where you placed. If the head placed at proper position on head locator for 5 sec time, then the wheel chair will start, else there will be no motion. This technique is used so as to avoid uncontrolled motion. Once, the wheelchair starts, the gyroscope sensor (mpu-6050) will read the 3-axis accelerometer value and 3 axis gyroscope value. This value will be passed to ATmega328p microcontroller which already contains the calibrated value of gyroscope sensor. According to this calibrated value of gyroscope sensor, the microcontroller will generate the appropriate PWM (pulse width modulated) signal. This PWM Signal will be passed onto motor driver (l298n). We use motor driver to supply power to the motor instead of directly supplying it to the motor because, the voltage requirement of motor is 12v and more (for our application) which cannot be taken out of the microcontroller which will damage the components of the ATmega328p microcontroller. The l298n motor driver can control two dc motor. The PWM signals can be given to the EN (enable) pins of the l298n for controlling the speed of the motor. This PWM signal is then passed to the motors. According to speed provided to the motor the wheelchair will move right and left. If you rotate your head more to the right and less to the left, the generated PWM signal will be more to the left motor which will drive the wheel chair to the right direction and for the right vice-versa.

VI. CONCLUSION

In order to improve driving safety, this study suggested developing a new smart wheelchair with an obstacle detecting system. The gyroscope sensor is the foundation of the smart wheelchair's hardware, which interfaces with a microprocessor. In order to manage the wheelchair's motions in accordance with the user's head gestures, this system made use of the gyroscope MPU-6050 sensor as its primary design element. The wheelchair pauses as it approaches an obstruction thanks to an obstacle detection technology that uses ultrasonic sensors. The microcontroller ATmega328p was in charge of connecting each of these sensors to the wheelchair. For the elderly and the disabled, the designed system creates a safer environment, allowing them to roam alone indoors or even outdoors with greater safety than before.

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