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AUTOMATIC ELECTRIC WHEELCHAIR CONTROLLER WITH HEALTH CARE MONITORING USING IOT

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Abstract: This paper introduces an automated system is to be developed to control the motor rotation of wheel chair based on head and hand movement of physically challenged person. According to the study, approximately 6 million people worldwide experience disabilities and depend on wheelchairs for their mobility needs. Traditionally, individuals had to manually navigate wheelchairs, often requiring external assistance. The advent of "joystick-controlled wheelchairs" emerged as a solution to this predicament. In this investigation, electrical wheelchairs incorporating the ADXL335 Accelerometer sensor's output signal, intricately linked to an Arduino microcontroller, are scrutinized. Furthermore, the study incorporates additional sensors for comprehensive patient monitoring. A heartbeat sensor measures the patient's heart rate and temperature sensor calculates the human temperature. The output of these processes is displayed on an LCD screen. The ADXL335 accelerometer sensor identifies specific movements of the patient's head or hand, such as nodding, looking up, or tilting left or right. The Arduino microcontroller interprets these readings and subsequently provides voltage to the motor driver, propelling the DC motor to facilitate wheelchair movement in various directions. Beyond catering to those with motor impairments, individuals with diverse health challenges can benefit from this innovative wheelchair integrated with health care monitoring using IoT.
Keywords: Arduino uno, Accelerometer, IoT, Heartbeat Sensor, Temperature sensor

INTRODUCTION

Recognizing the challenges faced by individuals with mobility impairments, advancements in assistive technology have paved the way for innovative solutions. Electric wheelchairs have been instrumental in providing independent mobility for those with motor system handicaps or debilitating health conditions. However, the conventional means of operating a wheelchair, often relying on assistance from others, can pose limitations and hinder the freedom of movement for the user. In response to this need, there have emerged two primary categories of medical devices exoskeletons and enhanced wheelchairs each designed to empower individuals with paraplegia and similar conditions. Both these devices incorporate sophisticated electronic systems comprising sensors, actuators, communication modules, and signal processing units. These components work in unison to not only recognize the user's intended movements but also facilitate and enhance their execution. The electronic systems within these assistive devices play a pivotal role in deciphering the user's activities, whether indoors or outdoors. By employing advanced sensors, the devices can interpret the user's commands and intentions, allowing for a more seamless and responsive experience. This technological integration aims to bridge the gap between dependence and independence, offering users a greater degree of control over their mobility.

In particular, electric wheelchairs equipped with these electronic systems represent a significant leap forward in enhancing the autonomy of individuals with mobility challenges. By incorporating cutting-edge technology, these wheelchairs enable users to navigate their surroundings more

independently, reducing their reliance on external assistance. This not only addresses the physical burden on caregivers but also fosters a sense of empowerment and self-sufficiency for the wheelchair users. In essence, the integration of electronic systems into medical devices like wheelchairs signifies a transformative step in the realm of assistive technology, striving to provide individuals with disabilities the means to lead more fulfilling and independent lives.

LITERATURE SURVEY OF THE PROPOSED SYSTEM

The literature survey reveals a growing interest in developing innovative wheelchair control systems to address the mobility challenges faced by physically challenged individuals[1]. Traditionally, manual navigation of wheelchairs posed limitations, prompting the emergence of joystick-controlled wheelchairs as a solution[2]. However, recent studies have explored alternative approaches, with a focus on utilizing advanced sensors and microcontroller technology. One notable sensor employed in these studies is the ADXL335 accelerometer sensor, known for its ability to detect specific movements accurately[3]. Researchers have integrated this sensor with Arduino microcontrollers to interpret head and hand gestures, offering a more intuitive and responsive wheelchair control mechanism. It highlights the importance of additional sensors, such as heartbeat sensors, for comprehensive patient monitoring[4].

The identified studies emphasize the potential impact of these automated wheelchair systems on improving the quality of life for individuals with disabilities[5]. Beyond catering to motor impairments, the proposed systems aim to provide user-friendly solutions for a broader range of health challenges[6]. The implementation involves coding in the Arduino IDE and the utilization of Arduino-based hardware, particularly the Arduino UNO[7]. Overall, the literature survey underscores the ongoing efforts to develop advanced wheelchair control systems, integrating sensor technologies and microcontrollers to enhance accessibility and mobility for individuals facing physical limitations. The articles of various works describes about the working of automatic wheel chair for handicapped person but there is no article summaries about the health monitoring of the user or patient who are handicapped.

PROPOSED SYSTEM DESIGN AND ITS OBJECTIVE

The purpose of this project is to develop and construct an automated wheelchair so that people with physical disabilities can move about independently and simultaneously monitoring the health condition of the user. The idea behind this effort is to use a physically challenged person's head or hand movements to control the wheelchair's motor rotation. These individuals are equipped with an accelerometer-based transmitter, either on their head or hand, to enable autonomous movement. The wheelchair's motor will be driven by the transmitter's generated command signals, which are based on the motions of the user's head or hands. The Arduino Uno Microcontroller powers the autonomous wheelchair, which is based on a straightforward electrical control system. People with a variety of additional impairments can also benefit from this autonomous wheelchair by just sitting in the chair, holding the accelerometer, and moving it to control the movement of the vehicle.

The proposed system introduces an automated wheelchair control mechanism, integrating the ADXL335 accelerometer sensor and Arduino microcontroller. The system aims to enhance the mobility of physically challenged individuals by interpreting specific head and hand movements, such as nodding, looking up, or tilting left or right. Additionally, the system incorporates a heartbeat sensor for comprehensive patient monitoring.

Through this integration, the proposed system seeks to provide a user-friendly and intuitive solution for wheelchair control, addressing the diverse mobility needs of individuals with physical disabilities. The utilization of Arduino-based hardware, specifically the Arduino UNO, and coding in the Arduino IDE forms the basis for the implementation of this innovative wheelchair control system. Here the system uses the foremost technology of the science for data management. It incorporates with the technology of Internet of Things. Here the system uses the Iot technology to monitor the patient or user in remote places also. The data collected from the processor it sends the data to the cloud. The user can also check the data of information from the other side.

BLOCK DIAGRAM OF PROPOSED SYSTEM

A block diagram is a type of diagram that presents a visual representation of a system or process using blocks connected by lines or arrows. Each block represents a component or stage of the system, and the lines or arrows represent the flow of information or materials between the blocks. The figure1 shows the actual block diagram of the proposed system. The block diagram includes the input modules and output modules which is integrated in to the system. Here the system uses the input module as Heart beat sensor, temperature sensor and accelerometer. Then it uses output modules as LCD display, DC motor and Wi-Fi Modules. The processor is the brain of the system, here the system uses the Arduino Uno as the microcontroller it collects the data of information from the input modules and maintains the data and reacts to the output modules depends on the instruction of users.

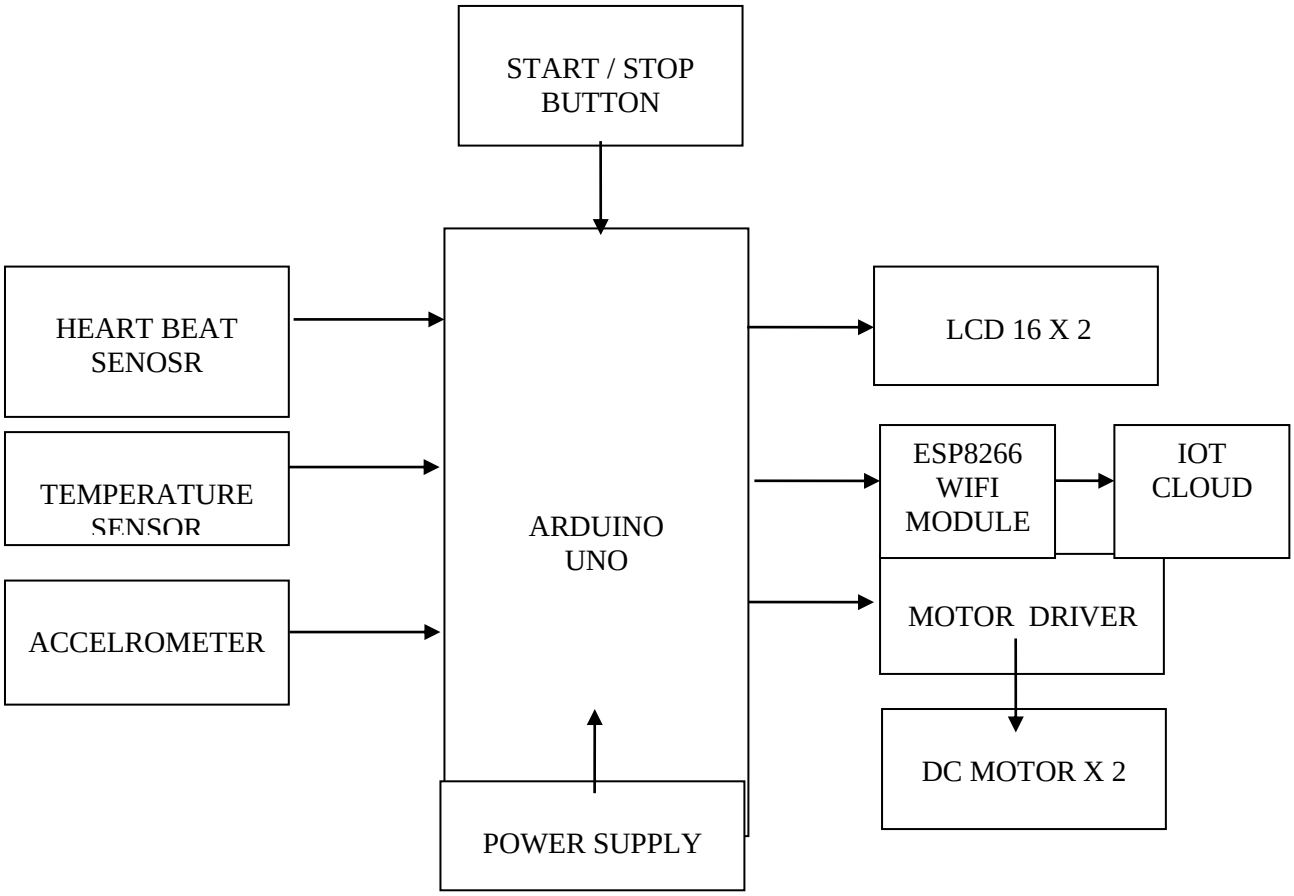


Figure 1- Block Diagram of Proposed System

HARDWARE DESCRIPTION OF THE PROPOSED SYSTEM

Power Supply: The motor driver is linked to the 9V power supply, and the Arduino Uno is connected to the 5V power source. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load.

Accelerometer: In this work, the accelerometer modifies the angle of direction with regard to the earth and detects acceleration caused by gravity. While moving, the accelerometer also regulates the device's direction and speed.

Arduino UNO: The Arduino Uno is a versatile microcontroller board designed for both beginners and advanced users alike. At its core lies the ATmega328P microcontroller, providing a robust platform for countless electronic projects. With 14 digital input/output pins, 6 of which support PWM output, along with 6 analog input pins, the Uno offers ample connectivity options for interfacing with sensors, actuators, and other devices. Its USB interface facilitates easy programming and power supply, allowing seamless communication with a computer and eliminating the need for external power sources during development. Operating at a clock speed of 16 MHz, the Uno delivers reliable performance for a wide range of applications. Its compatibility with a vast ecosystem of shields, sensors, and libraries further enhances its utility, making it an ideal choice for prototyping

and experimenting in the realm of electronics and programming. Open-source in nature, the Arduino Uno encourages exploration and innovation, empowering users to delve into the world of embedded systems with confidence and creativity.

Motor Driver: The DC motor's potential rotation is managed by the DC motor-driver (L293D). The motor-driver in this project is in charge of two DC motors at once. This implies that it concurrently controls the direction of two motors, assisting in the synchronized movement of the vehicle's wheels.

DC Motors: An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

Heart Beat Sensor: A heartbeat sensor, also known as a heart rate monitor, is a vital tool used for real-time measurement of heart rate. Operating on principles such as photoplethysmography (PPG), these sensors detect subtle changes in blood flow by emitting light onto the skin's surface and measuring the variations in light absorption caused by blood pulsation. By accurately capturing the heart's electrical signals, heartbeat sensors offer insights into an individual's cardiovascular health, exercise intensity, and stress levels. Widely utilized in wearable devices like fitness trackers and smartwatches, as well as in medical applications, heartbeat sensors are instrumental in promoting wellness and facilitating early detection of potential health issues. When integrated into projects, such as with Arduino Uno, heartbeat sensors provide a means to incorporate biometric data, enabling developers to create innovative solutions ranging from personalized fitness gadgets to advanced healthcare monitoring systems.

LCD Display: An LCD (Liquid Crystal Display) is a versatile visual output device commonly utilized in electronic projects, appliances, and devices for displaying text, numbers, and graphical information. Characterized by their compact size, low power consumption, and crisp display quality, LCD screens offer a user-friendly interface for presenting information in a wide range of applications. These displays typically consist of a grid of pixels, each controlled by individual transistors, which manipulate liquid crystal molecules to modulate light transmission and generate images. Here the system monitors the level of heartbeat and temperature of the user and displayed in the LCD.

SOFTWARE COMPONENT

Arduino IDE : The Arduino Integrated Development Environment is another name for the Arduino Software (IDE). It has several menus, a message box, a text terminal, a toolbar with buttons for commonly performed operations, and a text editor for writing code. It connects to the Arduino hardware in order to upload and communicate with programs.

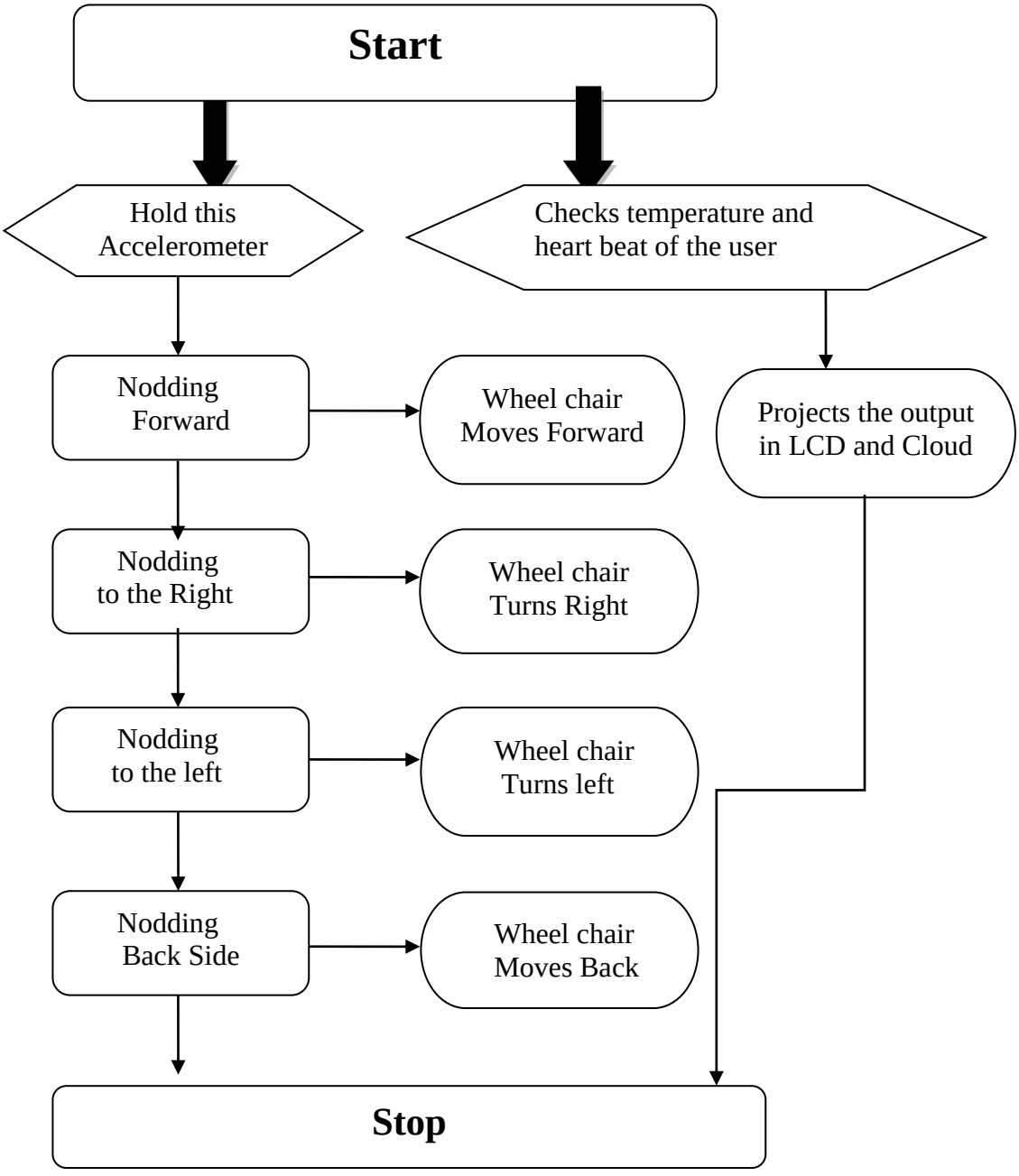
Writing Sketches : Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Serial Monitor : This displays serial sent from the Arduino board over USB or serial connector. To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the drop-down menu that matches the rate passed to **Serial.begin** in your sketch. Note that on Windows, Mac or Linux the board will reset (it will rerun your sketch) when you connect with the serial monitor. Please note that the Serial Monitor does not process control characters; if your sketch needs a complete management of the serial communication with control characters, you can use an external terminal program and connect it to the COM port assigned to your Arduino board.

WORKING PRINCIPLE

When the push button is pressed, the device turns ON. The Motor driver logical pins are connected to pins 7, 6, 5, and 4 on the Arduino Uno. The Motor driver allows the control of the direction, and the DC motor is used to move the wheelchair. The Heartbeat sensor contains 3 pins: VCC, GND, SIGNAL. The SIGNAL pins of the Heartbeat sensor are connected to the A0 Analog pins of the Arduino Uno. The Heartbeat sensor is used to measure pulse rate, and the pulse rate will be displayed on the LCD display. The Accelerometer ADX335 sensor contains 5 pins: VCC, GND, X, Y, Z. The X, Y, Z pins are connected to the A1, A2, and A3 Analog pins of the Arduino Uno. The Accelerometer sensor is used to determine the direction to go. The accelerometer changes the X, Y, Z direction and sends the analog data to Arduino. Arduino controls digital pins D7, D6, D5, D4, sending the logical output to the motor driver. The DC motor rotates to move: 1 0 1 0 for forward, 1 0 0 1 for right, 0 1 1 0 for left, and 0 1 0 1 for back. Additionally, a heartbeat sensor reads the pulse value and displays it on the LCD display. A pulse sensor is a hardware device that can be used to measure heart rate. When the button is pressed again, the device turns OFF.

WORK FLOW OF THE PROPOSED SYSTEM



RESULTS

The result of this study is the development of an automated wheelchair control system based on head and hand movements of physically challenged individuals. Utilizing the ADXL335 accelerometer sensor connected to an Arduino microcontroller, the system interprets specific gestures such as nodding, looking up, or tilting left or right. The Arduino then translates these signals into voltage for the motor driver, enabling wheelchair movement in various directions. Additionally, the system incorporates a heartbeat sensor and temperature sensor for patient monitoring, with the output displayed on an LCD screen. This innovative wheelchair technology not only caters to those with motor impairments but also provides a user-friendly solution for individuals with diverse health challenges.

CONCLUSION

The developed automated wheelchair control system, integrating the ADXL335 accelerometer sensor and Arduino microcontroller, presents an innovative solution for individuals with physical challenges. The system's ability to interpret head and hand movements enables intuitive wheelchair control, addressing the mobility needs of approximately 6 million people worldwide. The inclusion of a heartbeat sensor for patient monitoring further enhances the system's functionality. This technology not only benefits those with motor impairments but also offers a user-friendly solution for individuals facing various health challenges. The successful implementation, facilitated through coding in the Arduino IDE and the use of Arduino-based hardware, highlights the potential impact of this automated wheelchair system in improving the overall quality of life for individuals with disabilities. The system gives customers easy wheelchair control with a more natural and intuitive interface by allowing them to move their head or hand.. people with mobility impairments the ability to go about on their own and develop a sense of independence and autonomy. Wheelchair users may move more precisely and responsively thanks to accelerometer-based control, which improves their ability to accurately navigate a variety of surroundings. Users with LCD screen integration may examine real-time heart rate data. The accelerometer-controlled system is appropriate for individuals with varying degrees of technical proficiency due to its intuitive interface. Numerous users may tailor the system to their preferences and needs, ensuring that each person receives a special and adaptable solution.

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