Solar Powered Wheelchair with Voice Control and Gesture Controller

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Abstract **- Patients with physical injuries and disabilities who have good mental strength try to move around using a traditional hand-powered wheelchair. In our project, we enable a low-cost installation in any existing wheelchair that enables an intelligent system for automated movement controlled by any smartphone. The main concept is an Android smartphone that includes health monitoring and three motion control options: gesture, switch and voice command. The goal of our project can be extended to other Android mobile devices by sharing an IoT-enabled application. using an embedded system to design a smart, motorized, voice-controlled wheelchair The proposed design includes a voice activation system for industrial use.**

Index Terms **- Arduino, Bluetooth module, Gesture, Traditional hand powered.**

I.INTRODUCTION

An idea to make life easier for those of us unfortunate enough to have lost the ability to move our legs due to significant paralysis, accident or old age. Many differently abled people are usually dependent on others in their daily lives, especially when moving from one place to another. Wheelchair users always need someone to help them move the wheelchair. Life is made difficult for them by the fact that their wheelchairs lack an intuitive control system that would allow independent movement. Using an electric wheelchair leads to a lot of independence for people with physical disabilities who cannot walk independently or operate a mechanical wheelchair because it requires a lot of effort and the help of other people. There are various wheelchair driver-based jobs for the physically challenged. Most of them provide a controller to move the wheel in various forms of control and move the wheelchair using a voice controller. It also displays the results of chair movement in a noisy or quiet area. Our project specifies an Android-based system for automated wheelchair motion control. And a gesture control system using electronic circuits. Census data from 2001-2011 indicated that 8.3 percent of people in homes were people with various disabilities. Figures from the 2001 census revealed that more than 21 million people in India suffer from disabilities. This corresponded to 2.1% of the population. Among all those affected in the country were 12.6 million men and 9.3 million women. The number of affected is higher in rural and urban areas. According to the data, Tamil Nadu is said to have more than 1.75 percent disabled population to the total population.

The success of a technology product depends not only on its effectiveness, but also on the way it interacts with end users. End users are usually unaware of the ongoing processes that are necessary for the system to function effectively. So, the interface should be user-friendly to as many processes as possible. So, the Android platform is chosen because it provides various open tools for this task. The Arduino sends control signals to the motor drivers, a master-slave configuration is used to connect the Android app to the Arduino board, the smartphone acts as a master, and the HC-05 Bluetooth module acts as a slave to control voice commands.

With current developments in the field of robotics, embedded systems and artificial intelligence, a successful project has been developed to solve this matter simply and at very low cost. The cart in context can be remotely controlled from a few meters away wirelessly without actually sitting on it. The chair can be controlled by gestures with instructions as needed. Gesture recognition requires gesture recognition. Both

tasks are very demanding, mainly because of the variability of possible gestures (signs), and also because hands are complex, deformable objects that are very difficult to detect in a dynamic environment with a confusing background and changing lighting. So far, several techniques have been discovered to track the position of the hands and translate them to the appropriate level of tension. Standard input methods such as keyboard input and mouse pointer/position information do not provide natural human-machine interaction. Therefore, it is necessary to create models of natural communication between humans and machines. The ability to understand gestures will improve the naturalness and efficiency of human interaction with the machine and enable the user to communicate in complex tasks.

The project has some interesting features like solar panel, gestures, voice control, switch control, health monitoring sensors, DC motor, lead acid battery. These items are useful for a solar powered wheelchair in an automated system. But many individuals with disabilities who need a wheelchair are comfortable with it, and few members of the disability community find it difficult or impossible to operate a standard wheelchair. This project is included in assistive technology For disabled and dependent persons. It's a more independent, productive and enjoyable life. In order to perform functions, a disabled person with mobility impairment needs a wheelchair, which requires him to move. He can do this manually by pushing the wheelchair with his hands, but many of us have weak upper limbs or the manual mode of the wheelchair is too tiring. Therefore, it is desirable to provide them with a motorized wheelchair that is controlled by the movement of a gesture. Since the motorized wheelchair is important to be able to automatically avoid obstacles in real time, it can move at a decent speed. The price of this motorized wheelchair is affordable and it is useful to buy for middle class people. Through research and design a wise, solar powered wheelchair for control / development along with safe and effective use of providing independent mobility use. Using gestures, voice and a switch, they can control the solar wheelchair in four steps

- Forward direction
- Right direction
- Direction to the left
- Stop status

An Arduino is a tool that can be programmed to understand and interact with its environment. This is a good open-source microcontroller platform that allows electronics enthusiasts to build quickly, easily and at low cost with minimal project usage and monitoring. The combination of IoT and Arduino is a new way to introduce the Internet of Things into the healthcare system Monitor the patient system. The Arduino Uno Board collects data from the sensors and transmits it wirelessly to the IoT site. Communicating medical information, making the right decisions based on collected knowledge and patient knowledge can be a difficult task in IoT. For this project, a patient condition monitoring system (PHMS) primarily based on the Internet of Things Arduino is used to collect the specified parameters and examine the information obtained from the sensory devices. Together with Arduino, PHMS provides alerts to patients on preventive measures. This program advises the patient on medical support as well as the next step to follow in the event of an Associate in Nursing emergency. The combination of IoT with Arduino could be the new thing that will introduce the Internet of Things to the patient healthcare system. The Arduino nano Board collects information from the sensors and transmits it wirelessly to the IoT website. The designed PHMS system is certainly tested with parameters such as heart rate, temperature, pressure level, etc.

This project has numerous sensors that are used to monitor numerous health parameters to realize recovery rates and abnormalities in health status. In addition, the system uses Wi-Fi (Wireless Fidelity) technology for IoT, in which the application "Thing Speak" is used to display the health status of the presiding officer online through a mobile phone. Consequently, there is no need for the physical presence of a larger number of medical personnel accompanying the patients to check the health status of the presiding disabled person. This application sends the health status of the disabled with the appropriate time and date to evaluate the final result.

II.LITERATURE SURVEY

[1] A.B. Haque, S. Shurid, A. T. Juha [1] proposed that disable individuals are disregarded more often than not. Now they need human help 24/7 to proceed onward. They need a wheelchair to move

from one place to another as per their need. It would be much easier if the wheelchair needed for their task be automated and controllable by the person himself rather another constant human engagement. In this paper, a design has been proposed considering these facts. The wheelchair will be controlled by voice and gesture. To make the system energy efficient solar power will be used. Along these lines, while moving around all around the battery can be revived effectively. This keen wheelchair is additionally fit for hindrance recognition.

[2] S. N. Sakib, S. P. Mouri[2] This paper presents a study on a low-cost solar-powered wheelchair for the disabled in Bangladesh. The main components are: wheelchair structure, solar panels, DC motors, control circuits, microcontroller and joystick. The proposed model is very useful for physically challenged people from rural areas. This proposed model is available to low income people in countries like Bangladesh. The wheelchair is cost effective and user friendly. The proposed model is self-contained and independent. A life-cycle cost analysis is performed for the proposed model and compared with an electric wheelchair that draws power from the grid for charging, and the proposed model is shown to have a lower cost. A solar-powered wheelchair will significantly help physically challenged people in their daily movements. The proposed model will be very effective in rural areas as well as in urban areas.

[3] N. Madheswari, S. Latha [3] Patients with physical injuries and disabilities with good mental strength struggle to cross places using a conventional manually powered wheelchair. This document allows economical mounting on any existing wheelchair, enabling an intelligent system for automated movement that can be controlled by any smartphone. The main concept is a smartphone that has an Android-like operating system that has a built-in 3-axis accelerometer and Bluetooth wireless technology. The purpose of our project can be extended to other mobile devices with Android mobile phone by sharing the developed application. The main second part of our system architecture has a PIC16F877 microcontroller that drives the different directions of the DC motor for the directional movement of the wheelchair and feeds the DC motor for the linear movement of the wheelchair. A DC motor drives the front wheels to turn the wheelchair, while a pair of DC motors connected to the rear wheels allows for linear movement.

[4] K. Vijayakumar, T. R. Vikram [4] This project designs an automated wheelchair to help physically challenged people and will serve as a complete form of automatic system (mobility aid). This paper presents the design and fabrication of a smarter solar-powered wheelchair with two control interface modes. A prototype of the smarter features of the solar powered wheelchair system was built based on a manually operated wheelchair that is commonly available in the market, with the addition of related work done in electrical and mechanical advancements. Bluetooth control interfaces are deployed in the system along with a manual wheelchair control interface, a joystick with enhanced user interaction. The mechanical design of a wheelchair, the electrical and control system of a smarter wheelchair are introduced. The wheelchair is solar powered for indoor/outdoor use. A high torque DC motor is used in our project. Other features include fingerprint, panic alarm and liquid crystal display. The fingerprint emergency button setting is located in the joystick itself and the buzzer is also used to release a sound when the emergency button is pressed.

[5] V. Aromal, G.L. Gokulnath, [5] This paper discusses a motorized solar powered wheelchair with speed and direction control applications. Speed control is implemented in this wheelchair to compensate for the absence of manual vehicle movement. And to ensure smooth movements, it also includes a cruise control that helps the cart move in one direction at a constant speed. The main objective of this project is to provide an economically feasible and cost-effective electric wheelchair that helps a person to move freely without depending on another person. The solar powered electric wheelchair is powered by energy stored in batteries and photovoltaic energy from the solar panel, traction is obtained by an electric motor. So the wheelchair uses solar panels to charge the battery and use it for small applications like powering the LCD and sending electrical signals. This paper mainly focuses on the production of a cost-optimal solar-powered wheelchair with speed and direction control applications designed for both indoor and outdoor environments.

[6] M.R. Hans, K.K. Sandeep[6] Solar system gets pure and clean energy from the sun. Solar panels are able to generate energy from the sun's rays and

convert it into electricity using the photovoltaic effect. During this process, the panel creates no pollution and is less expensive. We designed the solar wheelchair for disabled people. This wheelchair consists of solar panel, battery, charge controller, brushless DC motor. This report contains all the information about the components related to the solar wheelchair. The designed wheelchair system is self-propelled, making it very useful for the physically challenged. This is the best invention in the field of medicine. Earlier wheelchairs use mains power to charge the batteries. Also, the price of these vehicles was not affordable for the common man. In this case, an attempt is made to design a solar wheelchair at an affordable price so that it can be accessible to the common man.

[7] B. Haque, S. Shurid,[7] Persons with disabilities are overlooked more often than not. Now they need human help 24/7 to keep moving forward. They need a wheelchair to move from one place to another according to their needs. It would be much easier if the wheelchair required for its task was automated and controlled by a human, rather another constant human involvement. In this article, a proposal was made with these facts in mind. The cart will be controlled by voice and gestures. To make the system energy efficient, solar energy will be used. In this direction, the battery can be effectively revived while moving all around. This smart wheelchair is also suitable for recognizing obstacles.

[8] D. S. R. Krishnan, S. C. Gupta[8] Currently Health-care Environment has developed science and knowledge based on wireless sensing node technology. Patients face the problematic situation of unexpected death due to the specific cause of heart problems and seizures, which is due to non-existence of good medical care for patients at the required time. This is for special monitoring of old patients and informing doctors and loved ones. So, we propose an innovative project to avoid such sudden deaths by monitoring the patient's health that uses sensor technology and uses the Internet to communicate with loved ones in case of problems. This system uses temperature and heart rate sensors to monitor patients' health. Both sensors are connected to Arduino-uno. To monitor the patient's health, the microcontroller is connected to an LCD display and a wi-fi connection to send data to a web server (wireless sensing node). In case of sudden changes in the patient's heart rate or body temperature, a patient alert is sent using IoT. This system also shows patients temperature and heart rate monitored live data with time stamps over the internet. Thus, the IoT-based patient health monitoring system uses the Internet to effectively monitor the health of patients and help the user monitor the work of their loved ones and save lives.

III.PROPOSED METHODOLOGY

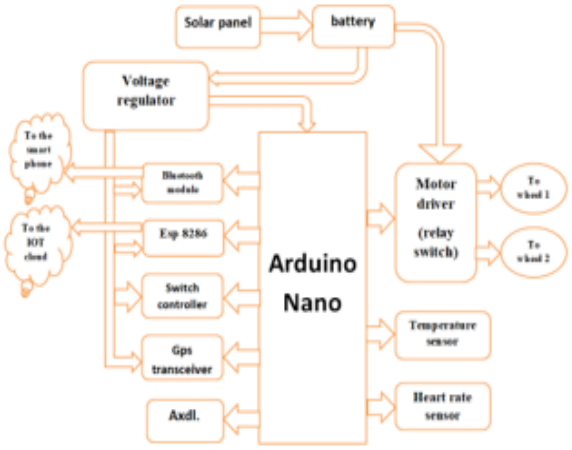

Figure 1: Block diagram of the proposed system

The block diagram of the proposed system shown in Figure 1, Methodology or block diagram is given above. At the very beginning, it checks which functions need to be used accordingly. If the user uses a gesture, the following steps will follow, otherwise the Bluetooth voice application will be used. Our examination allowed us to consider that although several models of smart wheelchairs are being created in a huge number of research enterprises far and wide, adapting their user interface to the patient is an often-ignored research point. In this way, businesses are required to focus on the growing new ideas of smart wheelchairs using multimodal interface and wheelchair interface adapted to the client's characteristics. Considering the price and other additional features, the wheelchair is designed entirely from metal and hardware. Two large tires were used to lift the chair and two small swivel wheels are added to balance the wheelchair before collapsing. In this wheelchair, the basic design of the gesture control circuit (which is known as the transmitter end) is to be implemented, and this circuit includes an ESP 8266, a motor controller, a Bluetooth HC-05 module, an Arduino nano, and a small battery (power source). Before initializing the source code on the transmitter

side, the Master-Slave Bluetooth module needs to be configured. There are online codes to configure the Master Bluetooth module (transmitter end) and the Slave Bluetooth module (receiver end) to receive data sent by the transmitter end from the hand. When configuring the Bluetooth module, the user needs to enter the AT command line to get the address of the Slave Bluetooth module. In addition, to set the transmission rate for the signals (data) to be transmitted wirelessly. Follow the same procedure to configure the master Bluetooth module and link the address of the slave module to the master module. Once the configuration is complete, the circuit must be designed to place the Master Bluetooth module and properly connect it to the Arduino Nano to send signals to the receiver end to control the movement of the wheelchair.

The work of the voice-controlled system

The voice confirmation module is a vital part of this enterprise which is used to arrange the ideal order of voice and yield. It consists of three stages which are voice matching, voice capture and voice confirmation. Voice matching is a way to coordinate with the ideal voice recorded for the desired yield signal. Voice capture is the phase that records the individual's ideal voice sequence and stores the voice depending on the adaptation adjustment. The voice confirmation stage is the last stage in which when the voice command is recognized, this module passes a specific message to the microcontroller for basic operation. In addition, the voice-controlled steering wheel seat will be limited by the application for its implementation in the IoT. This application-driven implementation takes into account clients other than the necessary client to control the bike seat. The system has two segments to be explicit: gear and programming. The hardware configuration includes an embedded system that relies on an Arduino nano board, a Bluetooth module, a motor

Android driver and phone. The Bluetooth module provides correspondence media between the customer through the Android phone and the structure through the voice request of the specified Android phone. The customer communicates the ideal request to the application of the item presented on the Android phone, which is connected via Bluetooth to the HC05 Bluetooth module. The voice request is turned into an assortment of strings and the string is passed to the associated Arduino Uno. The moment the Bluetooth module receives the message, the sent request will be isolated and executed by the attached microcontroller and depending on the commands processed by the motor drivers, the motors will operate as requested. The system will interpret the commands and control the cart in a similar way through the Android app.

Management

Forward: The wheelchair moves forward. All motors will move in the same direction as the front.

Right: only the motor on the left side will work and the motor on the right side will stop and move to turn the wheelchair to the right.

Left: only the motor on the right side will work and the left motor will stop and move to move the carriage to the left.

Stop: All motors will stop.

Arduino nano: Contains everything normal to help a microcontroller; connect it to a computer with a USB connection or power it with an AC-to-DC connector.

Usage: 13 staggered pins and 6 straight pins. These kinds of pins allow us to connect hardware to our Arduino nano board remotely. These pins are used as a key to extend the preparatory limit of the Arduino nano into this current reality.

Bluetooth module: The HC-05 Bluetooth module is a master/slave module. Clearly, the modern office environment is a slave. A module's role (Master or Slave) can be masterminded essentially using commands. Slave modules cannot establish a relationship with another Bluetooth device; however, they can recognize the affiliation. The main module can start a relationship with various gadgets. It is used to interface an adaptable application with an Arduino board.

Motor Driver: Consists of all the functions that help the microcontroller; connect it to a computer with a USB connection or power it with an AC-to-DC connector. This allows us to control the speed and direction of two DC motors or easily control a single bipolar stepper motor.

How voice control works

The voice request is turned into an assortment of strings and the string is passed to the associated Arduino Uno. The moment the Bluetooth module receives the message, the sent request will be isolated and executed by the microcontroller connected to it and depending on the commands processed by the motor drivers, the motors will be filled as needed. The system untangles the orders and correctly controls the wheelchair through the Android app.

a) CASE-1: Consider a user who wants to move a wheelchair in the forward direction using a voice command. It was observed that the Arduino software converts the given voice signals into low and high current signals which in turn move the motor in forward direction. When the user inputs their Bluetooth voice into the app, the wheelchair is observed to move forward.

b) CASE-2: Consider a user who wants to stop a wheelchair. When the user says “STOP” in the app, they will see that the wheelchair stops.

c) CASE-3: Consider a user who wants to move a wheelchair from a stop position to the right or left. When the user inputs their voice into the app, the app records a right or left command, and the wheelchair is observed to move to the right or left.

The work of the system controlled by gestures

An accelerometer is an electromechanical device used to quantify acceleration forces. The accelerator resembles the primary circuit for some larger electronic devices. A capacitive accelerometer detects changes in capacitance between microstructures located in the gadget. If an accelerating power moves one of these structures, the capacitance will change, and the accelerometer will interpret this capacitance as a voltage for explanation. Increasing the speed of gravity in the X direction: Hold the board so that the board is facing you and the line on one side of the token is set perpendicular to the table. The acceleration of gravity is static because the chip is stationary.

In the resulting vector [1x3], the primary value that tells about the acceleration on the X-pivot is ≈1 g (9.81 m/s2). The last two properties that speak of the Y and Z tomahawk accelerations (as opposed to the increasing speed of Earth's gravity) ≈ 0.00 g. Push the plate up at an increasing speed of A m/s2. The acceleration of gravity is a dynamic and equivalent acceleration squared briefly by the force of gravity ≈ (+A-9.81) m/s2. After the analog to digital converter via Arduino, the signals are passed to the DC motor. DC motors themselves are extremely basic; any basic DC motor will have two wires that can legitimately be connected to a battery or power supply with the appropriate limit. The side of the motor that is connected to the positive pole of the power source will detect which direction the motor is turning.

Working process of solar panel

The solar panel power system is one of the main focal points of the wheelchair. Make the system consume less electricity. When a person moves outside with a wheelchair, the solar panel starts working automatically. So, when the solar panel hits the sunlight, it starts charging the battery. Photovoltaics is the main thing in a solar panel system that converts the sun's energy into electricity. Photovoltaic cells produce direct current or direct current energy, but a single photovoltaic cell is not enough to produce a large amount of electricity for a wheelchair. For this reason, the photovoltaic cell module to get enough energy. At the stage when the light reaches the p-n junction, light photons can pass through the thin p-type layer without much stretching in the junction. Like photons, the light vitality of the penetration provides sufficient vitality to create different sets of electron gaps. The light of the episode will disturb the hot equilibrium state of the junction. Free electrons in the depletion region can quickly move to the n-type side of the junction. The taps can thus quickly switch to the p-type side of the junction.

IV. HARDWARE AND SOFTWARE DESCRIPTION

1.ESP 32:

This is ESP WROOM 32 MCU module. The ESP WROOM 32 is a powerful, generic Wi-Fi BT-BLE MCU targeting a wide range of applications, from low-power sensor networks to the most demanding tasks such as voice encoding, music streaming and MP3 decoding. The core of this module is the ESP32S chip, which is designed to be scalable and adaptive. There are 2 CPU cores that can be individually controlled or powered, and the clock frequency is adjustable from 80MHz to 240MHz, the user can also turn off the CPU and use the low power coprocessor to constantly monitor the peripherals for changes or crossing thresholds. The ESP32S integrates a rich set

of peripherals, from capacitive touch sensors, Hall sensors, low-noise amplifiers, SD card interface, Ethernet, high-speed SDIO/SPI, UART and I²C.

Using Bluetooth, users can connect to their phone or send out low-energy beacons to detect it. The use of Wi-Fi allows a large physical range as well as a direct connection to the Internet via a Wi-Fi router. Ideal for wearable electronics or battery-powered applications, the ESP32 chip uses less than 5 µA. In addition, this module can support data rates of up to 150 Mbps and output power of 22 dBm per PA to enable the widest possible physical range.

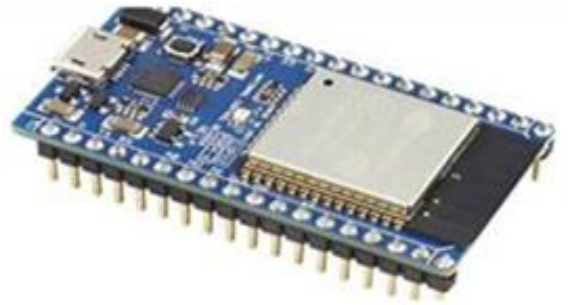

Figure 2: Wi-Fi module ESP 32

2. Arduino Nano:

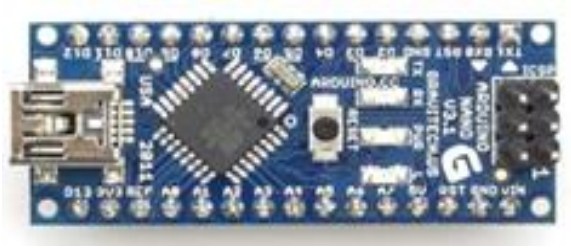

Figure 3: Arduino Nano

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs—a light on a sensor, a finger on a button, or a message on Twitter—and turn them into an output—activate a motor, light an LED, publish something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do this, you will use the Arduino programming language (based on Wiring) and the Arduino Software (IDE) based on Processing.

Over the years, Arduino has been the brain behind thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of creators—students, hobbyists, artists, programmers, and professionals—has gathered around this open-source platform, and their contributions have contributed to an incredible amount of available knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for rapid prototyping, aimed at students without knowledge of electronics and programming. As the Arduino board reached the wider community, it began to change to adapt to new needs and challenges, differentiating its offering from simple 8-bit boards to products for IoT applications, wearables, 3D printing and embedded environments. All Arduino boards are completely open source, allowing users to build them independently and possibly customize them to their specific needs. The software is also open source and grows thanks to contributions from users around the world.

3. HC-05:

Figure 4: HC-05 Bluetooth module

HC-05 Bluetooth module and perform Bluetooth communication between two separate Arduino boards as a master and slave device Before starting the first example, controlling the Arduino with a smartphone, let's take a closer look at the HC-05 Bluetooth module. Compared to the HC-06 module, which can only be set as a Slave, the HC-05 can also be set as a Master, allowing communication between two separate Arduino boards. There are several different versions of this module, but I recommend the one that comes on a breakout board because it's much easier to connect that way. The HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, which means it communicates with the Arduino via serial communication. HC-05 has two operating modes, one is Data mode, in which it can send and receive data. from other Bluetooth devices and another is the AT Command mode where the device's default settings can be changed. they can control the device in either of these two modes using the key pin as explained in the pin description.

It is very easy to pair the HC-05 module with microcontrollers because it works using SPP (Serial Port Protocol). Simply supply +5V to the module and connect the Rx pin of the module to the Tx MCU and the Tx pin of the module to the Rx MCU.

4. GPS:

Figure 5: GPS

The Global Positioning System (GPS) is a space-based satellite navigation system that provides position and time information in all weather conditions, anywhere on or near Earth where four or more GPS satellites have an unobstructed line of sight. The system provides critical capabilities to military, civilian and commercial users worldwide. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver. A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continuously transmits messages that include

*message sending time

*Position of the satellite at the time of transmission of the message. The receiver uses the messages it receives to determine the transmission time of each message and calculates the distance to each satellite using the speed of light. Each of these distances and positions of the satellites defines a sphere. The receiver is on the surface of each of these spheres if the distances and positions of the satellites are correct. These distances and satellite locations are used to calculate the receiver's position using navigation equations. This location is then displayed, perhaps with a moving map or latitude and longitude display; altitude information may be included. Many GPS units display derived information such as direction and speed calculated from position changes.

5. Humidity sensor:

The DHT11 humidity and temperature sensor makes it really easy to add humidity and temperature data. The DHT11 measures relative humidity. Relative humidity is the amount of water vapor in the air vs. saturation point of water vapor in air. At the saturation point, water vapor begins to condense and accumulate on surfaces to form dew. The saturation point changes with air temperature. Cold air holds less water vapor than it is saturated, and hot air holds more water vapor than it is saturated.

Figure 6: Humidity senso

6. DC Geared motors

Figure 7: DC gear motors

10RPM Economy Series DC Motor with Center Shaft is a high quality low cost geared DC motor. It has steel gears and pinions that ensure longer life and better anti-wear properties. The gears are mounted on hardened steel spindles polished to a mirror shine. The output shaft rotates in a plastic housing. The entire assembly is covered with a plastic ring. The gearbox is sealed and lubricated with lithium grease and requires no maintenance. The motor is bolted to the gearbox from the inside. Although the motor gives 10 rpm at 12V, the motor runs smoothly from 4V to 12V and provides a wide range of revolutions and torque. The tables below give a fairly good idea of motor performance in terms of rpm and no-load current as a function of voltage and inrush torque, inrush current as a function of voltage. You can find compatible wheels in the product category Wheels and accessories. You can also mount this motor on a chassis using the motor mount for an Economy series

DC motor with a center shaft. For information on adding a position sensor, see Economy Series Center Shaft DC Motor Sensor Kit.

7. Battery

Figure 8: Lead acid battery

One of the main problems with solar PV systems is that they only produce electricity when the sun is shining. If you want to go "off-grid" or have a battery backup during a grid outage, you'll need batteries in your solar PV system. In these systems, electricity produced from solar cells is either used in the home as needed, or if there is no demand in the home, it is converted into chemical energy in the form of batteries. These batteries can then produce electricity at night to allow you to use your solar PV system 24/7. The electricity produced by your solar system is stored in deep-cycle lead-acid batteries that look very similar to those found in most cars today (although different in design). The two most popular types of batteries are GEL and Absorbed Glass Mat (AGM), which store charge very well and don't degrade nearly as quickly as regular lead (wet) cells. Both types of batteries are designed to gradually discharge slowly and recharge to 80% of their capacity several times.

8. Solar panel

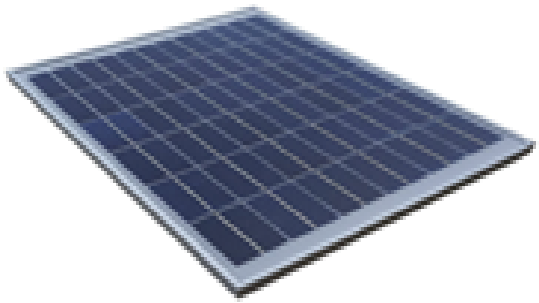

Figure 9: Solar Panel

The process of converting light (photons) into electricity (voltage) is called the solar photovoltaic (PV) effect. Photovoltaic solar cells convert sunlight directly into solar energy (electricity). They use thin layers of semiconducting material that is charged differently between the top and bottom layers. The semiconducting material may be enclosed between a sheet of glass and/or a polymer resin.

When electrons in a semiconducting material are exposed to daylight, they absorb photons, causing them to have high energy. These move between the upper and lower surfaces of the semiconducting material. This movement of electrons generates a current known as direct current (DC). This is then fed through an inverter that converts the energy into alternating current (AC) for use in your home.

9. Voltage Regulator

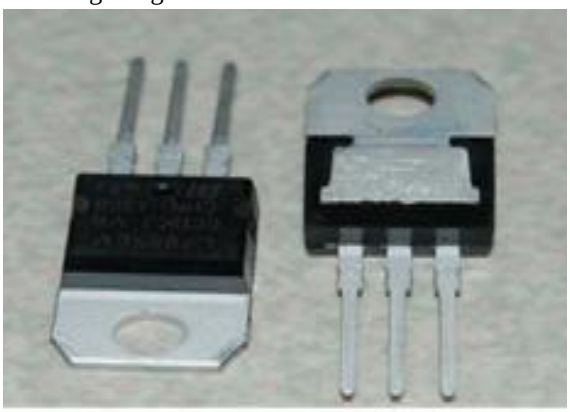

Figure 10: Voltage regulator

Voltage regulators are very common in electronic circuits. They provide a constant output voltage for varying input voltages. In our case, the 7805 IC is an iconic regulator IC that finds its application in most projects. The name 7805 has two meanings, "78" means it is a positive voltage regulator and "05" means it provides 5V as output. So our 7805 will provide an output voltage of +5V.

The output current of this IC can reach up to 1.5A. But ICs suffer from high heat losses, so a heatsink is recommended for projects that consume more current. For example, if the input voltage is 12V and you consume 1A, then (12-5) * 1 = 7W. These 7 watts are dissipated as heat.

10. Pulse sensor.

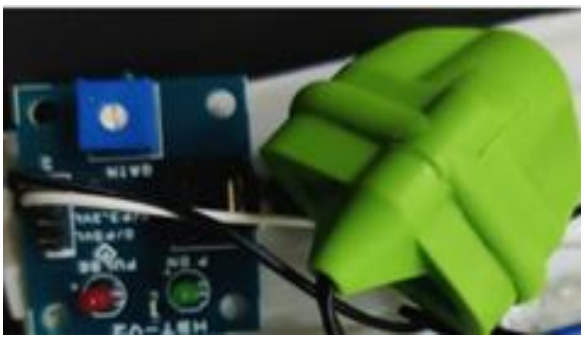

Figure 11: Pulse sensor

Green Easy Pulse Sensor Heartbeat Sensor HRM2511E is a DIY pulse sensor that is intended for hobbyists and educational applications, it is used to illustrate the principle of photoplethysmography (PPG), PPG is a non-invasive technique for the detection of cardiovascular diseases. pulse wave from the tip of the finger. The Easy Pulse Sensor uses a PPG probe sensor in transmission mode (HRM-2511E).

This sensor uses an infrared light source to illuminate the finger on one side, and on the other side of the sensor is a photodetector that measures small variations in the intensity of transmitted light due to changes in blood volume within the tissue.

• On-board components and instrumentation provide a clean and filtered analog PPG waveform.

• LED also indicates digital pulse output.

• Both analog and digital signals are synchronized with the heartbeat.

11. Gesture sensor

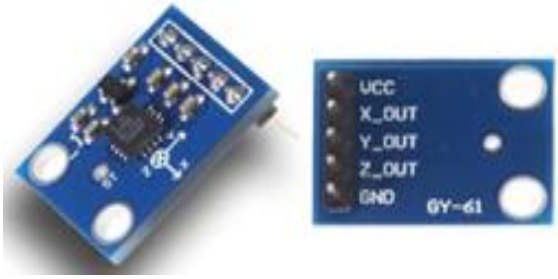

Figure 12: GY-16 gesture sensor

The GY-61 DXL335 3-Axis Accelerometer Module is a three-axis accelerometer sensor module based on the ADXL335 IC. The ADXL335 is a three-axis accelerometer with extremely low noise and power consumption. The sensor has a full sensing range of +/-3g. It can measure static acceleration due to gravity in tilt-sensing applications, as well as dynamic acceleration caused by motion, impact or vibration.

There is a built-in 3.3V voltage regulator to power the ADXL335, so the supplied power should be between 3.3V and 6V DC.

12. Relay

Figure 13: Relay driver circuit

A relay is a device that opens or closes contacts to cause another electrical control to operate. It detects an intolerable or undesirable condition with the assigned area and commands the circuit breaker to disconnect the affected area. It protects the system from damage. The internal part of the relay is shown in the figure below. It has an iron core that is wound by a control coil. Power to the coil is supplied through the contacts of the load and the control switch. The current flowing through the coil creates a magnetic field around it. Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Therefore, you close the circuit, causing current to flow through the load. If the contact is already closed, it moves in the opposite direction and thus disconnects the contacts.

13. Arduino IDE:

The Arduino Integrated Development Environment – or Arduino Software (IDE) – includes a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a number of menus. Connects to Arduino and Genuine hardware to upload and communicate with programs. Programs written using the Arduino software (IDE) are called sketches. These sketches are written in a text editor and saved with a file extension. The editor has cut/paste and text search/replace functions. The message area provides feedback during saving and exporting, and also displays errors. The console displays text output from the Arduino software (IDE), including complete error messages and other information. The configured board and serial port are displayed in the lower right corner of the window.

Buttons on the toolbar allow you to verify and load programs, create, open and save sketches, and open the serial monitor.

14. Things Speak

Thing Speak is open-source software written in Ruby that allows users to communicate with Internet-enabled devices. It facilitates data access, retrieval and logging by providing APIs for both devices and social networking websites.

Thing Speak originally launched ioBridge in 2010 as a service to support IoT applications.

Wheelchair health monitoring:

Step 1: Open the app

Step 2: Choose a wheelchair

Figure 14: Thing speak channel selection window

Step 3: observe the properties

Gps: Latitude and Longitude

Figure 15: Plot of latitude and longitude

Step 4: observe the properties

Temperature, humidity and heart rate:

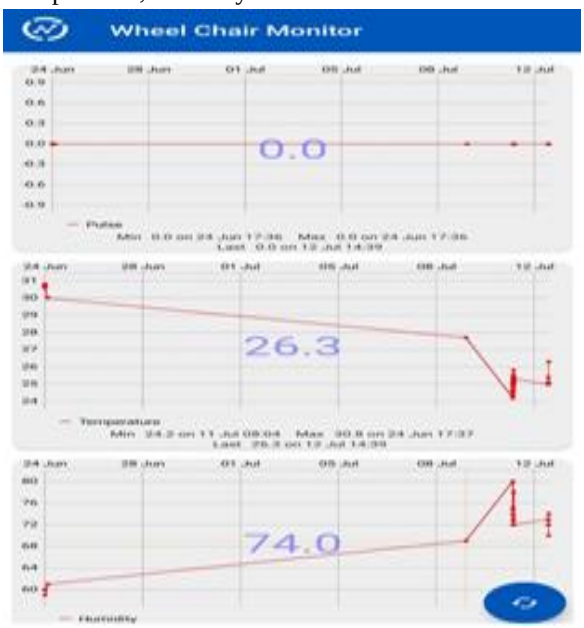

Figure 16: Health monitoring graph

15. Arduino Voice Controller Application:

The voice confirmation module is a vital part of this enterprise which is used to arrange the ideal order of voice and yield. It consists of three stages which are voice matching, voice capture and voice confirmation. Voice matching is a way to coordinate with the ideal voice recorded for the desired yield signal.

Application settings:

Step 1: Open the app

Step 2: Select a Bluetooth device

Figure 17: Bluetooth connection window

Step 3: Issue the command

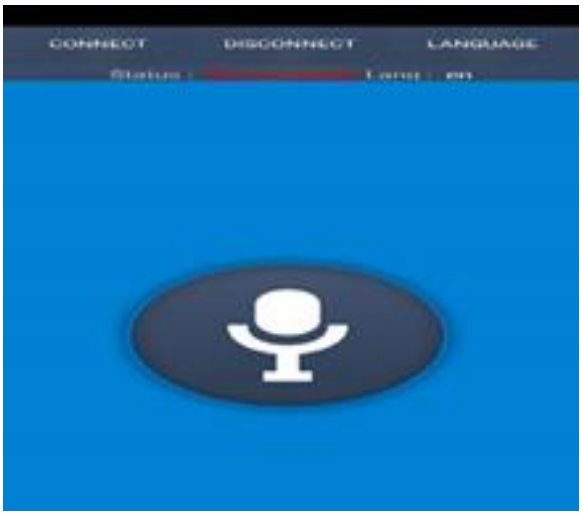

Figure 18: Voice commands window

commands:

Forward: The wheelchair moves forward. All motors will move in the same direction as the front

Right: only the motor on the left side will work and the motor on the right side will stop and move to turn the wheelchair to the right

Left: only the motor on the right side will work and the left motor will stop and move to move the carriage to the left.

Stop: All engine types will stop

V.RESULTS

The proposed project describes the results of the control system and IOT into two divisions. In the first division, the voice control results, gesture control results, and switch control results, and in the last division, the IOT cloud outputs were explained in the section below

Figure 19: Top, bottom, right and left side view of the wheelchair

Voice control results

A voice-controlled system using a Bluetooth voice application is used, with the command "forward" to move forward, "right" to turn to the right side, "left" to turn to the left side, and "stop" command to stop the wheelchair.

Gesture control results

Gesture control using the gy-61 three-way accelerometer is shown below It senses the hand gesture threshold angle for a forward angle of 25 degrees, for a stop angle of 0 degrees, for a left side of 30 degrees left, and for a right side of 30 degrees right

Figure 20: Gesture control position

Switch control

If both switches are off, the wheelchair will stop, if the right-side switch is on and the left side is off, then the wheelchair will turn right and the left side is on and the right side switch is off, then the wheelchair will turn left if both switches turn on, then the wheelchair moves forward.

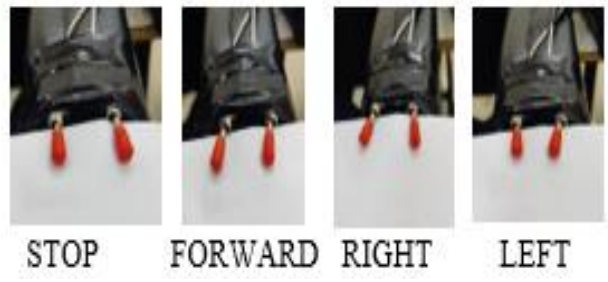

Figure 21: Switch control positions

IOT cloud results

It continuously monitors and updates heart rate, temperature and latitude and longitude values to update location using these options that anyone can monitor regularly in a wheelchair.

Figure 22: Things peak Cloud IOT window

VI.. CONCLUSION

This project develops the design and construction of a smart wheelchair using a Bluetooth module, gesture controller and switches. The circuit works properly to move as commanded by the user. The system has been successfully implemented to move the cart left, right, forward, backward or stay in the same position. After designing a circuit that allows the physically challenged to control their bike using an Android app on their smartphones, it has also been tested and validated. As one turns on the circuit and begins to move. This proposed system contributes to the self-sufficiency of differently abled and elderly people. Health deviation reports are generated, and periodic health reports are stored in a web-based application where the caregiver and physician have access, based on which effective diagnosis can be made. The smart wheelchair has proven itself both in the home and for commercial purposes.

The wheelchair is fully capable of carrying a load of up to 110 kg and moving in accordance with the gesture of the person using the wheelchair. Some improvisation and improvements can be made to make the wheelchair more accessible to those whose entire body is paralyzed. Some eye gesture or brain signal reader can be transferred to the wheelchair system to make it better.

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