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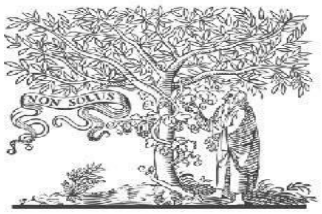

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Title **SAATHI [A VOICE CONTROLLED WHEELCHAIR]**

SYSTEM

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SAATHI [A VOICE CONTROLLED WHEELCHAIR]

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Abstract: The present-day society demands the people to be independent, irrespective of their natural challenges, mentally or physically. Physically impaired people have to rely on someone for fulfilling their even minor needs. The probability of them to go and interact with the outside world is very minimal unless they are provided with modern moving tools such as a Wheelchair. There are two possibilities of either using manual driven or electric powered driven wheelchairs. The former solution is only for the people who have disability in lower limbs and also long-term usage poses further health problems. Additionally, the efficiency of the manual driven wheelchairs is merely 10-20%.

This project aims to control a wheelchair by means of human voice. It enables the disabled people who can't move their hands and legs to move around independently using the voice recognition application which is interfaced with motors to make the movement easy as much as possible, using a voice recognition application which is interfaced with motors.

The prototype of the wheelchair is built using a computer software, in addition to its versatility and performance in mathematical operations and communication with other electronic devices. The system has been designed and implemented in a cost-effective way so that if our project is commercialized the needy users in developing countries will benefit from it. In order to do that we applied a program carried on Arduino circuit which is connected to the voice recognition the signal operates a motor to control the movement of the chair.In this way we have obtained a wheelchair which can be driven with using voice commands and with the possibility of avoiding obstacles and downstairs or holes detection. The wheelchair has also been developed to allow autonomous driving. The project, in which prototype has been produced, electronic system configuration, a sensor system, a mechanical model, voice recognition and autonomous control are considered.

Index Terms: Android Application, Wheel chair, physically Challenged, Ultra sonic Sensor, Voice Command, HC-05 Bluetooth Module, DC Motors, Arduino UNO Micro-controller.

1. INTRODUCTION

"Give me a wheelchair that is light and compact, that fits in a small plane when I need to fly outing the wet season. Make sure it's comfortable, does not give me

pressure sores, to make me look like a cripple straight out of hospital. It has to be easy to push because I want to get out, go crabbing in the boat and go fishing on the beach." (Hales S 2001) This quotation describes the needs of a wheelchair user in an Aboriginal community.

The number of people who need to move around with the help of some artificial means, whether through an illness or an accident, is continually increasing. These means have to be increasingly sophisticated, taking advantage of technological evolution, in order to increase the quality of life for these people and facilitate their integration into the working world. In this way a contribution may be made to facilitating movement and to making this increasingly simple and vigorous, so that it becomes similar to that of people who do not suffer deficiencies. Systems already exist which respond too many of the needs of people with different degrees of incapacity.

Recently, the old person and the physically handicapped person who use a wheelchair are increasing. However, only two type wheelchairs by the hand-operating and operating the joystick, have come into wide use. The former type needs muscular strength for the operation and the latter type needs the skill. Therefore, there is a problem that it is difficult for the old and the handicapped person to use these interfaces.

Today In biomedical sector, a wheelchair is an important device because of the recent advancements in the industrial populations. The demand of the physically handicapped and the aged are ever rising. As Smart wheelchair will play significant role in the future welfare society.

The use of smart wheelchair inspires the view of the machine as partner rather than as an instrument. The present wheelchairs do not have combination of technologies for their working.

However, only two types of wheelchairs are available in market like hand operated and joystick operated have come into wide use.

We are trying to construct a voice-controlled wheelchair; the system will recognize and follows natural language voice instructions such as "Start, Stop etc." The objective of this project is to make wheelchair moving forward, backward, Left & Right with the help of voice commands.

A wheelchair fitted with obstacle sensor to achieve some independent mobility when any obstacle is there in front of wheelchair. The obstacle sensor will help the rider control the wheelchair by taking over some of the decision for steering and avoiding objects until user is able to handle the job. The voice command we provide to the voice recognition model is person dependent. The system comprises of transmitting section and receiving section. Initially, the voice command is stored in the data base with the help of the function keys.

The voice received is processed in the voice recognition system where the feature of the voice command is extracted and matched with the existing sample in the database. The module recognizes the voice and sends control messages to the

microcontroller. The proposed Speech Recognition Based Wheelchair Operation allows physically disabled person to control the wheelchair easily without the need to use hands.

The movement of the powered wheelchair depends on the motor control and drive system which consists of microcontroller and motor driving. Once the voice recognition system recognizes the voice commands in comparison to the stored memory, the respective coded digital signals would be sent to the microcontroller which then controls the wheelchair accordingly.

Many disabled people require wheelchair for mobility. They are not always able to control it themselves. Caretakers not always able to actively monitor disabled individuals. Disabled people need a way to control their wheelchair that meets their specific need.

The objective of this project is to facilitate the movement of people who cannot even use their hands to operate power wheelchair. The result of this project will allow disabled people to live with less dependence of others. Speech recognition will provide a new way of human interaction with machine. This project also includes the Obstacle detection module for automatic detection of obstacles.

The use of Infrared sensors will help to detect the obstacle and the controller will automatically turn the wheelchair.

The goal of this smart wheelchair project is to enhance an ordinary powered wheelchair using sensors to perceive the wheelchair's surroundings, a speech interface to interpret commands. Intelligent wheelchair will play an important role in the future welfare society This project contains integration of the voice recognition system and Ultrasonic/Infrared sensor system. Basic voice commands will be used for the movement of the wheelchair. E.g. Start, Left, Halt/Stop. In order to avoid the environmental disturbances, we will provide less number of voice commands. With the help of Ultrasonic/Infrared sensors, Wheelchair will intelligently detect and avoid obstacles.

2. LITERATURE REVIEW

Shraddha Uddhav Khadilkar and Narendra Wag Darikar stated the wheelchairs are used by the people who cannot walk due to physical illness, injury, or other disability. Now a day's development promises a wide scope in developing smart wheelchair. This paper is to describe an intelligent wheelchair using smart phone is developed to control the rotation of wheelchair based upon voice and gesture movement for the physically challenged persons. In build voice and gesture function are used to control the wheelchair as well as by using smart phone reading SMS, Email, News. The sensor used are 8 in which 2 of them are IR sensors the remaining are for temperature, smoke detection, and light detection sensors. This system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing. The system is divided into 3 main units Voice recognition through Android, Gesture recognition through Android, Motor control through signal conditioning. The system is based on

grouping an android phone with an AVR micro-controller and sensors.

Rahul Jiwane, Priyanka Mahamunkar, and RituNotani stated the proposed system describes the design of a smart, motorized and voice-controlledwheelchair using an embedded system. The system design depicts the "Smart Wheelchair" that supports voice activation system for physically disabled and old aged people by incorporating voice commands which would control the movement of the wheelchair. The voice command is given through a cellular device such as cell phone having Bluetooth and the command is transferred and converted to the string for Adriano and is transferred to the Bluetooth Module SR-4.0 connected to the Adriano board for the control of the Wheelchair. When the user says "Go" the chair will move in the forward direction, the chair would move in the backward direction for "Back" and similarly "Left", "Right" for rotating it in left and right directions respectively and "Stop" to stop the wheelchair. This system is designed and developed to save cost, time, energy and dependence on the others for the movements of wheelchair using physically handicapped person.

Riya Ravi, Berly Paul, Sirin K.L and Varun Kumar4 stated the voice-controlledwheelchair is a mobile wheelchair whose motions can be controlled by the user by 5 giving specific voice commands. The speech recognition software running on a PC can identify the 5 voice commands 'Run', 'Stop', 'Left', 'Right' and 'Back' issued by a particular User. This system controls the wheelchair as well as read the parameters of patient.

M.Prathyusha,K. S. Roy and Mahaboob Ali Shaik stated to describe an intelligent motorized wheelchair for handicapped person using voice and touch screen technology. It enables a disabled person to move around independently using a touch screen and a voice recognition application which is interfaced with motors through microcontroller. When we want to change the direction, the touch screen sensor is modelled to direct the user to required destination using direction keys on the screen and that values are given to microcontroller. Depending on the direction selected on the touch screen, microcontroller controls the wheelchair directions. This can also be controlled through simple voice commands using voice controller. The speech recognition system is easy to use programmable speech recognition circuit that is the system to be trained the words (or vocal utterances) the user wants the circuit to recognize. The speed controller works by varying the average voltage sent to the motor. This is done by switching the motors supply on and off very quickly using PWM technique. The methodology adopted is based on grouping a microcontroller with a speech recognition system and touch screen.

3. METHODOLOGY

The system has two parts, namely, hardware and software. The hardware architecture consists of an embedded system that is based on Arduino Uno board, a Bluetooth Module, DC Motor and an Android phone.

The Bluetooth Module provides the communication media between the user through the android phone

and the system by means of voice command given to the android phone. The user speaks the desired command to the "Voice Control for Arduino voice (Voice Application)" software application installed in the android phone that is connected through Bluetooth.

The voice command is converted to an array of string and the string is passed to Arduino Uno connected to it. Once the Bluetooth Module receives the message, the command sent will be extracted and executed by the Arduino attached to it and depending on the commands fed to the Motor Driver, the motors will function accordingly. The system will interpret the commands and control the Wheelchair accordingly via android application.

Arduino board control wheelchair system with the Bluetooth module consists of two components mainly, the hardware component of the wheelchair and software component. The architecture of hardware component of an intelligent wheelchair system is based upon the Arduino board control along with the integration of Bluetooth module consisting of an embedded system, that is based upon an Uno Arduino board alongside a motor driver, Android phone integrated with a Bluetooth module. This system Bluetooth module gives a communication medium between the user and the wheelchair, that helps in controlling the wheelchair through the app on Android phone by giving voice commands. Specific commands are spoken by the user and the Arduino voice control BT and voice application AMR that is integrated into the smart phone analyzes the command and sends the digital information after analysis to the motor driver of the wheelchair. Bluetooth module gets the command from the user and then it converts this command into a language that is understandable for system's microcontroller for executing this specific user command accurately. Like for example, the disabled person gives the command of wheelchair going forward, the Arduino Uno board receives the command, and it converts or translates this information to the digital code of wheelchair forward and delivers it to the motor driver of the wheelchair, which is responsible for the wheelchair movements. If the disabled person gives the command of "Go" then the system of this wheelchair is programmed of understanding that command as an indication to move the wheelchair in forward direction. Similarly, when a disabled person says the command of "Back" this wheelchair system is programmed of understanding that command as the request of moving in backward direction, and in the same manner the system understands and executes the "Right" command as a request of turning the wheelchair in right direction and the "Left" command as a request of turning the wheelchair in left direction or rotate it in left direction. Finally, the command "Stop" is considered by the system to either park or stop the wheelchair movement.

The purpose of designing the system was mainly to ensure timesaving, cost saving, and energy saving for a disabled individual using the wheelchair. Ultrasonic sensors of the system are designed to help the detection of obstacles or objects that arrive in the way or path of this wheelchair. In doing so, it makes the system capable of not only detecting those obstacles but also avoiding them while moving.

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The wheelchair system can be controlled through an Android app that can be installed in the smart phone by the user to control the movement of the wheelchair. It basically contains two controlled modes, the first mode is known as the touch mode, and the second mode is known as the voice recognition mode. In the voice recognition mode, the user can control the movement of the wheelchair by giving voice inputs and commands through the smart phone app. The smart phone app of the wheelchair system converts the voice commands of the user into the string of data, and this string of data is sent through the Bluetooth module of the phone to the wheelchair. Lastly, it is delivered to Arduino Uno. Next, the Arduino Uno board on the wheelchair decodes the message and processes it. The motor driver on the wheelchair directs the wheelchair according to the given command of the user.

This implies that when the user says the "go" command the wheelchair system recognizes this as an instruction to move forward, while the word "reverse" from the user is interpreted by the wheelchair system as the command to move in the backward direction.

Components Used

- Arduino
- Ultrasonic Sensor
- IR Sensor
- DC Motor
- L293 Bridge
- Bluetooth

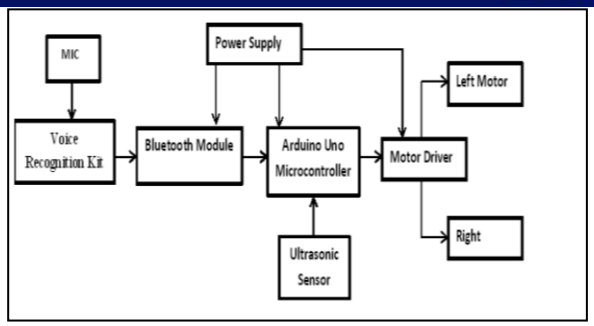

Fig 1 Block diagram For Proposed System

Arduino: The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Ultrasonic Sensor: Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects. Interfacing to a microcontroller is a snap. A single I/O pin is used to trigger an ultrasonic burst (well above human hearing) and then "listen" for the echo return pulse. The sensor measures the time required for the echo return and returns this value to the microcontroller as a variable-width pulse via the same I/O pin.

IR Sensor: An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting

and or the detecting infrared radiation. Infrared sensors are also measure or observe the heat of an object as well as by detects the motion .an infrared sensor circuit is one of the basic and popular sensor modules in an electronics device.

DC Motor: DC Motor is a device which transforms the electrical energy into mechanical energy. The working principle of the motor is the interaction between the magnetic field and the current to produce a force within the motor which helps the motor to do work. The motor principle is basically based on Faraday's Law, which states that, it is the conservation of electrical and mechanical energy. DC motor is one type of motor that uses the DC current to convert electrical energy into mechanical energy. When the electric current passes through a coil in a magnetic field, a magnetic force will be generated, which produces a torque in the DC motor.

L293 Bridge: L293D is basically a motor driver or controller. It has two built-in H-bridge circuits which are able to control two DC motors simultaneously in both clockwise and counter clockwise direction. It acts as an current high amplifier because it take low current signal at its input and provides higher current signal at the output in order to drives different load e.g. stepper motor & DC motors. Its features include large input voltage supply range, large output current high noise immunity input signals etc.

Bluetooth: Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks (PANs). In 1994 a group of engineers at Ericsson, a Swedish company, invented a wireless communication technology, later called Bluetooth. In 1998, the original group of Promoter companies—Ericsson, Intel, Nokia, Toshiba and IBM—came together to form the Bluetooth Special Interest Group (SIG).

4. IMPLEMENTATION

The item for the proposed system is executed utilizing the Arduino IDE.

Integrated Development Environment (IDE) for Arduino: A substance chief for composing code, a message region, a message terminal, a toolbar with buttons for normal undertakings, and a progression of menus are totally expected for the Arduino IDE. It talks with the Arduino equipment and sends dares to it.

File

New creates a new supervisor instance with all of the essential features of the drawing present.

allows you to browse the envelopes and papers on your PC to create a sketch record.

At the point when you open Later, a rundown of the latest drawings that might be gotten to is shown.

Within the envelope structure of Sketchbook, the corresponding representation is displayed in a different proofreading case whenever any name is mentioned.

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Models All models provided by the Arduino Programming (IDE) or library are displayed when this menu option is selected. The models are arranged in a tree, making it simple to search by library or subject.

closes the Arduino Programming instance clicked.

Save The current name is used to save the artwork. A name will be proposed for the record in a "Save as..." exchange on the off chance that it has not as of now been named.

You can save the current drawing under a different name by selecting "Save as..."

It shows the printing-explicit Page Setting window.

In accordance with the Page Arrangement limits, Print sends the ongoing drawing to the printer.

By clicking Inclinations, you can change many IDE settings, like the language of the IDE interface.

All IDE windows are closed by Stop. The next time you start the IDE, the open drawings that were open when Stopped was selected will be restored immediately.

Edit

- Record at least one stage of modification as a fix or retry; You can use retry again when you come back.
- Cut The chose text is replicated to the clipboard and eliminated from the editor.
- After reproducing the text from the proofreader, duplicate copies the selected text and copies it to the clipboard.
- Copy the code for your sketch to the clipboard in a format that is suitable for presenting on the discussion with punctuation shading. Duplicate for Collection
- Duplicate as HTML recovers the code from your sketch and copies it to the clipboard as HTML, ready for use on websites.
- Glue the contents of the clipboard into the supervisor by copying them there from the clipboard.
- The entire selection made by the manager is included in Select All.
- Remark/Uncomment Inserts the /remark tag at the beginning of each line or removes it altogether.
- Indent adds or subtracts a space at the beginning of each selected line, moving the text one space to the side or removing a space.
- When you click "Find," the "Find and Supplement" window opens. Here, you can use a few models to figure out the text you need to look for in the ongoing plan.

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- Depending on where the cursor is, Find Next will highlight the following event, if any, of the string that was entered in the Find window as the pursuit object.

- Based on where the cursor is, Find Earlier highlights the preceding event of the string in the Track down window.

Sketch

Verify or arrange your drawing after checking for errors while it was being made. In the control center section, it will show the factors and the amount of memory used by your code.

Transfer stacks the parallel record onto the designated board via the predefined Port after aggregation.

Using a software engineer to transfer This will replace the board's bootloader; Go to Devices > Consume Bootloader to reactivate the option to transfer to the USB sequential port. Nevertheless, it enables you to make use of the entire Blaze RAM for your artwork. Keep in mind that following this advice will not result in the wires lighting up, assuming it isn't too much work. Navigate to Apparatuses > Consume Bootloader to accomplish this.

Send Out Completed Double produces a.hex file that can be filed or sent to the board using a variety of tools.

In the ongoing representation organizer, open the Presentation the Sketch Envelope order.

Add a library to your drawing by using the #include instruction at the beginning of your code. For more details, see the libraries listed below. From this menu item, you can also import new libraries from.zip files and launch the Library Director.

A new document is added to the drawing using Embed Document... it will be duplicated from its current location). As is customary for assets like documentation, the record is saved in the sketch's data subfolder. The sketch programming excludes the objects in the information envelope because they have not been gathered.

Tools

Your code is precisely arranged by Auto Arrangement by indenting it so that the declarations contained within the wavy supports are also indented and the opening and closing wavy supports line up.

The current drawing is saved as a.zip file using Document Sketch. The chronicle and the artwork are kept in the same envelope.

Reload the page and resolve the encoding issue. The proofreader's single map encoding and the roast guides of other functioning frameworks are unaffected by this.

Screen for Successive beginnings the information exchange with any connected board on the at

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present chosen Port and opens the comparing screen window. On the off chance that the board upholds it, this for the most part resets it. Perform a reset to prevent the sequential port from opening.

Board Select your preferred board. The various sheets are depicted in the following image.

All of your PC's real and simulated sequential devices are stored in this menu. You should feel immediately energized as soon as you enter the high level gadgets menu.

Software developer: Programming a board or chip without using the USB-sequential connection that is already installed is done with a hardware developer. In any case, if you want to modify a brand-new microcontroller, you will require this.

Consume Bootloader You can embed a bootloader into the microcontroller of an Arduino board by utilizing the options in this menu. This is useful if you buy a different ATmega microcontroller, which sometimes doesn't have a bootloader, but it doesn't affect how the Arduino board works on its own. Make sure that the appropriate board has been selected from the Sheets selection before eating the bootloader on the goal board. The necessary wiring was also installed as a result of this direction.

5. RESULTS AND DISCUSSION

The figure shows the interconnection between the motor and all the components of the wheelchair. The sensor is placed at the front of the wheelchair and motors powered with battery.

Fig 2 Output Screen

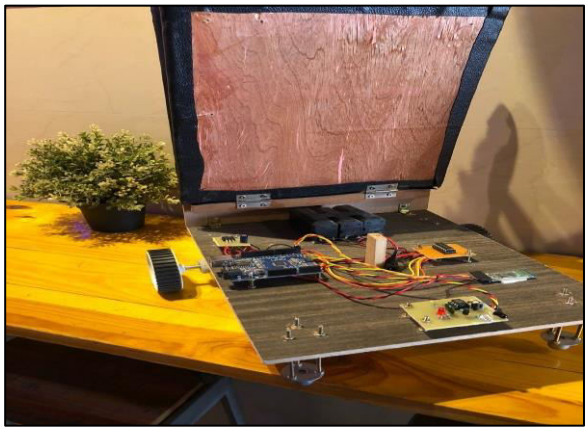

Fig 3 Output Screen

6. CONCLUSION

The social need is the independence of the physically challenged people. The mobility of the physically impaired people is made possible by the use of wheelchairs. Initially manual driven wheelchairs were used by physically handicapped people. However, the electrically driven wheelchairs are gaining popularity in the society.

The aim of the project was to design a voice-controlled wheelchair for disabled people usually depend on others in their daily life especially in getting from one place to another. From the above results and discussions following conclusion can be drawn. The voice controlled wheelchair runs successfully with a speed 0.5 m/s for 40kg load.

The wheelchair responds to the voice command from its user to perform any movement functions. The basic movement functions include forward and backward direction, left and right turns and stop. In order to recognize the spoken words, the voice recognition processor must be trained with the word spoken out by the user who is going to operate the wheelchair. This voice operated wheelchair will assist the handicapped persons to make them self-dependent for the purpose of movement for which these people are dependent on other most of the times. A person with disabled with legs and arms can use this wheelchair efficiently if he is able to speak, the motor drive and control system of the intelligent wheelchair has been presented.

The proposed Arduino based voice operated intelligent wheelchair would bring more convenience for the disabled people. The technology can also enhance safety for users who use ordinary joystick-controlled powered wheelchairs, by preventing collisions with walls, fixed objects, furniture and other people.

7. FUTURE SCOPE

Alternate Power Source:

Solar panel roof can be used as alternative power source and also it can be a protective layer from rain and sun.

Artificial Intelligence and Image Processing:

Artificial intelligence (AI) is technology and a branch of computer science that studies and develops intelligent machines and software. Major AI researchers and textbooks define the field as "the study and design of intelligent agents", where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.

GPS Navigation:

Navigating the actual position of wheelchair. A map and GPS system can be added to Arduino and by naming the places, wheelchair can go automatically to required place without commands of directions.

Mind control:

Controlling wheelchair by electric signal coming from brain. As our brain contains thousands of neurons, there is certain potential difference between each neuron. When we think something, neuron emits 0 to 50 HZ electric signal. By interpreting the signal by modulation/demodulation, we can control the chair.

A camera can be added to back of the wheelchair and a small LCD screen to let the user see without moving.

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