Semi-Automated Wheelchair withSafety Measures

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***Abstract*—Out of the total population in the world we found that 131,800,000 require a wheelchair. According to a study, 1% of people worldwide have rheumatoid arthritis. This is a chronic inflammatory disorder which affects many joints, including the ones in the hands and feet. This makes it difficult for them to perform daily activities and thus makes them dependent on others for their assistance. Although they can become self-independent by using certain type of device. For that purpose, a semi- automated wheelchair has been proposed. The wheelchair is one of the most used assistive and the benefit of having a Wheelchair is that it enhances a person's mobility and thus give independencefor the user and their relatives or colleagues, allowing them to take part in everyday activities, despite having reduced mobility. It helps performing day to day tasks with ease, also a wheelchair offers many social and mental health benefits. Thus, this proposedwheelchair can be controlled manually. It allows the user to givea command to the wheelchair to which direction he wants to go with the help a joystick which is being controlled by Arduino UNO. We also have planetary gear motors connected to read wheels of the wheelchair with the help of Arduino UNO. For movement the command goes through the microcontroller viathe joystick to the planetary motors which commands the motors to change the speed and direction of the wheelchair. Wheelchair is generally used my elder people or by people who are not physically independent. To help such people and ensure their safety we have enabled safety on the wheelchair. For this a GSM module is interfaced with the Arduino UNO. This feature deliversan SMS message to the registered Mobile number with the help of a GPS module. Furthermore, a wheelchair provides security by limiting unauthorized access to it. This is done by sending the live location of the wheelchair to the registered mobile number after certain interval of time. Thus, ensuring the users safety when he/she is travelling on its own and people won't have to worry about the safety of the person and the wheelchairs being stolen. Thus, we have proposed a Smart Wheelchair with Safety measures to meet the requirements of a user in today's world.**

***Index Terms*—Emergency button, GPSlocation tracker, Directional control using a joystick, and security.**

I.INTRODUCTION

Out of 7 billion people in the world there are approximately more than 1 billion disabled people. According to the WHO (World Health Organization) a disabled person is a personwho has "a problem in body function or structure, an activity limitation, has a difficulty in executing a task or action; with a participation restriction". Studies show that 75 million people need a wheelchair daily. This is nothing but 1% ofthe world's population. Also, there are about 1According tothe Wheelchair Foundation, WHO and EUobserver Statistics, out of the 34 developed countries in the world it is estimated that 1% or 10,000,000 people require a wheelchair. While,In the other 156 developing countries the figure is around at least 2% or 121,800,000 people who require a wheelchair. So out of 7,091,500,000 people in the world, approximately 131,800,000 or 1.85% require or need a wheelchair. Out of which an estimated 110 million people across the world(0.5 million in developed countries and 109.5 million in developing countries) need wheelchairs but don't have themor cannot access them. To help overcome this Situation the project idea was proposed and based on that created a Semi- Automated Wheelchair with Safety Measures. A wheelchair is "a device providing wheeled mobility and seating support for a person with difficulty in walking or moving about". Thus, the wheelchair is one of the most used assistive andthe benefit of having a Wheelchair is that it enhances a person's mobility and thus give independence for the user and their relatives or colleagues, allowing them to take part in everyday activities, despite having reduced mobility. It helps performing day to day tasks with ease, also a wheelchair offers many social and mental health benefits. Wheelchairs assist people with disabilities to participate in things theywere not able to because of their disabled condition. Thereare 3 types of wheelchairs out of which we are applying the concept of Standard Electric Powered Wheelchair.

In this project the system utilizes Arduino Uno along with a joystick, planetary motor, rf technology and a motorized circuit. The proposed system in this project consists of a controller circuit and a wheelchair circuit. The controller circuit is developed with the help of the Arduino UNO which allows the user to provide direction commands to the wheelchair through a directional Joystick. The wheelchair circuit has a rf receiver used to receive the commands and then operate or command the wheelchair motors in order to achieve the movement givenby the user. This allows the disabled person to operate the wheelchair easily. Also, the system consists of help features forthe disabled in case of emergency. If the person is in trouble orneeds help the person just needs to press a button and his or her GPS coordinates are sent to his/her loved ones through an SMS message. Furthermore, this project also provides wheelchair security by limiting unauthorized access to the wheelchair by sending the live location of the wheelchair after a certain interval of time. Thus, ensuring the users safety when he/sheis travelling on its own and people won't have to worry about their wheelchairs being stolen.

II.LITERATURE SURVEY

1 The major goal of this project is to portray the breadth and complexity of electric powered wheelchair (EPW) control technology while also providing insights intofuture directions. The goals of this project are to raise awareness about the current state of powered wheelchair control technology and to improve the functional mobility of people who use EPWs.

2 In this study, a measurement approach for quantifying the posture of able-bodied persons seated in wheelchairs is created. It is suggested that the method describedin this research could be utilized to accurately characterize the posture of persons sitting in wheelchairs. The purpose of this work is 1) to provide a methodfor assessing the three-dimensional position of seated persons using external anatomical cues. 2)Define a setof geometrical and mechanical characteristics, as well as their combination, to characterize the seated posture; and 3) Present the findings of a variability investigation of these parameters and anatomical landmarks on a group of able-bodied persons sat in a wheelchair.

3 This study seeks to provide a comprehensive review of Smart WheelChair research developments. We anticipatethat the information acquired in this study will raiseknowledge of the current state of PW and SW technologies, as well as promote the functional mobility of persons who use PWs. Microphones and other sensors are utilized to provide input to the wheelchair. Sensors receive input from the environment, which the wheelchair's computer then analyses. Sensors are frequently utilized to enhance the safety aspects of wheelchairs.

4 The purpose of this paper is to provide Smart wheelchairs, which are electric-powered wheelchairs with numerous extra components such as a computer and sensors that assist the user or guardian accompanying the wheelchair in handling it quickly and efficiently. Sensors included ultrasonic, infrared, and laser range finders (LRFs). They scan the environment with a 180- degree two-dimensional scan. Smart wheelchairs thatare currently available can be used simply indoors, but they must be watched by a companion in outdoor locations for safety. Smart wheelchairs for mentally disabled persons to utilize independently should also be studied.

III.WORKING

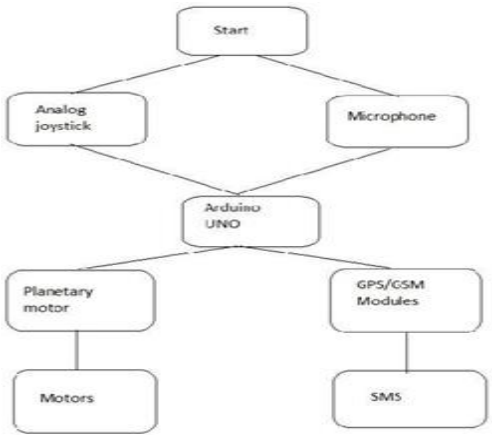
This wheelchair is a smart wheelchair, meaning it will operate on the basis of the instructions given by the user. This Semiautomated wheelchair consist of an analog joystick whichis inrerfaced with the Arduino Uno. Let the analog valueobtained from the Joystick in the x-axis be Vx and the analog value obtained in the y-axis be Vy. We will program theArduino to operate in digital mode, with only three motor states. They will either rotate clockwise or anticlockwise, or they will be free. In these circumstances, we shall set up two analog threshold values. The joystick is thus used to givedirection to the wheelchair on this basis of the input given by the user. It operates on the basis of the code which is uploaded in the Arduino UNO microcontroller. After this the Arduino UNO interprets this and send the command to the Motor driver. The motor driver we are using is BTS7960. This motor driver controls two planetary motors attached to each rear wheel of the wheelchair. The planetary motors are responsible for the operation of the wheelchair. Thus, according to the command the wheelchair will move in the responsible direction. This Semiautomated wheelchair also consist safety measures. Such measure is that we use GSM (Global System for Mobile

Communication) for the navigation of the wheelchair. First, wesend an SMS from the carer to the GPS (Global Positioning System) in the wheelchair. This GPS module will find outit's current location with the help of an antenna installed inthe GPS module. This location is sent to the microcontroller and the code will interpret the message into a Google map link. This Link is then sent back to the carer using the GSM module. Thus, ensuring the safety of the user and helps user to go in an unknown location independently with their carer knowing the location of where the user is going. Also it will make sure if the wheelchair is being stolen or not

IV.RESULTS AND DISCUSSION

Increased mobility: Semiautomated wheelchairs can pro- vide enhanced mobility for users with limited upper bodystrength or dexterity. Reduced caregiver burden: Semiautomated wheelchairs can potentially reduce the burden on caregivers by allowing users to navigate their environment with more independence. This can result in enhanced user autonomy and less reliance on caretakers for mobility tasks, thus improving the overall quality of life for both users and caretakers. Potential for cost savings: While semiautomated wheelchairs may require an initial investment, the potential forreduced caregiver burden Enhanced social participation: Im- proved mobility and safety can enable users to participate moreactively in social and community activities, lead to enhanced social inclusion and improved mental health. Ensures safety: With the safety measures in the Semiautomated wheelchair, the safety of the user is ensured when travelling alone in an unknown location.

V.FLOWCHART



V.COMPONENT DESCRIPTION

1) BTS7960 Motor Driver:
a) Motor Driver Input voltage: 6V- 27V
b) Model: IBT-2, Maximum current: 43A
c) Input level: 3.3-5V
d) Control mode: PWM or level
e) Duty cycle: 0-100%

2) SIM 900A GSM GPRS Module
a) Quad band GSM/850/900/1800/1900MHz
b) Power supply 12v amp to 2amp max

3) Planetary Gear motor:
f) Gear Ratio - 512:1
g) 12V dc motor
h) Current - 5A(Max. Load) Torque - 120kg

4) GPS(Neo-6M)- GNSS:
a. Refresh rate -5Hz
b. Supply Voltage - 3.3V
c. Default Baud rate - 9600
d. Cold start time - 38s
e. Hot start time 16

5) Arduino Uno R3:
a. Arduino Uno R3
b. Microcontroller Chip- ATmega328 (SMD)
c. Operating Voltage (VDC) -5
d. Input Voltage - 6-20V
e. Analog I/O Pins - 6
f. Digital I/O Pins - 14 (of which 6 provide PWM output).

VI.CONCLUSION

From this we can conclude that the wheelchair can be upgraded to face challenges of a person having different types of physical disparity and thus make the required changes tothe wheelchair and make it suitable for them.

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