



IOT POWERED SMART WHEELCHAIR WITH HEALTH MONITORING SYSTEM

¹Vijayaprabhu A, ²Dr.C. Priya, ³M. Diana Amutha Priya

¹Associate Professor, ²Professor, ³Assistant Professor

¹²³ Department of Electronics and Communication Engineering

¹²³Siddharth Institute of Engineering and Technology, Puttur, India.

Abstract : We have made enormous strides in the health industry and have created numerous smart wheelchair systems, but despite these developments, people still occasionally experience problems using these systems. With the development of smart wheelchairs that operate automatically, the amount of effort required from the user will be reduced. This could also resolve many of their everyday issues and significantly lessen the stress in their lives. Additionally, it will result in reduced need for human labour and increase these people's independence. The goal of this work is to create an android phone application that can control a wheelchair simply and provide a manual joystick as a backup. This primary goal is to give wheelchair users additional mobility and independence by increasing their range of motion. Therefore, this new wheelchair design, which will be more advanced than current technology and prove to be a benefit for medical departments, also includes a health monitoring system that uses real-time measures of body temperature, heart rate, and humidity. which will ultimately reduce the likelihood of an incident occurring and enable the victim to have a far more independent life.

IndexTerms - IoT, Android, Health Monitoring, motion control, Automatic control.

I. INTRODUCTION

Humans everyone has known that a wheelchair is a device with wheels that makes it easy for those who are unable to move independently to move around [1]. A wheelchair also reduces the time and effort required of other people who were previously obligated to be by the wheelchair user's side in order to attend to all of their needs [2][3]. Individuals who have impairments in their hands, feet, or lower extremities find it difficult to carry out daily tasks. They must ask for assistance even for simple tasks like using the restroom or merely stepping outside, which has a significant impact on their mental health [4].

Since the number of aged and handicapped persons has grown, a variety of support gadgets and sophisticated technology have been created to assist them enhance their quality of life and live life more independently and without as much need on others [5]. Due to a lack of force, certain patients who are unable to move the wheelchair with their arms experience the most challenging issues with mobility, safety, and orientation. Wheelchairs come in a variety of styles, including (1) manual wheelchairs and (2) self-propelled wheelchairs [6].

It might be the standard chair configuration with wheels on both sides that patients drag manually or it could be a joystick-operated wheelchair where the joystick is used to drive or, more simply said, move the wheelchair but it takes a lot of hand power to operate. 2) Wheelchair with voice recognition: With this technology, the wheelchair understands the patient's spoken commands and responds by moving. To interpret the spoken orders supplied by the user, a guided application must be pre-installed in the wheelchair with the aid of the phone. 3) Wheelchair with an image acquisition system [7][8]. With this method, the camera is used to detect hand movement and determine when movement takes place [9]. Technology has also advanced to the point where we are able to monitor or recognise finger movement by employing flex sensors built into hand gloves, which in turn moves the wheelchair as necessary. 4) Sensor-controlled wheelchairs: With these, the user's movement is detected by sensors like accelerometers and flex sensors. When it comes to identifying the wheelchair fall detection system, this kind of device is quite helpful [10] [11]. When a person falls, this system may be embedded with emergency contacts and Google API to find the closest hospital and send an emergency message to it. It is fairly good in terms of safety and medical assistance; however high coding accuracy is needed while developing [12].

The demands of those with disabilities have still not been met by these wheelchairs. These systems either concentrated on fall detection or only wheelchair control. Hence, it is essential that issues be well recognised and that sensors be installed as necessary. In order to simultaneously meet all of the demands. So, the creation of a multipurpose chair is part of the demands of the patient and those who are caring for them to meet their fundamental needs.

II. LITERATURE SURVEY:

The above-discussed specific functionality explains our strategies for preventing accidents, ways to manage the movement of the chair, and how the Health Monitoring System functions. Since we have a thorough understanding of the issues and a desire to prevent

them from occurring, this is all we have ever wanted to do. The functionality should be intelligent enough to halt the move further and react appropriately if any threat is recognized [13].

According to the 2011 census data, the number of handicapped people in the nation increased by 22.4% between 2001 and 2011. The number of handicapped people was 2.19 billion in 2001, but it increased to 2.68 billion in 2011, of which 1.5 billion are men and 1.18 billion are women. Physically challenged people make up the majority of the handicapped population, 20.3% of all disabled people.

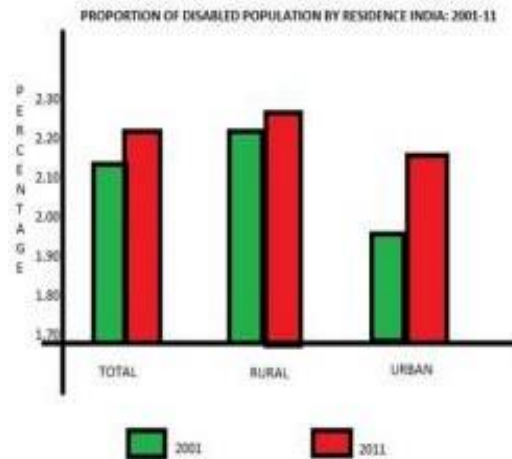


Fig. 1 Proportion of Disabled population in India

The population of handicapped persons in India has rapidly expanded over the past ten years, both in rural and urban areas, according to the graph titled "Proportion of Disabled population in India (2001-2011)". We have thus tried to improve these people's quality of life.

These are the most recent developments in the creation of smart wheelchair systems, as shown in table 1 below. The bulk of smart wheelchairs that have been created up to this point have been closely connected with the underlying motorised wheelchair and needed substantial alterations to work effectively [14]. Several different types of smart wheelchairs are now being explored and produced. Several of them have yet to be put into use for clients in manufacturing.

Researchers have constructed "smart wheelchairs" using technology that was first created for mobile robots in order to suit this group. A smart wheelchair generally consists of either a mobile robot base with a seat attached or a normal motorised wheelchair base with a computer and many sensors added [15].

It is important to remember that the goal of this work was to create an intelligent robotic wheelchair to give persons with cognitive and motor disabilities autonomous mobility. Several wheelchair designs, as shown in the table below, demonstrate the system's flexibility to a dynamically changing environment, including curving paths, constrained spaces, and ever-changing impediments. The majority of smart wheelchairs now under development are intimately connected with the underlying motorised wheelchair, necessitating substantial adjustments to work effectively [16] [17]. The small size and greater resolution of this device, which uses a 4-wired resistive touch screen, make it more user-friendly [18]. This system is developed using an ARM microprocessor, which contains 512 KB of on-chip memory that may be used to record planned pathways without requiring an external memory interface. By incorporating a number of sophisticated and recently created interface devices, this system may also be adjusted to accommodate individuals with conditions other than cerebral palsy [19] [20].

Table1: Research studies on smart wheelchairs that are ongoing and recent

SYSTEM	DESCRIPTION
Powered wheelchair with several modes	Offers a variety of modes that may be employed according on the scenario and demands, including manual, speech, vision, and autonomous
Wheelchair with an intelligent system	Using an automatic navigation system, the driver steers the car around obstacles, even in unpredictable and dynamic situations.
Governed motion for a motorised wheelchair	Wheelchairs come with straight and curved motion modes that use a joystick to determine synchronised motion ratios for safe travel on roadways with obstacles or uneven surfaces.
Using an electric wheelchair	Both joystick-based manual operation and autonomous navigation is handled by a computer vision system.

Wheelchair operated by hand motion	Facial motions made by the user are input to the system and are read using computer vision algorithms. Based on the presence of wheelchairs, the response to user input (facial gestures) changes.
Wheelchair with intelligent control	By equipping the wheelchair with cameras, a laser rangefinder, and onboard processors, it offers automated navigation.

III. DESIGN OF PROPOSED SYSTEM:

The major purpose of this venture is to make it easier for someone who is handicapped to move around. It is imperative to offer simple-to-use devices due to the technology's ongoing exponential expansion. The numerous control methods will enable the chair to be moved with less assistance from a person. You can see in detail the numerous connections made between the microcontroller and other sensors to ensure optimal operation in the image below.

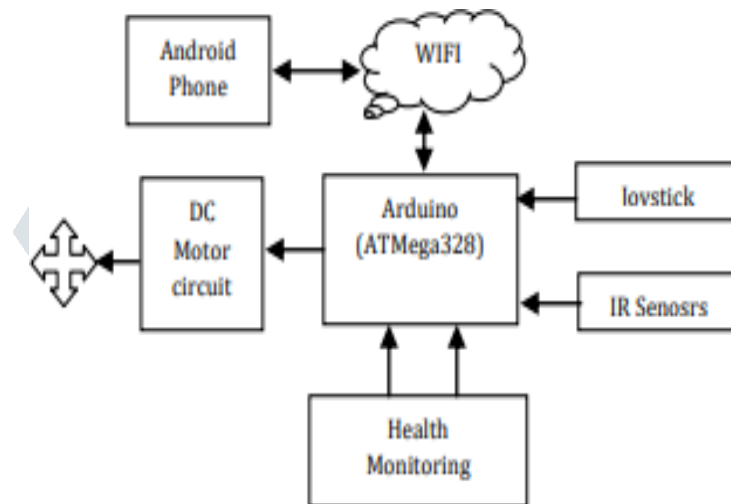


Fig. 2 Block Diagram

The wheelchair may be controlled via an Android app that connects through Wi-Fi and a manual joystick that is fastened to the chair's hands; employing these two options will reduce the user's dependence on other people. Also, we added infrared sensors to our chair to assist prevent collisions with obstructions. When an impediment is close by, sensors will react. Eventually, commands will be sent to the microcontroller (ATMega328), permitting the necessary additional motion. This system also has a health monitoring component that tracks the user's health and sends that information to the application.

The entire apparatus is built on utilising an android application that has been preinstalled on the patient's phone. The phone will have a bidirectional connection to the WiFi network. The DC motor circuit, which controls the mobility of the wheelchair, will receive information from Arduino that Arduino received through WiFi and joystick and IR sensors through a bidirectional link with Arduino made possible by WiFi. The health monitoring system, which tracks things like heart rate and temperature, is connected to the Arduino as well. As a result, only the Arduino, WiFi, and Android phones will have unidirectional connections across the whole system, which implies that information will only be exchanged in one direction.

A. Transmitter

As input, an Android phone is utilised. The Android platform is used to construct the application. The graphical user interface gives the user access to an SOS assistance area as well as navigation choices. A string for that specific direction is supplied and then communicated from the transmission unit to the receiving section using WI-FI when the user presses the virtual direction button at that moment.

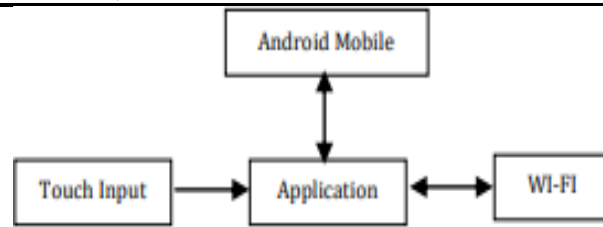


Fig. 3 Transmitter unit

B. Receiver

The string is converted by the CPU into ASCII code, which is then decoded and utilised to decide how to power and rotate the wheelchair's motors. A 5 volt Wi-Fi module is used to wirelessly transmit data. A 12V battery powers the wheelchair. Using batteries allows for mobility. With the L293D driver IC, DC motors are moved. The L293D IC is a dual bridge. For forward movement, the motors are pushed forward, and for reverse movement, they are pushed backward. On turning left, the right motor advances while the left motor comes to a stop. While turning right, the right motor comes to a stop while the left motor advances.

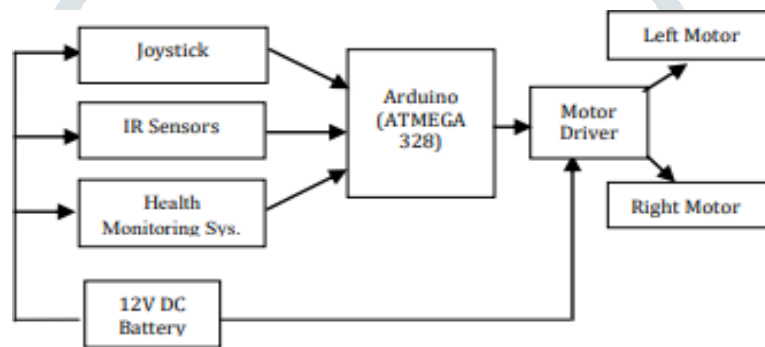


Fig. 4 Receiver unit

IV. RESULT AND DISCUSSION:

As a result, the paper aims to incorporate both the demands of the patient and those of the carers. It is efficiently carried out with consideration for basic patient monitoring systems like temperature and heart rate. It has a manual joystick as a backup control option and is controlled by an Android phone. The major goal of this initiative is to increase the movement of those who are unable to walk freely as well as those who are disabled.

The chair has several driving options, which significantly reduces the amount of effort required to move it. The number of integrated IR sensors in the chair enables dependable safety as well as accident prevention. This technology is both affordable and small. The Android application will get real-time health information from the health monitoring system.



Fig. 5 Communication model with the server

The current prototype may be upgraded to include a voice control system or IR sensor glasses for wheelchair mobility. These two will raise the chair's degree of movement to a very high quality, making it more effective and less reliant on external sources of propulsion. The addition of a gearbox will also quicken the chair and improve manoeuvrability. For supporting the environmentally friendly charging of this chair, we can also add solar power panels. To scale slopes and small obstacles, a removable metallic stair case may be installed. So, the overall impact of all these developments will be positive for the medical industry.

V. CONCLUSION:

This will make it much easier for impaired persons to move around and interact with others while requiring little human effort. We have discussed the system that is controlled by sophisticated algorithms and sensors. Also, it is simple to use and control because the movement is only a touch away. The prototype module is small and reasonably priced; the addition of the health monitoring system and the numerous sensors makes it an improved module that is extremely dependable and useful. We have discussed the system that is controlled by sophisticated algorithms and sensors. Even though we are mostly concentrating on touch screen-based system interfaces, more research may be done to make improvements. Depending on the patient's level of handicap, the software and interface may be altered. Even though we are largely concentrating on medical-based system interfaces, additional research may be done to make improvements.

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