NextGen Wheelchair: A Semi-Autonomous Approach For Disabled People Using Head Motion and Digital Twin Technology

User Manual Report

Integrated Design Project

CSE – 460
Group: A1

Submitted By

202014002 (Abrar Faiyaz Khan)
202014022 (M Rayhan Ferdous Faisal)
202014037 (Mohiuddin Bilwal)
202014049 (Sheikh Easin Arafat)
202014051 (Shekh. Md. Saifur Rahman)
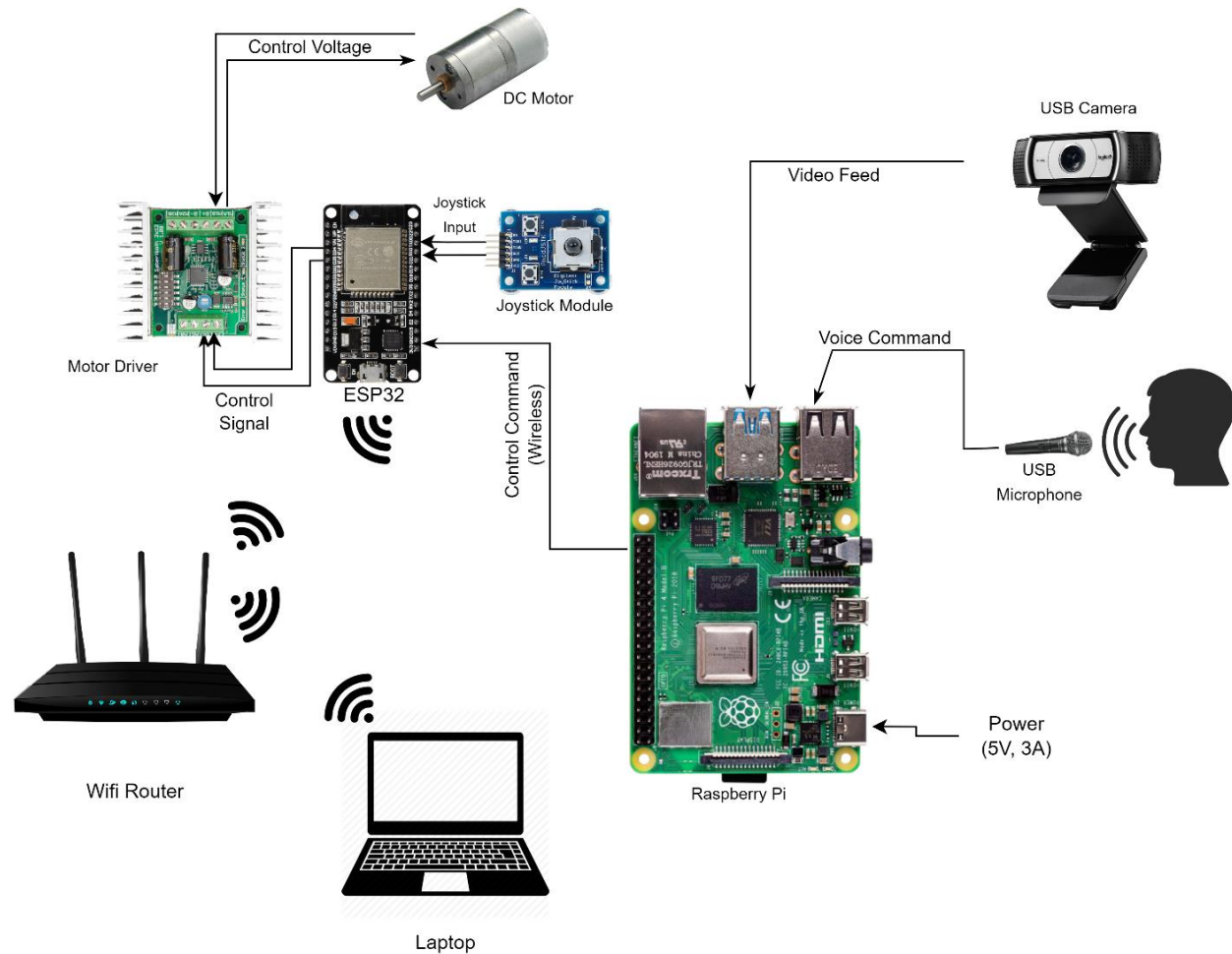
Table of Contents

Tools Description

Fig: System Workflow

1.0 General Information

The general information section explains in general terms the system and the purpose for which it is intended.

1.1 System Overview

The development of the NextGen Wheelchair is for those patients who can't move most of their body muscles due to mobility issues. The system aims to improve the mobility of paralyzed patients by capturing their head motion video feeds. Besides, there're two more alternative methods integrated into the system – voice and manual joystick. Our system also focuses on reducing the physical strain and damage the caregivers experience due to the prolonged use of manual wheelchairs. They can keep an eye on the patients via a suitable website, where they can see their condition whenever the patient operates the system. The system will also be able of making intelligent decisions, such as stopping the system and producing emergency alarms

whenever an obstacle in the path is identified, a patient becomes unconscious, or the system malfunctions.

1.2 Organization of the Manual

The user's manual consists of the following sections:

a) General Information

b) System Summary

c) Using of System

a) General Information:

The general information section explains the purpose for which the tool is intended.

b) System Summary:

System Summary provides a general overview of the system. It outlines the uses of the system's hardware and software requirements, the System's configuration, user access, and risk factors.

c) Using of System:

Using of System section will have a detailed description of system functions.

2.0 System Summary

System Summary provides a general overview of the system. It outlines the uses of the system's hardware and software requirements, the system's configuration, user access, and risk factors.

2.1 System Configuration

NextGen Wheelchair operates on computer devices integrated with hardware tools. It is for a web-based application system. The website requires a Wi-fi connection in order to integrate with hardware and software packages and libraries, so that hardware along with the website can run simultaneously. Video feeds, Recognition voice speech, Manual Joystick direction along with angles, and Obstacle finding notifications can be seen on the website, which will be detected by the system. NextGen Wheelchair can be used immediately without further configuration.

2.2 User Access

NextGen Wheelchair has mainly two groups of users:

a) Paralyzed patient

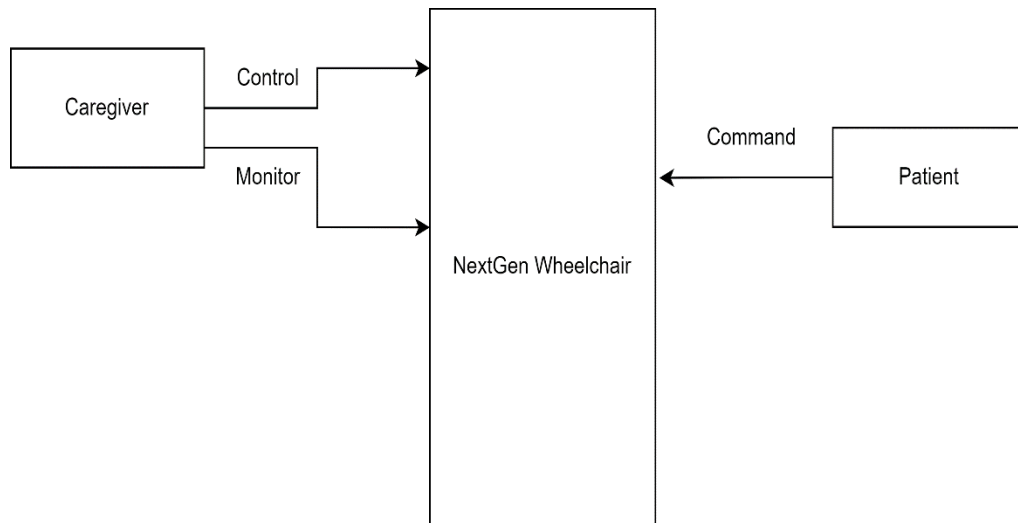b) Caregiver of the patient who'll monitor the system

Fig: Users of NextGen Wheelchair

3.0 Using the System
3.1 Log In
A username and Password is required to log onto the system.
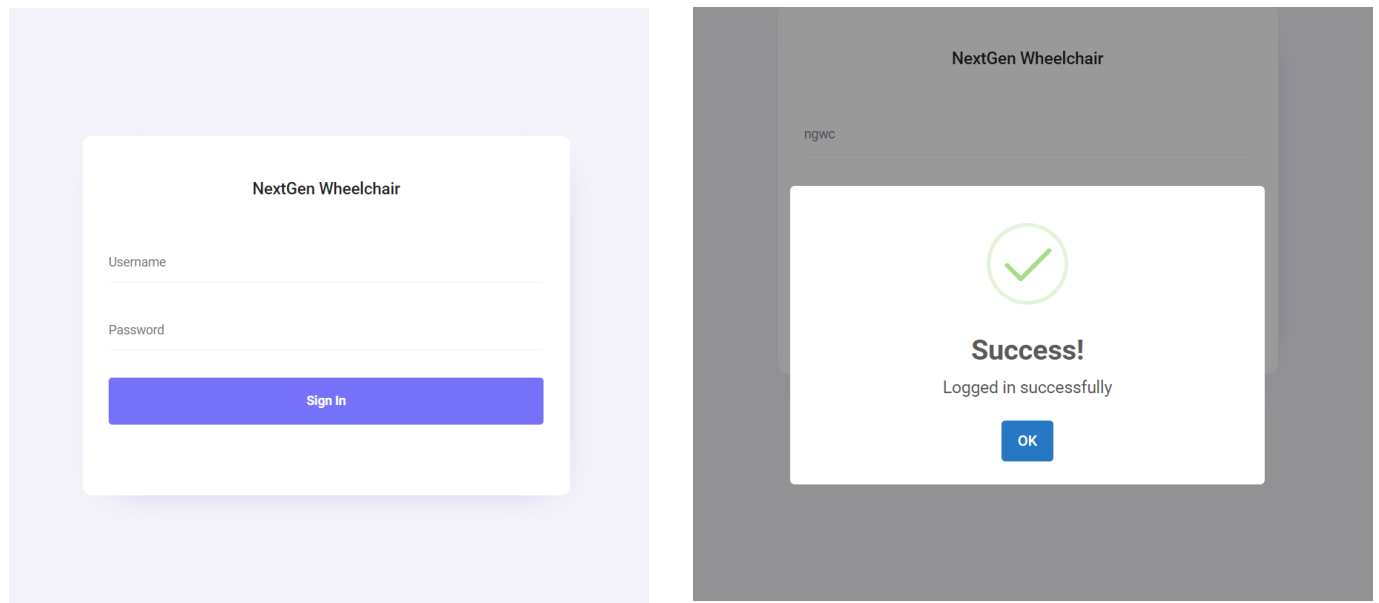

Fig: Log In Page

3.2 Connecting to the Internet
A smooth internet connection is required to run the website smoothly. An internet connection is required to send the video feeds, send voice and manual commands to the website, and make a

stable connection between the hardware and software parts. By using the internet, a local server is created from where the user can run the website.

3.3 Selecting Controls

The user can select the control from the navigation bar. Here, three types of control methods are available in the system – Head Motion, Voice Recognition, and Manual Control. The user can select these controls to monitor and run the system.

3.3.1 Head Motion Page

From the head motion page, the user can monitor the condition of the patient through video feedback and see how the system is running. Here, real–time video feeds of the patient will be shown instantly and the user will be able to see in which direction the system is moving currently. Besides, if any kind of obstacle occurs in the system, the webpage will notify the user through a message like 'Obstacle Detected'.
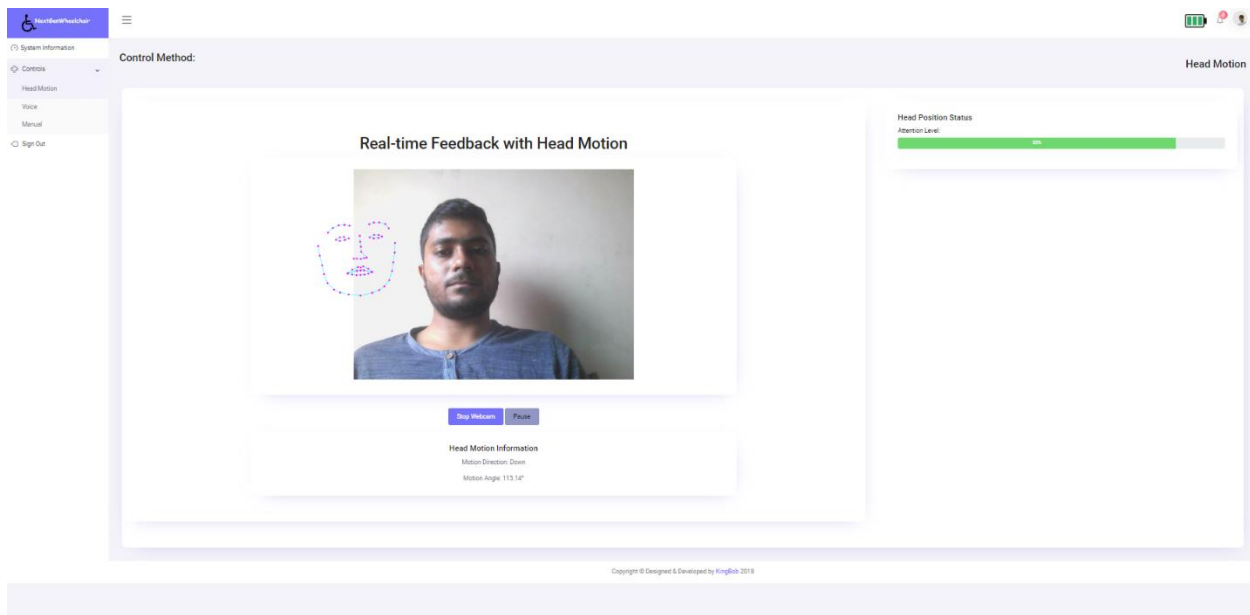

Fig: Head Motion Page

3.3.2 Voice Recognition Page

Here, the user can give voice commands to control the system. Our system will take the user's voice inputs from a microphone and recognize the speech of the user. Based on the recognized speech, the system will run in the required direction. In our system, we've implemented the direction commands for four recognition speeches – Left, Right, Forward, and Backward. A 'Stop' command will be used for stopping the system.
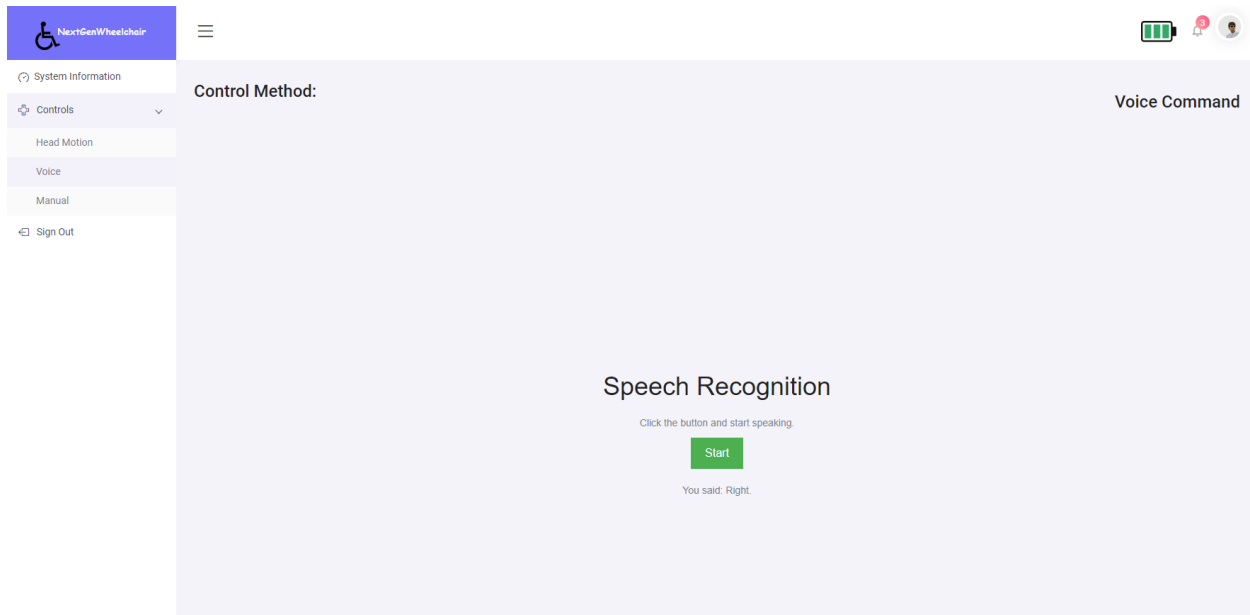
Fig: Voice Recognition Page

3.3.3 Manual Control Page

From this page, the user will be able to control the system through a manual joystick from the website. The user can move the joystick manually and set the direction where the system will move. The user can see the direction and angles of movement while running the system. Besides, if any kind of obstacle occurs in the system, the webpage will notify the user through a message like 'Obstacle Detected'.
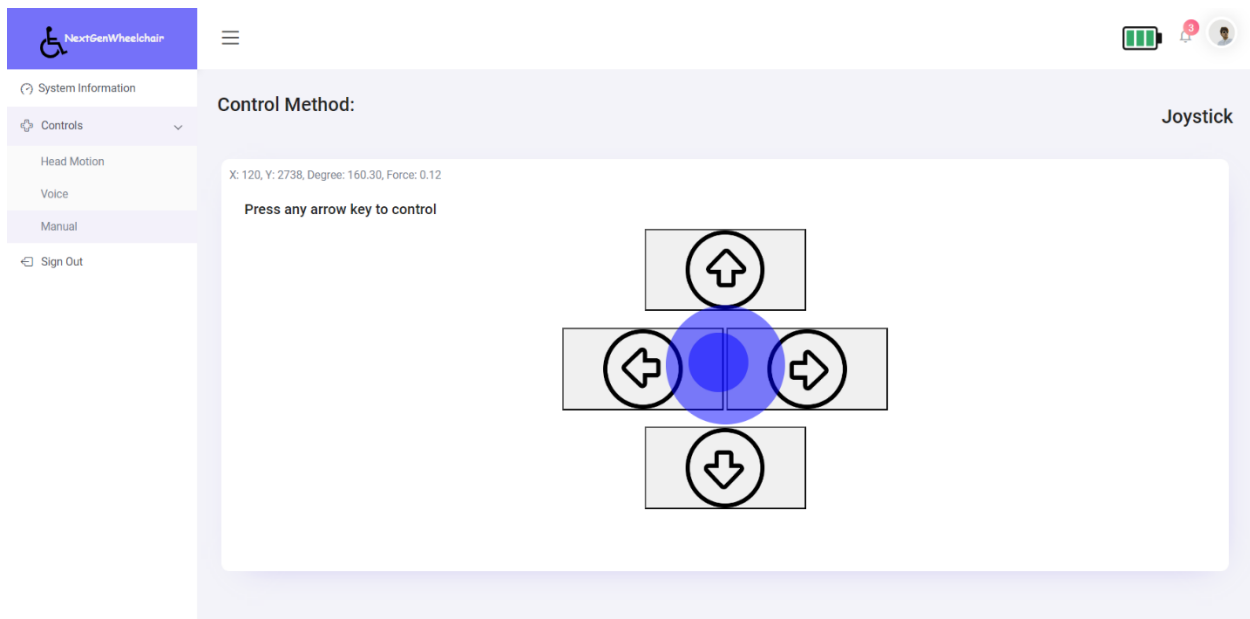

Fig: Manual Control Page

3.4 Emergency Stop

An emergency stop system has been integrated to halt the system for system malfunctioning or any other emergency cases. If the patient does not blink his eyes for a long period of time or if his eyes remain open for a long period of time, the system will detect the unconsciousness of the patient and halt instantly. Besides, an emergency switch is set to the system by which the user can switch off the system whenever it's needed.

4.0 Risk Management

There're some particular precautions that needed to be considered:

Risk Description	Mitigation Plan (What to do to avoid the risk occurring)	Contingency Plan (What to do if the risk occurs)	Impact (What the impact will be to the project if the risk occurs)
Obstacle detection doesn't work properly.	Sonar sensors should be connected properly to the system.	The system should be halted instantly.	Emergency situations like accidents and injuries may occur. So, the impact can be higher.
Raspberry Pi can't detect voice speech properly.	A high level of the platform can be used.	The system can be controlled through the other two modules.	The impact will be less.
Internet connection may not be available for long distances.	The system can be operated on a fixed range.	The system will have to be controlled by a continuous internet connection.	The impact will be less.