Project Design Phase-I

Solution Architecture

Date	15 October 2022
Team ID	PNT2022TMID33359
Project Name	Solution Architecture for Real-Time Communication System Powered by AI for Specially Abled
Maximum Marks	4 Marks

Solution Architecture:

The medical conditions that require the use of wheelchair is termed as mobility-impairment. According to a medical website, the major ailments such as-amputation, cerebral palsy, paralysis, multiple sclerosis, muscular dystrophy, spinal cord injury leads to this condition. It is alarming to know that people with diabetes of Type-2 and Alzheimer's disease also require wheelchair for their mobility. It is proven medically that using a comfortable and well-suited wheelchair helps them to continue with their routine. Traditionally used joystick controlled wheelchair is well preferred for persons diagnosed with paraplegia but is not possible in the case of quadriplegic patients who can use voice systems to control the chair.

The differently abled or old-aged people require assistance for their movement. Generally, such assistant providing tool is wheelchair. Normal wheelchairs are manually operated and heavy to move adding burden to the suffered. Hence, automated wheelchairs that are equipped with sensors and a data processing unit constitute a special class of wheeled mobile robots, termed as "smart wheelchairs" in general. In the existing system, the wheelchair movement that is controlled by joystick uses buttons to start and stop the wheel. This is difficult for the differently abled to press the required button with precision. Although there are smart wheelchairs with gesture control, it lacks accuracy in the calculation of the location. The proposed system uses artificial intelligence for its working and proves to be a unique combination of wheelchair and health monitoring system.

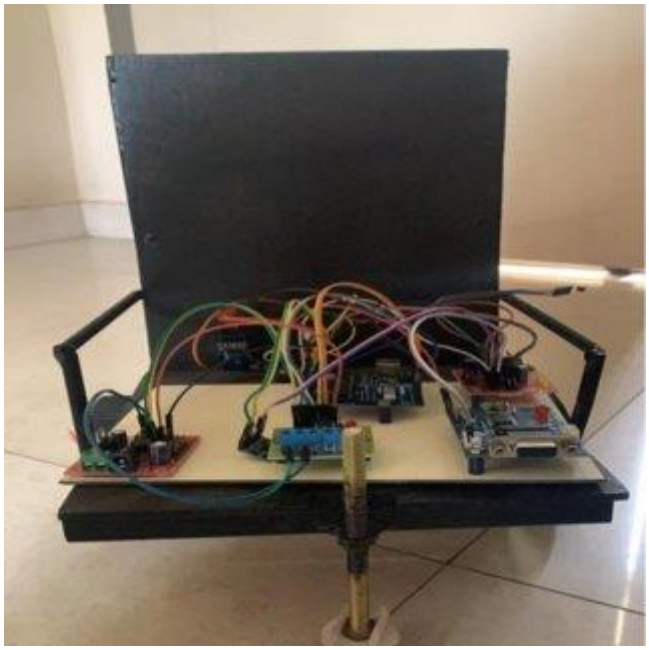
The wheelchair can be accessed both in manual and automatic modes. In the manual mode, the wheel is controlled using joystick whereas in the automated mode, MPU6050 sensor and accelerometer is used to control the direction by gesture. SPO2 sensor attached to the wheelchair is used to collect the health parameters. Thus, enabling the self-dependency of the person. Further, deep learning analysis of the data from the sensors and the wheelchair usage pattern is compared with the dataset to determine the stress level. The signal from the sensors is monitored and the vitals data is updated in the Thing Speak website via Bluetooth module serving as a digital health chart.

The flow chart in depicts the working process of the system. Once the power supply is switched on, the patient can either operate the wheelchair with the joystick or by using hand gesture.

The hand gesture is read by the MPU6050 sensor and sends the signals to the Arduino microcontroller and based on these signals, the motor is driven accordingly. Using Beacon sensors, the location of the wheelchair is known. The master Beacon sensor reads the slave Beacon ID and GPRS is used to track and monitor the patient's movement continuously. Since the system is a combination of wheelchair and health monitoring system, SPO2 sensor placed on the handle bar is used to read the heart rate and oxygen level in the blood and LM35 sensor is connected as well to measure the body temperature.

With the help of the Zigbee module, the data collected from the hardware is dispatched to software module, MATLAB IDE. In the software module, the collected data is processed and the indispensable data is extracted from the noisy content received. This data is then inspected and documented for the deep learning analysis, where, it is matched with the dataset already fed for prediction of the stress level.

The vitals detail is separately stored and the analysis report is made available online. All the data is read and monitored through AI and is available on the Thing Speak website created for the user. As seen in the vitals of the patient is updated online and can be retrieved anytime and utilized as their digital health chart.



Example - Solution Architecture Diagram: