International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Vehicle Steering System for People with Disability using Gesture Control

Manimala K

Assistant Professor. Government College of Engineering, Salem

Abstract

Gesture recognition and control is a relatively modern concept, humans through their body gestures generate physical control signals in order to interact and control technologies around them. It has found important application in the field of robotics, electrical appliances, computer gaming, fitness accessories and other sectors. This paper showcases a new mechanism which assists people with disabilities, specifically people who don't have completely developed arms or have lost their arms in an accident during their lifetime. The mechanism employs accelerometer to recognise gesture and generate control signals accordingly. These signals then have been used to steer a vehicle. Accelerometer is installed on a module which is strapped on to the tip of disabledperson's amputated arm. This mechanismbeing electronic in nature is an upgrade from previously available mechanical driving assistance mechanisms.

Keywords: Gesture Recognition, Gesture Control, Accelerometer, Driving Aid, Disability Aid.

1. Introduction

Gesture recognition is a concept or technology developed in Computer Science with the motive of decoding human gestures via mathematical algorithms and functions [1]. Hence, it creates a new form of human to computer interaction. There are static and dynamic gesture which are processed by the computer and interpreted. This has created a new ecosystem where products from different field are using this technology to better the user experience and also to improve on the old products by incorporation of gesture recognition and control. Humans generate gestures using face, hands, body posture and other ways, for the proposed electronic vehicle steering mechanism extension from shoulder is used to generate input gestures [2]. Minimal dynamic movements of extensions from shoulder is traced by accelerometer and converted into continues data set which forms the input signal. This input enables a computer to help disabled people control a vehicle and overcome one of the most important problem in their lives i.e. difficulty to drive, which makes them dependent on others for their long range mobility [3]. In the new electronic mechanism, a person can control a vehicle in terms of angle of steering and direction of motion (i.e. forward, stationary or reverse motion).

2. Working of the Device

2.1. Part-wise Working

2.1.1. Accelerometer

Accelerometer is mounted on transmitter module and is responsible for the continuous tracking of gesture, thus acting as an important interface between human and system. The sensor operates in 3-axis and provides the orientation in terms of numerical values corresponding to x, y and z axis. These values are transmitted to a microcontroller which processes the inputs and takes further action.

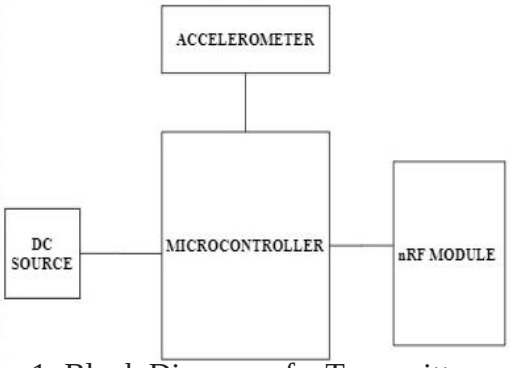


Fig. 1: Block Diagram of a Transmitter

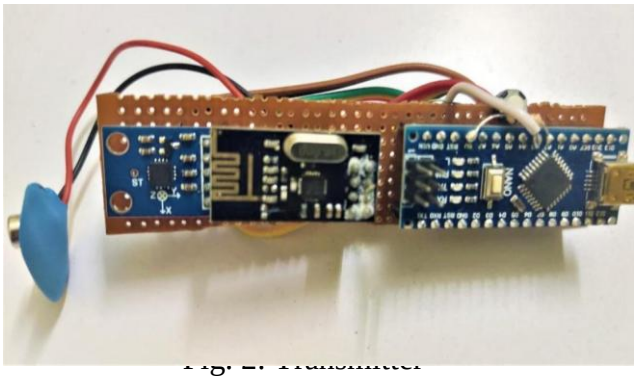


Fig. 2: Transmitter

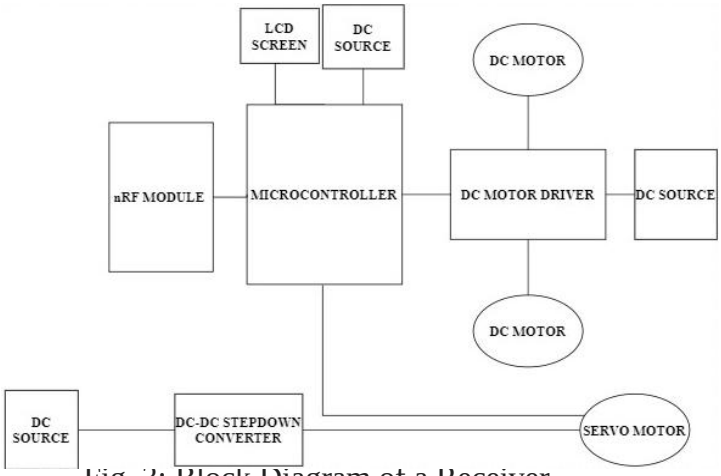


Fig. 3: Block Diagram of a Receiver

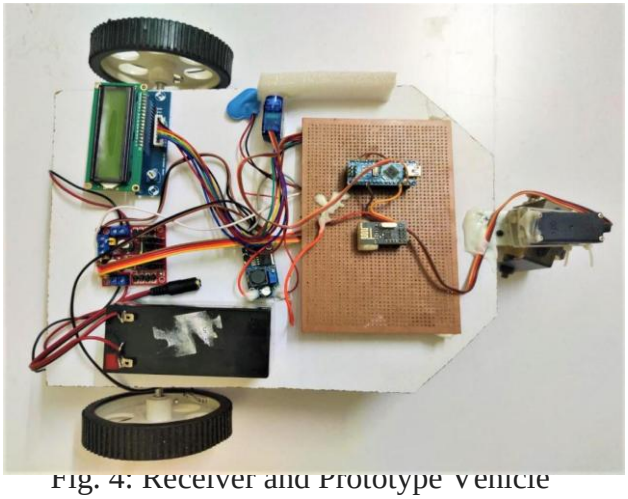


Fig. 4: Receiver and Prototype Vehicle

2.1.2. NRF Module

Input values from accelerometer is required to transmit to the microcontroller for processing which is mounted on the prototype vehicle. It is essential that the communication between the systems is fast and at the same time it is needed to incorporate technologies which are ergonomic is design.Thus NRF provides wireless connection which eliminates the need of wires. As wires are entangle-prone and limited in reach [4].

2.1.3. Microcontroller

Microcontroller has the role of processing the input signals and on the basis of the processing generate control signals for all the components. There are two microcontroller used in the system which controls two different aspects i.e. first microcontroller is responsible for accelerometer and then transmitting the input signal through NRF module, whereas second microcontroller processes the input signal received by the NRF module and on the basis of that it control motors [5]. Control signals are generated on the basis of processing of accelerometer's input using pre-determined control logic. Control signals for motors are generated for two type of steering by microcontroller. First, angular steering determines the angle at which the vehicle's wheel is going to be turned. Second, directional steering has three modes of motion i.e. forward, stationery and reverse.

2.1.4. Motors and Motor Drivers

In order to produce motion of the prototype vehicle in controlled way,motors and motor drivers are used and regulated by the motor control signals which are produced by the microcontroller [3]. Two key roles of motors in the prototype vehicle are to produce directional motion and to set the angle of turn. In prototype, servo motor is used for angular steering and two DC motors are used for directional steering.

2.1.5. LCD

In order to display current processing status and data of the microcontroller, a LCD is attached which helps monitor the system. Mounted on the prototype vehicle, it significantly improves the user interface of the system and making the experience of user with the system better.

2.1.6. Power Source

A DC power source in form of batteries are used to power various components of the mechanism.

2.1.7.Casing of Transmitter

Transmitter is cased in a box which with the help of velcro band is strapped on to the tip of the extension from the shoulder. This allows accelerometer to turn with the gesture, thus continuously track gesture and transmit input signals [6]

2.2. General Working

To be able to generate control signals from gesture, the primitive objective is to track the angle of rotation of shoulder extension with accelerometer. Accelerometer generated values are then sent by a NRF module from transmitter circuit to receiver circuit. Microcontroller is then provided with the input signals and control logic takes processing further. The input value from the accelerometer is put through parameters set by control logic which gives control signals for motor control. These signals are sent to motor control modules which intern control the motors. This makes disabled person able to control the direction of the prototype vehicle and steer it.

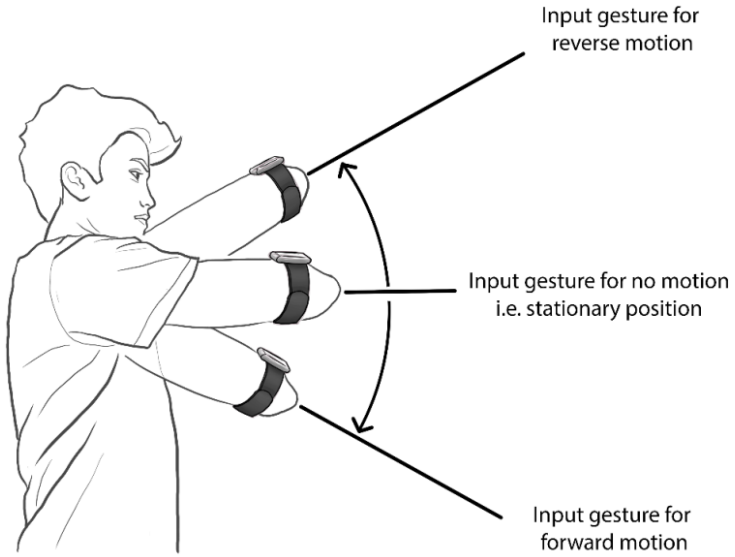


Fig 5: Control Gesture for Forward, Stationary and Reverse modes

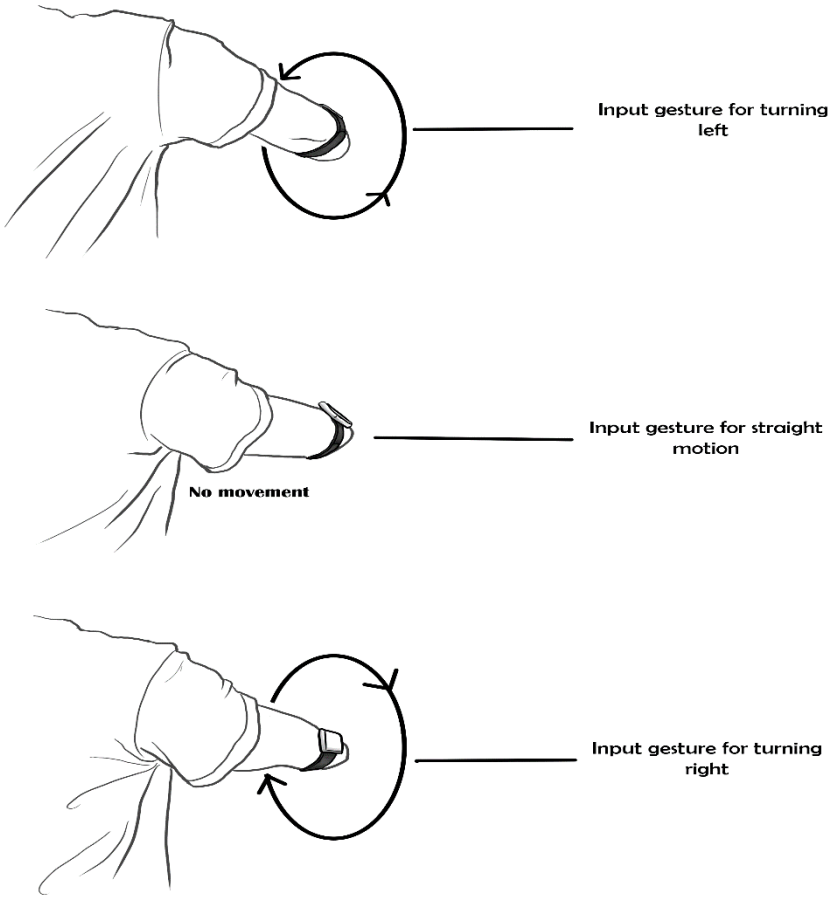


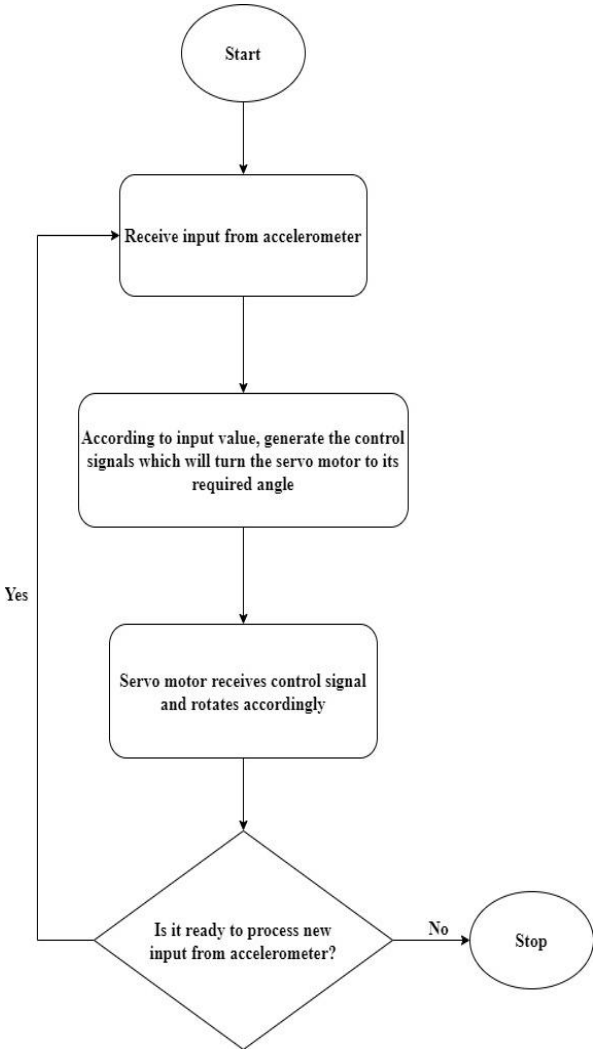
Fig 6: Control Gestures for Turning

Control Logics are pre-determined and programed in the microcontroller. Directional control logic and angular control logic are two types of control logics on the basis of which micro-controller processes and generates control signal. Both require accelerometers data as input and generates control signals for motor control as output.

Values of accelerometer are compared through three set of thresholds which ultimately leads to the selection of the type of motion been required as per accordance with the gesture. It being a constant process the system continuously runs in a loop and responds to each and every gesture which is tracked by the accelerometer.

3. Results

A new electronic mechanism for vehicle steering has been designed and developed by incorporating gesture recognition and control. This system has the scope to help many people with disabilities acting as a driving aid for them and thus provide them with a cost effective solution while making them independent. System is uniquely customized to every person's unique need which provides better results. Being electronic in nature the product can be repaired and maintained easily.



4. Conclusion

Technologies such as gesture recognition and control has successfully been utilized to solve a real world problem and making disable people's life better. The new mechanism is able to control a prototype vehicle in all areas of motion with great ease. Design of the whole system has been made keeping users comfort in mind. This has also huge scope of implementation in various other fields.

5. Future Work

The mechanism being in prototype phase needs to be taken to industry and trials are to be done. The concept can be used in many people-machine interaction where people with disability face problem due to absence of griping capability of hands. With trials done, such system can be incorporated in vehicles which will provide as a driving aid at a cost effective technology solving an important problem.

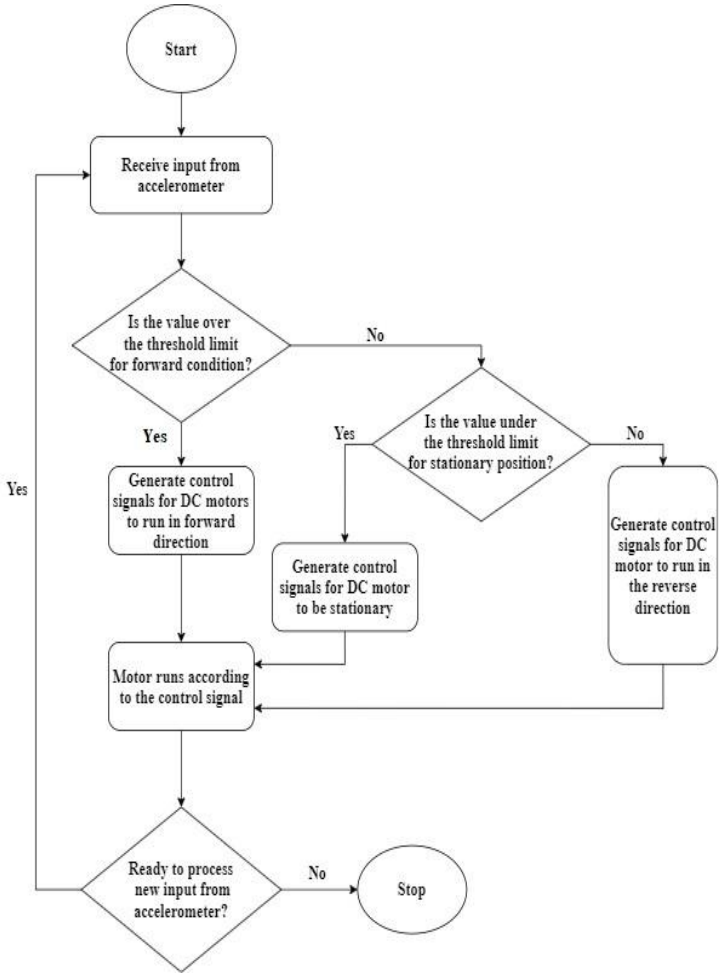


Fig. 7: Directional Control Logic& Angular Control Logic

References

1. KumbakonamK.GunasekaranM.Mathankumar "*Hand Gesture Based Mobile Robot Control Using PIC Microcontroller*" IEEE paper.
2. Daniel Sarb, RazvanBogdan. "Wireless motor control in automotive industry", 2016 24th Telecommunications Forum (TELFOR), 2016
3. Sureshkumar A, Suresh P "Design a Dynamic State Observer in Active Power Filter for Power Quality Improvement" published in International Journal of Control Theory and Applications (IJCTA) Year 2016; Volume no 5, Issue No:6; pp– 195 to 205
4. R. Posada-Gomez, L. Sanchez-Medel, G. A. Hernandez, A. MartinezSibaja, A. Aguilar-Laserre, and L. Leija-Salas, "A hands gesture system of control for an intelligent wheelchair," in Electrical and Electronics Engineering, 2007. ICEEE 2007. 4th International Conference on, 2007, pp. 68-71.
5. Sureshkumar A, Kalyanasundaram V, Vidyasagar S, George Fernandez, Vishnuram, P, Suresh, P, "Design a Single Stage AC to DC Converter for LED Driver With Power Factor Improvement" International Journal of Recent Technology and Engineering, Volume-8, Issue-2S11, September 2019; pp- 3312 – 3318.
6. Mrs.M.S.GhuteMs.MohsinaAnjum Mrs K.P.Kamble "*Gesture Based Mouse Control*" IEEE paper.