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Gesture Controlled Wheelchair with Stretcher

Mr. Chetan R. Sakure[1], Miss. Tejswini A. Sawwalakhe[2], Mr. Shubham B. Shendre[3], Mr. Rahul H. Satpal[4], Prof. Ankush M. Hatwar[5]

[1]UG, DESCOET, Dhamangaon RLY, Maharashtra, India.
[2] UG, DESCOET, Dhamangaon RLY, Maharashtra, India.
[3]UG, DESCOET, Dhamangaon RLY, Maharashtra, India.
[4]UG, DESCOET, Dhamangaon RLY, Maharashtra, India.
[5] Professor, Dept. of Mechanical Engineering, DESCOET, Maharashtra, India

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Abstract - *The smart wheelchair is need of disabled person for transportation and a replacement for walking especially in indoor and outdoor environment. Wheelchairs and stretchers are the most essential part of the hospital for transportation of patients. Transferring the patients from wheelchair to stretcher or to the medical bed is always an issue for the patients as well as for the attendants/ nurses. This may even result in musculoskeletal disorders to those who are not trained to do so especially, when it comes to the caretakers. So there is a need of automatic gesture control wheelchair with stretcher to facilitate the disabled patient's mobility and to provide novel medical equipment for use in the hospitals. The caregiver can merely shift the patient from a bed on to the device while the device is in the form of a stretcher, otherwise in absence of caregiver patient can operate wheelchair by itself. The device can be convert wheelchair into stretcher automatically with a press of a button. This can be done in the reverse direction as well as, when the patients in sitting in the wheel chair can be converted to a stretcher smoothly for the purpose of diagnosis etc. Wheelchairs are used by the people who cannot walk due to physical illness, injury or any disability. The present article presents a gesture based wheelchair with stretcher which controls the wheelchair using hand movements. The system is divided into two main units: MEMS Sensor and wheelchair control. The MEMS sensor, which is connected to hand, is a 3-axis accelerometer with digital output that provides hand gesture detection. The wheelchair control unit is a wireless unit that is developed using other controller.*

Key Words: Mobility Aid, Stretcher, Wheelchair control, Hand gesture recognition, Wireless.

1. INTRODUCTION

Automatic wheelchair is a device which can gives the independent mobility to the paralyzed person. Automatic wheelchair can control by the hand gesture. The most of wheelchair can operate buttons, joysticks to control the motion wheelchair. The system enables the patient to have command over the wheelchair its direction of movement and conversion of wheelchair into stretcher. This wheelchair helps the user to move in environments without help of other persons. This work is based on previous research in wheelchairs must be highly interactive to enable the system to work most efficiently. To avoid the problem associate with wheelchair having joysticks, the alternative to joystick control various motions of human body such as head movement, hand gesture, voice controller, chin controller Electromyogram (EMG), or Electrocephalogram (EEG) signal controller are developed to improve comfortless and easy to operate the wheelchair to the patient.

The hand gesture recognizes the detecting, tracking and directing which is works as human robot interface for the intelligent wheelchair. It is demonstrate that the accelerometer is to transmit the effective signals. The accelerometer is device which measure magnitude and direction of gravity to movement induced acceleration. The accelerometer sensor can works in three axes with respect to gravity, by using a single chip wireless solution with a MEMS (Micro Electro-mechanical system) accelerometer. The gesture controlled wheelchair is suitable to physically challenged people. For hand gesture controller consist (Micro Electro-mechanical system) MEMS accelerometer sensor which highly sensitive and able to sense the tilt. By using accelerometer sensor the motion wheelchair can change by the tilting the figure. Due to accelerometer sensor wheelchair movement possible in left, right, forward, backward and stop direction. It can easy to operate by the patient. Hence the physically chandelled person can control their wheelchair with their hand gesture. [3]

2. NEED OF PROJECT

The movement of wheelchair is possible in four direction, that will tried to achieve backward, forward, left, stop and right motion which gives the independent mobility to paralyze person.

3. LITERATURE SURVEY

Study helps to identify the need of the product, product environment and users experience. From literature survey wheelchair with stretcher is basic need in hospital. The many of people due to accident, unspecified birth issue, post- polio syndrome, spinal cord injury and many other problems causes a paralysis. The paralyze person suffering from independent mobility, they require need help of other person to travel from one place to another .Due to lack of force paralyze person can't manipulate wheelchair with their arm. So to overcome this problem, the gesture controller wheelchair comes. The gesture controller wheelchair can

operate by micro-controller and transmitter RF. It will transmit signals to receiver, with the help of sensor wheelchair can move. Wheelchairs and stretchers are the mobility equipment used to transport the patients from one place to other, independent mobility and various problems are identified by conducting the user study.

- A wheelchair or stretcher design without cushion is not recommended for the hospitals purposes.
- An excellent approach to the wheelchair selection is to set priorities based on user's mobility and seating needs.

4. METHODOLOGY

Micro electro-mechanical system (MEMS) is technology used for acceleration and pressure sensor. MEMS are combination of mechanical element, sensor, actuator, and electronics which can mount on single silicon chip by using micro fabrication technology. MEMS is highly sensing device which can provide control on motion of wheelchair in surrounding. The MEMS sensor is connected to microcontroller. The device consist of RF transmitter and receiver through MEMS sensor produce different analog signals for different orientation. The control circuit has switched to control the wheelchair motion. When switch on receiver sensing the signal and by tilting finger wheelchair can operated. [4]

5. HARDWARE DEVELOPMENT

5.1 Arduino Compiler:

The ATmega8 consume low power CMOS 8-bit micro-controller based on AVR enhanced RISC architecture. It can capable of executing powerful signals in clock cycle the Atmega8 achieves throughputs approaching 1 MIPS per MHz allowing the. System is design to optimal power consumption versus processing speed.

- Current consumption: 500mA
- Operating voltage: 5V

Figure 1: Arduino compiler

5.2 Accelerometer:

The gesture recognition is mainly base on accelerometer. Acceleration is vector quantity which having magnitude and direction. The acceleration sensor can manipulate the motion of wheelchair in three directions through a single tilt. It has moderate cost and small in size. It is an effective devise to sense to human body gesture.
Current consumption: 1mA
Operating voltage: 3.3V

Figure 2: accelerometer.

5.3 TRANSMITTING MODULE (RF Modem, 9600bps serial RS232 Level)

It is a wireless transceiver which required less power and cost. It transmitting signals for long distance, if the obstacle comes between transmitter and receiver. It will operate at frequency of 433MHz an RF transmitter receives serial data and transmit it wirelessly. [4]

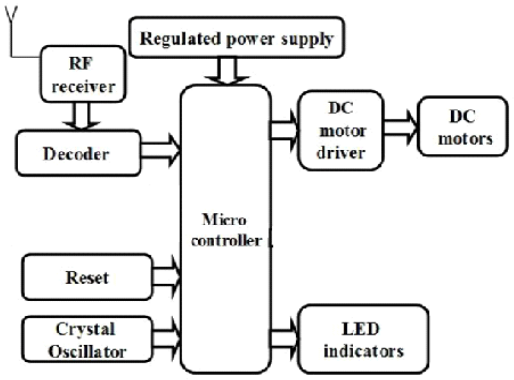

Figure 4: Receiver block diagram

6. GESTURE RECOGNITION

6.1 Data Acquisition and Pre-processing:

The sensor system collecting the data of hand gesture and perform indicated task. The sequence of two gestures can separate correctly by the segmentation program. During data acquisition process, pre-processor collect raw data from sensor. [1]

6.2 Segmentation:

The function of segmentation module is to identify the beginning and end of gestures. The beginning and end of gesture is controlled button based segmentation. [1]

6.3 Vector Quantization:

Vector quantization is used to convert the three dimensional signal data into one dimensional prototype vector. The collection of vector type data signal called as codebook. [1]

7. WORKING OF WHEELCHAIR:

The wheel chair there will be a direction key provided which gives the signal to the microcontroller after

pressing it. This in turn generates the signal which makes the gear motor to rotate the gears attached to the motor are also attached to the microcontroller. The linear actuator attached to the back resting support and to the leg support portion which slowly rotates in the clock wise direction and simultaneously the foot part will rise up after reaching the prescribed position it will stop. For converting from stretcher to bed the mechanism is similar but the portion of back will move in anti-clock wise direction and the foot will move down wards to make wheel chair position. This process of conversion can be stopped anywhere if the patient feels that it is the comfortable position. The whole process works only with the help of linear actuator on hinge joint mechanism. A reasonable number of gears are used here in order to increase the gear reduction ratio. Increasing the gear has the advantages that its speed reduces so that the conversion system can be done slowly. It also increases the torque of the shaft so that a heavy load can be easily carried. The wheelchair is operated with the help of accelerometer, which in turn controls the wheelchair with the help of hand gesture. The wheelchair moves front, back, right and left. Due to which disabled and partially paralyzed patient can freely move. [6], [7]

7.1 Wheelchair movement:

To use wheelchair automatically for moving forward, backward, left & right through fingers movements.

- When person tilt his fingers in forward direction above 20^{o} angle chair will move in forward direction.
- If person tilt his fingers in backward direction above 20^{o} angle chair will stop suddenly due to its disc break.
- If person tilt his fingers in left direction above 20^{o} angle chair will move in left direction.
- If person tilt his fingers in right direction above 20^{o} angle chair will move in right direction.

7.2 Stretcher Movement:

For the motion of stretcher the following hand gesture will use:

- When person tilt his fingers in backward direction above 20^{o} angle then front portion of chair will lift up.
- If person tilt his finger in forward direction above 20^{o} angle then front portion of chair will get down.
- If person tilt his finger in left direction above 20^{o} angle then back portion will down.
- If person tilt his finger in right direction above 20^{o} angle then back portion will get lift up.

Figure 5: Wheelchair.

APPLICATION:

- In hospitals this wheelchair is employed for the patient requirement.
- In household purpose for the paralyzed person.
- In old age home it is also applicable.

FUTURE SCOPE:

- Sensor detection can be installed which is used to notify the wheelchair comes across the obstacles.
- Go up and down on stairs without assistance.
- Another type of gesture control such as head motion, eye motion etc. can be implemented.
- Variable speed control with joystick.

CONCLUSION:

The gesture control wheelchair with stretcher is more efficient device for disable's person. Due to this device disable's person can able work individually and freely enjoy their freedom. It is also use for household purpose of paralyzed person.

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