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Automatic Wheelchair Using Accelerometer

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Abstract: **Patients who have inabilities in movements will get a much better life by using electronic supports for their daily needs. The aim of this work is to implement wheel chair direction control with hand gesture reorganization. This paper proposes an integrated approach to real time detection, tracking and direction recognition of hands, which is intended to be used as a human-robot interaction interface for the intelligent wheelchair. This paper demonstrates that accelerometers can be used to effectively translate finger and hand gestures into computer interpreted signals. For gesture recognition the accelerometer data is calibrated and filtered. The accelerometers can measure the magnitude and direction of gravity in addition to movement induced acceleration. Design and development of motion controlled wheelchair has been achieved using accelerometer sensors and ATMEGA328 microcontroller. The system is implemented practically and works well. The ACCELEROMETER senses the change in direction and accordingly the signal is given to microcontroller. Depending on the direction of the Acceleration, microcontroller controls the wheel chair directions like LEFT, RIGHT, FRONT, and BACK with the aid of DC motors.**

Keywords: **accelerometer, ATMEGA328 microcontroller, DC motor, wheelchair, gesture.**

1. INTRODUCTION

The aim of this project is to controlling a wheel chair and electrical devices by using MEMS ACCELEROMETER SENSOR (Micro Electro-Mechanical Systems) technology. MEMS ACCELEROMETER SENSOR is a Micro Electro Mechanical Sensor which is a highly sensitive sensor and capable of detecting the tilt. This sensor finds the tilt and makes use of the accelerometer to change the direction of the wheel chair depending on tilt. For example if the tilt is to the right side then the wheel chair moves in right direction or if the tilt is to the left side then the wheel chair moves in left direction. Wheel chair movement can be controlled in Forward, Reverse, and Left and Right direction.

Quadriplegics are persons who are not able to use any of the extremities. The reasons for such decreased motion possibilities can be different: stroke, arthritis, high blood pressure, degenerative diseases of bones and joints and cases of paralysis and birth defects. Also, quadriplegia appears as a consequence of accidents or age. The patients with such severe disabilities are not able to perform their everyday actions, such as: feeding, toilette usage and movement through space. Depending on the severity of the disability, a patient can retain freedom of movement to a certain level by using different medical devices [1]. Mobility has become very important for a good quality of life. Designing a system with independent mobility for such disabled people is our aim in this project.

2. LITERATURE REVIEW

When an unfortunate event affects the motor capacity of a person, it is necessary to use devices like wheelchairs that offer a means of displacement for patients with motors problems of the lower limbs. Tremendous leaps have been made in the field of wheelchair technology. However, even these significant advances haven't been able to help quadriplegics navigate wheelchair unassisted. Some patients that cannot manipulate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members, request electric wheelchairs, frequently manipulated with head motion. The present article presents the partial results in the development of a wheelchair controlled by head motion,

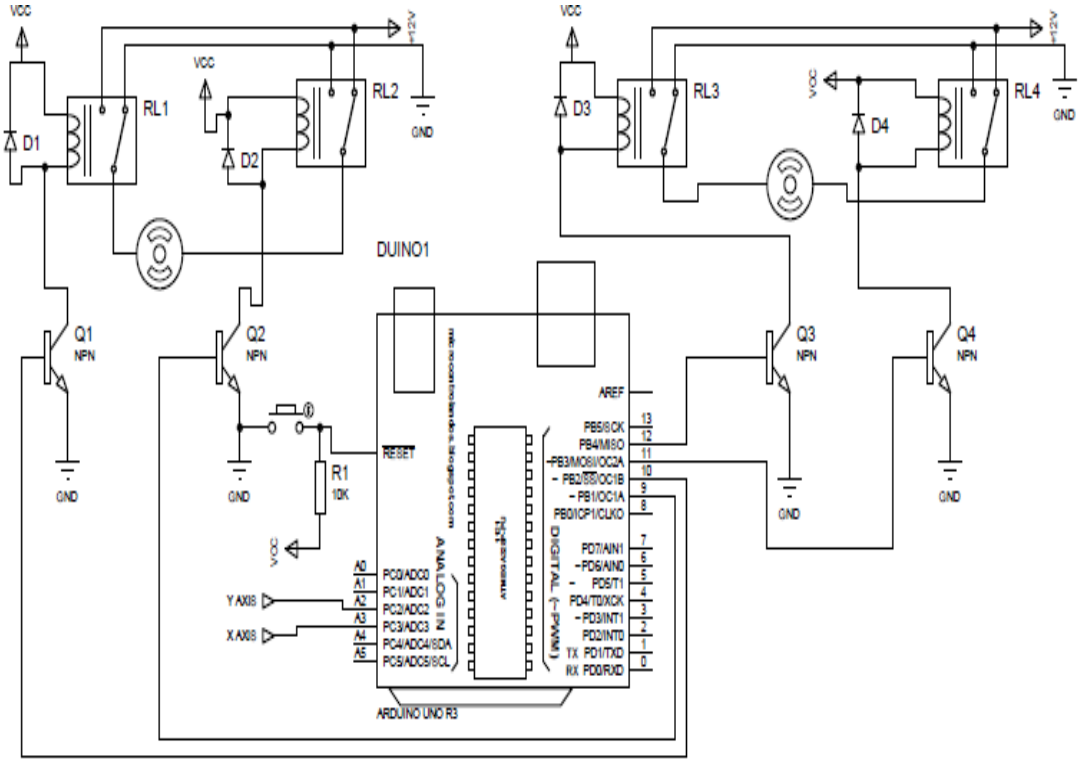
where the instructions are given by head motion. The advances are presented in the realization of the control software using an accelerometer and some distances and actuator sensors controlled by a ATMEGA328 microcontroller that establishes the communication with a program developed in Lab view.

Smart wheelchairs will remain fertile ground for technological research for many years to come. Smart wheelchairs are excellent test beds for sensor research, particularly machine vision. Smart wheelchairs also provide an opportunity to study human-robot interaction, adaptive or shared control, and novel input methods, such as voice control, EOG, and eyetracking. Furthermore, smart wheelchairs will continue to serve as test beds for robot control architectures.

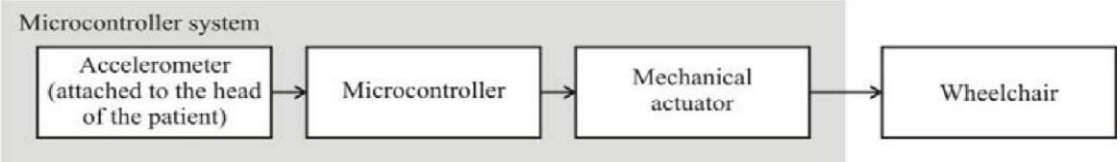
3. BLOCK AND CIRCUIT DIAGRAM

The system consists of major components like ATMEGA328 with 32K Flash memory, accelerometer Sensor, 2 DC Motors and 12V DC supply, Relays, ADC, Crystal oscillator, LED circuitry etc

CIRCUIT DIAGRAM:



BLOCK DIAGRAM:



ACCELEROMETER:

An accelerometer is an integrated device that measures proper acceleration, the acceleration experienced relative to freefall. Single- and multiaxis models are available to detect magnitude and direction of the acceleration as a vector quantity, and can be used to sense orientation, acceleration, vibration shock, and falling. Micro machined accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input. It is a capable of measuring how fast the speed of object is changing. It generates analog voltage as the output which is used as an input to the control system. The accelerometer used in this automated system is ADXL335. It is a three axis accelerometer, which senses the tilt in two directions only. The supply voltage ranges from 2 to 3.6v [2].

ADVANTAGES:

a. User Friendly

b. Efficient and Low Cost Design

c. Fast Response

d. Low Power Consumption

e. Helpful for the paralysis stroke people who don't have much stamina in the hands.

f. Reduces the human activity.

d. Reduces the physical strain.

e. Easy to operate with least movement required.

4. CONCLUSION

Accelerometers have a secure place in the movement of equipment based on actions done. The system can be made free from challenges and will be cost effective in the near future. Calibration though at times is problem but with more introspection and research better calibration and performance can be achieved. The system developed by us despite calibration errors and problems still is able achieve accuracy of 88-95%, further improvements can used to achieve an accuracy of 95-99%. The system proves a very competitive performance computationally and in terms of recognition accuracy. Interesting topic to research is the problem of tilting. As mentioned earlier, tilting of the remote can lead to erroneous recognition if not taken into account. Therefore, in our proposed system, subjects were requested to hold the remote in a natural way while performing the gestures and to avoid any tilting of the remote as much as possible. However, this way of holding the remote can result in some inconvenience to users of the system. Consequently, a system which is immune to tilting of the accelerometer is definitely a desirable one.

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