Mems Based Wheel Chair For Physically Handicap People

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Abstract: — **This paper is to develop a wheel chair control which is useful to the physically disabled person with his hand movement or his hand gesture recognition using Acceleration technology. 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. It is wheelchair which can be controlled by simple hand gestures. It employs a sensor which controls the wheelchair hand gestures made by the user and interprets the motion intended by user and moves accordingly. In Acceleration we have Acceleration sensor. When we change the direction, the sensor registers values are changed and that values are given to microcontroller. Depending on the direction of the Acceleration, microcontroller controls the wheel chair directions like LEFT, RIGHT, FRONT, and BACK. The aim of this paper is to implement wheel chair direction control with hand gesture reorganization.**

Keywords- **Micro-electromechanical systems (MEMS), wheelchair..**

I. INTRODUCTION

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. The system consists of development of a wheel chair control. This paper is to demonstrate 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. In order to calibrate the accelerometers, we rotate the device "sensitive axis with respect to gravity and use the resultant signal as an absolute measurement. Integrating a single chip wireless solution with a MEMS accelerometer would yield an autonomous device small enough to apply to the fingernails, because of their small size and weight [1]. Accelerometers are attached to the fingertips and back of the hand. Arrows on the hand show the location of accelerometers and their sensitive directions, that the sensitive direction of the accelerometer is in the plane of the hand.. Elders find it tough to move inside the house for day to day activities without help or external aid. Our proposed system makes use of a wheelchair that can be used by elderly or physically challenged to move inside the home without difficulty and without external aid[2].

The physically challenged, find difficult to move the wheel chair without help from others. By making use of the system, the elderly and the physically challenged can go to different rooms in the house like kitchen, living room, dining room etc by just showing a gesture which is predefined to that particular room. It is also a virtue of the system that even the foot can be substituted in place of the hand for users who might find that more convenient. 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 Electromechanically 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 [3]. Wheel chair movement can be controlled in Forward, Reverse, and Left and Right direction along with obstacle detection using ultrasonic sensor. Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. One among the technologies, which had greater developments, is the MEMS ACCELEROMETER SENSOR. These had greater importance than any other technologies due its user friendly nature. MEMS ACCELEROMETER SENSOR based devices can be easily reachable to the common man due to its simpler operation.

II. NEED OF PROJECT

This paper to develop a wheel chair control which is useful to the physically disabled person with his hand movement or his hand gesture reorganization. With the help of the wheel chair physically disabled person would able to move himself to the desired location with the help of hand gestures which controls the movement of the chair[1]. This paper aims to provide a feasible solution to those handicapped people who do not have the ability to maneuver the wheelchair by themselves. These include people with serious paralytic condition. Wheelchair automated control systems proved to be versatile tools for many problems in human-computer interface systems. Basically, they are used for providing better usability of a computer or a system for people, including disabled people.

III. TECHNOLOGY

Micro-electromechanical systems (MEMS) are free scale's enabling technology for acceleration and pressure sensors. MEMS based sensor products provide an interface that can sense, process or control the surrounding environment. Micro-Electro Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro--mechanical elements (i.e., devices and structures) that are made using the techniques of micro fabrication[4]. MEMS based sensors are a class of devices that builds very small electrical and mechanical components on a single chip. MEMS-based sensors are a crucial component in automotive electronics, medical equipment, hard disk drives, computer peripherals, wireless devices and smart portable electronics such as cell phones and PDAs. The functional elements of MEMS are miniaturized structures, sensors, actuators, and microelectronics, the most notable (and perhaps most interesting) elements are the micro sensors and micro actuators. Micro sensors and micro actuators are appropriately categorized as "transducers", which are defined as devices that convert energy from one form to another. In the case of micro sensors[3], the device typically converts a measured mechanical signal into an electrical signal .MEMS technology provides the following advantages: cost-efficiency, low power, miniaturization, high performance, and integration. Functionality can be integrated on the same silicon or in the same package, which reduces the component count. This contributes to overall cost savings. Hence with this paper we can save the physically disabled persons who use wheel chairs they can control their wheel chair with their hand movements[6].

IV. LITERATURE SURVEY

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 joysticks; however the joystick manipulation is even not practical and frequently it must be handle with the mouth[5]. The present article presents the partial results in the development of a wheelchair controlled by an intuitive interface, where the instructions are given by hand gesture instructions. The advances are presented in the realization of the control software using a Webcam and some distances and presence sensors controlled by a PIC microcontroller that establishes the communication with a program developed in Lab view. This paper is inspired from an IEEE Research Paper Titled „A Wearable Head-Mounted Sensor Based Apparatus for Eye Tracking Applications" that was presented in the IEEE International Conference on Virtual Environments, Human-Computer Interfaces, and Measurement Systems Istanbul, Turkey, dated 14-16 July 2008. The above paper approach was dealing with wheelchair control using eye ball movement with slight modification to it. Our paper deals with the control of wheelchair motion by hand gesture.
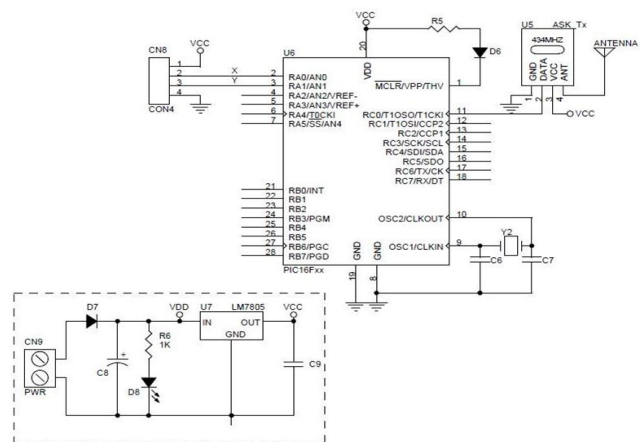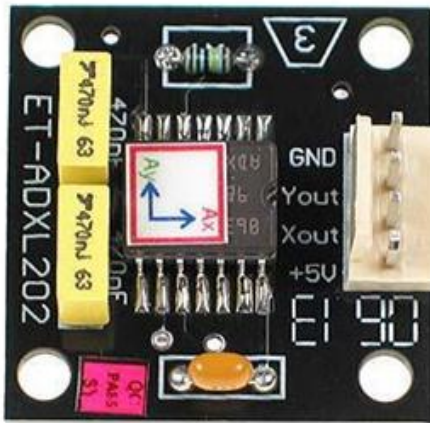
V. HARDWARE

2.1 Transmitter Module

Figure 1. Circuit Diagram Of Transmitter Module

2.1.1. ACCELEROMETER

An accelerometer is an apparatus, either mechanical or electromechanical, for measuring acceleration or deceleration - that is, the rate of increase or decrease in the velocity of a moving object. The measurement of acceleration or one of its derivative properties such as vibration, shock, or tilt has become very commonplace in a wide range of products[1]. Compact acceleration sensor for measuring acceleration is 2axis. Our new acceleration sensor using the high-quality ADXL202 sensor from analog devices and can measure acceleration from -2g to +2g in either X or Y axis. Save time and money with this pre-mounted and assembled acceleration sensor unit. No need to solder the small SMD ADXL part, this unit comes completely assembled and ready to operate. The compact unit can be easily mounted on a robot or mobile unit, with easy to connect header for signal output. Output is in PWM format and can be connected directly to a microcontroller. The unit has minimum power requirements and a fast response time. Ideal for use in robots, guidance systems ,car systems, model aircraft and much more.

General Description

The ADXL202E is a low-cost, low-power, complete 2-axis accelerometer with a digital output, all on a single monolithic IC. It is an improved version of the ADXL202AQC/JQC. The ADXL202Ewill measure accelerations with a full-scale range of 2 g. TheADXL202E can measure both dynamic acceleration (e.g., vibration)and static acceleration (e.g., gravity).The outputs are analog voltage or digital signals whose duty cycles(ratio of pulse width to period) are proportional to acceleration. The

ADXL202E is a complete, dual-axis acceleration measurement system on a single monolithic IC. The resolution of the data acquire is ultimately determine by analog to digital converter[1]. It contains a poly silicon surface micro machine sensor and signal conditioning circuitry to implement open loop acceleration measurement architecture. For each axis, an output circuit converts the analog signal to a duty cycle modulated (DCM) digital signal that can be decoded with a counter/timer port on a microprocessor[2]. The ADXL202E is capable of measuring both positive and negative accelerations to at least 2 g. The accelerometer can measure static acceleration forces such as gravity, allowing it to be used as a tilt sensor. The sensor is a surface micro machined poly silicon structure built on top of the silicon wafer. Poly silicon springs suspend the structure over the surface of the wafer and provide a resistance against acceleration forces. Deflection of the structure is measured using a differential capacitor that consists of independent fixed plates and central plates attached to the moving mass. The fixed plates are driven by 180° out of phase square waves. An acceleration will deflect the beam and unbalance the differential capacitor ,resulting in an output square wave whose amplitude is proportional to acceleration. An accelerometer output value is a scalar corresponding to the magnitude of the acceleration vector. The most common acceleration, and one that we are constantly exposed to, is the acceleration that is a result of the earth's gravitational pull. This is a common reference value from which all other accelerations are measured (known as g, which is ~9.8m/s^2). This filtering improves measurement resolution and helps prevent aliasing .After being low-pass filtered, the analog signal is converted to a duty cycle modulated signal by the DCM stage[4]. A single resistor set the period for a complete cycle (T2), which can be set between 0.5ms and 10ms (see Figure 12). A 0g acceleration produces 50% duty cycle.

Theacceleration signal can be determined by measuring the length of the T1 and T2 pulses with a counter/timer or with a polling loop using a low cost microcontroller. An analog output voltage can be obtained either by buffering the signal from the XFILT and YFILT pin, or by passing the duty cycle signal through an RC filter to reconstruct the dc value. The ADXL202E will operate with supply voltages as low as 3.0V or as high as 5.25V.This graph shows the X axis[5]. The accelerometer starts level, and then is tilted to the left, then to the right, then level again:
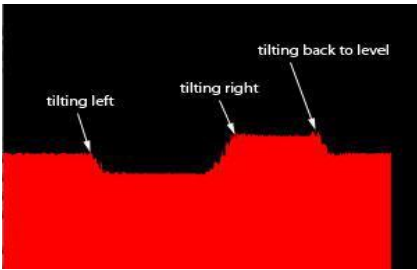
Fig 2. X-axis of accelerometer

This graph shows the Y axis. The accelerometer starts level, and then is tilted forward, then back then level again.

Fig 3. Y-axis of accelerometer
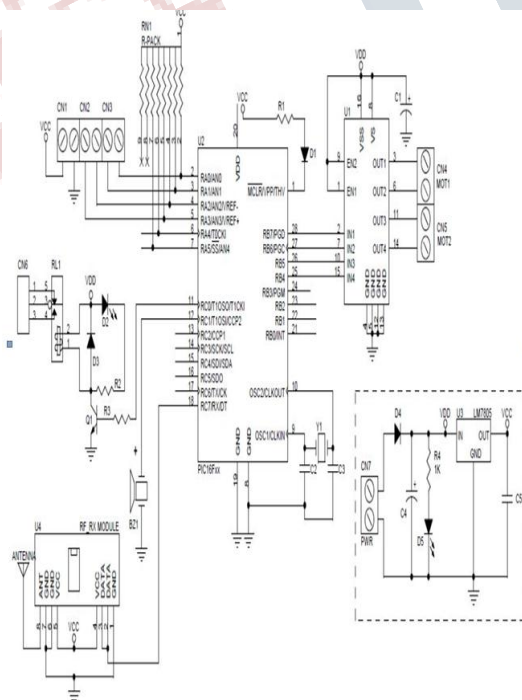
2.2 Receiver Module

Figure 4.Circuit Diagram Of Receiver Module

RF ASK Receiver Module*:* This is an ASK Hybrid receiver module. It is an effective low cost solution to receiving data at 315/433MHz.

2.2.1. D.C. Motor A dc motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors Now to go into the details of the **operating principle of DC motor** its important that we have a clear understanding of Fleming right hand rule to determine the direction of force acting on the armature conductors of DC motor[1]. The input of a DC motor is current/voltage and its output is torque (speed).

Fig 5. DC Motor

The DC motor has two basic parts: the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. Figure shows a picture of a typical DC motor, Figure shows a picture of a DC armature, and Fig shows a picture of a typical stator. From the picture you can see the armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings[2]. You should also notice that the ends of each coil of wire on the armature are terminated at one end of the armature. The termination points are called the commentator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

H – Bridge (Dc Motor Driver):
The H-bridge is so named because it has four switching elements at the "corners" of the H and the motor forms the cross bar. The basic bridge is shown in the figure to the right
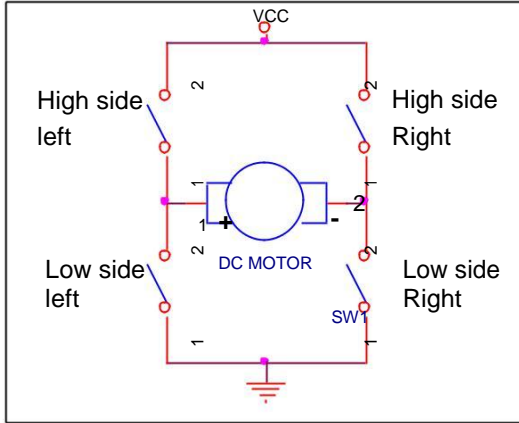
Figure 6.H – Bridge (Dc Motor Driver)

The switches are turned on in pairs, either high left and lower right, or lower left and high right, but never both switches on the same "side" of the bridge. If both switches on one side of a bridge are turned on it creates a short circuit between the battery plus and battery minus terminals[1]. If the bridge is sufficiently powerful it will absorb that load and your batteries will simply drain quickly

VI. APPLICATIONS

In Hospitals for handicapped patients: Some patients that cannot manipulate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members require electric wheelchair. 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[1]. Due to which disabled and partially paralyzed patient can freely move.

Overview Of The Project

VII. RESULT

COMPONENTS	VOLTAGE RATINGS
LM7805 input voltage	11.05
LM7805 output voltage	4.89
Sensor's input voltage	4.87
L293d output voltage	11.04

FUNCTION	ANGLE
Forward	Forward 45°
Backward	Back 45°
Left	Left 45°
Right	Right 45°
Stop	0°

VIII. FUTURE SCOPE

Voice monitoring helps the disabled person to determine the obstacle by acknowledging with alarm signals with slight modification in power section by monitoring the battery voltage levels to enhance the speed and estimate the delay for action to be taken .to enhance the speed of the wheelchair dc motors can be replaced by servomotors.

IX. CONCLUSION

Our paper is capable to control the wheelchair motion for disabled people using hand gesture. Improvements can be made by using various body gestures such as eye gaze, leg movement or head movement accordingly.

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