Memes Accelerometer Controller Wheel Chair

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ARTICLEINFO

ABSTRACT

The aim of this project is to controlling a wheel chair 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, Left and Right direction.

Keywords: MEMS, ACCELEROMETER SENSOR

I. INTRODUCTION

The introduction of this project is to controlling a wheel chair 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, Left and Right direction.

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, and at the same time it challenges the designers of the device.

This device is portable and this system operation is entirely driven by wireless technology. User can wear it to his wrist like a watch and can operate it by tilting the MEMS ACCELEROMETER SENSOR Accelerometer sensor.

This project makes use of a micro controller, which is programmed, with the help of embedded C

instructions. This microcontroller can communicate with transmitter and receiver modules. The MEMS ACCELEROMETER SENSOR based sensor detects the tilt and provides the information to the microcontroller (on board computer) and the controller judges whether the instruction is right movement or left movement instruction and controls the direction respectively. The controller is interfaced with two dc motors to control the direction of the wheel chair. To perform the task, Microcontroller is loaded with an intelligent program written in embedded C language.

II. 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. 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.

Existing System

Wheelchair is a gadget utilized by crippled and elderly individuals for their transportation reason. A few sorts of smart wheelchairs are accessible in the market. For some situation, for example, absolutely loss of motion individual in Amyotrophic Lateral Sclerosis (ALS) and typical sort of framework. They depend close by motion, eye position, voice acknowledgment, and mind waves and so forth. A self-impelled manual wheelchair fuses a casing, seat, maybe a couple footplates (footstools) and four wheels: generally, two caster wheels at the front and two huge wheels at the back. They have designed the control system including software and hardware. Voice controlled posture change and driving was realized, the hardware circuit and software program are tested and debugged, the recognition rates of voice control of the wheelchair for the same person are acceptable. But it can't be applicable in crowded place due to it recognize numerous numbers of voice.

Proposed System

The Wheelchair operates with Motion, taking motion as an input signal for the movement of wheelchair in a particular direction. A MEMS sensor is used to track these motions. This sensor is fitted to any movable part of body. The variations of the are trapped and those signals are fed as inputs to the micro-controller. Now based on these variations the micro-controller is programmed to take decisions which in turn control the movement of wheelchair. If person tilt his hand in right or left direction above, chair will move in right or left direction.

III. Related Work and Motivation:

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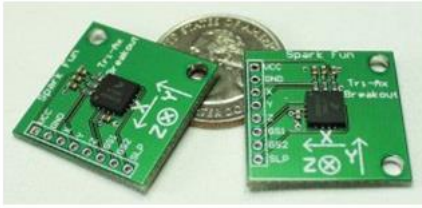
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Figure: MEMS sensor MMA7260Q

The MMA7260Q is a 3-axis accelerometer. An accelerometer measures acceleration (change in speed) of anything that it's mounted on. Single axis accelerometers measure acceleration in only one direction. Dual-axis accelerometers are the most common measure acceleration in two directions, perpendicular to each other. Three-axis accelerometers measure acceleration in three directions.

Accelerometers are very handy for measuring the orientation of an object relative to the earth, because gravity causes all objects to accelerate towards the earth. A two-axis accelerometer can be used to measure how level an object is.

(This would be a good place to fill in equations to calculate a body's angle from the X and Y accelerations on the body).

With a three-axis accelerometer, you can measure an object's acceleration in every direction.
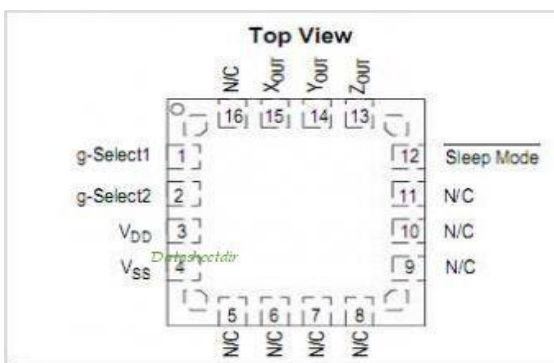
This three-axis accelerometer is essentially a carrier board or breakout board for Freescale's MMA7260QT MEMS (micro-electro-mechanical systems)

accelerometer; we therefore recommend careful reading of the MMA7260QT datasheet (199k pdf) before using this product. The MMA7260QT is a great IC, but its small, leadless package makes it difficult for the typical student or hobbyist to use. The device also operates at 2.2 V to 3.6 V, which can make interfacing difficult for microcontrollers operating at 5 V. This carrier board addresses both issues while keeping the overall size as compact as possible.

IV. Implementation

This project is implemented using following software's:

- Express PCB – for designing circuit
- PIC C compiler - for compilation part
- Proteus 7 (Embedded C) – for simulation part

4.1 Express PCB:

Breadboards are great for prototyping quipment as it allows great flexibility to modify a design when needed; however the final product of a project, ideally should have a neat PCB, few cables, and survive a shake test. Not only is a proper PCB neater but it is also more durable as there are no cables which can yank loose.

Express PCB is a software tool to design PCBs specifically for manufacture by the company Express PCB (no other PCB maker accepts Express PCB files). It is very easy to use, but it does have several limitations.

It can be likened to more of a toy then a professional CAD program. It has a poor part library (which we can work around) It cannot import or export files in different formats   It cannot be used to make prepare boards for DIY production

Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB

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patterns and use the toner transfer method with an Etch Resistant Pen to make boards. However, Express PCB does not have a nice print layout. Here is the procedure to design in Express PCB and clean up the patterns so they print nicely.

4.1.1 Preparing Express PCB for First Use:

Express PCB comes with a less then exciting list of parts. So before any project is started head over to Audio logical and grab the additional parts by morsel, ppl, and tangent, and extract them into your Express PCB directory. At this point start the program and get ready to setup the workspace to suit your style.

Click View -> Options. In this menu, setup the units for "mm" or "in" depending on how you think, and click "see through the top copper layer" at the bottom. The standard color scheme of red and green is generally used but it is not as pleasing as red and blue.

4.1.2 The Interface:

When a project is first started you will be greeted with a yellow outline. This yellow outline is the dimension of the PCB. Typically after positioning of parts and traces, move them to their final position and then crop the PCB to the correct size. However, in designing a board with a certain size constraint, crop the PCB to the correct size before starting.

Fig: 4.1 show the toolbar in which the each button has the following functions:

Fig 4.1: Tool bar necessary for the interface

- The select tool: It is fairly obvious what this does. It allows you to move   and manipulate parts. When this tool is selected the top toolbar will show buttons to move traces to the top / bottom copper layer, and rotate buttons.
- The zoom to selection tool: does just that.
- The place pad: button allows you to place small soldier pads which are useful for board connections or if a part is not in the part library but the part dimensions are available. When this tool is selected the top toolbar will give you a large selection of round holes, square holes and surface mount pads.
- The place component: tool allows you to select a component from the top toolbar and then by clicking in the workspace places that component in the orientation chosen using the buttons next to the component list. The components can always be rotated afterwards with the select tool if the orientation is wrong.
- The place trace: tool allows you to place a solid trace on the board of varying thicknesses. The top toolbar allows you to select the top or bottom layer to place the trace on.
- The Insert Corner in trace: button does exactly what it says. When this tool is selected, clicking on a trace will insert a corner which can be moved to route around components and other traces.
- The remove a trace button is not very important since the delete key will achieve the same result.

4.1.3 Design Considerations:

Before starting a project there are several ways to design a PCB and one must be   chosen to suit the project's needs.

Single sided, or double sided?

When making a PCB you have the option of making a single sided board, or a double-sided board. Single sided boards are cheaper to produce and easier to etch,

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but much harder to design for large projects. If a lot of parts are being used in a small space it may be difficult to make a single sided board without jumping over traces with a cable. While there's technically nothing wrong with this, it should be avoided if the signal travelling over the traces is sensitive (e.g. audio signals).

A double sided board is more expensive to produce professionally, more difficult to etch on a DIY board, but makes the layout of components a lot smaller and easier. It should be noted that if a trace is running on the top layer, check with the components to make sure you can get to its pins with a soldering iron. Large capacitors, relays, and similar parts which don't have axial leads can NOT have traces on top unless boards are plated professionally.

When using a double sided board you must consider which traces should be on what side of the board. Generally, put power traces on the top of the board, jumping only to the bottom if a part cannot be soldiered onto the top plane (like a relay), and vice-versa.

Some projects like power supplies or amps can benefit from having a solid plane to use for ground. In power supplies this can reduce noise, and in amps it minimizes the distance between parts and their ground connections, and keeps the ground signal as simple as possible. However, care must be taken with stubborn chips such as the TPA6120 amplifier from TI. The TPA6120 datasheet specifies not to run a ground plane under the pins or signal traces of this chip as the capacitance generated could affect performance negatively.

4.2 PIC Compiler:

PIC compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. PIC compiler also supports C language code.

It's important that you know C language for microcontroller which is commonly known as Embedded C. As we are going to use PIC Compiler, hence we also call it PIC C. The PCB, PCM, and PCH are separate compilers. PCB is for 12-bit opcodes, PCM is for 14-bitopcodes, and PCH is for 16-bit opcode PIC microcontrollers. Due to many similarities, all three compilers are covered in this reference manual. Features and limitations that apply to only specific microcontrollers are indicated within. These compilers are specifically designed to meet the unique needs of the PIC microcontroller. This allows developers to quickly design applications software in a more readable, high-level language. When compared to a more traditional C compiler, PCB, PCM, and PCH have some limitations. As an example of the limitations, function recursion is not allowed.

This is due to the fact that the PIC has no stack to push variables onto, and also because of the way the compilers optimize the code. The compilers can efficiently implement normal C constructs, input/output operations, and bit twiddling operations. All normal C data types are supported along with pointers to constant arrays, fixed point decimal, and arrays of bits.

PIC C is not much different from a normal C program. If you know assembly, writing a C program is not a crisis. In PIC, we will have a main function, in which all your application specific work will be defined. In case of embedded C, you do not have any operating system running in there. So you have to make sure that your program or main file should never exit. This can be done with the help of simple while (1) or for (;;) loop as they are going to run infinitely.

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We have to add header file for controller you are using, otherwise you will not be able to access registers related to peripherals.

  #include <16F73.h> // header file for PIC 16F73//

4.3 Proteus:

Proteus is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the pic compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply circuit designed and connected to the microcontroller in proteus. The program which is to be dumped in to the microcontroller is edited in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller using a dumper
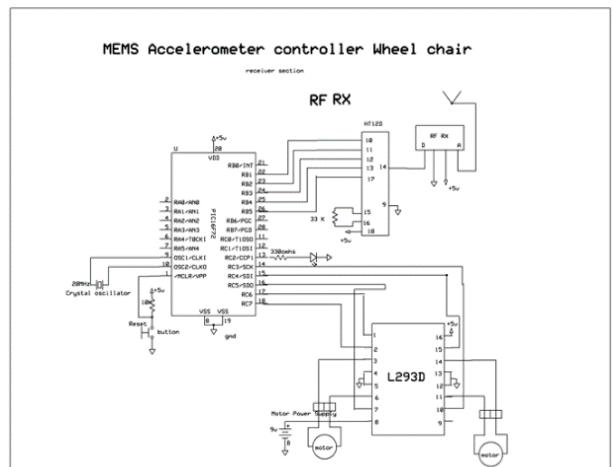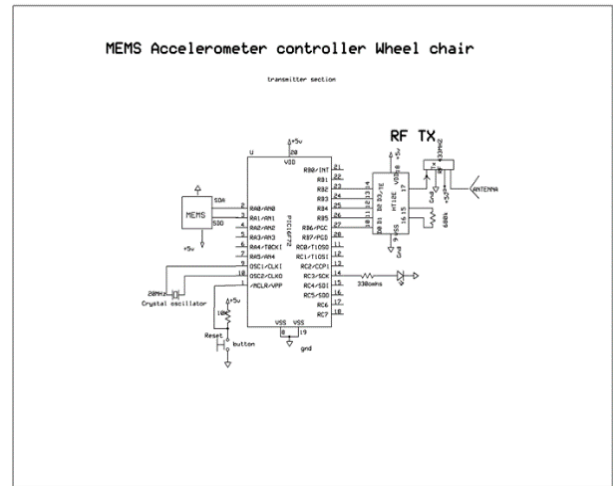

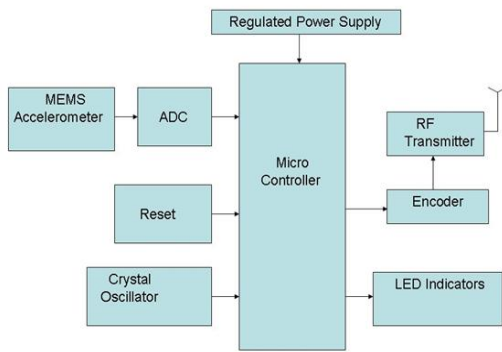

Figure: Simulation Implementation

V. Hard ware Implementation

The main blocks of this project are:

1. Regulated Power Supply.
2. Microcontroller.
3. MEMS ACCELEROMETER SENSOR.
4. RF transmitter and receiver modules.
5. Encoder and Decoder
6. Crystal oscillator.
7. Reset.
8. DC motors with driver.
9. LED indicators.

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MEMS Accelerometer controller Wheel chair
1. Transmitter

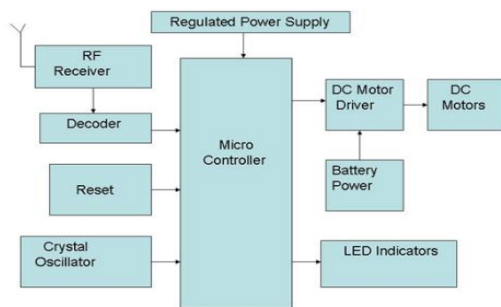**MEMS Accelerometer controller Wheel chair**
2. Receiver

Figure: Block Diagram of MEMS Sensor

This enables the sensor to detect the acceleration motion. MEMS sensor contain Tilt register. When the changes in the direction, the tilt register values are changed and that values are given to ADC, which converts analog to digital values these values are given to microcontroller. Depending on the direction of the MEMS, microcontroller controls the wheel chair directions like LEFT, RIGHT, FRONT, and BACK By implementing the above circuit, the obtained values are:

Table 1: Experimental Values

position	X-axis	Y-axis
Left	>150&&>200	<200&&<250
Right	>100&&>200	>150&&200
Forward	>150&&>200	<200&&<250
Backward	>100&&>200	<150&&<250

VI. Conclusion

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

VII. Future Scope:

"**MEMS ACCELOROMETER sensor-based wheel chair**" is mainly intended to design to a wheel chair which can be controlled by a movement of a part in the human body, which is very useful for handicapped and paralyzed persons. This system has a MEMS accelerometer and a wheel chair interfaced to the controller. The Micro Controller is programmed in such a way that basing on the tilt angle of the MEMS accelerometer the wheel chair will be moved in a particular direction. This microcontroller can communicate with transmitter and receiver modules.

This project can be extended by using a heartbeat sensor to this system. Heart beat sensor continuously monitors the heart rate, which can be designed such that alarm horns if the heart level goes beyond set level. Also, this MEMS accelerometer can be used to control different devices basing on the tilt angle.

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