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HOME AUTOMATION USING MEMS ACCELEROMETER

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ABSTRACT

This project discuss about the automation of a house using MEMS accelerometer sensor. MEMS stands for the Micro electromechanical system. This technology mainly deals with the devices which involves the motion of the object. accelerometer detects motion in three perpendicular directions (x, y ,z). Accelerometer is an electromechanical device that measures the force of acceleration due to gravity in g unit. It can be used in applications requiring tilt sensing. Arduino uses a simple software and sophisticated peripherals in it. Here the direction measurement is done by the Arduino controller. Arduino Microcontrollers can process these voltages by converting them to digital signals using ADC. Software code plays essential role to check whether its tilted or not. It will make the Load on and off the devices or circuit . Nowadays, arduino controllers are widely used in many industrial, home, and wide variety of applications because of its flexibility. As this circuit is very compact and economical in many applications it can be used in motion controlled devices. This project helps many disabled ,visually, challenged and semi-paralyzed persons.

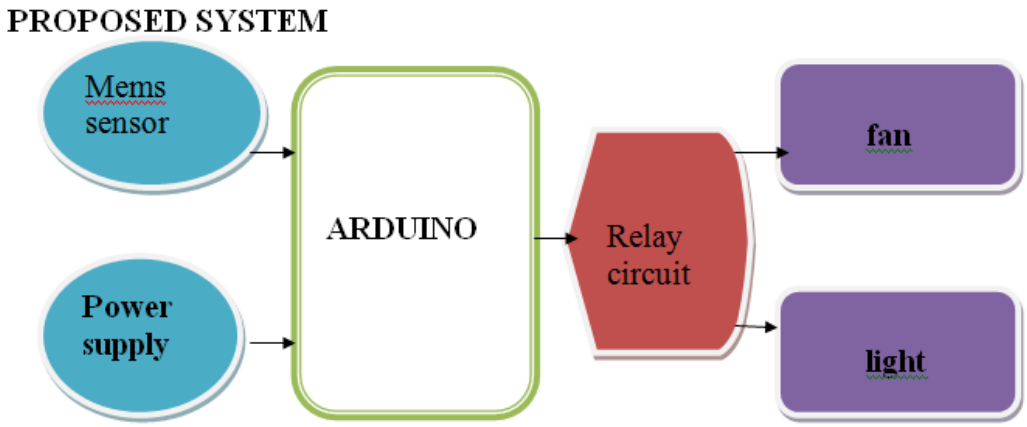
INTRODUCTION

Micro Electro Mechanical Systems(MEMS) is the technology of small device that in general form to be defined as miniaturized mechanical and Electro-mechanical elements that are made using the techniques of micro fabrication. MEMS are made up of components between 1 to 100 micrometers (20 millionths of a meter) to a millimeter (I.e. 0.02 to 1.0 mm).Micro Electro mechanical systems (MEMS) refer to a collection of micro sensors and actuator that can sense its environment through measuring mechanical ,thermal ,biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through the decision making capability direct the actuators to respond by moving ,positioning, regulating, Pumping and filtering thereby controlling the environment for some desired outcome or purpose. The system may also need micro power supply, micro relay, and micro-signal processing units. Micro-components make the system faster, more reliable, cheaper and capable of incorporating more complex functions.MEMS are not about any one application or device, nor are they defined by a single fabrication approach that conveys the advantages of miniaturization, multiple components, and microelectronics to the design and construction of integrated electromechanical systems; they are also a new paradigm for designing mechanical device and systems.

Embedded systems are a system is which performs a specific or a pre-defined task. It is the combinations of hardware and software. It is nothing but a computer inside a product. It is a programmable hardware design nothing but an electronic chip. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. In many cases their embedded may be such that their presence is far from obvious to the casual observer and even the equipment for sometime before being able to conclude that an embedded control system was involved in its functioning. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious.

All embedded systems are or include computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

Block Diagram



Explanation

Accelerometer has three accesses X, Y, &Z. Here we consider two directions X&Y. here I took home appliances as output devices. Whenever the accelerometer moves right to left the fan will on and off accordingly to the movement. The light will on and off for vertical and bottom direction. From the inputs of the sensor the controller took measures by comparing one reference axis and another is measuring axis the comparison is taken into account. Some are stored axis value will be present in the controller and depends on movement of the axis the output will be generated. The program here used is embedded c, used in integrated development environment. It is very easy language and flexible. With minimum knowledge we can perform various tasks.

CIRCUIT DESCRIPTION

The heart of this project is Mems accelerometer sensor. Accelerometer is an electromechanical device that measures the force of acceleration due to gravity in g unit. It can be used in applications requiring tilt sensing.

The ADXL335 measures acceleration along X, Y and Z axes and gives analog voltage output proportional to the acceleration along these 3 axes. Microcontrollers can process these voltages by converting them to digital signals using ADC.

The circuit can be connected in various types based on the type of pins of controller and Application. In this project circuit details as follows. Mems sensor can be connected to following ports of the arduino controller as shown in below figure. It uses the following ports.

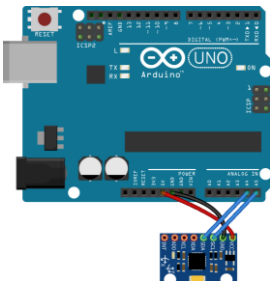
1.Vcc to port 5V

2.GND to GND

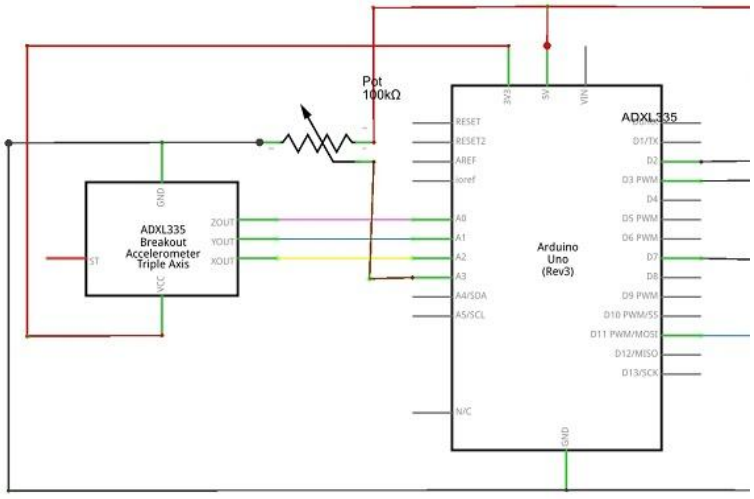
3.SCL to A5

4.SDA to A4

External Circuit



3.2 internal circuit of arduino with mems circuit:

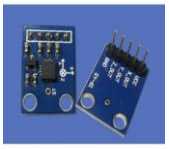


Internal circuit of mems with accelerometer

Above circuit diagrams refers to internal circuit of mems ADXL 335 and ARDUINO Controller. position **of** the product measures acceleration with a minimum full-scale range of ±3g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. It's powered by a 3.3v

source and also generates 3.3v peak outputs. It has three outputs for each axis i.e. X, Y & Z.

Hardware explanation:



1.MEMS accelerometer 2.Arduino Board

we know that accelerometer has three access X, Y, &Z. Here we consider two directions X&Y. It can be used in applications requiring tilt sensing. The ADXL335 measures acceleration along X, Y and Z axes and gives analog voltage output proportional to the acceleration along these 3 axes. Whenever the accelerometer moves right to left the Load1 will on and off accordingly to the movement. The Load2 will on and off for vertical and bottom direction. From the inputs of the sensor the controller took measures by comparing one reference axis and another is measuring axis the comparison is taken into account. Some are pre-stored axis value will be present in the controller and depends on movement of the axis the output will be generated.

Software Description

The software used by the arduino is Arduino IDE. The Arduino IDE is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring project. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. There is typically no need to edit make files or run programs on a command-line interface. Although building on command-line is possible if required with some third-party tools such as Ino.

The Arduino IDE comes with a C/C++ library called "Wiring" (from the project of the same name), which makes many common input/output operations much easier. Arduino programs are written in C/C++, although users only need define two functions to make a runable program:

- setup() – a function run once at the start of a program that can initialize settings
- loop() – a function called repeatedly until the board powers off

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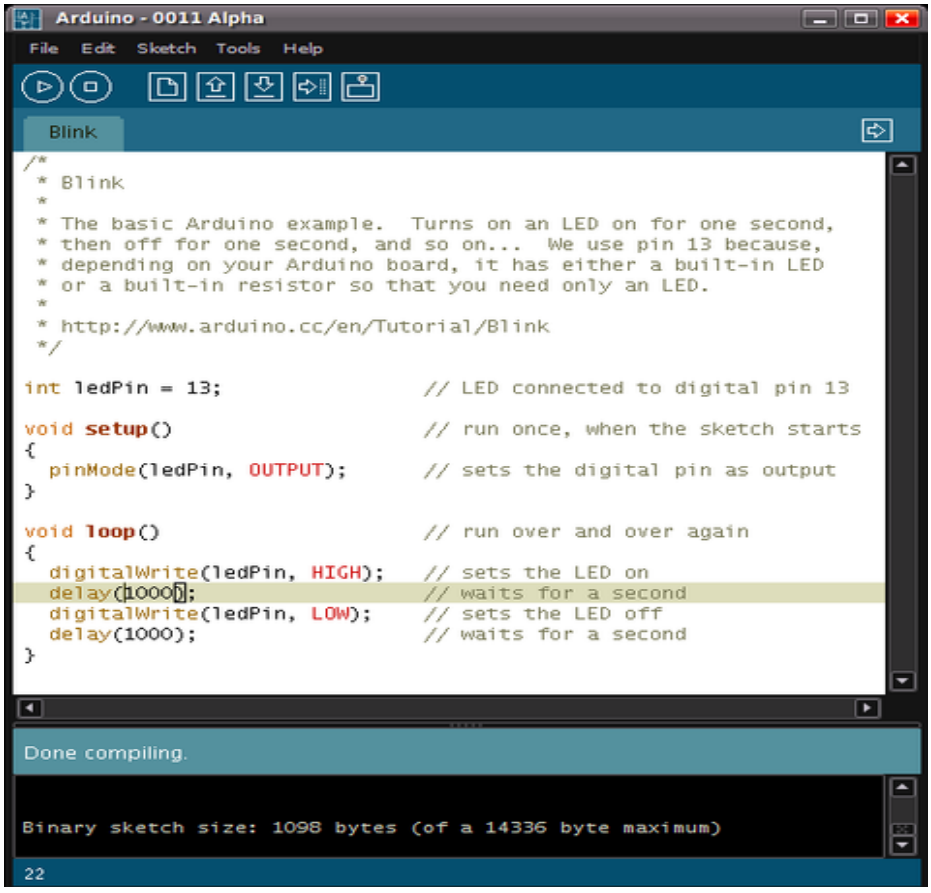

Figure 5.1 A screenshot of the Arduino IDE showing the "Blink"program,a simple beginner program

A typical first program for a microcontroller simply blinks a LED on and off. In the Arduino environment, the user might write a program like this:

```
#define LED_PIN 13
void setup () {
   pinMode (LED_PIN, OUTPUT);     // enable pin 13 for digital output
}
void loop () {
   digitalWrite (LED_PIN, HIGH);  // turn on the LED
   delay (1000);                  // wait one second (1000 milliseconds)
   digitalWrite (LED_PIN, LOW);   // turn off the LED
   delay (1000);                  // wait one second
```

RESULT AND CONCLUSION

Accelerometer is a device that measures the vibration or acceleration of motion of structure that works on hand gesture . Accelerometer has three access X, Y, &Z. Here we consider two directions X&Y. here I took home appliances as output devices. whenever the accelerometer moves right to left the fan will on and off accordingly

to the movement. The light will on and off for vertical and bottom direction. from the inputs of the sensor the controller took measures by comparing one reference axis and another is measuring axis the comparison is taken into account. some pre stored axis value will be present in the controller and depends on movement of the axis the output will be generated.

The program here used is embedded c , used in integrated development environment. It is very easy language and flexible. With minimum knowledge we can do perform various tasks.

Hand movement or Direction	**Load opearation**
Right	Load 1 ON (fan on)
Left	Load 1 OFF (fan off)
Up	Load 2 ON (light on)
Down	Load 2 OFF (light off)

Fig 6.1 Functions of sensor output

Accelerometer works in 3-axis X,Y and Z but my system works in 2-axis X and Y.. Accelerometer can move in major direction-right, left, down and up. As long as there is no power the loads will remain off . Whenever sensor get movement or tilt as input it produces voltage. That voltage generated drives the output loads.

Future scope：

The project has been developed with ease of use and accessibility in mind. The gesture controlled system provides an easy mechanism for people, specially people with special challenges, illness, old age etc. Using MEMS technology, the system is gesture controlled and can also implemented with password protection. The password protection ensures secure use of the technology. The password itself is gesture based for easy access. Using the device, home appliances in the range can be controlled easily and securely. Nowadays IOT is also incorporated in many automation applications. But it requires data security and more power compare to other technologies.

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