IIT KANPUR

AEROSPACE ENGINEERING
VIRTUAL INSTRUMENTATION LABORATORY
AE 251

WIRELESS CURSOR USING MPU6050 GYRO ACCELEROMETER SENSOR AND ARDUINO WITH WIFI MODULE

Abhijeet(170015)
Mataria Pence(170382)
Naveen Balaji(170426)

1 ABSTRACT

This wifi cursor works the same way as a wieless mouse. But since it is based on sensors which are compact, it opens up a new space of scopes.The user can just wear a glove having the system mounted in it and with the gesture of his hand he can control the cursor. This will allow it to act as a smart control for motions required in virtual games. It can also replace the device used by professors during lectures to change slides and to point. A glove wore on hand working with gestures of hand is far convenient than a remote control with buttons. The sensor will record the movement of hand in a specific direction which will result in the required movement.

2 INTRODUCTION

Nowadays, people want to keep everything in their hands. As if doing all of the hand signals. Recently, strong efforts have been carried out to develop intelligent and natural interfaces between users and computer based systems based on human gestures.An IMU is a navigation sensor with accelerometer and gyroscope as it parts. The accelerometer gives the acceleration across various axes and gyroscope the orietation. Once mounted on a glove, this altogether is capable of giving sufficient data to control the movement of a system properly programmed to function accordingly. Thus, these gesture-based interfaces can not only substitute the common interface devices, but can also be exploited to extend their functionality.

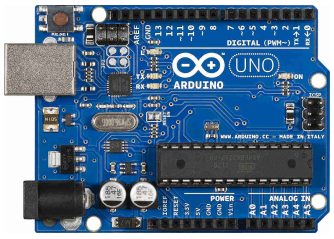
3 MOTIVATION

Our motivation to work on this project came from the very idea of small remote controls used by professors to change slides and to point. So, we tried making a device which can simplify the task. Not only this, sometimes it is difficult playing games or a doing topsy-turvy tasks using a normal mouse on your system. Then why not find an easy way which can do work with the gestures of hand.

4 SENSOR DESCRIPTION

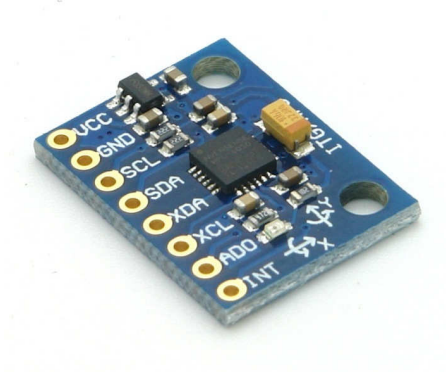
i.Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.



ii.MPU6050 Gyro Sensor

MPU6050 sensor has many functions over the single chip.This MPU6050 module is a compact chip having both accelerometer and gyro. This is a very useful device for many applications like drones, robots, motion sensors.It can measure acceleration along various axes as well as the orientation.

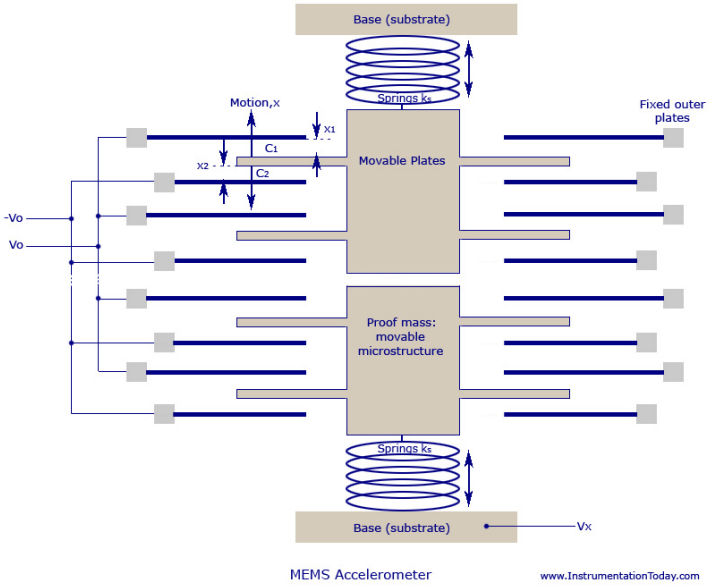


5 WORKING PROCESS

In this project, a cursor is controlled by the gestures made by the hand by a glove. The working of this glove is explained here.

The IMU data is recorded by Arduino and sent via wifi to the PC, where it is further analysed and mapped to the cursor coordinates

i.Accelerometer (MEMS)



If two plates are kept parallel to each other and are separated by a distance'd', and if 'E' is the permitivity of the separating material, then capacitance produced can be written as

C0 = E0.E A/d = EA/d

EA = E0EA

A – Area of the electrodes

A change in the values of E, A or d will help in finding the change in capacitance and thus helps in the working of the MEMS transducer. Accelerometer values mainly depend on the change of values of d or A.The movable plates and the fixed outer plates act as the capacitor plates. When acceleration is applied, the proof mass moves accordingly. This produces a capacitance between the movable and the fixed outer plates.

If Vx is the output voltage of the proof mass, and V0 is the output voltage produced between the plates, then

(Vx +V0) C1 + (Vx -V0) C2 = 0

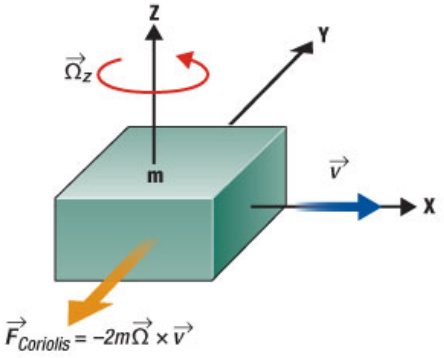
We can also write

Vx =V0 [(C2-C1)/(C2+C1)] = (x/d) V0

1

[1] *source:http://www.instrumentationtoday.com/mems-accelerometer/2011/08/*

ii.Gyro (MEMS)



MEMS gyroscopes are making significant progress towards high performance and low power consumption. They are mass produced at low cost with small form factor to suit the consumer electronics market.
When a mass (m) is moving in direction v→ and angular rotation velocity Ω→ is applied, then the mass will experience a force in the direction of the arrow as a result of the Coriolis force. And the resulting physical displacement caused by the Coriolis force is then read from a capacitive sensing structure.Most available MEMS gyroscopes use a tuning fork configuration. Two masses oscillate and move constantly in opposite directions. When angular velocity is applied, the Coriolis force on each mass also acts in opposite directions, which result in capacitance change. This differential value in capacitance is proportional to the angular velocity Ω ¿ and is then converted into output voltage for analog gyroscopes or LSBs for digital gyroscopes.

The gyroscope sensor within the MEMS is tiny (between 1 to 100 micrometers, the size of a human hair). When the gyro is rotated, a small resonating mass is shifted as the angular velocity changes. This movement is converted into very low-current electrical signals that can be amplified and read by a host microcontroller. [2]

6 RESULT

We achieved our object without any hurdles the control of a cursor using gesture. The system is showing proper response whenever we move our hand .Different hand gesture to make the cursor move in specific direction are as follow:

[2] *source: https://electroiq.com/2010/11/introduction-to-mems-gyroscopes/ https://learn.sparkfun.com/tutorials/gyroscope/all*

7 CONCLUSION

Hand Gesture Control becomes an example of companionship between man and machine in the race of man vs. machine, further enhancing the technology to the next level from Speech recognitions and wired connections to wireless hand gesture control technology. There is a rapid growth on application development considering gesture recognition system. So in this paper, we propose a model of a wireless controller based on navigation sensors utilizing hand gestures to communicate with a system. The 3- axis accelerometer selected to be the input device of this system captures the human gestures. When compared with the other input devices accelerometer is easier to work and offers the possibility to control a anything by wireless means. The low price and short set-up time are other advantages of the system but an important limitation to consider is the reliability of the system.