A PROJECT REPORT

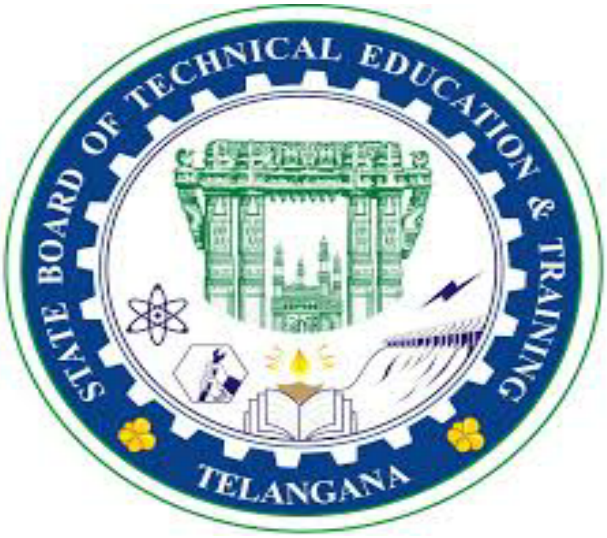
ON

ACCELEROMETER BASED 3D AIR MOUSE

Submitted in fulfilment of the

Requirements for the Award of

DIPLOMA IN COMPUTER ENGINEERING



S.G.M. GOVERNMENT

POLYTECHNIC ABDULLAPURMET

R.R. DISTRICT (2019-2020)

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SANJAY GANDHI MEMORIAL GOVERNMENT POLYTECHNIC

ABDULLAPURMET,R.R DIST.

UNDER THE ESTEEMED GUIDANCE OF

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CERTIFICATE

This is to certify that the thesis is entitled "Accelerometer Based 3D Air Mouse" being submitted by the team members in fulfillment of the requirements for the award of DIPLOMA IN COMPUTER ENGINEERING for the STATE BOARD OF TECHNICAL EDUCATION AND TRAINING,T.S, during the year (2019-2020).

PROJECT GUIDE

Mrs . K SUNITHA, B.E

EXTERNAL EXAMINER

The results presented in this thesis have been verified and found to be excellent.

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It is our privilege and pressure to express our profound sense of respect, gratitude and indebtedness to **SRI CH.V.KRISHNA RAO ME,** MBA,DIS FIE(Ph.D), principal, S.G.M Government Polytechnic, who has helped and guided us by his valuable suggestions.

We express our deep sense of gratitude to **SRI J.SUSHEEL KUMAR JOSHI, M.tech** , Head of the Computer Engineering Department**,** S.G.M Government Polytechnic, for his indefatigable inspiration, guidance, constructive criticisms and encouragement throughout this dissertation work.

We are greatful to our project guide **Mrs . K SUNITHA, B.E**; **MBA**, Lecturer in Computer Engineering Department for the guidance, inspiration and constructive suggestions that helped us in the preparation of this project.

Last but not least, we wish to acknowledge our friends, family members, and colleagues for giving moral strength and helping us to complete this dissertation.

TEAM MEMBERS

DECLARATION BY THE CANDIDATES

We,team members here by declare that the project report titled" ACCELEROMETER BASED 3D AIR MOUSE "Under the guidance of Mrs.K.SUNITHA., B.E, MBA, Lecturer in Computer Engineering Department , S.G.M GOVERNMENT POLYTECHNIC Abdullapurmet, R.R.District,is submitted in partial fulfillment of the Requirements for the award of DIPLOMA IN COMPUTER ENGINEERING.This is a record of Bonafide work carried out by us and the results embodied in this project have not been copied or reproduced from any source.

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TEAM MEMBERS

Index:-

Abstract

Accelerometer based 3D Air Mouse :-

We have seen different types of Human Interface Devices (HIDs), for example mouse and keyboard. In older versions of computer mouse, optical sensors were used to detect movement relative to a surface, thus they require smooth surface to function properly.

These mice can work with only two coordinates. With advancements in technology, we are now talking about 3D user interfaces ((3DUIs). So, we must start developing a 3D HID device which has the capability to work with all coordinates. In this project we are going to make 3D wireless HID device that will give you a whole new experience of using computers and playing online games. With this device, you will be able to control computers and Smartphone by just moving your hand in air. you can draw any design by moving your hand in the air.

Further we can develop such device for 3D holographic display and in VR that gives us a 3D UI. Best application of this device is that it will enable differently able people to use computers and Smartphone. People who don't have hands to operate computer or phones can now do so with the help of this device. They can wear this device on their head and operate gadgets by moving their head.

Keywords: Arduino lenardo, Arduino nano, MPU 6050 Sensor, RF transmitter receiver.

ACCELEROMETER BASED WIRELESS 3D AIR MOUSE

Introduction

We have seen different types of Human Interface Devices (HID'S), for example mouse and keyboard. In older versions of computer mouse, optical sensors were used to detect movement relative to a surface, thus they require smooth surface to connect function properly. These mice can work with only two coordinates. With advancements in technology, we are now talking about 3D user interfaces (3DUIs).With this device;

we will able to control computers and Smartphone by just moving your hand in

Air Mouse:-

AIR Mouse is also called gesture-controlled mouse and it works based on hand gesture. In this project an accelerometer is used for measuring the tilt of hand in X and Y direction and moves the cursor according the tilt.In the project two types of circuit are used, one is the transmitter circuit and other is the receiver circuit

Transmitter circuit makes use of MPU6050 series of accelerometer, which is connected to Arduino through I2C communication. The data is transferred to receiver Circuit using RF module, ASK433.Two switches are also used in transmitter circuit to work as Left Click and Right Click.

In the receiver side an Arduino Leonardo is used. The purpose of using Arduino Leonardo is that it supports HID (Human Interface Device). HID allows us to control the mouse and Keyboard of our PC or Laptop Components.

In this project, going to make 3D wireless HID device that will give you a whole new experience of

using computers and playing online games.We have Arduino lenardo which will receive data from accelerometer sensor and transfer it to Arduino nano via RF transceiver

The signal received by the Arduino lenardo and is sent to computer using micro USB port. Here after our project starts working, according to the hand gestures/movements.

This device can be very helpful in making 3D UI based systems. We can use this device in 3D designing as well. For instance, you can draw any design by moving your hand in the air. Further we can develop such device for 3D holographic display and in VR that gives us a 3D UI.

Components:-

- Arduino nano
- RF transceiver
- MPU 6050 Sensor
- Arduino Leonardo Micro(At mega 32u8)
- Jumper wires
- Micro USB Cable
- 2 Push Switch

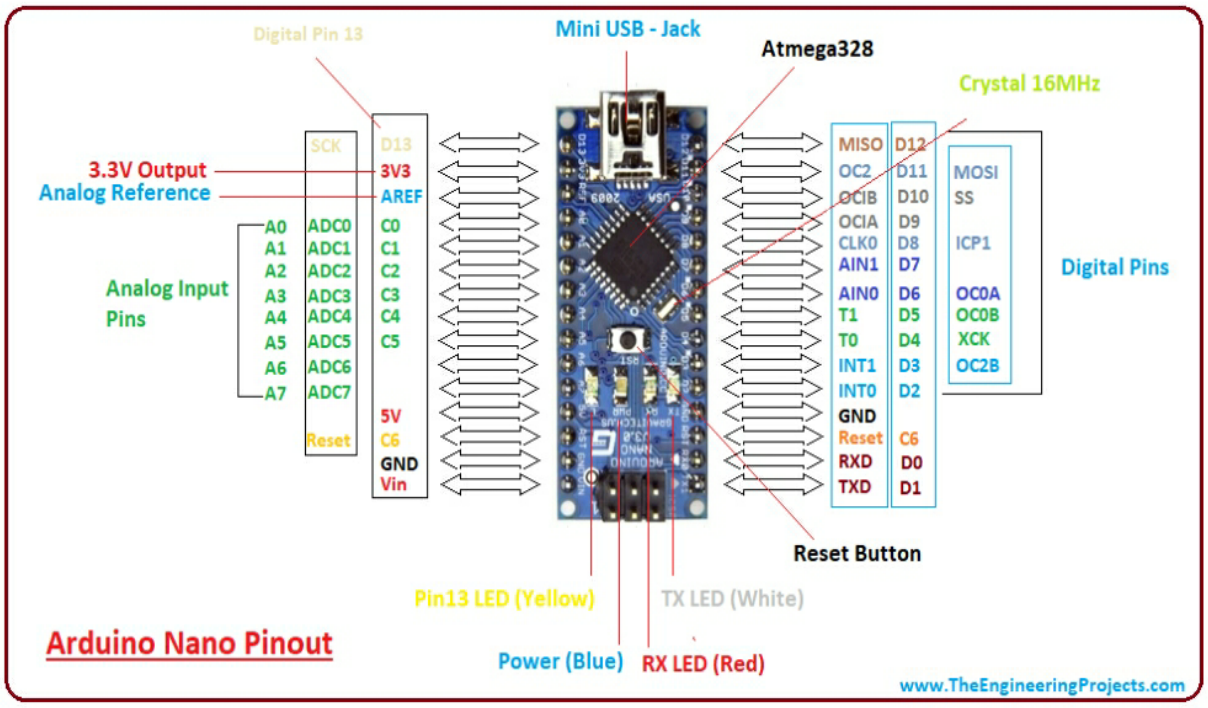
ARDUINO NANO:-

Arduino Nano

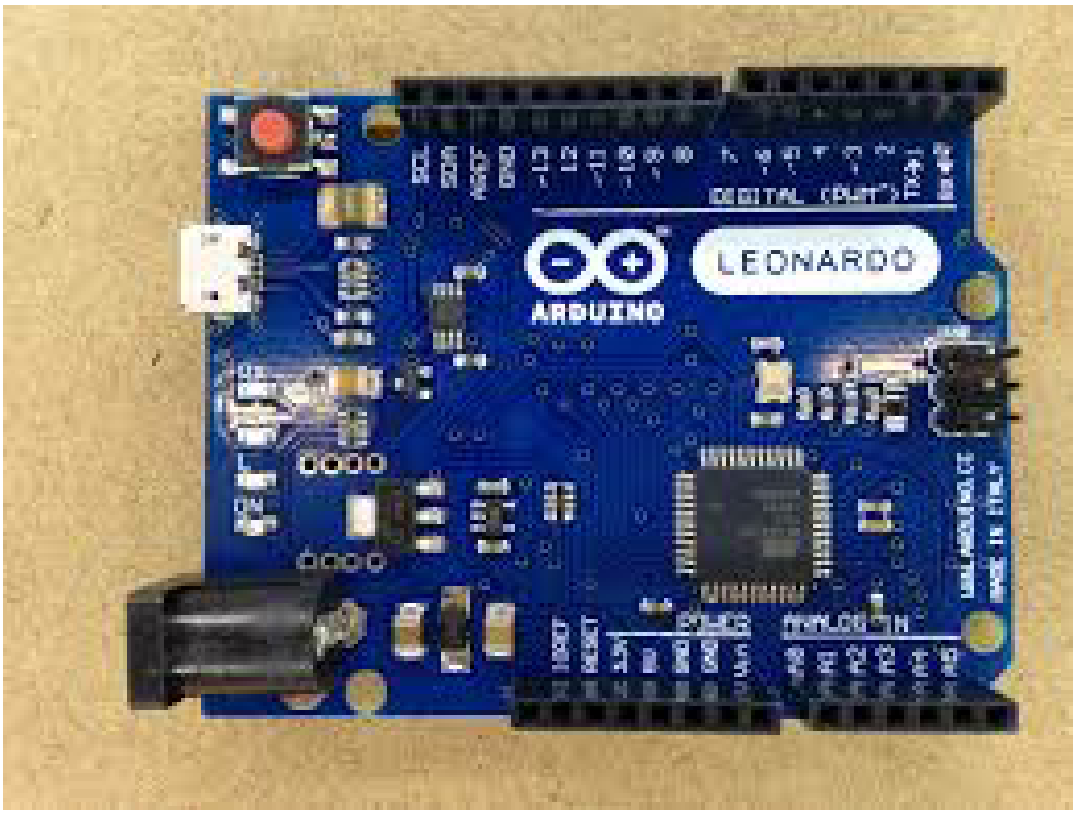
Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x).

- It comes with exactly the same functionality as in Arduino UNO but quite in small size.
- It comes with an operating voltage can vary from 7 to 12v
- Arduino nano pinout contains14 digital pins,8 analog pins, 2 reset pins and 6 power pins.
- Each of these digital and analog pins are assigned with multiple functions but their main function is to be configured as input or output.
- They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output.
- Functions like pinMode() and digitalWrite() are used to control the operations of digital pins while analogRead() is used to control analog pins.
- The analog pins come with a total resolution of 10bits which measure the value from zero to 5v.

- Arduino nano comes with a crystal oscillator of frequency 16MHz.It is used to produce a clock of precise frequency using constant voltage.
- There is no limitation using arduino nano i.e. it doesn't come with DC power jack, means you can't supply external power source through a battery.
- This board doesn't use standard USB for connection with a computer, instead, it comes with Mini USB support.
- Tiny size and breadboard friendly nature make this device an ideal choice for most of the applications where a size of the electronic components are of great concern.
- Flash memory is 16KB or 32KB that all depends on the Atmega board i.e. Atmega 168 comes with 16KB of flash memory 32KB.Flash memory is used for storing code. The2KB of memory to start boot loader.



ARDUINO LEONARDO:-

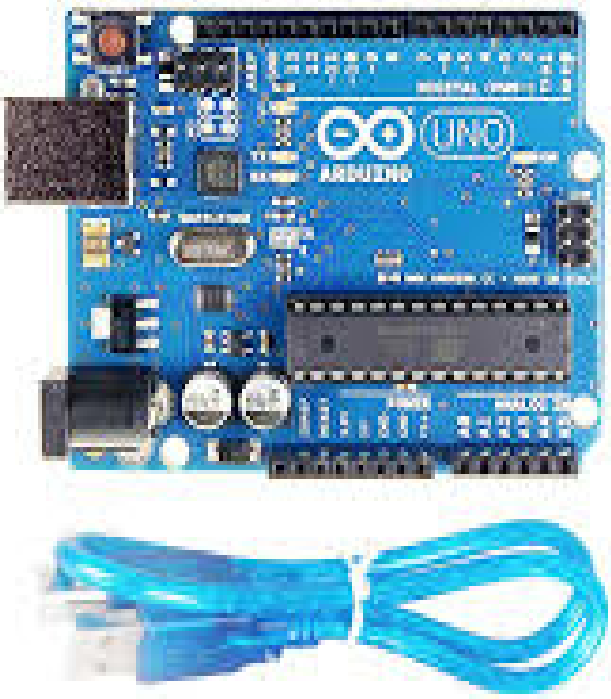


The Arduino Leonardo is a microcontroller board based on the ATmega32u4 (datasheet). It has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analog inputs), a 16 MHz crystal oscillator, a micro USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to started.

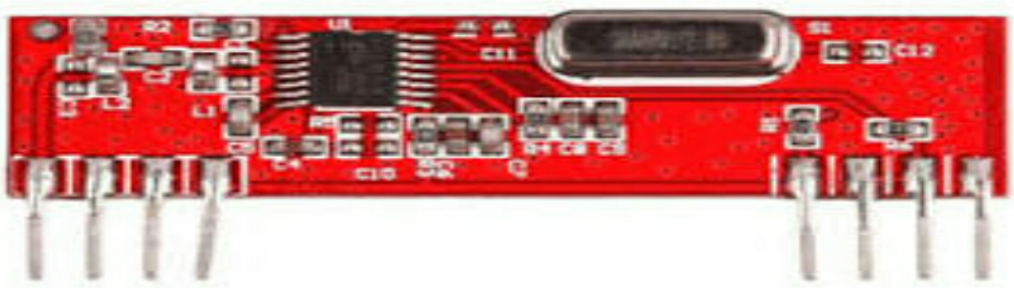
The Leonardo differs from all preceding boards in that the ATmega32u4 has built-in USB communication, eliminating the need for a secondary processor. This allows the Leonardo to appear to a connected computer as a mouse and keyboard, in addition to a virtual (

serial / COM port. It also has other implications for the behavior of the board; these are detailed on the getting started page.

Arduino lenardo:-



RF TRANSCEIVER MODULE:-



An **RF module** (short for **radio-frequency module**) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio-frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and a receiver. They are of various types and ranges. Some can transmit up to 500 feet. RF modules are widely used in electronic design owing to the difficulty of designing radio circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency.

In addition, reliable RF communication circuit requires careful monitoring of the manufacturing process to ensure that the RF performance is not adversely affected. Finally, radio circuits are usually subject to limits on radiated emissions, and require Conformance testing and certification by a standardization organization such as ETSI or the U.S. Federal Communications Commission (FCC). For these reasons, design engineers will often design a circuit for an application which requires radio communication and then "drop in" a pre-made radio module rather than attempt a discrete design, saving time and money on development.

RF modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm or monitoring systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are sometimes used to replace older infrared communication designs as they have the advantage of not requiring line-of-sight operation.

Several carrier frequencies are commonly used in commercially available RF modules, including those in the industrial, scientific and medical (ISM) radio bands such as 433.92 MHz, 915 MHz, and 2400 MHz. These frequencies are used because of national and international regulations governing

the used of radio for communication. Short Range Devices may also use frequencies available for unlicensed such as 315 MHz and 868 MHz.

RF modules may comply with a defined protocol for RF communications such as Zigbee, Bluetooth Low Energy, or Wi-Fi, or they may implement a proprietary protocol.

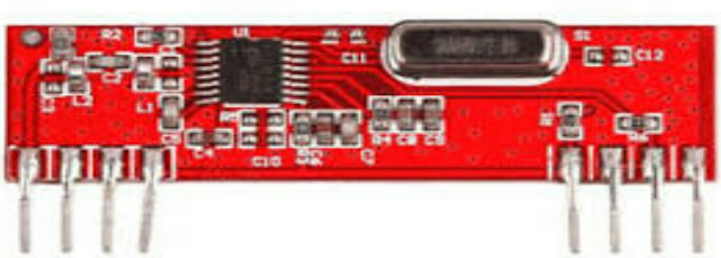
TYPES OF RF MODULES:-

The term RF module can be applied to many different types, shapes and sizes of small electronic sub assembly circuit board. It can also be applied to modules across a huge variation of functionality and capability. RF modules typically incorporate a printed circuit board, transmit or receive circuit, antenna, and serial interface for communication to the host processor.

Most standard, well known types are covered here:

- transmitter module
- receiver module
- transceiver module
- system on a chip module.

TRANSMITTER MODULE:-



An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a microcontroller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

RECEIVER MODULE:-

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: superheterodyne receivers and superregenerative receivers. Superregenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Superregenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage.[citation needed] Superheterodyne receivers have a performance advantage over superregenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a comparatively more expensive product. However, advances in receiver chip design now mean that currently there is little price difference between superheterodyne and superregenerative receiver modules.

TRANSCEIVER MODULE:-

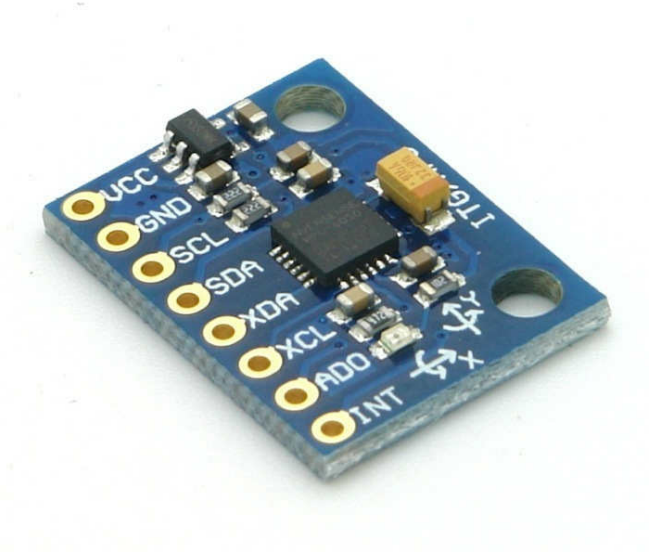
An RF transceiver module incorporates both a transmitter and receiver. The circuit is typically designed for half-duplex operation, although full-duplex modules are available, typically at a higher cost due to the added complexity.

MPU 6050:-

MPU 6050 is a 6 DOF (degrees of freedom) or a six-axis IMU sensor, which means that it gives six values as output: three values from the accelerometer and three from the gyroscope. The MPU 6050 is a sensor based on MEMS (micro electro mechanical systems) technology.

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers.

It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc.If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output.



Interfacing MPU6050 with Arduino:-

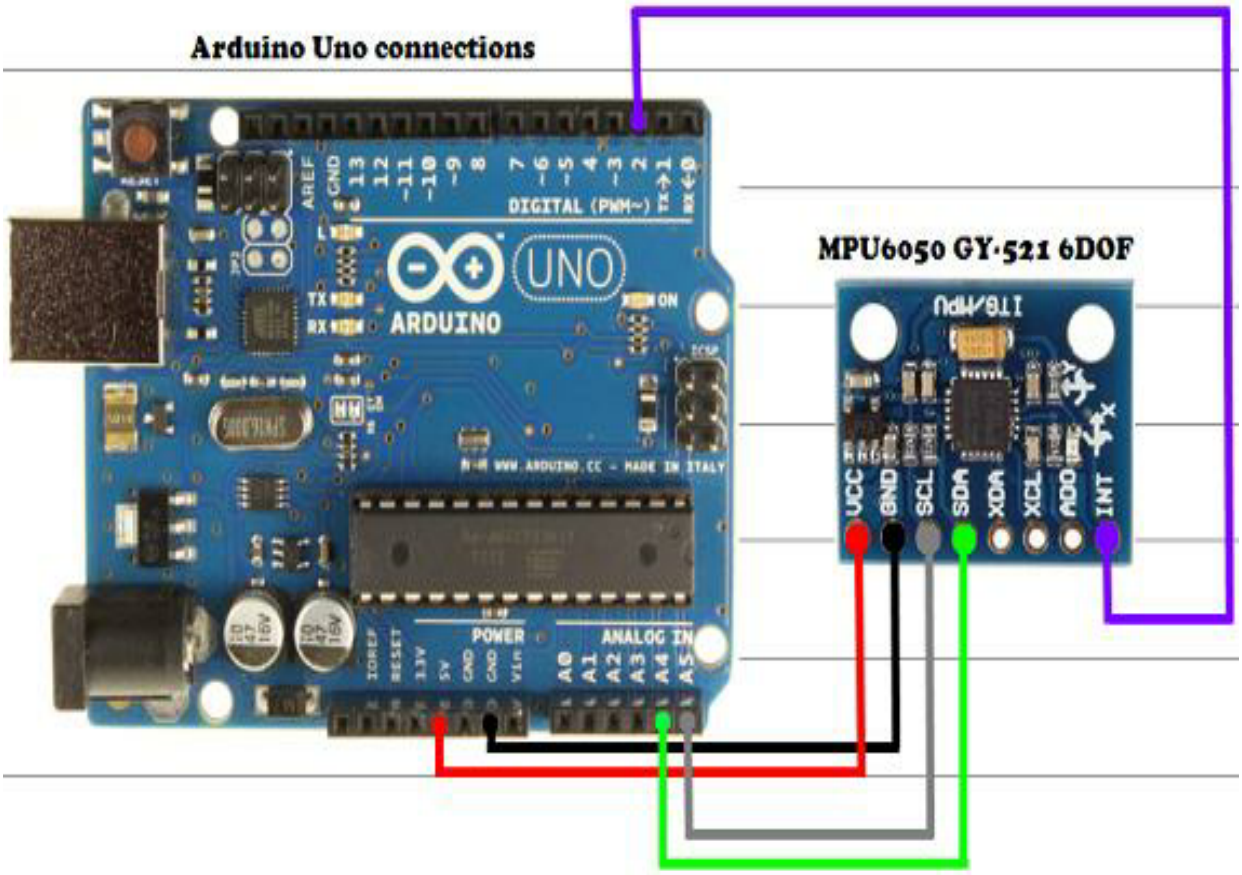
Arduino MPU6050 Circuit Connections.The library provides two example programs, which can be found at File -> Examples -> MPU6050. In these two examples one will give raw values while the other will give optimized values using the DMP. The following data values can be obtained using this example program.

- Quaternion Components
- Euler angles
- Yaw, Pitch, Roll
- Real world Acceleration
- World frame acceleration
- Teapot invent sense Values

Out of all these data, the Yaw, Pitch, Roll us commonly used. However the library is capable of

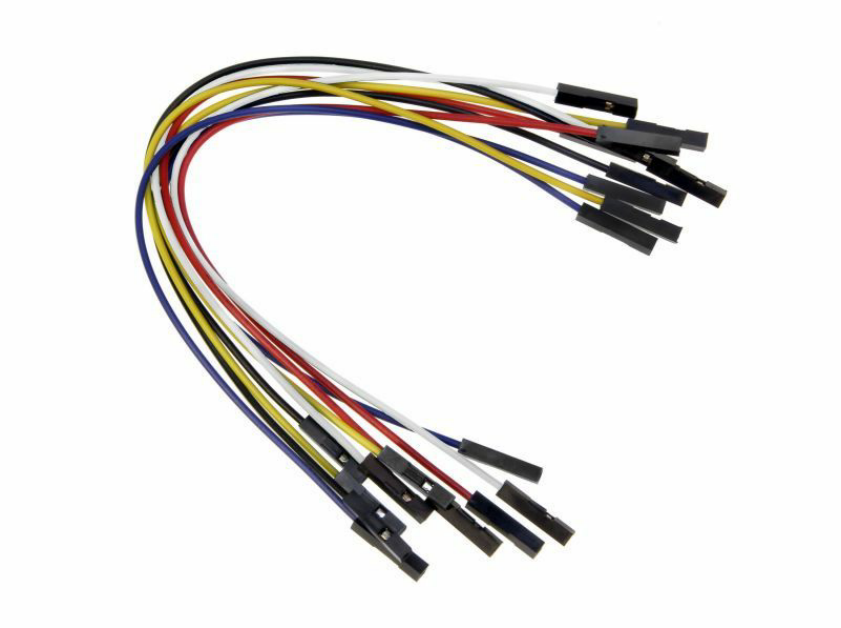
performing more than that and can be used for different purposes. Once the program is uploaded, open serial monitor and set it to 115200 baud rate and you should see the data being printed on the screen.

MPU6050 with Arduino:-



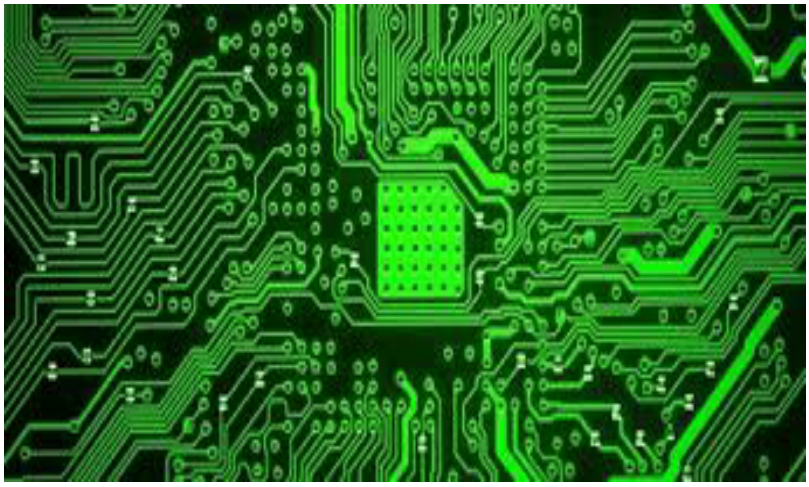
Jumper Wires:-

Jumper wires are simply **wires** that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. **Jumper wires** are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.



Circuit:-

In the project two circuits are used, one is the transmitter and other is Receiver circuit.



Transmitter Circuit:-

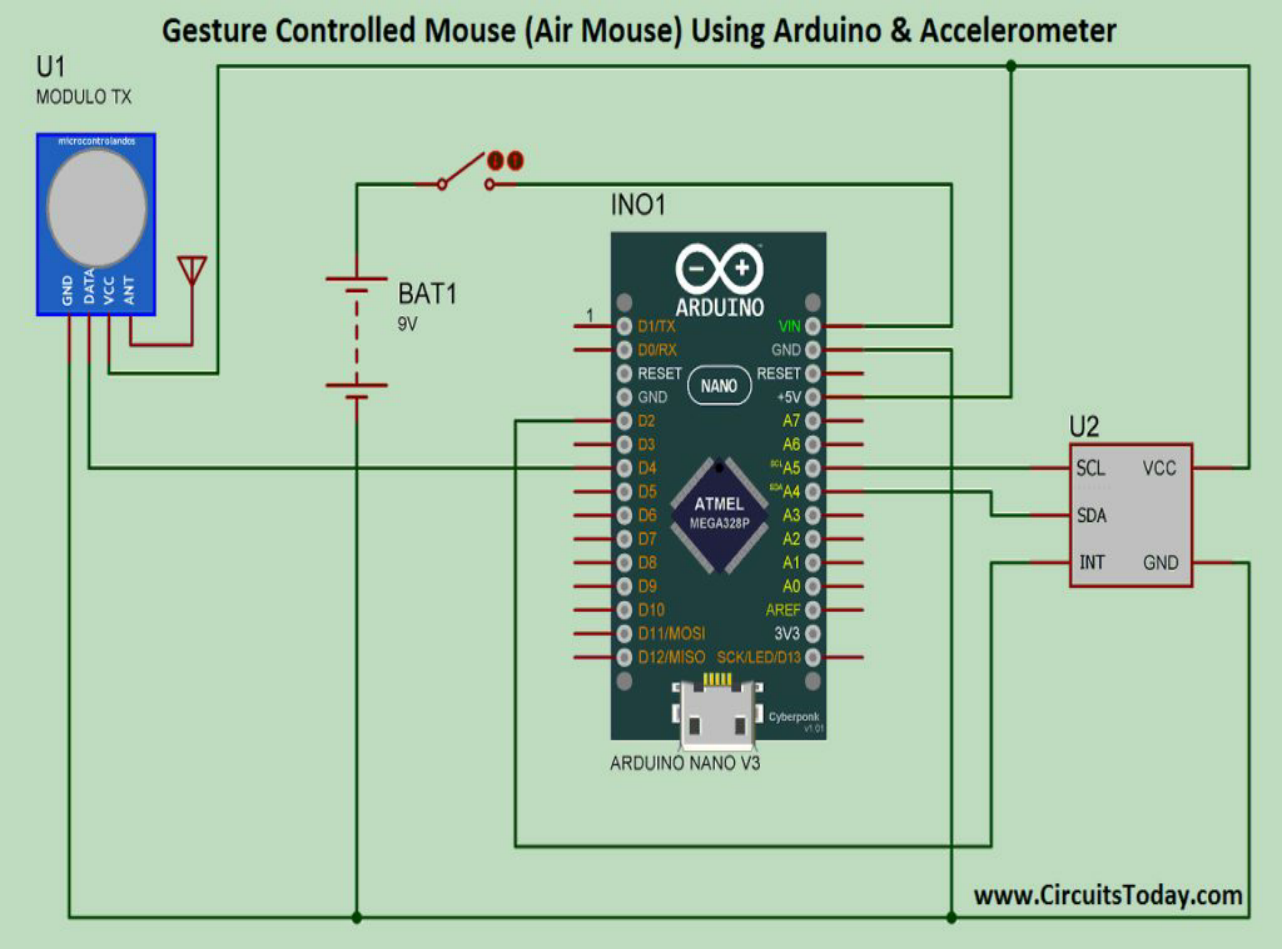
The transmitter circuit is placed in our hand. In this circuit, Arduino Nano is used which receives the data from accelerometer through I2C communication. MPU6050 is used in the transmitter circuit, which is accelerometer and supports I2C communication.

SCL and SDA pins or accelerometer (MPU 6050) are connected to SCL and SDA pin of Arduino Nano, where SCL is A5 and SDA is A4 pins of Arduino. MPU 6050 have an INT pin, which is connected to interrupt (INT0) pin of Arduino that is D2.

Now data of accelerometer is transferred to receiver circuit using RF communication. For RF communication RF transmitter is used in transmitter side.Data pin of RF transmitter is connected to D4 pin of Arduino.

An antenna is connected to ANT pin of RF transmitter. Antenna is nothing but only a 15 cm long single core wire.Two switches are connected to D11 and D13 of Arduino that are Left Click and Right Click. This whole circuit is powered by 9-volt battery which is connected to vin pin of Arduino through a switch.

Transmitter circuit:-



Receiver Circuit

In the receiver side, two major components used are the Arduino Leonardo and RF Receiver.Two switches are used for Enable/Disable the mouse and on/off the RF communication.

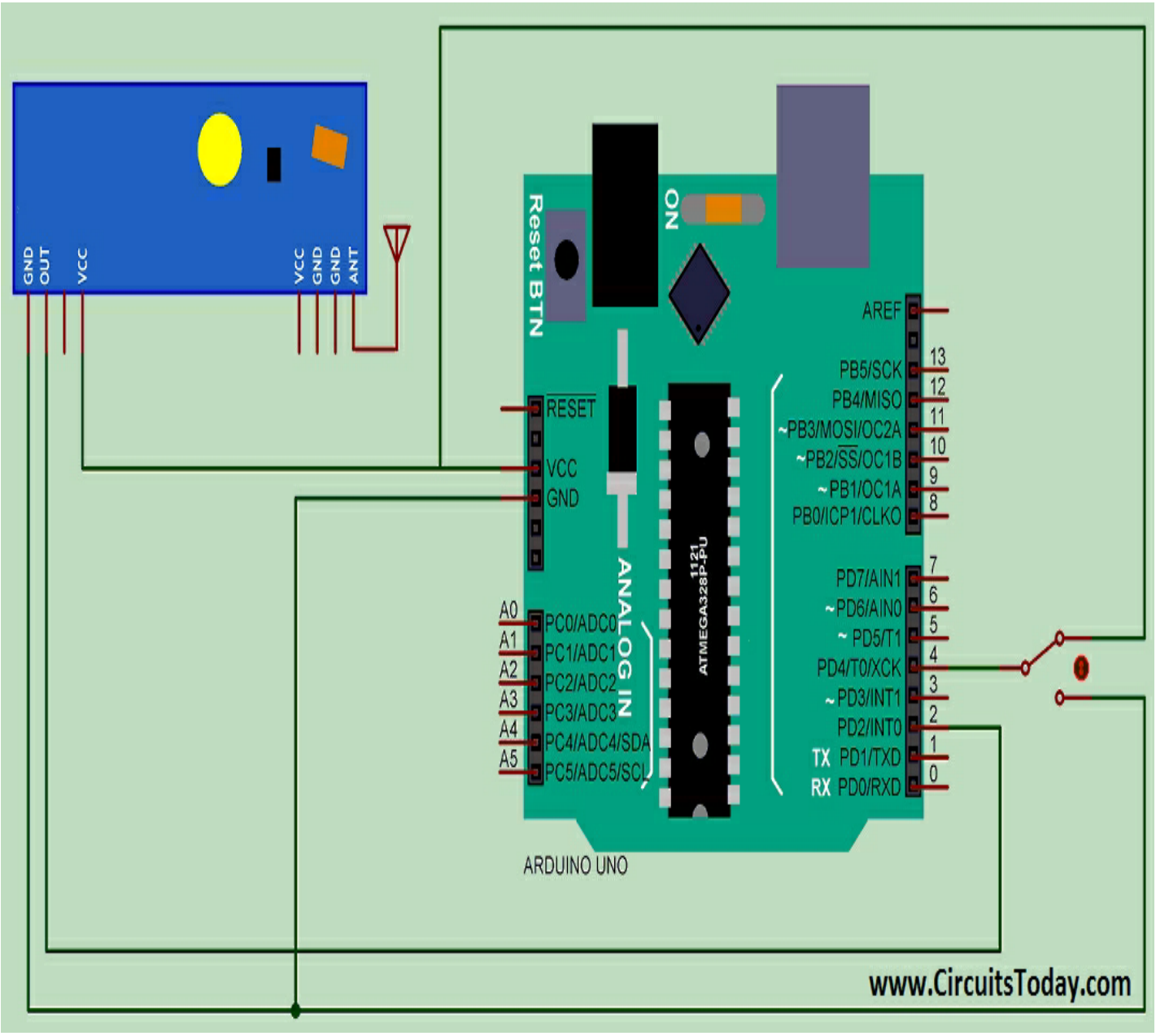
In the receiver circuit data pin of RF Receiver is connected to Interrupt pin (INT1) of Arduino, that is D2 pin.

A switch is used in the power line of RF Receiver, which is used for ON/OFF of the RF Receiver.

Another switch is also connected to D4 pin of Arduino that is used to Enable/Disable the mouse.

Arduino Leonardo is connected to PC,Through standard USB cable.

Receiver Circuit :-



Receiver circuit:-

Arduino Mini Pin	Components Pin
Arduino Mini SCL	MPU 6050 SCl
Arduino Mini SDA	MPU 6050 SDA
Arduino Mini VCC	MPU 6050 VCC
Arduino Mini GND	MPU 6050 GND
Arduino Mini TX	Bluetooth HC 05 RX
Arduino Mini RX	Bluetooth HC 05 TX
Arduino Mini VCC	Bluetooth HC 05 +Ve
Arduino Mini VCC	Push Switch Pins
Arduino Mini (A3,A0,A2,A1)	Push switch(1, 2,3,4)

Coding:-

First of all, we need to install an MPU 6050 library. Open library manager of Arduino IDE and search for MPU6050, and then install the library. After this,after using this RF transceiver one is used as transmitter and another is used as receiver and both are connected.

RECEIVER CODE:-

```
#include <RCSwitch.h>
#include "Mouse.h"
RCSwitch mySwitch = RCSwitch();

int rvalue,a,b,c,d;
float xReading,yReading;

void setup() {
  //Serial.begin(115200);
  mySwitch.enableReceive(1);  // Receiver on interrupt 0 => that is pin #2

  Mouse.begin();

  pinMode(5,INPUT);
}

void loop() {
  if (mySwitch.available()) {

    rvalue = mySwitch.getReceivedValue();

    a = (rvalue) % 10;
    b = (rvalue/10) % 10;
    c = (rvalue/100) % 10;
    d = (rvalue/1000) % 10;
```

```
  if (d == 1 ){xReading =  3;}
  if (d == 2 ){xReading =  2;}
  if (d == 3 ){xReading =  0;}
  if (d == 4 ){xReading =  0;}
  if (d == 5 ){xReading =  0;}
  if (d == 6 ){xReading =  0;}
  if (d == 7 ){xReading = -2;}
  if (d == 8 ){xReading = -3;}

  if (c == 1 ){yReading =  3;}
  if (c == 2 ){yReading =  2;}
  if (c == 3 ){yReading =  0;}
  if (c == 4 ){yReading =  0;}
  if (c == 5 ){yReading =  0;}
  if (c == 6 ){yReading =  0;}
  if (c == 7 ){yReading = -2;}
  if (c == 8 ){yReading = -3;}

  mySwitch.resetAvailable();
}
if (digitalRead(5) == LOW){
  Mouse. Move(xReading, yReading, 0);
  }

if (a == 1) {
  if (!Mouse.isPressed(MOUSE_LEFT)) {
```

```
    Mouse.press(MOUSE_LEFT);
   }
  }
  else {
   if (Mouse.isPressed(MOUSE_LEFT)) {
    Mouse.release(MOUSE_LEFT);
   }
  }

  if (b == 1) {
   if (!Mouse.isPressed(MOUSE_RIGHT)) {
    Mouse.press(MOUSE_RIGHT);
   }
  }
  else {
   if (Mouse.isPressed(MOUSE_RIGHT)) {
    Mouse.release(MOUSE_RIGHT);
   }
  }
}
```

TRANSMITTER CODE:-

```
#include <Wire.h>
```

```
#include <MPU6050.h>
#include <RCSwitch.h>

RCSwitch mySwitch = RCSwitch();

MPU6050 mpu;

int Lclick = 11;
int Rclick = 13;

void setup()
{
  Serial.begin(115200);
  while(!mpu.begin(MPU6050_SCALE_2000DPS, MPU6050_RANGE_2G))
  {
    Serial.println("Could not find a valid MPU6050 sensor, check wiring!");
    delay(500);
  }

  checkSettings();


  mySwitch.enableTransmit(4);

  pinMode(Lclick, INPUT);
  pinMode(Rclick, INPUT);
```

```
}

void checkSettings()
{
  Serial.println();

  Serial.print(" * Sleep Mode:            ");
  Serial.println(mpu.getSleepEnabled() ? "Enabled" : "Disabled");

  Serial.print(" * Clock Source:          ");
  switch(mpu.getClockSource())
  {
    case MPU6050_CLOCK_KEEP_RESET:     Serial.println("Stops the clock and keeps the timing generator in reset"); break;
    case MPU6050_CLOCK_EXTERNAL_19MHZ: Serial.println("PLL with external 19.2MHz reference"); break;
    case MPU6050_CLOCK_EXTERNAL_32KHZ: Serial.println("PLL with external 32.768kHz reference"); break;
    case MPU6050_CLOCK_PLL_ZGYRO:      Serial.println("PLL with Z axis gyroscope reference"); break;
    case MPU6050_CLOCK_PLL_YGYRO:      Serial.println("PLL with Y axis gyroscope reference"); break;
    case MPU6050_CLOCK_PLL_XGYRO:      Serial.println("PLL with X axis gyroscope reference"); break;
    case MPU6050_CLOCK_INTERNAL_8MHZ:  Serial.println("Internal 8MHz oscillator"); break;
  }

  Serial.print(" * Accelerometer:         ");
  switch(mpu.getRange())
```

```
  {
    case MPU6050_RANGE_16G:            Serial.println("+/- 16 g"); break;
    case MPU6050_RANGE_8G:           Serial.println("+/- 8 g"); break;
    case MPU6050_RANGE_4G:           Serial.println("+/- 4 g"); break;
    case MPU6050_RANGE_2G:           Serial.println("+/- 2 g"); break;
  }

  Serial.print(" * Accelerometer offsets: ");
  Serial.print(mpu.getAccelOffsetX());
  Serial.print(" / ");
  Serial.print(mpu.getAccelOffsetY());
  Serial.print(" / ");
  Serial.println(mpu.getAccelOffsetZ());

  Serial.println();
}

void loop()
{
  //Vector rawAccel = mpu.readRawAccel();
  Vector normAccel = mpu.readNormalizeAccel();

  int xval =normAccel.XAxis/3 + 5;
  int yval =normAccel.YAxis/3 + 5;

  int RCval = digitalRead(Rclick);
```

```
  int LCval = digitalRead(Lclick);


  int T = 1000*xval + 100*yval + 10*RCval + LCval;


  mySwitch.send(T, 24);



  //delay(10);
}
```

Working:-

In the transmitter side an Arduino Nano is used as the controlling unit. The accelerometer is connected to Arduino through I2C communication that measures the gravitational acceleration in X, Y and Z direction, but we need only values in two axis so we are using values of X and Y.

Two switches are also connected to Arduino, they are used for Left and Right click.Arduino measures all the values, now we have four values

1. Acceleration in X direction
2. Acceleration in Y direction
3. Status of Right click
4. Status of left click

All the values are merged into an integer of four digits, where each digit shows each value.In the receiver side, Arduino receives the data (integer) from transmitter and breaks into four values. Arduino Leonardo supports HID (Human Interface Device) so it moves the cursor according to values of X and Y.

Advantages And Application:-

Advantages of this project are easy usage of mouse over different applications.

Best application of this device is that will enable differently baled people to use computers and smart phones.

People who don't have hands to operate computer or phones can now do so with the help of this device

They can wear this device on their head and operate gadgets by moving their head.

Conclusion:-

Main motto of this project is to change the way we use the traditional mouse.

In order to control and create 3D objects with high ease we tend to flow towards Air mouse.

This device can be very helpful in making 3D UI based systems. We can use this device in 3D designing as well.