

# TILT DETECTOR

V. V. Mani Raghu Teja<sup>1</sup>

<sup>1</sup>UG Student, Department of Electronics & Communication Engineering,  
Padmasri Dr. B. V. Raju Institute of Technology, Medak (India)

## ABSTRACT

The Tilt Detector is used to detect the change in angular position of the system or an object and visually indicate the direction of tilt. The paper represents the total idea about this project and the working of it.

**Keywords:** Accelerometer, Angular Position, Arduino Uno, Direction of Tilt, Visually

## I. INTRODUCTION

Detecting the change in angular position of a system or an object is necessary for applications such as motion sensing and motion control. There must be some device which can detect that change in angular position of a system. One such device is a Tilt Detector which detects the change in tilt with the help of accelerometer.

## II. TILT DETECTOR

The Tilt Detector is a device which detects the change in angular position of the system or an object and visually indicates the direction of tilt.



Figure 1: Image of a tilt detector

## III. CONCEPT

An Accelerometer, which is an electromechanical device comes under the family of Micro-Electro-Mechanical Systems or MEMS devices.

Tilt detection is a simple application of an accelerometer where a change in angular position of a system or an object in any direction is detected and indicated visually through LED's. An Arduino Uno board is used to process the data received from the accelerometer and switch on the corresponding LED to indicate the direction of tilt.

#### IV. CIRCUIT DESIGN

The circuit only requires an Arduino Uno board, an Accelerometer module and few other components for construction.

Pins A0 to A5 of the board are connected to pins ST, Z-axis, Y-axis, X-axis, GND and VCC of the accelerometer module, respectively. The values for the accelerometer are predefined by user according to the requirement in the tilt level by using Self-Test pin (ST). Pins 8 to 12 of the board are connected to LED's.

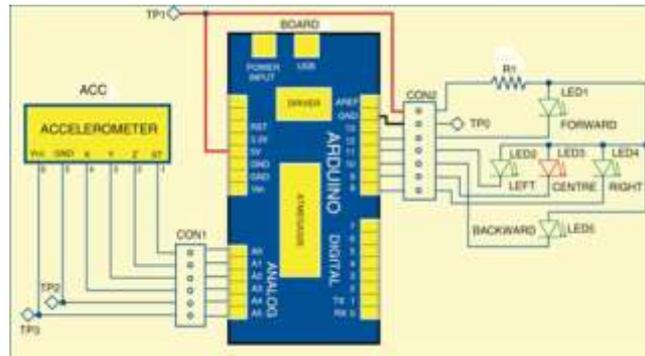


Figure 2: Circuit diagram

#### V. WORKING

When there is a change in angular position of the system or an object on which the accelerometer is mounted, logic levels are provided to VCC and GND of the accelerometer module through pins A5 and A4, respectively. The microcontroller of the board receives data for X, Y and Z axis from the accelerometer at pins A3, A2 and A1, respectively. This data is continuously compared with predefined values for each axis.

If the received value for any axis crosses the predefined value, the corresponding LED (Green) is lit. If the angular tilt is within the threshold limit for each direction, the LED in the center (Red) is lit.

#### VI. TESTING

To test the circuit, check for the voltage levels at the test points as shown in the test points table below:

Table 1: Test points

| TEST POINTS |         |
|-------------|---------|
| Test Point  | Details |
| TP0         | 0V, GND |
| TP1         | 5V      |
| TP2         | Low     |
| TP3         | High    |

For functional testing of the circuit we need to trigger the values for LED's after assembling the circuit. The steps involved in this process are:

- Connect the Arduino board to the computer with USB cable.
- Open the source code (test.ino) in the Arduino IDE and burn it on the Arduino board.
- Open the serial port from Arduino environment and press reset button.

- You will see the screen shown in Fig. 3 in which the values of X, Y, and Z axis will vary corresponding to the position of your accelerometer.

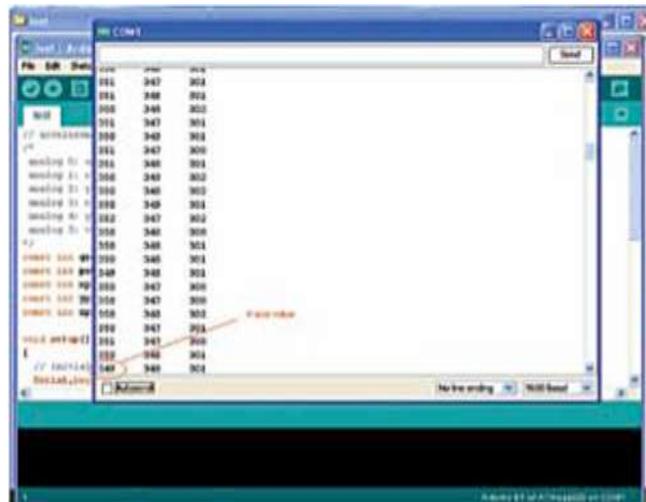


Figure 3: Screenshot of values for X, Y and Z axis

- Tilt it to the left and note the value for 'A\_max' after which you want the corresponding LED to glow. The same trigger will be applied for backward tilt too.
- Tilt it to the right and note the value for 'A\_min' after which you want the corresponding LED to glow. The same trigger will be applied for forward tilt too.
- The trigger values are defined by 'A\_max' and 'A\_min' in the final code (tiltdetection.ino).
- Open the final code in the Arduino IDE and put the values for 'A\_max' and 'A\_min' as shown in the Fig. 4.

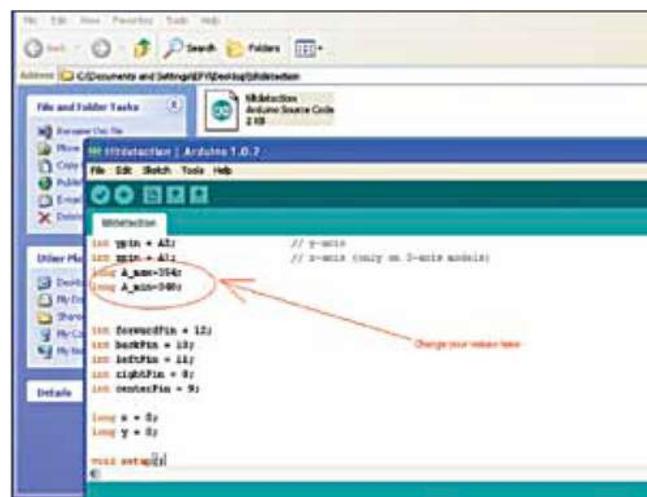


Figure 4: Screenshot of changing trigger values

- Program the Arduino again with the new code and the system is ready to work.
- If the angular tilt is within the threshold, red LED will glow. Otherwise green LED's corresponding to each direction will glow.
- You can see the same on serial port also. Connect the USB and open the serial port in Arduino environment. You will see on the serial port 'forward' if tilted forward, and similarly for the other directions.

## VII. RESULTS

The results can be seen by opening the serial port in the Arduino environment as shown in the Fig. 5 below:

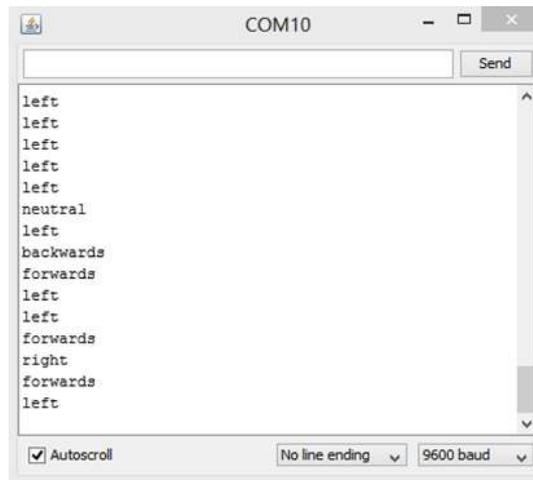


Figure 5: Screenshot of result

## VIII. CONCLUSION

In summary, a Tilt Detector is a device that visually indicates the direction of tilt made by the system or an object. It can be used for various applications like tilt detection, obstacle detection, motion inputs, and earthquake sensing. It can also be used in theft protection, disk drive protection, mobile devices, gaming systems, etc.

## REFERENCES

- [1] Simon Monk, *Programming Arduino: Getting Started with Sketches*, McGraw-Hill, 2012.
- [2] Accelerometer Module ADXL335, [www.analog.com](http://www.analog.com)
- [3] Arduino Environment Guide, [www.arduino.cc](http://www.arduino.cc)
- [4] Arduino Uno Rev3, [www.arduino.cc](http://www.arduino.cc)