

Alert system for Earthquakes

1)AIM:

The aim of this project is to design and implement an Arduino-based earthquake detector using an ADXL335 accelerometer, LCD display, buzzer, and LED. The system detects unusual ground vibrations and provides real-time alerts through visual and audio signals, enhancing early warning and safety measures during seismic activity.

2)COMPONENTS USED :

Hardware (Simulated):

- Arduino Uno
- ADXL335 Sensor
- 16x2 LCD Display
- Potentiometer (10k)
- LED
- Resistors (220 ohm × 3)
- Jumper Wires
- buzzer
- bread board

Software: • Tinkercad Circuits (for simulation)

3) Circuit Description:

The ADXL335 accelerometer continuously monitors vibrations along the X, Y, and Z axes. It sends analog voltage signals to the Arduino Uno corresponding to acceleration in each direction. The Arduino processes these values and compares them to calibrated baseline readings.

When significant changes (indicative of tremors) are detected:

- The **buzzer** is turned ON
- The **LED** is turned ON

- The **LCD** displays "**Earthquake ALERT**"

When no unusual movement is detected:

- The **buzzer** remains OFF
- The **LED** remains OFF
- The **LCD** shows real-time X, Y, Z axis values

This setup forms a simple early-warning system for earthquakes, enhancing safety and awareness in sensitive areas.

4. Arduino Code:

```
#include <LiquidCrystal.h>
```

```
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
```

```
#define X_PIN A0
```

```
#define Y_PIN A1
```

```
#define Z_PIN A2
```

```
#define BUZZER 12
```

```
#define LED 13
```

```
int xSample = 0, ySample = 0, zSample = 0;
```

```
int alertFlag = 0;
```

```
long startTime = 0;
```

```
#define SAMPLES 50
```

```
#define MAX_CHANGE 20
```

```
#define MIN_CHANGE -20
```

```
#define BUZZ_DURATION 5000
```

```
char displayLine[17];
```

```
void setup() {
```

```
    Serial.begin(9600);
```

```
    lcd.begin(16, 2);
```

```
pinMode(BUZZER, OUTPUT);
pinMode(LED, OUTPUT);
lcd.print("EarthQuake");
lcd.setCursor(0, 1);
lcd.print("Detector");
delay(2000);
lcd.clear();
lcd.print("Calibrating...");
lcd.setCursor(0, 1);
lcd.print("Please wait...");

for (int i = 0; i < SAMPLES; i++) {
    xSample += analogRead(X_PIN);
    ySample += analogRead(Y_PIN);
    zSample += analogRead(Z_PIN);
}

xSample /= SAMPLES;
ySample /= SAMPLES;
zSample /= SAMPLES;

delay(1000);
lcd.clear();
lcd.print("Calibrated!");
delay(1000);
lcd.clear();
}

void loop() {
    int xVal = analogRead(X_PIN);
    int yVal = analogRead(Y_PIN);
    int zVal = analogRead(Z_PIN);
```

```
int dx = xSample - xVal;
```

```
int dy = ySample - yVal;
```

```
int dz = zSample - zVal;
```

```
bool isQuake = (
```

```
    dx < MIN_CHANGE || dx > MAX_CHANGE ||
```

```
    dy < MIN_CHANGE || dy > MAX_CHANGE ||
```

```
    dz < MIN_CHANGE || dz > MAX_CHANGE
```

```
);
```

```
if (isQuake && alertFlag == 0) {
```

```
    startTime = millis();
```

```
    alertFlag = 1;
```

```
}
```

```
if (alertFlag && millis() - startTime > BUZZ_DURATION) {
```

```
    alertFlag = 0;
```

```
}
```

```
lcd.setCursor(0, 0);
```

```
if (alertFlag) {
```

```
    lcd.print("Earthquake ALERT");
```

```
} else {
```

```
    lcd.print(" X  Y  Z ");
```

```
}
```

```
sprintf(displayLine, "%4d %4d %4d", dx, dy, dz);
```

```
lcd.setCursor(0, 1);
```

```
lcd.print(displayLine);
```

```
Serial.print("X: "); Serial.print(dx);  
  
Serial.print(" Y: "); Serial.print(dy);  
  
Serial.print(" Z: "); Serial.println(dz);  
  
  
digitalWrite(BUZZER, alertFlag);  
  
digitalWrite(LED, alertFlag);  
  
  
delay(300);  
}
```

5. Simulation , Demo & Github links:

This project was built and tested using Tinkercad Circuits, where:

- The **ADXL335 accelerometer** was simulated using adjustable analog inputs to mimic ground vibrations
- The **LED**, **buzzer**, and **LCD** functioned according to the detected changes in acceleration
- Vibration thresholds were tested by varying X, Y, and Z values to trigger the "**Earthquake ALERT**" on the LCD and activate the buzzer and LED accordingly

Demo Video Link:

Tinkercad Circuit Link:

<https://www.tinkercad.com/things/67ouMw8Zbba-joshith>

Github link – includes all the files:

6)Results:

- When vibration is detected, the **LED** and **buzzer** turn **ON**, and the **LCD displays "Earthquake ALERT"**
 - When no vibration is detected, the **LED** and **buzzer** remain **OFF**, and the **LCD** shows real-time **X, Y, Z** axis values
 - The system mimics a real-time earthquake detection and alert system, and it performed as expected during **Tinkercad simulation**
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7) Conclusion

This project demonstrates the use of accelerometer sensors and microcontrollers for seismic activity detection and alerting.

It is highly applicable in:

- Early warning systems for earthquake-prone regions
- Home and building safety monitoring
- Industrial equipment protection

It can be extended in real-world environments by replacing the LED and buzzer with relays to trigger sirens, emergency lighting, or even automated shutdown systems for critical infrastructure.

8. Submitted By

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