Anti-Theft Security System using Seismic Sensor ADXL335 (GY-61)
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Abstract:
This paper presents an Arduino based home security system. The need for security systems nowadays is a serious demand. As the numbers of crimes are increasing everyday so, we need something that will keep us safe. We are all aware of high end security systems present in the market but they are not easily available to everyone. We therefore intend to provide a solution by constructing a low power consumption electronic system that has the capability of sensing the motion, detect the foot fall frequency of the intruders and turn on the alarm which it will automatically send a message to the owner phone. The basic idea behind this project is that all the bodies generate some heat energy in the form of infrared which is invisible to human eyes. But, it can be detected by electronic motion sensor. Since, at home there will be present of domestic animal like cat, mice, dog etc. but we need to detect only human being so, we use a seismic sensor which will detect the footfall vibration frequency of human being which is 4Hz to 8Hz and above depending on the floor but footfall of animal like cat, mice etc. is less than 0.5Hz, so the sensor will not detect these animals.

Keywords: Arduino Uno, GSM module, P.I.R Sensor, Seismic Sensor.

I. INTRODUCTION:
We have designed an interesting and cheap security system that can differentiate between human and domestic animal like cat, mice etc. This Gadget helps you to protect your house from thieves. In this project we are going to use an Arduino Uno R3 board, PIR sensor module, seismic sensor, GSM module, LCD and some other components.

This project can either power with 9V battery or with U.S.B of your computer. This system is a basic motion-sensing and footfall vibration alarm that detects when someone enters the area. When an intruder is detected, it activates a siren and send message automatically to the owner mobile phone.

Our body generates heat energy in the form of infrared which is invisible to human eyes. But it can be detected by electronic sensor. This type of sensor is made up of crystalline material that is Pyro-electric. Since, at home there will be present of domestic animal like cat, mice etc.

but we need to detect only human being so, we need a 3 axes accelerometer which will detect the footfall vibration frequency of human being (which is 4Hz to 8Hz and above depending on the floor) but the footfall of animal like cat and mice is less than 0.5Hz so the 3axes accelerometer will not detect these animal, because it detect the range of 0.5Hz to 1600Hz for X and Y axes, and a range of 0.5Hz to 550Hz for Z axis.

In this project, we are using P.I.R motion sensor module as an infrared sensor that generates electric charge when exposed in heat and sends a signal to Arduino and seismic sensor to detect the footfall vibration of human beings. According to level of the infrared in front of sensor P.I.R sensor activate the Seismic sensor to detect the footfall vibration, Arduino displays the status on the LCD and start buzzing the speaker automatically.

II. BLOCK DIAGRAM:

III. WORKING OF THE SYSTEM:
As shown in fig.1 this system is a basic motion sensor and footfall vibration alarm that detects when someone enters the area. It is built around an Arduino Microcontroller. It is connected to a P.I.R motion sensor, a buzzer, Seismic sensor, and output of the Arduino is connected to GSM module and finally the signal will transmit to the mobile phone. The user can easily notify when the intruder entered the house by using the P.I.R sensor. If anyone present in the coverage area of the P.I.R motion detector immediately it will triggered a Seismic sensor within a short interval of time i.e. 1sec delay. When the Seismic is triggered it will detect the footfall vibration of the intruder foot step, the Seismic send the signal to the Arduino and sound an alarm and automatically it will send message from GSM module to the user mobile phone. The main advantage of using the Seismic sensor is to differentiate between humans and animals. The system is function by uploading a program using the Arduino software IDE version 1.06. The LCD is used to display the status of the system.
IV. WORKING FLOW OF THE SYSTEM:

V. PROCEDURES:

Step 1: Connecting the P.I.R sensor to Arduino
1. Connect Vcc pin of P.I.R sensor to positive terminal of Arduino (5V).
2. Connect Gnd pin of P.I.R sensor to any ground pin of Arduino.
3. Connect out pin of P.I.R sensor to pin no.7 of Arduino.

Step 2: Connecting Active Passive Buzzer to Arduino
Connect positive terminal (red wire) of buzzer to collector pin of BC547 and the base is connected to pin no.8 of Arduino through 1k resistor.
Connect negative terminal (black wire) of buzzer to any ground pin.

Step 3: Connecting LCD to Arduino
To link your LCD screen to Arduino, connect the following pins:
- LCD RS pin to digital pin 12
- LCD Enable pin to digital pin 11
- LCD D4 pin to digital pin 5
- LCD D5 pin to digital pin 4
- LCD D6 pin to digital pin 3
- LCD D7 pin to digital pin 2
Additionally, wire a 10k pot to +5V and GND, with its wiper (output) to LCD screens VO pin (pin3).

Step 4: Connecting Seismic sensor to Arduino
1. Connect Vcc pin of the seismic sensor to positive terminal of Arduino (3.3V).
2. Connect ground pin of seismic sensor to any ground pin of Arduino.
3. Connect pin Xout, Yout and Zout of seismic sensor to analog pin A0, A1, and A3 of Arduino respectively.

Step 5: Connecting GSM module to Arduino
1. Connect the Transmitter pin of GSM module to pin no.9 of Arduino.
2. Connect the Receiver pin of GSM module to pin no.10 of Arduino.
3. Connect the Ground pin of GSM module to any round pin of Arduino.

Step 6: Programming Arduino
2. Connect your Arduino to your computer using USB cable.
3. Open Arduino IDE, choose your correct board from Tools—Serial Port.
4. Choose your correct port from Tools—Serial port.
5. Copy the following sketch which appears in your Web Browser to your Arduino Sketch Page.
6. Click on Upload Icon or go to File-Upload.

VI. SEISMIC SENSOR ADXL335 (GY-61):

Figure 2. Working flow of the system.

The ADXL335(GY-61) is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3g. It can measure the static acceleration of gravity on tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidth can be selected to suit the application, with a range of 0.5Hz to 1600Hz for the X and Y axes, and a range of 0.5Hz to 550Hz for the Z axis. The ADXL335 is available in a small, low profile, 4mm × 4mm × 1.45mm, 16-lead, plastic lead frame chip scale package.

Features:
- 3-axis sensing
- Small low profile package.
- 4mm × 4mm × 1.45mm LFCS
- Low power: 350μA (typical)
- Single-supply operation: 1.8V to 3.6V
- 10,000g shock survival
- Excellent temperature stability
- BW adjustment with a single capacitor per axis

VII. ADVANTAGES AND DISADVANTAGES:

Advantages:
1. The given system is handy and portable, and thus can be carried from one place to another.
2. The circuitry is not that complicated and thus can be easily troubleshoot.
3. The given system sets off a powerful buzzer, and it is effective as any other alarm system available in the market.
4. The system can differentiate human and domestic animal (like cat, mice etc.).

Disadvantages:
1. The alarm activates only when the person cuts through the line of the P.I.R sensor and step in the seismic sensor range.
2. It will detect big animal (e.g. horse, cow etc.).

VIII. LIST OF COMPONENT:
1. Arduino Uno
2. P.I.R sensor module
3. Seismic sensor
4. Transistor (BC547)
5. Resistor (1k (2nos.), 220 ohm)
6. L.C.D (16 X 2)
7. 9V Battery (2 nos.)
8. 9V Battery connector
9. L.E.D
10. Buzzer
11. PCB
12. GSM Sim800 module
13. Potentiometer (10k)
14. USB cable

IX. APPENDICES:
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
#include <LiquidCrystal.h>
int push_switch=6;

#define buzzer 8
#define x A0
#define y A1
#define z A2
int xsample=0;
int ysample=0;
int zsample=0;
long start;
int b=0;
int sensor=7;
int sensor_value; //variable to hold read sensor value
#define samples 50
#define maxVal 20
#define minVal -20
#define buzTime 2000
int sms_count=0;
void setup()
{
    Serial.println();
    pinMode(sensor,INPUT);
    mySerial.begin(9600);
    lcd.begin(16,2);
    delay(500);
    lcd.setCursor(2, 0);  // Set LCD
cursor position (column, row)
lcd.print("Adv Security"); // Print text
to LCD
    lcd.setCursor(5, 1);  // Set LCD
cursor position (column,row)
    lcd.print("System"); // Print text to LCD
delay(4000); // wait 4s
text
    lcd.clear(); // clear LCD display
    lcd.setCursor(2,0);  // Set LCD
cursor position (column, row)
lcd.print("Developed By"); // Print text to LCD
    lcd.setCursor(2, 1);  // Set LCD
cursor position (column, row)
lcd.print("NMRP GROUP"); // Print text to LCD
delay(5000); // Delay to read text
    lcd.clear(); // Clear LCD
    lcd.setCursor(0, 0);
lcd.print("Processing Data.");
delay(3000);
lcd.clear();
lcd.setCursor(3, 0);
lcd.print("Waiting For");
lcd.setCursor(3, 1);
lcd.print("THIEF...");
    Serial.begin(9600);
delay(1000);
pinMode(buzzer, OUTPUT);
b=0;
digitalWrite(buzzer, b);
for(int i=0;i<samples;i++)
{
xsample+=analogRead(x);
ysample+=analogRead(y);
zsample+=analogRead(z);
}
xsample/=samples;
ysample/=samples;
zsample/=samples;

void loop()
{
    Check_Burglar(); // subroutine to check sensor status and activation of outputs
}
void Check_Burglar()
{
    int value1=analogRead(x);
    int value2=analogRead(y);
    int value3=analogRead(z);
    int xValue=xsample-value1;
    int yValue=ysample-value2;
    int zValue=zsample-value3;
sensor_value=digitalRead(sensor); // Reading sensor value from pin 7
    if(sensor_value==HIGH) // Checking if PIR sensor sends a HIGH signal to Arduino
    {
        lcd.clear();
lcd.setCursor(1,0);
lcd.print("Motion Detected");
delay(40);
lcd.clear();
if(xValue < minVal || xValue > maxVal || yValue < minVal || yValue > maxVal || zValue < minVal || zValue > maxVal)
```java
if(b == 0)
    start=millis();
b=1;
}
else if(b == 1)
{
    if(millis()>= start+buzTime)
        b=0;
    lcd.clear();
    lcd.setCursor(1,0);
    lcd.print("thief Detected");
    delay(1000);
    lcd.clear();
    while(sms_count<1) //Number of SMS Alerts to be sent limited at 1
    {
        SendTextMessage(); // Function to send AT Commands to GSM module
    }
    sensor_value=HIGH;
}
digitalWrite(buzzer, b);
    lcd.setCursor(3, 0);
    lcd.print("Waiting For");
    lcd.setCursor(3, 1);
    lcd.print(" thief....");      // We only want to print on the output change, not state
    sensor_value = LOW;
    sms_count=0; // Reactivating the SMS Alert Facility
}
else if(sensor_value==LOW)
{
    digitalWrite(buzzer, 0);}}

void SendTextMessage()
{
    mySerial.println("AT+CMGF=1");    //To send SMS in Text Mode
    delay(100);
    mySerial.println("AT+CMGS="+918787799877\r"\r""); // change to the phone number you using
    delay(100);
    mySerial.println("thief detected Take care of your belongings. Be Alert"); //the content of the message
    mySerial.println((char)26); //the stopping character delay(100);
    sms_count++;
}

X. CONCLUSION:

This type of security system can be easily employable for security purposes at banks, various offices and even for sensitive establishments such as for military. We can easily set up this system for household purposes.

XI. REFERENCES:


