Earthquake Detector using Arduino

[1]Dr. Vinod B. Durdi, [2]Kumar Snehit, [3]Anupam Shrivastava, [4]Mehul Jain, [5]Anupam

[1]Associate Professor, [2,3,4,5]Students
Department of T.C.E.
Dayananda Sagar College of Engineering
Bangalore, India

***Abstract*: An Earthquake detector using Arduino board and sensitive vibration device that can detect minute vibrations is presented in this paper. The components are able to provide immediate alert and helps to take preventive measures against earthquakes accordingly.**

***Keywords*: Vibrator, Arduino, earthquake, vibration**

I. INTRODUCTION

Earthquakes are the major natural disaster. Earthquakes are shaking of the Earth's crust caused by immediate release of energy in its interior, most often as a resulting in strains accumulated in rocks, exceeding its elastic limit and causing it to explode. An earthquake is generated when two crust of the earth experience friction against at one another. Thus, detection and prediction of the earthquake phenomenon to different areas could result in lowering the earthquake disaster generated by it. In this paper, an earthquake indicator using a micro-controller-Arduino Mega and a sensitive vibrator is used that can sense vibrations. Vibrators are very responsive to tremor. Vibrators provides analog voltage which is identical to imposed acceleration [1][2]. The vibrator is connected with Arduino MEGA Analog to Digital Convertor (ADC) pins and any vibration results due to fluctuation is detected by the vibrator and hence detected by Micro-controller. If dynamics are large enough in the middle of an earthquake and crosses a certain value called threshold value, a light, which acts as an indicator of earthquake glow as well as an alarm is sound. While the alarm may be used for household principle and it can also be used in industrial purposes. An LCD has been added in the device for warning notification hence making the system efficient and user-friendly. A GSM module is provided so that any tremors caused due the Earthquake can be notified to cell phones of the user. A GPS module is also provided to identify the exact location where the tremors are generated.
This paper consists of Implementation, Results and Discussions and Conclusion.

II. IMPLEMENTATION

The fig. 1 shows the block diagram of Earthquake indicator Using Arduino. Arduino MEGA board is connected with Vibrator, alarm system, Threshold Setting, Power supply and LCD screen, GPS module, GSM module. Arduino board is a micro-controller which is connected to hardwares and the vibration readings is processed by Arduino Board. Alarm system is used to buzz a sound when the vibration readings crosses a certain threshold value [3]. A power supply of 12V is provided to the Arduino and an LCD display is used to display warning notifications to the user. The Arduino MEGA board is linked with Vibrator module where the sensitivity of the vibrations are processed by the micro-controller. A sensitivity tuner is also provided to the vibrator module which is used for increasing and decreasing the sensitivity of the vibration. A 16x2 LCD is connected in 4-wire method with Arduino pins disparity control and backlight enabled.

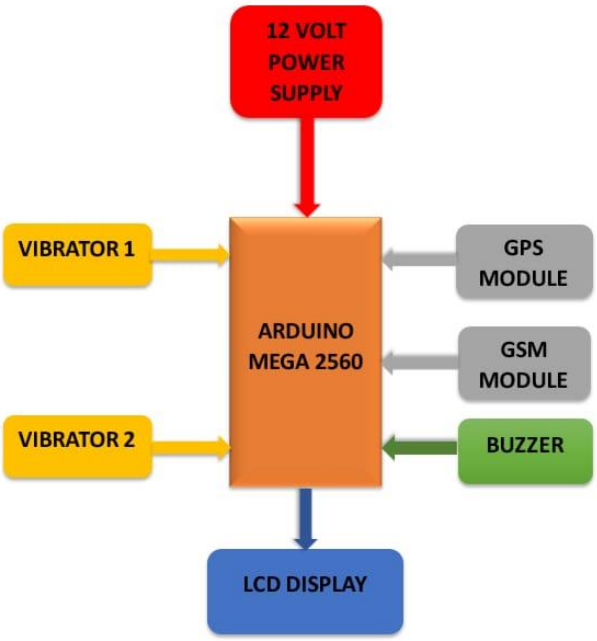

Fig 1. Block diagram of earthquake Detector using Arduino

A buzzer is wired to pin7 of Arduino Uno for warning notification. Pins RS, EN, D4, D5, D6, D7 of LCD are connected with A8, A9, A10, A11 and A12 of Arduino Mega board respectively [4]. When the setup is switched on, it saves and gather real time vibration values in Arduino internal EEPROM regardless of its inclination. Since the ADC device is 10-bit device, special header file EEPROM X has been provided for all voltages and for the structure to be durable before any initial value is read. Arduino's microcontroller stores all the vibrations and saves the values from the vibrator and stores in the EEPROM.

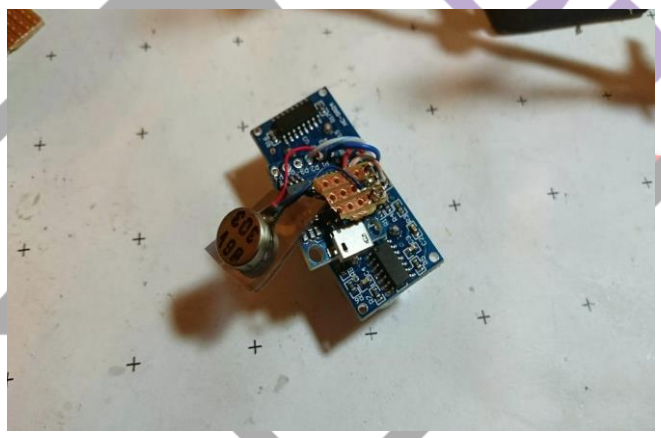

Fig 2. Connections between Arduino Mega and Vibrator

The vibrator is connected to pin A5, a ground connection pin and a 5V pin to the Arduino mega board and are processed by the Arduino as shown in fig. 2 and the warning notification is displayed in the 16x2 LCD screen. The Vin, VDD, GND is connected to pin number A8, A9 and A9 of the Arduino mega boards as shown in Fig. 3.

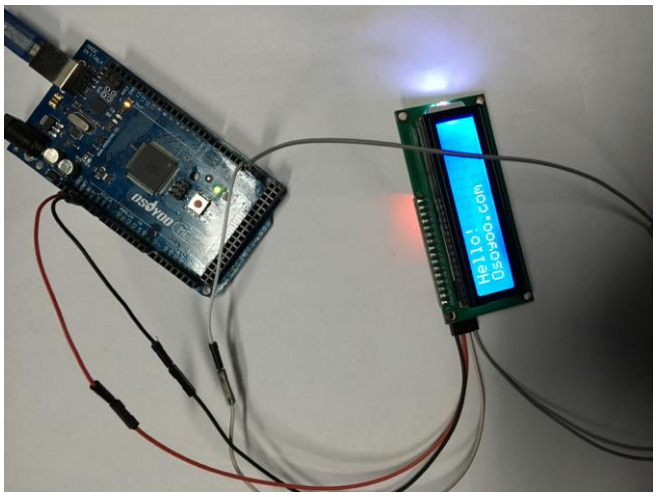

Fig. 3 Connection between Arduino Mega and 16x2 LCD

This LCD will allow the user for proper warning display.

Pushbuttons connected to pins 2 and 3 of Arduino Mega micro-controller deals as a delay for increasing and decreasing threshold values for subtlety improvements. For an earthquake, threshold value of 500 to 600 is better.

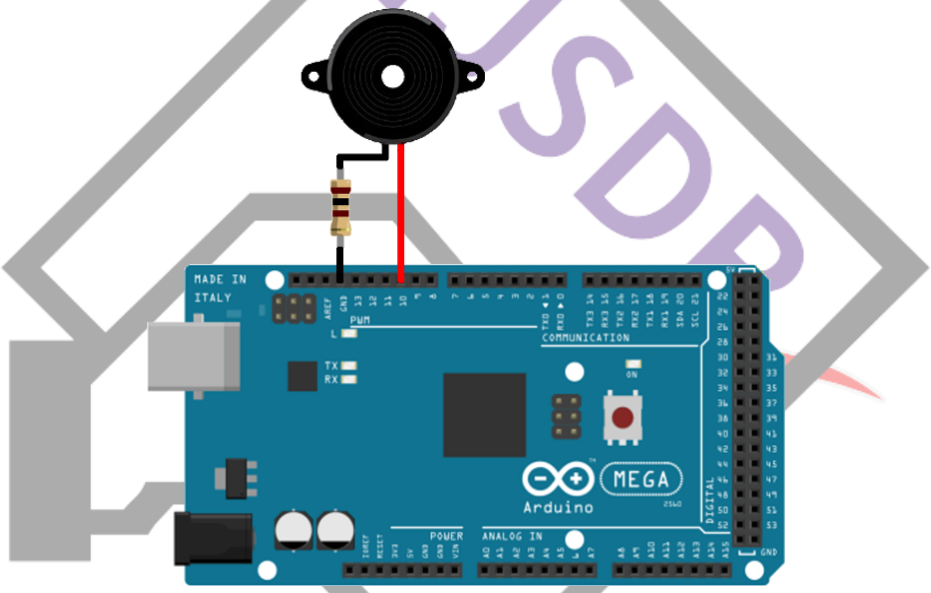

Fig 4. Connection between buzzer and Arduino Mega

A buzzer is connected to 5V and pin 16 of the Arduino board as shown in Fig. 4. A resistor is provided at 5v pin to maintain the voltage flow so that the buzzer does not malfunction.

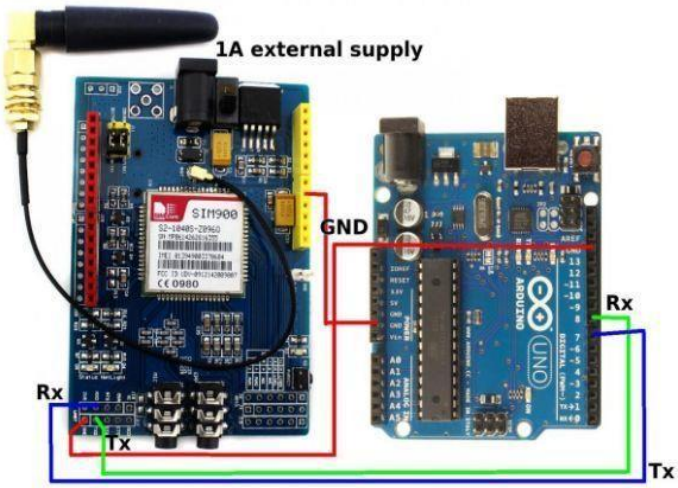

Fig 5. Connection between Arduino Mega and GSM Module

A GSM module is used to send notification to users via SMS and inform users about earth-quake alerts [5]. The Rxd, Txd and Gnd of the GSM Module is connected to the Rxd, Txd and ground of the Arduino board as shown in fig 5. The transmitted message is processed by Arduino board and SMS notifications are send to receiving pin of the Arduino board. This provides an efficient way of notifying the users about earth-quakes and alert then before casualty happens.

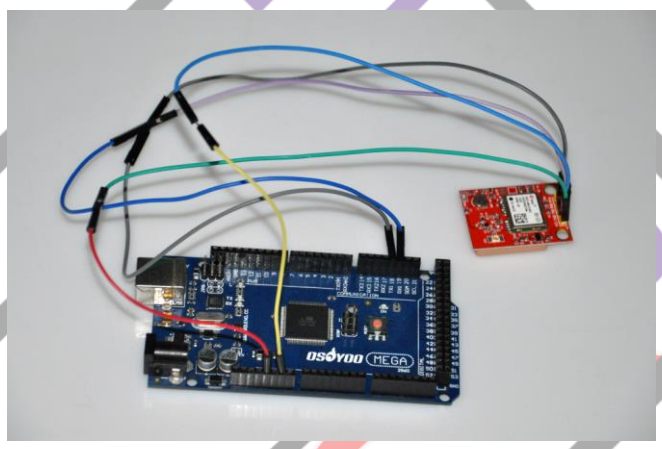

Fig. 6 Connection between Arduino Mega and GPS Module

The GPS Module is used to send real-time location of the earth-quakes, this sends co-ordinates to the user equipment devices alerting about the emergence of earth-quakes and alert the users [6]. Pin number 1, 2,3, 4, 5, 6 of GPS is connected to the pin A11, A12, Txd, Rxd and Gnd of the Arduino board respectively as shown in Fig 6.

III RESULTS AND DISCUSSIONS

Using this device, result was achieved by increasing the sensitivity of the vibrator and noting down the readings displayed on LCD screen. The sensitivity of the vibrator ranges between 0-1023hz. For small vibration intensity, the LCD screen displayed the vibration as 300hz. For medium vibration intensity, the LCD screen displayed the vibration as 545hz. and for large vibration intensity, the LCD screen displayed the vibration as 1000hz. The threshold is set to 500hz which is equivalent to 4.5 of Richter scale. As soon as the vibration crosses 500hz, a warning notification and location of earthquake is sent to the user's mobile number. The vibrators provide high sensitivity reading and can be adjusted according to the choice.

CONCLUSION

Earthquake indicator using micro-controller- Arduino Mega and Vibrator has settled to be a decisive, salvage and a user-friendly device. The product is requiring less money for large majority of people in terms of device cost and installation cost. Casual controlling of the system is not mandatory. The device can be easily established in resident places and industrial places. Power provision of the system are also limited to minimum. Careful management is essential for this device and it can be readily regulated by the user. It is expected that the device will be largely available in the display due to its user-friendly nature and efficiency. The device can be used in earthquake possible areas. This product can be improved and can be used in machine learning applications. It will help in predicting earthquakes with ease.

ACKNOWLEDGEMENT
Authors would like to thank their colleagues for the valuable input and discussions on the topic.

REFERENCES

[1] Hima MS, Josphin Subha, Kalyani Devi G, Karthika Sankaran, Naveen S Department of Electronics and Communication Engineering LBSITW, Trivandrum, Kerala, India.

[2] R.J. Geller, D.D. Jackson, and Y.Y. Kagan, and F. Mulargia, "Enhanced Earthquakes cannot be Predicted", Science, Vol 275. pp.1616-1620. 1997.

[3] Ronie Adhiraaj Gosh,"Earthquake Indicator Using Arduino", Electronics for you, Jan 2016.

[4] Sanjib Kalita, J.N. Borole, "Application of MEMS Accelerometer to Consume Electronics" International Conference on Modeling and Simulation in Engineering and Technology, ICMSET-2014, pp188-190, Feb15-16

[5] Farine, M., N. Thorburn, and D. Mougenot. "General application of MEMS sensors for land seismic acquisition- is it time?", The Leading Edge, 23, pp246-250. 2004.

[6] Takao Aizawa, Toshinori Kimura, Toshifumi Matsuoka, Tetsuya Takeda, Youichi Asano; "Application of MEMS accelerometer to geophysics"; International Journal of the JCRM; Japanese committee for Rock Mechanics.