

# Earthquake Detection and Monitoring Using Arduino

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**Abstract:** This study uses Arduino technology to prove a new method for monitoring and detection of earthquakes. The contribution describes the planning and implementation of the economic and efficient seismic monitoring system, which can collect and analyze data in real time. Through the integration of many sensors, such as gyroscopes and accelerometers, the system is designed to identify ground movement and timely announcements. The results of this study provide scalable solutions for endangered areas and increase the tactics of preparedness for earthquakes and the tactics of reaction.

**Keywords:** Earthquake detection, monitoring, using, arduino

## INTRODUCTION

Millions of people around the world are always endangered by earthquakes, which are very destructive natural disasters that can occur suddenly and without warning. It is more important than ever to have effective detection and monitoring systems, as seismic activity becomes more frequent and intense. The affordable, flexible and creative way to detect and monitor the earthquake is the use of Arduino technology. This not only improves our ability to respond to seismic disasters, but also gives communities a chance to introduce preventive measures and increase general safety. With their potential to completely transform our ability to predict and respond to one of the most unpredictable phenomena of nature, this essay explores features and advantages of Arduino -based systems to monitor earthquakes.

## LITERATURE SURVEY

1. Randika Israj Aditya et.al[2] Investigated, Arduino UNO was used to process 3-Mim ADXL335 Accelleromin Sensor to create a system. It provides early warnings before serious damage to the use of the ESP8266 NODEMC to detect vibration and communication.
2. Sneha R, Gayatri et al.[3] Discussed, This study shows the proposal and deployment of AUEDS for real -time warning and early seismic detection. By combining the Arduino UNO microcontroller with the MPU6050 accelerometer, the system can distinguish between the surrounding noise and earthquake vibrations and send warnings via the GSM module.
3. I. Sianturi et al. [4] Reviewed, to design the early warning system based on the Arduino UNO microcontroller with the Accelerometer-MPU6050 and NodeMCU-sleep8266" (2024) sensor. In order to reduce possible losses by sending early alerts, this study created a system of early earthquake -based earthquake and equipped with NodeMCU ESP8266 and MPU6050 Ackelerom sensor.
4. Savitha A. C et al.[5] Suggested, The aim of this project is to create an earthquake detection system with the Arduino microcontroller and a accelerometer sensor. The system offers real -time graphical capabilities to support early warning systems and disaster management initiatives.

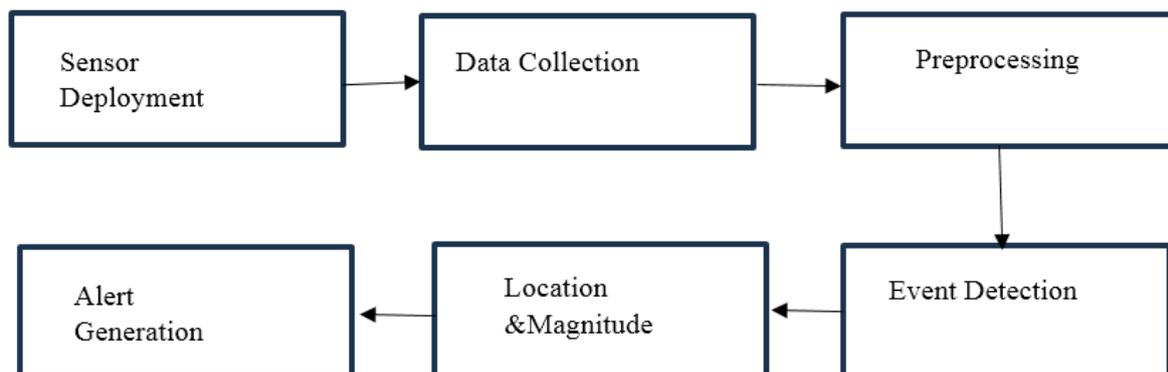


Fig 1. Architecture diagram of proposed system

METHODOLOGY

Research proposal

This study uses research strategies using mixed methods in which quantitative and qualitative methods are integrated to provide a complete understanding of earthquake detection and monitoring with Arduino technology. The quantitative aspect focuses on the technical performance of the detection system, while the qualitative aspect examines user experience, perception and practical consequences of implementing these systems in different communities.

Data collection methods

Prototype development: A prototype of the Arduino seismic sensor was created. Accelerometers and other relevant sensors were used to identify seismic activities. In order to guarantee accurate measurements of the earthquake vibration, the sensors had to be calibrated during the procedure.

Testing in the field: Several places with different seismic dangers were used to set the prototype. During the six-month period, data were collected to take into account potential seismic events and changing environmental circumstances. During this time, vibrating data was recorded in real time and recorded for analysis.

Interviews and surveys: To get qualitative information, the questionnaires were given to people in the neighborhood and organizations dealing with the readiness for disasters. Important stakeholders were also interviewed for an interview, including representatives of local administration and reaction to emergencies. The purpose of these interviews was to find out how people felt about the effectiveness of the Arduino system and the community readiness for possible seismic activities.

Secondary data analysis: Data from local seismic monitoring agencies have been examined to compare the Arduino detection capabilities with the abilities of established monitoring systems. The data was placed in the perspective and the prototype reliability was evaluated thanks to this investigation

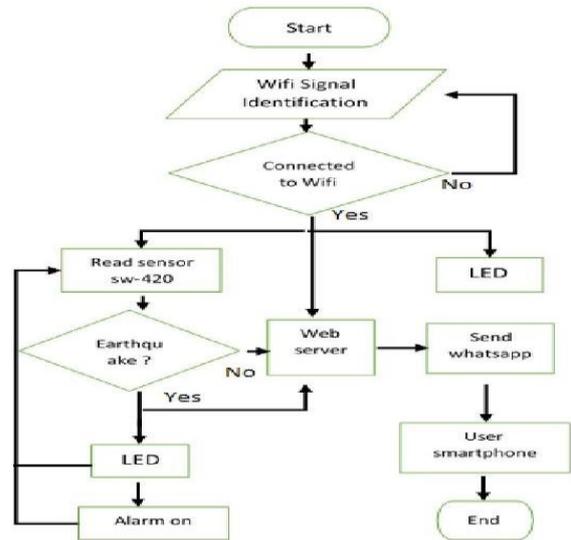


Fig 1: Design

Analysis Techniques

Quantitative analysis: The statistical tools were examined by data collected from Arduino sensors. Critical metrics such as frequency and amplitude of seismic signals were evaluated to determine the accuracy of the system in the detection of the earthquake. For comparison of results, set standards from renowned seismic monitoring organizations were used.

The thematic analysis was used to coded and rewrite qualitative information obtained from surveys and interviews. This method made it possible to find recurring topics and trends on community attitudes, knowledge gaps and general acceptability of technology in preparedness for disasters.

Comparison: A comparison between the Arduino -based system and conventional seismic monitoring systems has been made. These were the evaluation of community involvement, usability and cost efficiency. The results were shown in a way that emphasized the possible advantages of using Arduino technology in community efforts for help in disasters.

Through the integration of various techniques, research seeks to offer a thorough analysis of the Earthquake -based earthquake detection systems and offers important knowledge to improve community resistance to seismic risks.

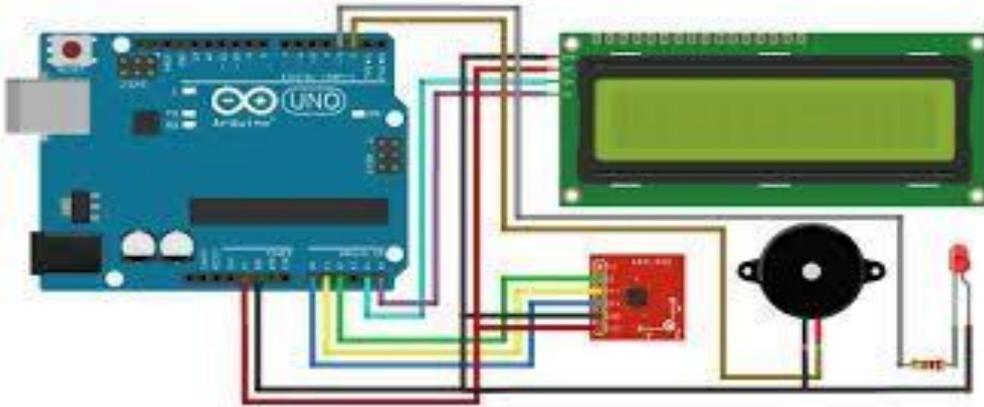


Fig 2: Circuit Diagram

Arduino hardware and software was developed for artists, designers, fans, hackers, newcomers, and anyone interested in creating interactive objects and environments. The Arduino can interact with buttons, ice cream, engines, speakers, GPS units, cameras, the internet, and even smartphones and televisions. This flexibility, combined with the fact that Arduino software is free, hardware boards are very inexpensive and software and hardware can be easily learned, led to a large community of users who provided code and gave instructions to numerous Arduino-based projects. What do you have on the board? There are many types of Arduino boards (explained in the next page) that can be used for a

variety of purposes. Some boards look a little different from the ones below, but most of these ingredients have most of these ingredients in a common force (USB/Barrel). Each Arduino board requires a way to connect it to an energy source. The Arduino UNO can be equipped with a USB cable from a computer or power source (such as this) that terminates in a barrel. The diagram above for the USB connection shows 20 AISSMS-IOIT recognition and monitoring marked Arduino(1) and run (2). You can also charge your Arduino pen (5V, 3.3V, GND, Analog, Digital, PWM, AREF) cords when plugged in the Arduino. So we'll connect the wires to create the circuit (probably within the wires).

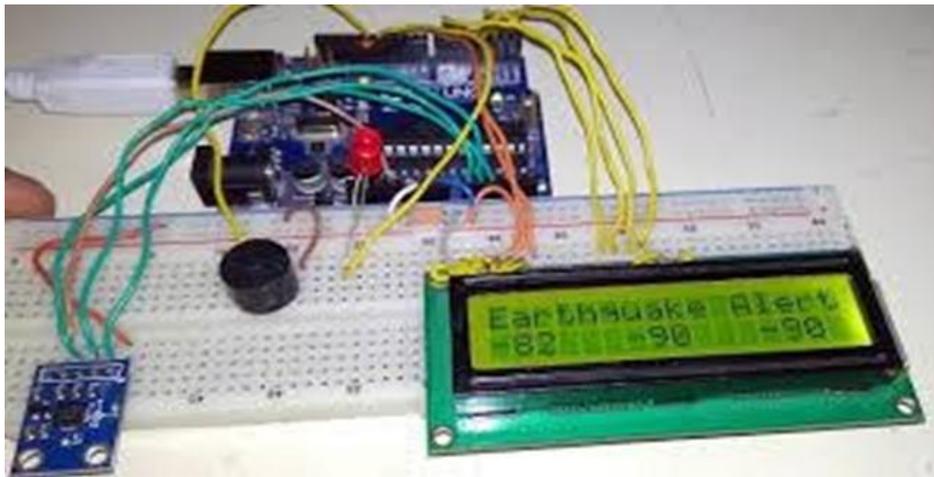


Fig 3: Hardware Setup Circuit

Analog (6): The area of the pen under the label "Analog in" (UN from A0 to A5) is similar to that of the pen. These pens can read signals from analog sensors (such as temperature sensors) and convert them into digital values that can be read. IV Digital (7): Compared to analog pens, a digital pen (0-13 for UN) is located. These pens can be used for digital inputs (for example, the story when a button is pressed) and digital outputs (as LED performance). In PWM (8), you may have noticed Tilde (~) in addition to some digital pens (3, 5, 6, 9, 10, 11).

These pens act as normal digital pens, but can also be used for pulse width modulation. PWM has tutorials, but at the moment I look at these pens and simulate analog output (like a fade LED). vi aref(9): Means an analog reference. In most cases, you can leave this pin alone. It may be used to set the external reference voltage (0-5 volts) as the upper limit of the analog input pencil. VII -Analog(6): The area of the pen under the label "Analog in" (a0-A5 for un) is similar to the foundation. These pens can read signals from analog sensors (such as temperature sensors) and

convert them into digital values that can be read. VIII Digital (7): Compared to analog pens, it is a digital pen (0-13 for UN). These pens can be used for digital inputs (for example, the story when a button is pressed) and digital outputs (as LED performance). IX PWM(8): In addition to some digital pens (3, 5, 6, 9, 10, 11), you may have noticed Tilde(~). These pens act as normal digital pens, but can also be used for pulse width modulation. PWM has tutorials, but at the moment I look at these pens and simulate analog output (like a fade LED). 21 AISSMS IOIT recognition and earthquake monitoring with Audino - analog (6): The area of the pen under the analog label (UN A0-A5) is similar on the basis. These pens can read signals from analog sensors (such as temperature sensors) and convert them into digital values that can be read. Xi Digital (7): Digital pen (0-13 for UN) is offset by an analog pen. These pens can be used for digital inputs (for example, the story when a button is pressed) and digital outputs (as LED performance). XII PWM(8): You may have noticed Tilde(~) in addition to some digital pens (3, 5, 6, 9, 10, 11). These pens act as normal digital pens, but can also be used for pulse width modulation. PWM has tutorials, but at the moment I look at these pens and simulate analog output (like a fade LED). xiii aref(9): Means an analog reference. In most cases, you can leave this pin alone. It may be used to set the external reference voltage (0-5 volts) as the upper limit of the analog input pencil. 5.2. Vibration Sensor Vibration Sensors are tools in which the frequency and size of vibration are quantified in a machine or another structure. There are many applications for you, including: Prediction: With the help of vibration sensors, you can monitor the health of your machine, and there may be possible issues before they appear. This way you can prevent expensive repairs and downtime. Machine control: The operation of the machine can be managed with vibration sensors. They can be used to stop excessive vibrations and ensure that the machine runs at the right pace. Vibration sensors can be used to carefully pose potential security risks to the structure. For example, it can be used to find cracks in structures or bridges.

RESULT

For the following purposes, an earthquake -based detection system may be useful: for teaching purposes: The design and operation of the system can improve your knowledge of sensor technology, seismic science and basic programming. DO-IT-

YOURSELF project: Experimenting with electronics and learning new abilities can be pleasant and fulfilling. Preliminary warning system: in places where access to professional systems of early warning is limited could offer a simple seismic warning. (Keep in mind that professional systems should not be replaced.) The result: Arduino is a good place to start in terms of earthquake detection, but it is important to understand its limitation and potential consequences. Limited ability to detect: the device is able to identify only the intensive vibration of the land after the start of the earthquake. An earthquake cannot be foreseen in advance. False alarms: Accurate calibration is necessary to reduce false positives caused by routine movements or surrounding vibrations. Optional data logging: If you use it, you can be able to record vibrating data for analysis. However, due to the sensitivity of the sensor and the simplicity of the system, this data may not be advanced enough to accurately detect seismic formulas. Warning (not necessary): Depending on network configuration and system, sending notifications can include delays and restrictions. The effectiveness of the warning could be endangered by these delay. In general, an earthquake -based detection system can bring the following results: learning about the concepts of earthquake science and sensor data is instructive. Limited warnings: During the earthquake, it serves as a preliminary warning, but is not a replacement for official early warning systems. It offers basic vibration data for individual studies.

Sr.No.	Phase	Output
1	Low Earthquake	-90
2	Medium Earthquake	82
3	High Earthquake	90

TABLE I: Static Performance

CONCLUSION

In conclusion, the inventive and promising method for strengthening timely warning systems and increasing the reaction to disasters is the detection and monitoring of earthquakes using Arduino technology. For effective detection and monitoring of seismic activity, seismic sensors can be placed strategically at various places using Arduino abilities. The data of these sensors in real time can then be sent to the centralized system for thorough analysis, which could lead to early detection of earthquakes and the possibility to send early warnings to communities that are at risk. In addition to improving

overall readiness on disaster, this proactive approach can significantly reduce the impact of seismic shocks. All things considered, there is a considerable chance that the detection and monitoring -based earthquake systems can transform the reaction and readiness to disasters and emphasize the importance of ongoing research and funding in this area.

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