A Minor Project Defence

On

"Earthquake Detection and Alert System "

Presented By:

Alija Bhujel[WRC077BEI002]

Anisha Kharel[WRC077BEI004]

Ashim Shrestha [WRC077BEI007]

Pragati Basnet [WRC077BEI029]

Outline

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Introduction

- Earthquakes result from the constant friction and movement between tectonic plates.
- The breaking point, known as the hypocenter, generates seismic waves that travel to the surface through the epicenter.

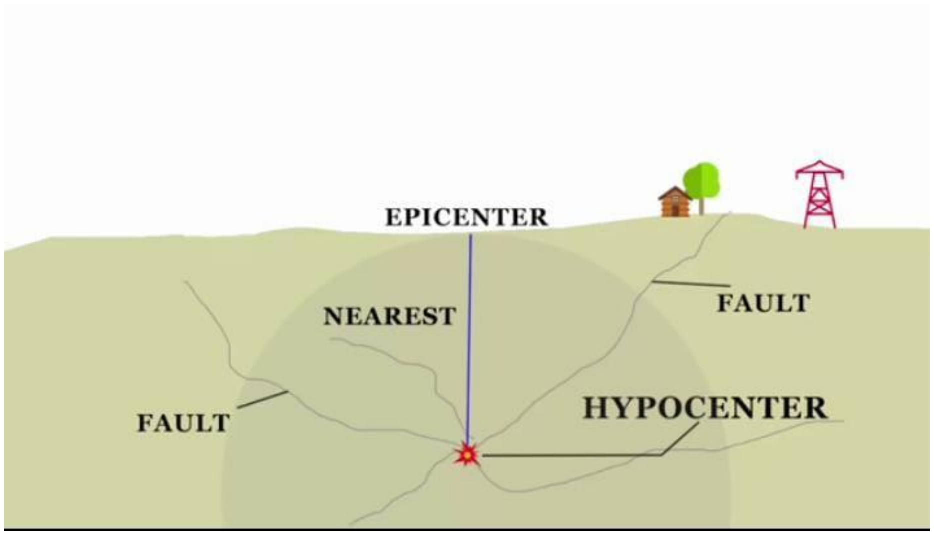


Figure 1: Demonstration of epicenter and hypocenter

Introduction

Detecting Earthquake

- Seismic waves are the key to detecting earthquakes.
- Two types of seismic waves: P-waves and S-waves.

Types of seismic waves

- **P-waves**: Travel faster at 5 m/s, move linearly, and are not the primary cause for concern.
- **S-waves:** Slower at 3.5 m/s, travel in a sideways and vertical pattern, causing disruption by displacing rocks.

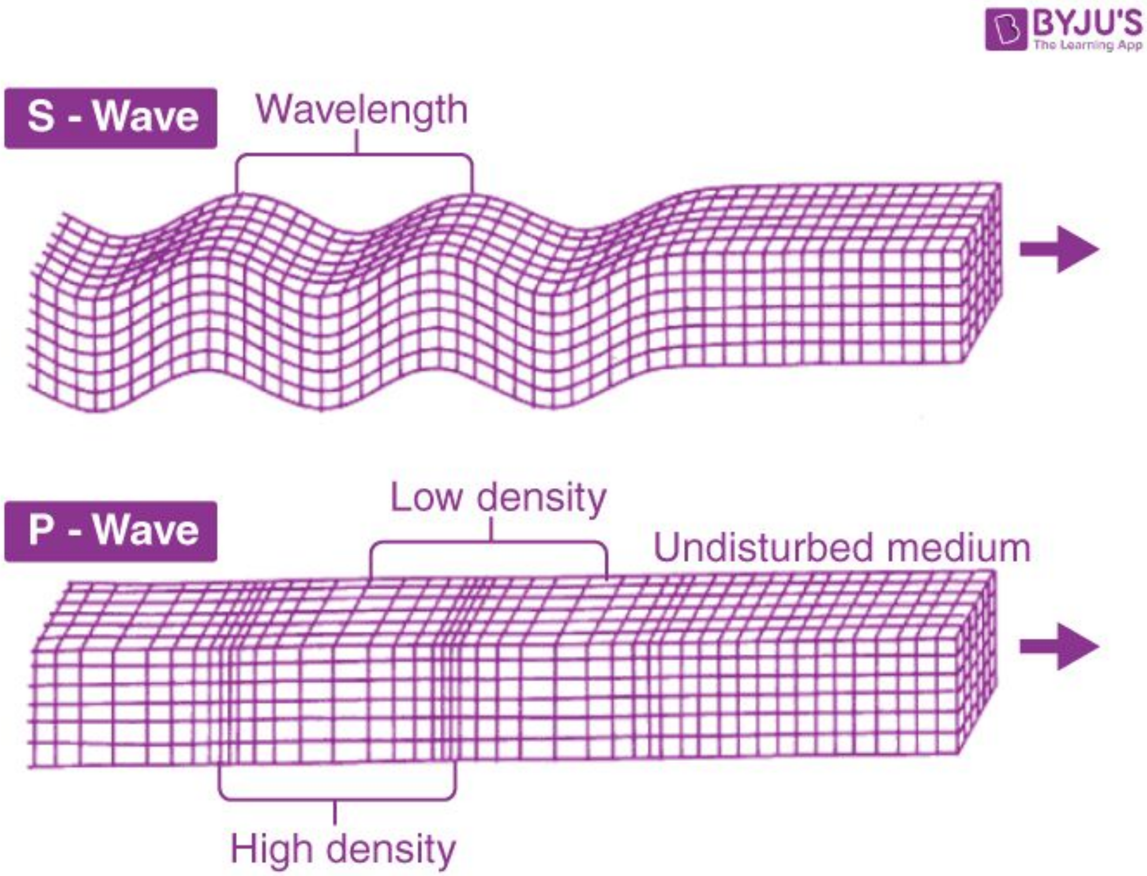


Figure 2: Pictorial demonstration of s and p waves

Introduction

Utilizing wave properties

- We focus on detecting P-waves to prevent the subsequent disruptive effects of S-waves in our project.
- Leveraging the difference in wave speeds and directional patterns to aid in earthquake detection.

Introduction

	Primary Wave (P)	Secondary Wave (S)
Solid Rock	6 - 8	3.5 - 4.5
Loose Soil	1.8 - 3.0	1.0 - 1.5
Water	~1.5	Not
Concrete	3.5 - 5.0	2.0 - 3.0
Sand	1.0 - 2.0	0.5 - 1.0
Steel	5.0 - 6.0	3.0 - 4.0

Introduction

Innovative and applicability

- Overcome challenges in resource-constrained environments.
- Democratize earthquake monitoring.
- Enhance system applicability for diverse technological infrastructures.

Problem Statement

- The current system may generate false alarms, leading to unnecessary public panic and eroding public trust.
- The existing system may not cover all areas, leading to missed detections and potential risks in remote areas.
- There may be communication failures, potentially hindering the delivery of critical alerts.
- Ongoing maintenance challenges can compromise the reliability of earthquake data.

Objectives

- To create a user-friendly interface for easy access to earthquake data.
- To enhance the accuracy and reliability of seismic data to minimize false alarms.
- To implement an effective warning system that provides timely alerts.
- To establish a real-time monitoring system for continuous monitoring and alerting.

Literature Review

Paper Title	Authors	Components Used	Key Findings
Wireless earthquake alarm system using ATmega328p, ADXL335 and Xbee S2	S. Katila, J. N. Borole, & K. Rane	ATmega328p,ADXL335 XBeeS2	Detection of earthquake shock by monitoring the X, Y, and Z axes of the ADXL335 accelerometer
Earthquake Alarm System Based on Advanced Wireless GSM Modem	Prof. P. Khatwa, G. Ingle, & R. Shinde	Microcontroller, GSM modems	Enhanced with GSM modems for mobile communication

Paper Title	Authors	Components Used	Key Findings
Automatic pothole and speed breaker detection using android system	V. Rishiwal and H. Khan	Built-in accelerometer of an android device	Android device placed on a flat horizontal surface for data collection
Wireless Monitoring of a Structural Beam to be Used for Post-Earthquake Damage Assessment	B. Ozbey, O. Kurc, H.V.Demir, V. B. Erturk & A. Altintas	Passive Nested Split-Ring Resonator (NSRR) Probes,rebars ,antenna	Detection of plastic deformation strain/displacement in the beam
An emergency earthquake warning system using mobile terminals with a built-in accelerometer	T. Uga, T. Nagaosa & D. Kawashima	Server,mobile-based seismometer	Acknowledgment of challenges related to false alarms and limited sensor coverage

Requirement Analysis

Hardware Requirements

- GSM Module : Communication system for notify
- ADXL335 accelerometer :reads acceleration as analog voltage
- Arduino Nano: Microcontroller which reads sensor data
- Node MCU : communicate with backend server.
- LCD Display: Visual interface and sensor readings.
- Buzzers : Alert users through alarms.

Software Requirements

- React.js: develop user interface and give visual data in frontend.
- Node.js : For Backend.
- Arduino IDE : Software application designed specifically for programming Arduino boards.
- VS Code: Visual Studio Code, often abbreviated as VS Code, is a popular source-code editor developed by Microsoft for Windows,Linux, and macOS.

Methodology

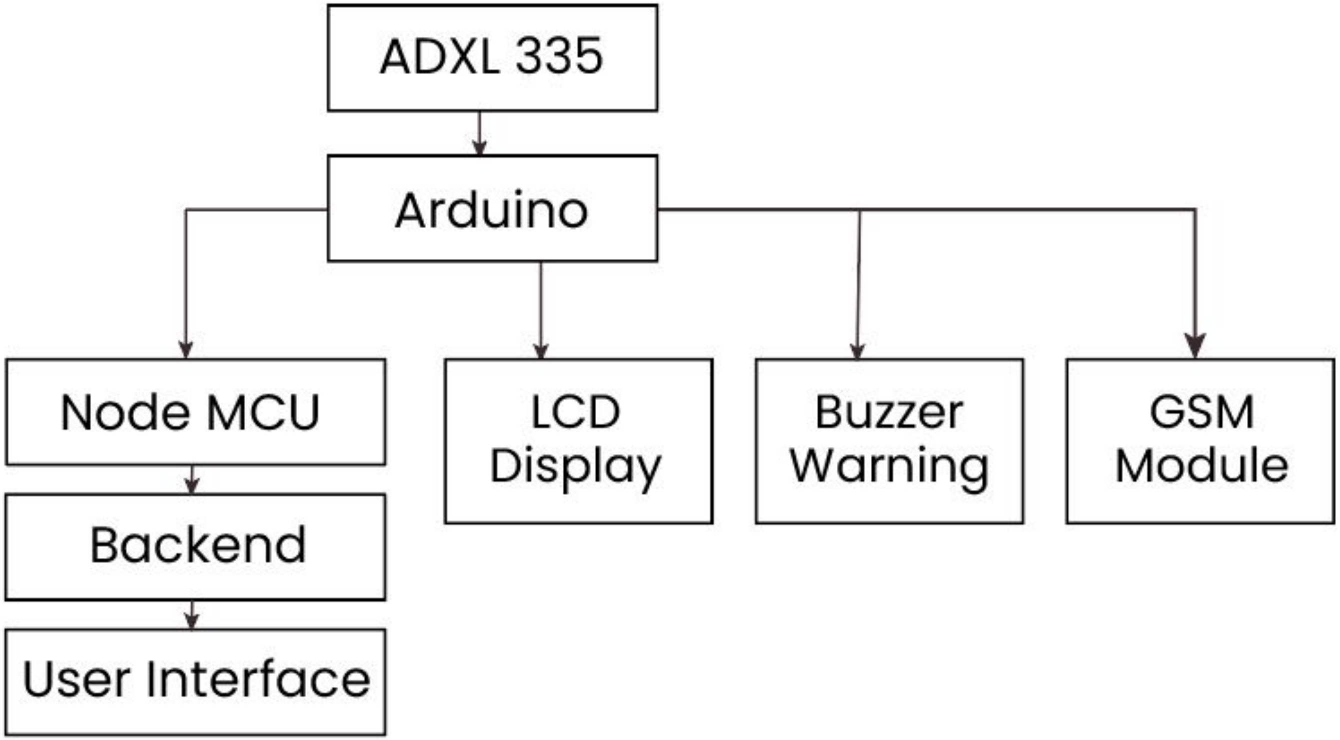
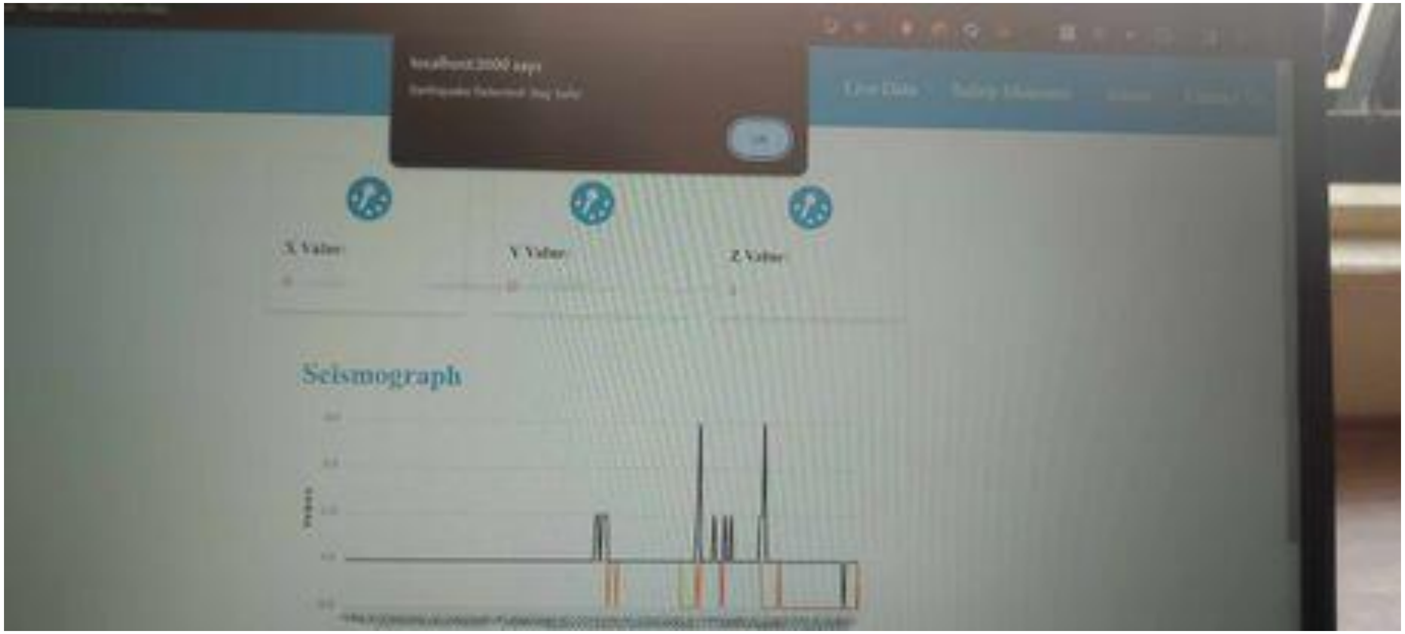


Figure 3: System Architecture

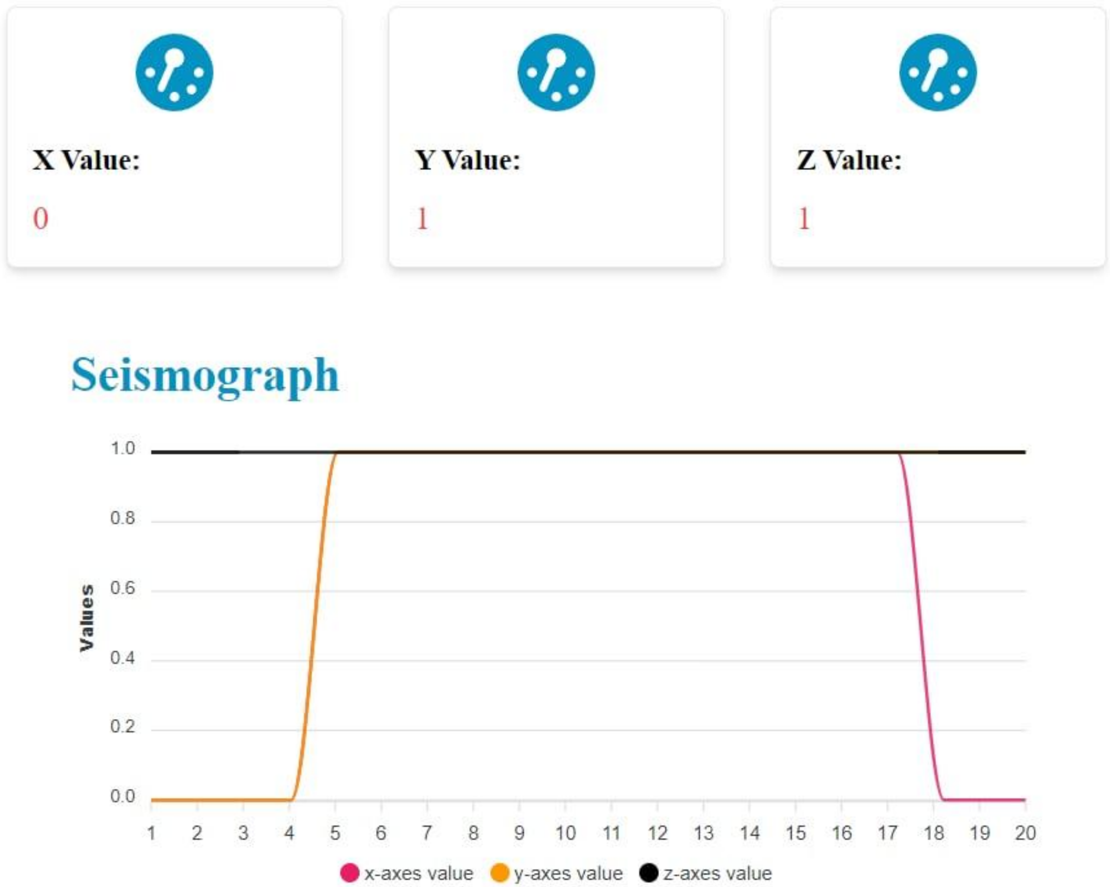
Results

User interface of our software



Results

User interface of our software

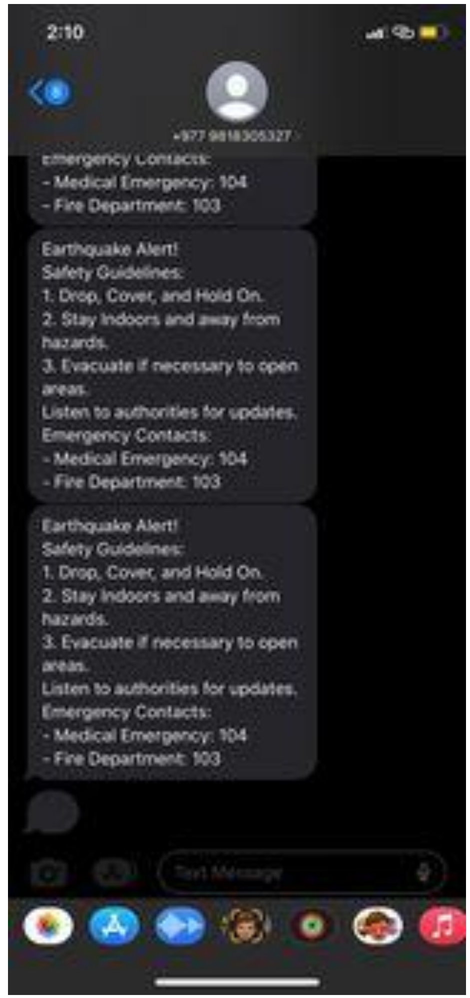


Results

LCD display result

Results

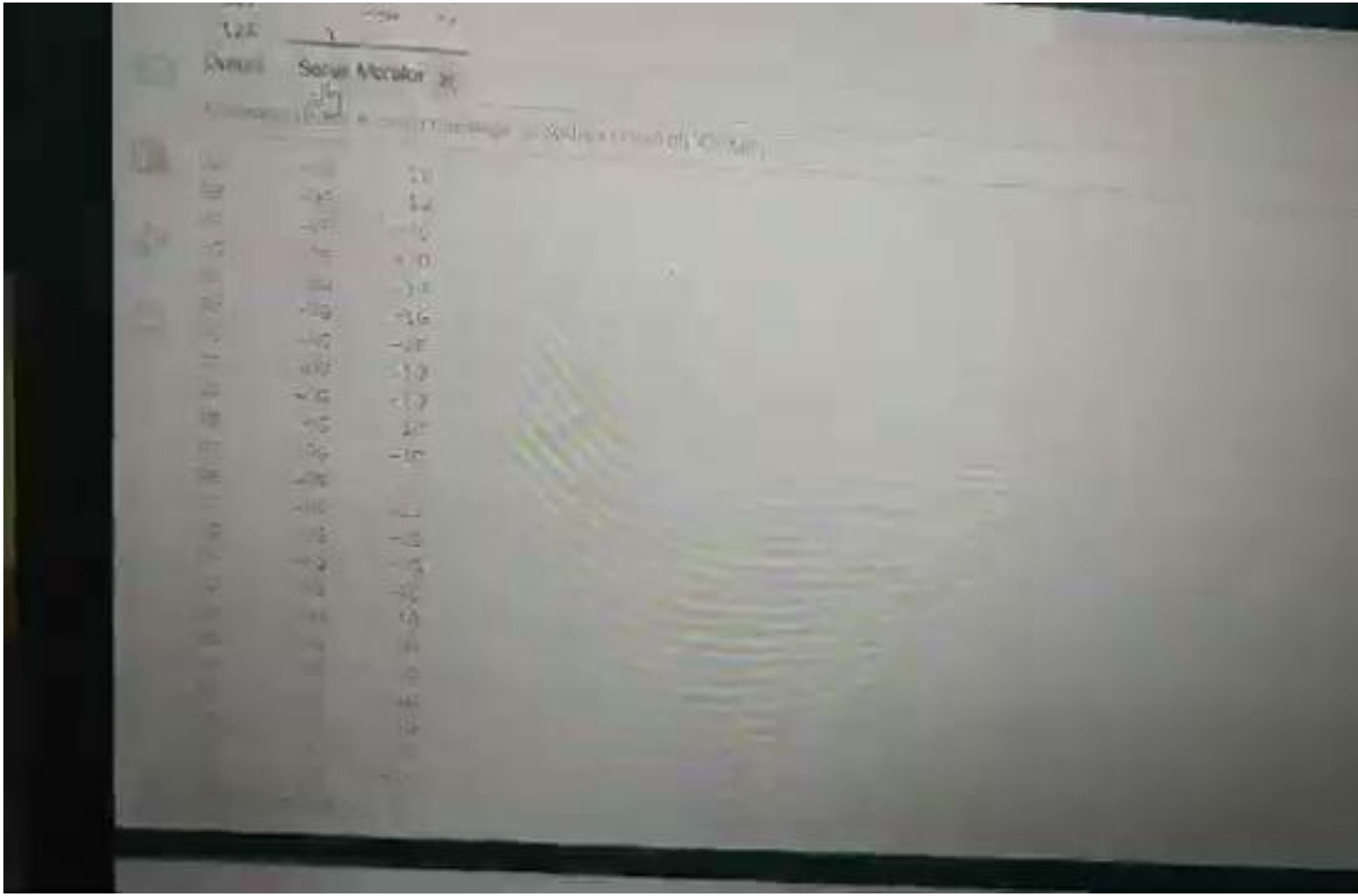
Alert message through GSM module



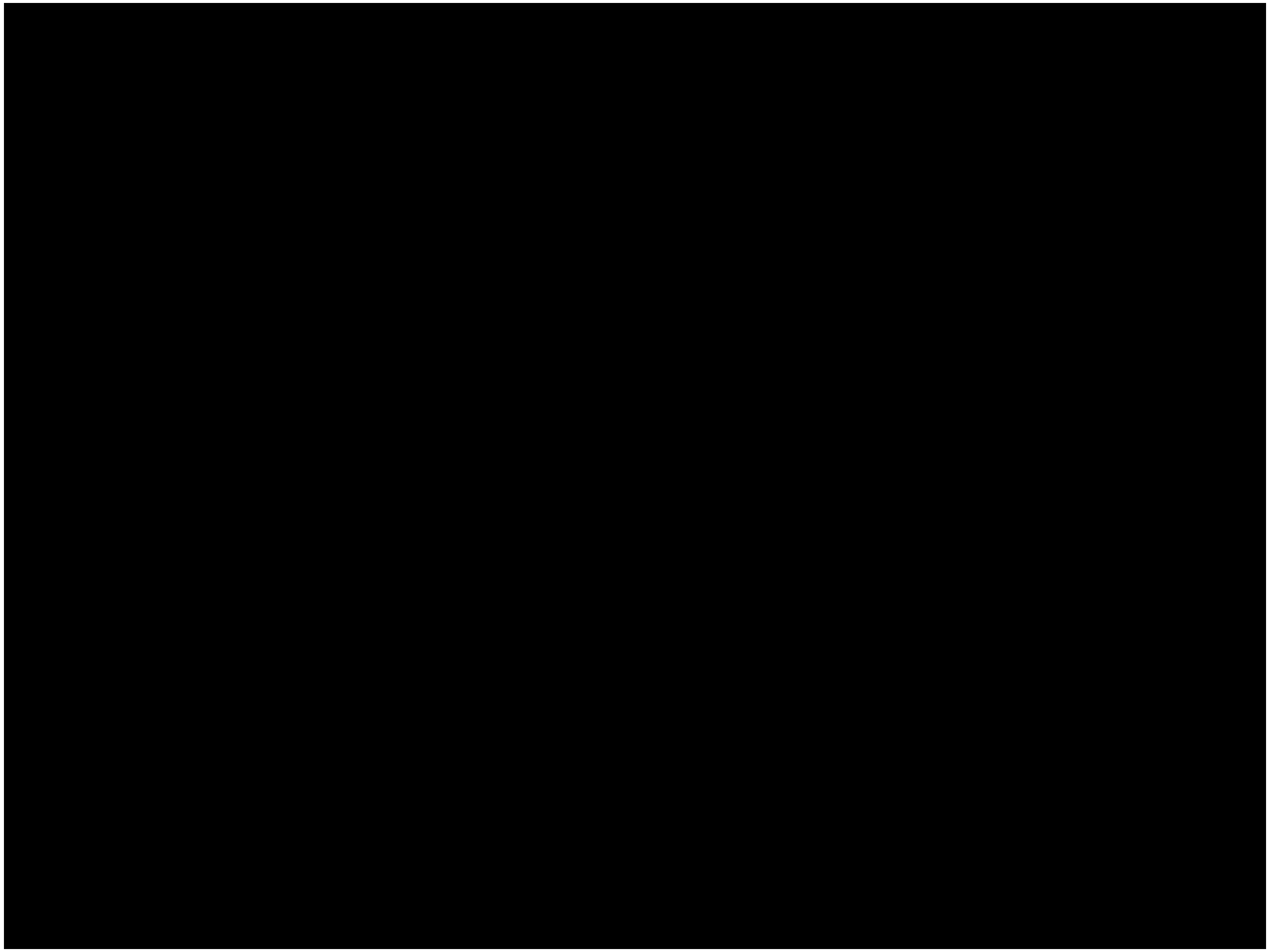
Future Enhancements

- Integrate machine learning algorithms for enhanced data analysis and predictive capabilities.
- Implement cloud-based data storage for simplified access and analysis.
- Collaborate with research institutions for valuable insights and advancements.
- Develop algorithms to provide precise date, time, and magnitude of earthquakes for effective response.

Results



Results



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[4] Burak Ozbey, Ozgur Kurc, Hilmi Volkan Demir, Vakur B. Erturk, and Ayhan Altintas (August 2017) “Wireless Monitoring of a Structural Beam for Post-Earthquake Damage Assessment”

[5] T. Nagaosa, Daichi, T. Uga, “An emergency earthquake warning system using Mobile Terminals with a built-in accelerometer, 12th International conference on ITS Telecommunication.”

THANK YOU