JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Detection of Earthquakes and Tsunami through GSM Network

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***Abstract*— In a dangerous location or while sleeping helplessly, earthquakes and tsunamis claim thousands of lives every year. Here is a seismic alert system based on GSM that could provide warnings before an earthquake and tsunami occur. Tsunamis and earthquakes happen suddenly. If residents of the earthquake- or tsunami-prone area are already equipped to endure the hit, the following damage can be reduced and lives can be saved. This calls for a warning before the earthquake and tsunami cause significant ground motion. This technique doesn't look for the earthquake's epicentre or fault line. It merely keeps track of earth vibrations and sends out a warning signal when the level of vibrations exceeds a certain level.**

Keywords: GSM, Accelerometer, Interface unit, Application server, Network or SMS server.

I. Introduction

An earthquake can happen at any time. This causes hundreds of individuals to pass away every year. By warning people of the possibility of natural disasters, such as earthquakes, tsunamis, etc., the extent of damage can be reduced. We employ cutting-edge technologies like GSM (Global System for Mobile communication technology) for this aim.

Fig 1: Tsunami hitting the city area

West of Aceh in Sumatra, Indonesia, a 9.0 on the Richter scale earthquake struck on December 26, 2004. The epicentre was around 680 kilometres northwest of Kuala Lumpur and 590 kilometres west of Penang, at latitude 3.1 degrees north and longitude 95.5 degrees east. This earthquake caused a gigantic and deadly tsunami that spread over the whole Indian Ocean, striking the shores of several nations in the area with strong "tidal" waves. Thousands of people were killed by this huge tsunami in numerous nations surrounding the Indian Ocean.

II. NEED FOR EARLY WARNING SYSTEM

Because no country bordering the Indian Ocean had any expertise or capacity in the issuance of tsunami warnings, the tragedy occurred. The Government won't be able to effectively alert the people in the case of another tsunami produced in the Indian Ocean if there is no adequate tsunami warning system in place.

Maintaining a year-round, round-the-clock, real-time continuous monitoring system for earthquake and tsunami activity. Information, advice, notices, early warnings, and warnings are given on the possibility of earthquakes and tsunamis, which pose a threat to security and safety.

The system will be a crucial component of the planned Indian Ocean Tsunami Warning System, which is particularly worried about the country's inability to issue tsunami early warnings and conduct tsunami watches. upholding the specifications' integrity.

III. LITERATURE SURVEY

Using sensors to measure vibration and ultrasonic sensors to measure distance, data will be transmitted remotely via the SIM900A GSM Module after some variable is detected. This will aid in the detection of tsunamis, and when the vibration values produce a significant variation, a signal will be sent to the GSM and a real time graph of the earthquake will be plotted too.

There are numerous initiatives for the separate hazard detection, but none of them have a model for the simultaneous earthquake and tsunami detection.

Table 1: Comparison Table on previous models

Reference No.	Year of Publication	Drawbacks	Merits
1	2019	Had issue of false alarms	The project was feasible and easily made.
2	2018	Prone to wrong readings and alert	Detection was done in all three axes x, y and z.
3	2018	Beyond the <=319cm range sensor cannot detect the disaster.	The project was based on early indication of tsunami disaster.
4	2011	Actual prototype was not widely successful in detection	GSM module was used in conversating the information as an alert.

IV. WORKING

This technology merely tracks earth vibrations and sends out a warning signal when they reach a certain threshold. Since earthquakes with a magnitude below 5.5 hardly ever have an impact on buildings, 5.5 is typically the threshold. There are three different types of earth quake waves: 1. Primary waves. 2. Subsequent waves. Surface waves 3. 1. Primary waves (p): Of the three, these waves move the fastest. These move at a speed of 8 km/s.

Similar to sound waves, these are compression in nature. They cause the materials to be compressed and expanded in the direction of movement. 2. Secondary wave(s): These waves have a 4 km/s speed. These cause the earth to move up and down perpendicular to their motion. These lead to the construction of buildings, particularly high-rise structures. Example: On January 26, 2001, Ahmadabad, which is located 370 kilometres from Bhuj, was attacked 80 seconds later. The The national seismological network, which issues the first level alert on the potential for a tsunami, will also be a crucial component of the national earthquake and tsunami early warning system at the National Centre as well as the Regional Centre. The main objective of this sub-system is to supply the Tsunami Early Warning Centre with more broadband, high dynamic range seismic waveform data so that the location and magnitude of the earthquake could be calculated more quickly and accurately. This will ensure that an effective system can be implemented in the area. Additional seismic network data is used to either support the continuation of the warning or its cancellation after the initial tsunami warning has been issued.

An SMS sent from a mobile device first travel to the SMS server before reaching the handset of the intended recipient. The application server (AS) should have records for all source phones. The AS determines if it is a P or S wave as soon as it gets an alarm message from a specific source handset or transmitter. P wave is sent out by an epicentre initially, followed by S wave a short time afterwards. The SMS server can deliver 40 messages per second, therefore notifying the predefined destinations can happen in as little as one second.

1. *Study of Earthquake and Tsunami disasters; causes and preventions Induced*

   Results indicate that our GSM-based technology can provide an accurate and dependable solution in the case of a disaster and can stop the damage they inflict.

2. *Android Application which can alert people*

   Our disaster alert system must be a way to assist and provide the public with the required instructions that would save many lives.

3. *Prevention System Equipped with accelerometer*

In order to provide information as soon as possible using prototypes made based on early indications of tsunami disasters and similarly for earthquake detection in earthquake-prone areas, the prototype made it is expected to reduce the death of coastal populations due to a sudden tsunami and no sign of any.

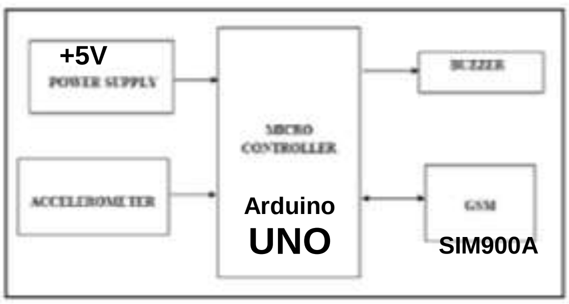


Fig 2: Circuit Diagram

V. OVERVIEW FOR TSUNAMI DETECTION SYSTEM

In order to offer real-time monitoring, alerts of seismic and tsunami activity, and prompt distribution of earthquake/tsunami warning, advisory, and information, the tsunami warning system will contain multiple components made up of several sub-systems. The following Sub Systems are included in this Component:
a. The seismic network sub-system, which keeps track of earthquakes and establishes their position and magnitude.
b. A portion of the deep ocean buoy network for tracking far-off tsunamis.
c. Wave activities reaching the beaches are measured and tracked by the tide gauge network sub-system.
The National Tsunami Warning Centre receives real-time images of the state of the ocean from strategically placed cameras through the coastal camera network sub-system.
e. Connection to IOTWS and additional tsunami warning facilities.

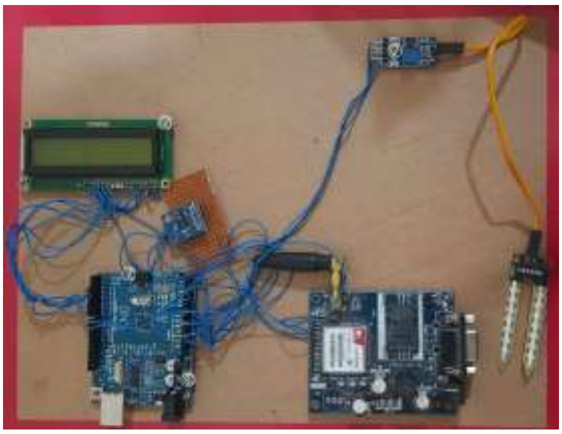
Accelerometers placed at far-flung locations across the country can detect earthquakes using the real-time digital seismic network. A three-component weak motion seismometer and a three-component strong motion accelerometer are put in each remote seismological station. One field station in the network uses a digital leased line to transmit data in real time, and the other eleven field stations use VSAT telemetry and a 128-kbps digital leased line to transmit data from the service provider's satellite gateway to the network's central processing hub for processing, analysis, and dissemination.

VI. MAIN BENEFICIARIES

1. Audio alarms can be installed to alert people.
2. Trains could be stopped.
3. Fire stations and hospital operation rooms can be alerted.
4. Emergency generators can be started.

VII. CONCLUSION

This earthquake warning system detects seismic waves and sends these precise magnitude values via to a central location. GSM cell phone network, which employs computer-based decision-making to send alert signals to the designated receivers located at various towns and cities for usage by the general people and the government. The system is straightforward and is adaptable to the nation's resources. To optimise the system and lower the likelihood of a false alert, thorough simulation, feasibility research, and experimentation are needed.



VIII. RESULT

As a result, this technique can benefit those who reside in coastal areas in earthquake-prone regions. By adopting this approach, early safety precautions and steps can be done. The technology generates results that are accurate and quick.
The results of our project simulation are shown here. This simulation will aid in the early identification of earthquakes and tsunamis and assist people in leaving the area before any personal safety or property risks arise.

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