International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

Web development on Earth-Quake Measurement in Seismic Scale

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Abstract: ***Seismometer is an instrument that generates seismic wave signals and accurately reflect the movement of the ground. With the development of science and technology, especially when the introduction of electronic feedback technology and the development of digital seismic, the development direction of seismometer was high sensitivity, wide band, anti-interference and low power consumption. Looking forward to the new development direction of seismometer, the research development and application prospect of seismometer are widening. In this paper, the complexity faced in the seismic wave is introduced. The seismometer (newton-meter) calculated by the seismometer instrument during earth-quake has complexity in it due to large amount of magnitude therefore converting it into logarithmic moment (magnitude) becomes ease in data representation. Conversion of given seismic-moment (newton-meter) value to logarithmic magnitude should be performed by using simple logarithmic calculation and also conversion of given logarithmic magnitude value to a logical Seismic - moment value should be performed vice versa. The data visualization is enhanced easily since data of infinite value is converted into measurable finite value .Therefore convertion eases analyzing data during underground nuclear weapon test, occurance of natural tremors etc.***

Key Words: ***Seismometer, anti-interference, Logarithmic Moment, Newton-Meter, anti-interference, logical Seismic – moment.***

I. INTRODUCTION

A seismometer detects, amplifies, records tiny ground motion as well as earthquakes. Therefore it is the ground-motion detector of the seismograph system. Ancient seismometer have a spring and inertial mass, were the assembled seismometer amplifies slightest movement of the land. Therefore the developed web application provides the magnitude (log moment) for given amplitude value measured in the rotating drum and performs data transformation with respect to the magnitude dataset present in the database.The seismic-moment (newton-meter) calculated by the seismometer instrument during earth-quake has complexity in it due to large amount of magnitude therefore converting it into logarithmic moment (Magnitude) becomes ease in data representation. Conversion of given seismic moment (newton-meter) value to logarithmic magnitude is performed by using simple logarithmic calculation and also conversion of given logarithmic magnitude value to a logical seismic - moment value is performed vice versa. The graphical representation is done for the given magnitude dataset.

Most modern instruments are actually completely computerized, and work by sensing how hard they have to work to make the mass move with the rest of the instrument. This record of the force necessary to make the mass move is stored digitally in a computer connected to the seismometer, and sent via phone lines or the Internet to a processing center, where seismologists use computers to look at the records and play with the earthquakes. These days, most seismic data processing never actually involves paper records. The scope of the project is to decrease the hands on calculation work to convert magnitude value from seismic moment value and to depict a pictorial representation of the magnitude dataset, which may be used for further reports.

II.A.WORKING OF THE SEISMOMETER

Seismometers are very sensitive to oscillations or vibrations. At ancient times a simplest technique was used to represent the ground oscillation or vibration signal occurring by attaching a pen or any writing instrument to the pendulum. The pen or anything contacts the paper roll wound around a rotating drum. As technology developed, the field of seismology simultaneously developed therefore digitizers came into the play. Later seismometer was developed such that, they have signal conditioning circuit and eddy current sensor (core). Seismic wave measured is converted to electric signals using sensor, then connects the signal conditioning circuit through special purpose connection circuit. Here the signal is digitalized, amplified and filtered. Later using the help of software technology the digitally manipulated signals are formulated, stored and shown for future work.

II.B.SIMPLE PENDULUM AND INVERTED PENDULUM

At early seismometers were developed based on simple pendulum architecture were the moving mass is suspended from the frame vertically.

Manuscript published on November 30, 2019.
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Later to strengthen sensitivity, the above type of device was upended, were the evolution of inverted pendulum was started. In this type, the mass center of the pendulum is above to the pivot point. As comparing it with the first design, it is more unstable were least oscillation or vibration felt in the ground may change it's equilibrium state and oscillates left and right to plot seismograph.

III.PLOTTING A SEISMOGRAM

The seismogram is plotted or provided by the seismometer, which is plotted by the pendulum by changing it's position or oscillation due to slight change ground movement. Earlier, the first seismometer was attached with a basic metal needle which is connected along with a mobile mass such that plots a mark of moving path . Later, ink pen was replaced in the place of metal needle that records the movement in a roll paper, i.e attached in the rotating drum. Nowadays, in the current era, the calculated seismic waves are digitized and stored, such that software technologies visualize them more responsively. This kind of seismometer was the first flown to the moon in Apollo's mission in early 1970's. The sensors attached in the seismometer will be able to perform the below operations efficiently (i) Any change in mass with respect to "zero" equilibrium (ii) velocity of the mass (iii) change in velocity over time.

IV.ITERATIVE DECIMAL POWER CALCULATION METHOD

Step 1 : Assuming $N=X^n$ (x is the base value and n is the exponent value).
Step 2 : Making Ln() on both sides, Therefore, Ln(N)=n*Ln(x).
Step 3 : Making exponential on both sides becomes $N=e^{(n*Ln(x))}$ (Since exponents and Ln are inverse function each cancel out at RHS).
Where ,

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

$$\ln x = 2\left[\frac{x-1}{x+1} + \frac{1}{3}\left[\frac{x-1}{x+1}\right]^3 + \frac{1}{5}\left[\frac{x-1}{x+1}\right]^5 + \ldots\right]$$

Magnitude value (logmoment) : ln x / 2.303
Amplitude value (seismic moment): 10^x

V.A.USER LOGIN/REGISTER FLOW

If the user registers for the first time store the username and hashed password in the server. After storing the credentials acknowledge the user. If the user tries to login get the username and password from the user and send the hashed password and username to the server. Check for the validity of the credentials in the server and if the user is authenticated give an auth token to the user for further requests.

V.B.USER INTERACTION AFTER SUCCESSFUL LOGIN

After the login is successful the user is allowed to type the name of the place, distance from the epic-center to the seismometer measured place, seismic scale (or) log moment, Which will automatically converts to its own needed value and stored in the database.

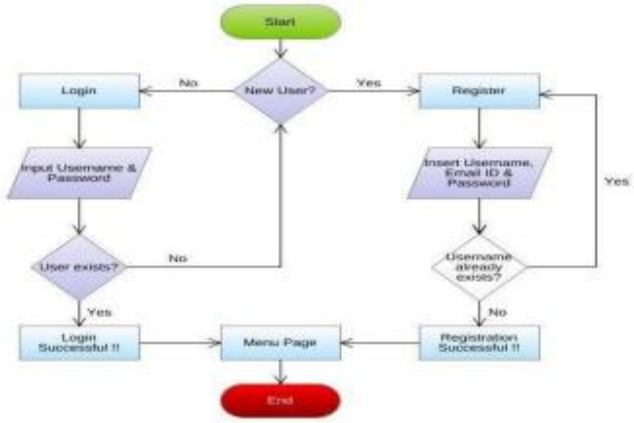
USER INTERACTION

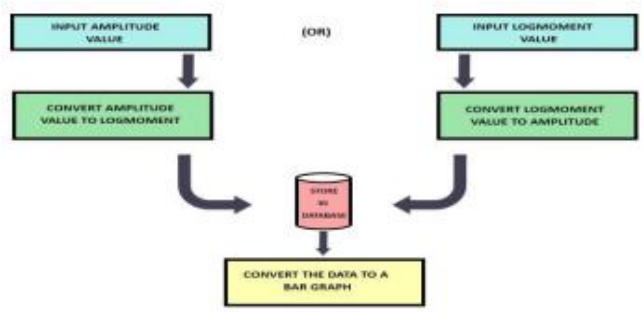
VI. A.RESULT AND DISCUSSION

The webpage was tested with many real world example values of amplitude and converted it into Magnitude (Log moment) as shown in the below table.

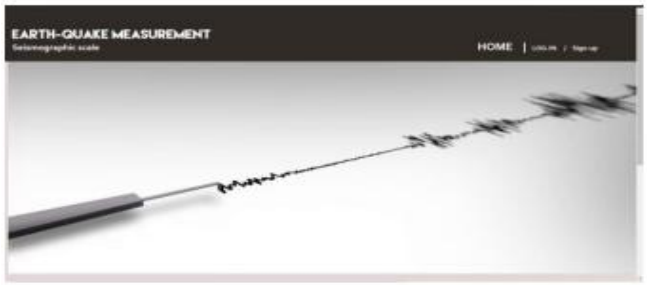
Table 1: Sample input test cases

PLACE	DISTANCE FROM EPIC CENTER	AMPLITUDE	LOGMOMENT
Megalaya	19	3981.07	3.6
Palgar	30	316.228	2.5
India-Myanmar	24	5118.7	4.7
Guwahati	10	794328	5.9
Andaman and Nicobar	43	100000	5
Arunachal Pradesh	50	794328	5.9
Coos Bay	296	1995260	6.3





VI.B.OUTPUT/SCREENSHOTS



1. Login Page
2. Sample Database Output
3. Logarithmic Moment Value
4. Graphical Representation

V. CONCLUSION

In this paper, seismometer is briefly introduced which place an important role in the earthquake or ground motion monitoring. The Implementation of this earth-quack measurement web page made the conversion of seismic moment to magnitude value. The conversion of seismic value to the magnitude value is achieved automatically without any manual interpretation. Database maintain impact place, distance from the Epic–center, amplitude and magnitude. The log moment values are represented for various places and represented in the bar graph.

REFERENCES

1. J. Friedman, T. Hastie, and R. Tibshirani, “The elements of statistical learning” vol. 1, New York, NY, USA:: Springer series in statistics, 2001.
2. Southern Califoria Seismic Network, SCEDC primary repository for data recorded or processed by the SCSN. http://scedc.caltech.edu/about/dataindex.html, 2013
3. F. Azadeh, and G. M. Atkinson, “Aftershock statistics for earthquakes in the St. Lawrence Valley.” Seismol. Res. Lett. vol. 85, pp. 1125–1136, 2014.
4. http://pubs.usgs.gov/gip/earthq1/measure.html
5. http://earthquake.usgs.gov/learn/kids/eqscience.php
6. http://pubs.usgs.gov/gip/earthq4/severitygip.html
7. http://earthquake.usgs.gov/learn/glossary/?term=magnitude
8. http://www.saarcsadkn.org/about_earthquake.aspx
9. http://www.geo.mtu.edu/UPSeis/intensity.html

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