

IoT Based Earthquake Detection By ThingSpeak

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Abstract— Earthquake early-warning systems detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking. The Alert system that has been proposed for all over the world would use a network of digital seismometers deployed around the state to give populated areas up to a minute of advance warning (depending on the location of the epicentre). The alerts would allow businesses, residents and public agencies time to get ready. The purpose of the study focuses on the sensor data to decide if an earthquake is occurring. Finally experimental results are provided showing that the system will support the expected performance with the sensor data. A possible extension of the approach could be implementing one wireless sensor networks using thingspeak for data acquisition.

Key words: ThingSpeak, BOLT-IoT Platform, Sensor, Microcontroller, Rectifier

I. INTRODUCTION

When a natural disaster, such as a big earthquake, happens, we should first grasp the range and sinuousness of the damaged areas for supporting the rescue activities. For collecting the information around the damaged areas widely and rapidly, the aerial images are useful. In our previous study [1], we have proposed the method of detecting the damaged areas before the earthquake and after the earthquake. In the method, two images are registered manually, and hence, it is troublesome for detecting the damaged areas taken by various locations. In many methods of detecting the damaged areas are not automatically registered. In this paper, we propose a new method of automatic detection of the damaged areas. The damaged areas are detected automatically and displayed graphically on thingspeak webpage by our proposed method. The combining of the sensors accelerometers, gyroscopes, GPS, etc. and the different connectivity options allows to have well-equipped IoT devices on our hands and, through these, automatically monitor our movements, locations, and workouts throughout the day; and beyond that, it can be the key to the solution of problems in other areas as transportation, medicine, weather, social, or the seismology, that is the field our research focuses; and involve us in the new topic of smart cities. While it is true that the quality of Micro-Electro-Mechanical Systems (MEMS) sensors, as well as the ones embedded into SPs, is lower than specific seismic devices, it is also important to consider that with the data collection from a large number of SPs, known as mobile crowd-sensing, it is possible to obtain a huge low cost network that uses individual sensing SPs capabilities. Although an earthquake is totally unpredictable, this research presents a real-time and economic countermeasure to this natural hazard. Through opportunistic applications and online services into SPs it is possible to monitor a whole area, learn their physical characteristics, and most important,

detect seismic movements to raise early warnings in order to provide extra time for making better decisions. Just to mention, the seismic activity is increasing, and consequently the risk that it occurs also is of interest; so that in April 2014 there was a world record number of large earthquakes greater than 6.5.

II. RELATED WORK

- 1) Da-YiChen , Yih-MinWu ,Tai-LinChin Empirical evolutionary magnitude estimation for early warning of earthquakes The tremor early cautioning framework is hard to give reliable size gauge in the beginning time of a quake event in light of the fact that exclusive couple of stations are activated and couple of seismic signs are recorded. One of the achievable techniques to quantify the measure of seismic tremors is to extricate adequacy parameters utilizing the underlying part of the recorded waveforms after P-wave landing. Notwithstanding, for an extensive greatness tremor, an opportunity to finish the entire cracks came about because of the comparing deficiency might be long. The greatness estimations may not be effectively anticipated by the underlying part of the seismograms. To gauge the extent of a substantial seismic tremor continuously, the adequacy parameters ought to be refreshed with progressing waveforms as opposed to embracing sufficiency substance in a predefined settled length time window, since it might think little of size for vast size occasions.
- 2) A.M.ZambranoI,PerezC,PalauM,Esteve Technologies of Internet of Things applied to a Earthquake Early Warning SystemWeb of Things (IoT), more than brilliant homes and associated apparatuses, is to achieve physical learning continuously and remotely; and exploiting the cell phone's expanding dispersion, it is conceivable utilizing its inserted sensors to screen the earth, whenever and anyplace; this could be the answer for some group issues and additionally characteristic risks. This paper concentrates on the answer for a stand-out amongst the most dangerous characteristic perils, tremors; taking seismic information of Ecuador, a nation with a normal of 6 quakes for each day in 2013. Advancements of IoT like Sensor Web Enablement Framework and Message Queue Telemetry Transport give the advantage of accomplishing an Early Warning System equipped for suspecting up to 12 seconds the most extreme seismic crest in the epicenter zone through cell phones. The framework is upheld by a remote sensor system and its primary parts, prerequisites and plan choices are portrayed. It considers time and spatial examinations, not present in some other work, making it more exact and adjustable, and adjusting it to the highlights of the topographical zone and assets. A preparatory assessment of the arrangement was led to decide its qualities and

- shortcomings as far as reaction time. The got comes about demonstrate that the vitality utilization is as pertinent for end-clients as their own security.
- 3) Libo Hana Zhigang ,Peng .b Christopher W.Johnsonc Fred Shallow micro earthquakes near Chongqing, China triggered by the Rayleigh waves of the 2015 M7.8 Gorkha, Nepal earthquake We exhibit an instance of remotely activated seismicity in Southwest China by the 2015/04/25 M7.8 Gorham, Nepal quake. A neighbourhood greatness ML3.8 occasion happened close to the Qijiang locale south of Chongqing city around 12 min after the Gorkha main shock. Inside 30 km of this ML3.8 occasion there are 62 quakes since 2009 and just 7 ML>3 occasions, which compares to a probability of 0.3% for a ML>3 on any given day by an arbitrary possibility. This perception persuades us to examine the connection between the ML3.8 occasion and the Gorkha main shock. The ML3.8 occasion was recorded in the China Earthquake National Centre index and happened at shallow profundity. By analysing high-recurrence waveforms, we distinguish a littler neighbourhood occasion is before the ML3.8 occasion. The two occasions happened amid the initial two cycles of the Rayleigh waves from the Gorkha main shock. We perform seismic occasion discovery in light of envelope capacity and waveform coordinating by utilizing the two occasions as layouts. The two examinations found a factually huge rate change amid the mains hock, recommending that they were to be sure progressively activated by the Rayleigh waves. The two occasions happened amid the pinnacle typical and dilatational push changes, steady with perceptions of dynamic activating in other geothermal/volcanic districts.
 - 4) Gopal Sharma, P.K. Champati ray, S. Mohanty, Suresh Kannaujiya Ionospheric TEC modelling for earthquakes precursors from GNSS data in introduce ponder, we gauged the Total Electron Content variety in the ionosphere from Global Navigation Satellite System information which may have been incited by seismic tremors in the Himalayan area. The outcomes were broke down with other instigating factors geomagnetic storm and sunlight based flare influencing tec keeping in mind the end goal to limitation the causative factor. The examination has been performed to comprehend a connection between ionosphere electron substance and seismic tremors events with extraordinary accentuation on Himalayan locale and gives data on spatio-fleeting variety from perception stations versus conspicuous quakes of the area. The outcomes demonstrate that the ground based perceptions demonstrate the deviation in vertical aggregate electron content in ionosphere few days preceding the seismic occasion as obvious from our two consistently working reference stations and additionally from server farm. Ionospheric bother has likewise been seen if there should be an occurrence of low greatness seismic tremors mw 4.9 in show ponder at whatever point recording station lies near the epicenter. Detective variety is found to increment as the epicenter separations diminishes. If there should arise an occurrence of Mw 7.8, 2015 Nepal seismic tremor the TEC variety is found to increment by 15– 20 TEC unit recorded at station isolated by 60 km separated. This may give us the road to epicenter identification as TEC fixation was found to increment as we draw nearer to the epicenter. Sleuth varieties have been seen amid a time of 0– 8 days before 4 seismic tremors
 - 5) Zijun Wang, Boming Zha Automatic event detection and picking of P, S seismic phases for earthquake early warning and application for the 2008 Wenchuan earthquake. The arrangement of high-accuracy blend calculations to identify and pick seismic stages for the tremor early cautioning. In the first place by the polarization examination of the three-segment seismograms, we created two channels to isolate P and S waves for each record through a sliding time window. At that point in view of the transient normal/long haul normal trademark work on the enraptured follows, an enhancement coefficient, regarding δ , was acquainted with be duplicated by the first proportion to delicately mirror the progressions of signs' sufficiency and recurrence, where a superior discovery of the stage landing was accomplished. Next as per the preparatory location, we utilized the Akaike data criteria work joined with the higher request insights to refine the flag and bolt on the entry time with a higher level of precision. We tried our procedures to the principle stun and post-quake tremors of the Ms 8.0 Wenham seismic tremor, where several three-segment quickening records over extents of Ms 5.0 were dealt with. In contrast with the examiner picks, the consequences of the proposed location calculations were appeared to perform well and can be connected for the early cautioning of looming quakes happened with different central systems, confused engendering procedure and site effects.
 - 6) Peter T. Dunn, Alicia Y.E. Ahn, Ann Bostrom, John E. Vidale was did the perceptions of earthquake early warnings on the U.S. West Coast Earthquake early cautioning frameworks can give seconds to minutes of lead time by alarming individuals that a tremor has begun and shaking is coming, empowering them to make defensive move. To inspect how tremor early notices may be gotten on the U.S. West drift, we led reviews of occupants in the west drift conditions of Washington, Oregon and California through Google pay wall block overviews directed in three adjusts between September 2014 and September 2015. A dominant part of inhabitants in all states have by and by encountered a tremor. The individuals who have encountered a seismic tremor see higher hazard and more noteworthy potential for viably decreasing that hazard with quake early cautioning. In spite of the fact that respondents feel that elected and neighbourhood government should pay for seismic tremor early cautioning, just about 66% report being willing to pay something for "an Earthquake Early Alert application on their cell phone or PC."
 - 7) Ellen M. Rathje, Kevin Franke Remote sensing for geotechnical earthquake reconnaissance. It describes recent efforts that incorporate remote sensing techniques and platforms into geotechnical earthquake reconnaissance to document damage patterns, collect three-dimensional geometries of failures, and measure

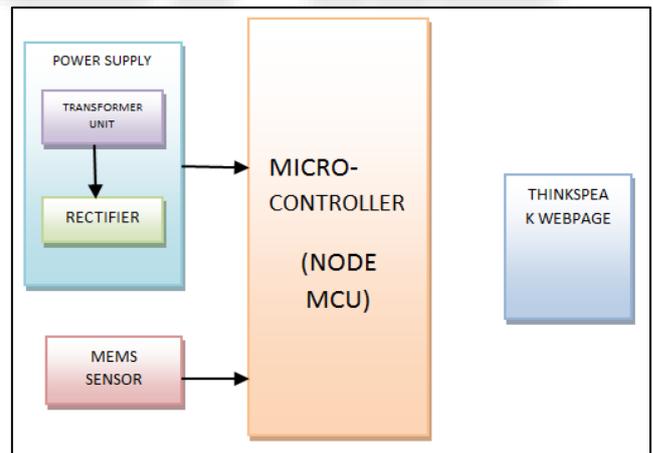
ground movements. The most-commonly used remote sensing techniques in geotechnical engineering satellite imagery and, as well as unmanned aerial vehicles, are introduced and recent case histories of the use of these techniques in reconnaissance efforts are provided. We think about forecasts of coseismic elevate and subsidence got from geophysical models of seismic tremors with various break modes. The spatial examples of assertion and rebels between demonstrate forecasts and quantitative recreations of coseismic. These examples demonstrate the potential for remote sensing to improve our understanding of geotechnical effects both at a regional scale and at a local level. The use of remote sensing to measure ground movements is particularly noteworthy and has the potential to provide data sets that will improve our ability to quantitatively predict the consequences of liquefaction and landslides. However, to realize this potential, investments must be made in collecting appropriate pre-earthquake data.

- 8) Katelyn Freeseman, Lev Khazanovich, Kyle Hoegh, Alireza Nojavand make research on non-destructive monitoring of subsurface damage progression in concrete columns damaged by earthquake loading The appraisal of the basic respectability of foundation after extraordinary occasions is a critical use of nondestructive innovation. Progressions in versatile wave-based strategies as of late have took into account beneficial and exact quantitative investigation which was beforehand inadequate. In this investigation, ultrasonic cluster estimations combined with a changed mark examination technique were actualized for harm discovery purposes. Full-scale testing of a fortified solid section subjected to mimicked seismic tremor stacking was tried utilizing ultrasound nondestructive testing at different phases of stacking. A mark investigation procedure was adjusted to make enhanced reproductions and was combined with a quantitative examination joining Pearson's connection coefficient. A full-scale RC column was subjected to simulated earthquake loading. Testing was supplemented using a shear wave ultrasound array system. Reflectivity reconstructions showed damage before it was visible at the surface. Quantitative characteristics were developed to assess damage progression. The proposed method is non-destructive and requires only one-sided access.
- 9) A.J.(Tom)van Loon , Malgorzata , Pisarska-Jamroży , Māris Nartišs make seismites resulting from high-frequency,high-magnitude earth quakes in Latvia caused by Late Glacial glacio-isostatic uplift Geographically to a great degree fast changes in elevation by cold bounce back of the Earth outside layer after withdraw of the Scandinavian Ice Sheet toward the finish of the last Weichsel Ian glaciation affected the paleogeography of northern Europe. The inspire of the Earth outside clearly was not continuous, but rather stun savvy, as the elevate was joined by visit, high-greatness quakes. This can be concluded from unequivocally distorted layers which are deciphered as seismites. Such seismites have been depicted from a few nations around the Baltic Sea, including Sweden, Germany and Poland. The two sections have not been dated precisely up till

now, but lithological correlations and geomorphological characteristics suggest that the sediments at the valmiera site cannot be older than 14.5 ka.

- 10) I.Valverde-Palacios, F.Vidal, I.Valverde-Espinosa, M. Martín-Morales simplifies empirical method for predicting earthquake-induced settlements and its application to a large area in Spain The majority of the regularly utilized existing exact strategies to anticipate quake initiated settlement in sandy soils require various cycles or the utilization of graphs, tables and outlines. When all is said in done, these strategies assess the one-dimensional settlement of dry sandy soil on level ground by utilizing a notable well-ordered methodology in view of Standard Penetration Test values, which is especially successful for handy applications. An audit of the cutting edge techniques demonstrates that seismic settlement in all cases increments as the layer thickness of sandy soils increments and adjusted SPT blow tally 60 diminishes. On account of that, we propose a novel straightforward approach to gauge S in light of the proportion for a reference seismic tremor size. This approach gives a device that can quickly get S in various locales and can be connected to expansive zones. Over the most recent fifty years, the number of inhabitants in the Metropolitan Area of Granada has multiplied. The measure of created arrive has expanded by roughly 4650 ha and the zones with the best populace and development are situated on sedimentary stores. The land underneath the urbanized regions of the MAG is situated on alluvial, collegial, sediment and dirt stores with various thicknesses of granular soils and fluctuating water table profundities.

III. SYSTEM ARCHITECTURE



REQUIREMENTS

| Platforms | Storage Space | Platform | Tools |
|------------|---------------|-----------|----------------------------|
| Windows OS | 30 GB | BOLT-IoT, | sensor, vibration detector |

IV. SYSTEM DESCRIPTION MICROCONTROLLER

It gets information from sensor and process on it. It compares the received data with the threshold level set and accordingly output is generated. The LPC131/32/34//38 microcontrollers are based on a 16/32-bit ARM7TDMI-S

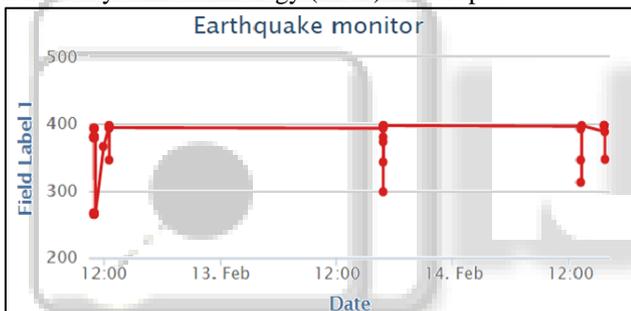
CPU with concurrent emulation and entrenched outline holdup, that unite the microcontroller with 32KB, 64KB, 128KB, 256KB and 512KB of entrenched.

V. THINGSPEAK WEBPAGE

Thing Speak is an open source “Internet of Things” application and API to store and retrieve data from things using HTTP over the Internet or via a Local Area Network. With ThingSpeak, you can create sensor logging applications, location tracking applications, and a social network of things with status updates. <https://github.com/iobridge/ThingSpeak> This repository is contains Python module that helps in talking to ThingSpeak API.

VI. MEMS SENSOR

Micro electromechanical systems (MEMS), also written as micro-electro mechanical, Micro Electro Mechanical or microelectronic a micro electro mechanical systems and the related micromechatronics) is the technology of microscopic devices, particularly those with moving parts. It merges at the nano-scale into nano electromechanical systems (NEMS) and nanotechnology. MEMS are also referred to as micromachines in Japan, or micro systems technology (MST) in Europe.



VII. CONCLUSION

The designed system was a just a proof of qualitative concept and was not tested on a large scale during actual earthquakes. The prototype did manage to detect simulated earthquake-like tremors with magnitudes of 4.0. Several improvements may be brought to this system. A 3 axis accelerometer can replace the FSR for detection in all planes independent of frequency. 2D Multi-gas mapping techniques with cascading module system over a wireless sensor network can be used to monitor the gas leaks at multiple points. 3. Pattern recognition algorithms based on positive decision logic may be integrated into this system. Nowadays, smartphone applications can answer questions as what, where, when, and how, about the device’s surroundings; and consequently, using different network links provide information about the smartphone’s environment, community problems or natural risks, as in this case, an earthquake. It is impossible to know where and when a seismic event can happen, thus it is known that an earthquake is unpredictable at the epicentre. So, the best way to mitigate damages in infrastructure, assets and even human lives, is the early detection, where a real-time

architecture and an efficient communication between actors becomes a requirement.

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