Patent Application

TITLE

System and method for Earthquake Alarm using wireless positioning by signal strength

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BACKGROUND

1. Earthquakes cause great damage to humanity. Earthquake waves are categorized into P-Waves (Primary Waves) and S-Waves (Secondary Waves), Love Wave (L-Wave) and R-Wave(Rayleigh waves). L-Wave and R-Waves are surface waves. P-Waves are faster than other type of waves and they contains lesser kinetic energy than S-Wave. In major earthquakes, there is a several seconds gap between P-Wave and S-Wave. Earthquakes may occur during day or night, these energetic jolts devastate the areas without any prior indication. High-power explosions may cause seismic jolts. Human beings should be able to be awake and alert during and after the quake happens. Especially if they happen during night time, while people are in deep sleep, it is difficult to wake up and perform an escape maneuver. People get petrified due to anxiety during initial stage of earthquake, though it can be a good opportunity to escape. For example, if an earthquake occur at morning 4 o'clock, during this time people are in deep sleep. The initial stage of earthquake could not wake up people as the waves contain low energy. Small shakes and jolts could not wake them. After earthquake people follow social media, news feeds, smartphone applications, government services or websites for earthquake updates more anxiously and inform nearby friends and family members. There is always a panic time that makes people not to go to their beds due to this phobia.

2. There are various technologies already existing to predict, alarm, spread early warnings about earthquakes/seismic activities. Current solutions for early warnings are inadequate and expensive. There are mounted single device solutions, which can alarm on earthquake vibrations but may result in false alarms due to human activity. Some solutions require internet, when earthquake happens there may not be internet available. Internet availability is may not be in all areas. Some solutions require more computing devices for analysis and sensor points, which makes them difficult and expensive to setup and configure. Some solutions require a special skill install and handle the device units.

3. Accordingly, it would be desirable need for a simple devices work like alarm immediate alert. The desirable system need to function without internet and power failures. An addition to that, a live monitoring of jolts can aid people after earthquake circumstances. We never know when an earthquake starts and how it ends. Better to be prepared.

SUMMARY

4. When an earthquake occur, one system that can alarm the users within a minimal seconds. One system and method to identify earthquake waves along with not react to false alarms due to human activities and likewise. One system, that can provide builtin website where users can change configurations, avial information during emergency situations, observe the jolts on live graphs and likewise. One system with two devices, wirelessly connected and fault tolerance is good enough to identify and produce accurate alarms during earthquakes and moderate seismic jolts.

BRIEF DESCRIPTION OF THE DRAWINGS

5. The subject matter describes about the system and method of the operation. The accompanying drawings, which are included to represent a further understanding of the disclosed subject matter. The diagrams incorporated in and depict a part of this specification. The drawings illustrate embodiments of the disclosed subject matter, and together with the detailed description help to teach the principles of the embodiments of the disclosed subject matter. No attempt is made to show clear structural details in more details that may be necessary for the foundational understanding of the disclosed subject matter and various ways in which they may be practiced.

6. Fig. 1A: shows of an exemplary earthquake alarm setup according to an embodiment of the disclosed subject matter.

7. Fig. 1B Illustrates the wireless network availability over distance from Primary Device (P-Device).

8. Fig 2: A method to generate recommendation for good enough position of Secondary Device (S-Device) and Primary Device (P-Device).

9. Fig 3 shows An exemplary Computer on Module (COM) board used for Primary Device and Secondary Device as described in the disclosed subject matter.

10. Fig 4A, 4B shows an architectural view representation of software components present in the Primary Device and Secondary Device.

11. Fig 5A, 5B, 5C shows method followed by Primary Device(P-Device) and Secondary Device (S-Device) to read and confirm earthquake wave detection.

12. Fig 6 shows a mockup website hosted in Primary Device(P-Device).

DETAILED DESCRIPTION

13. To address the above problems mentioned, the present disclosure comprises of system and methods. The described herein to provide an explanation about a pair of devices, and software, configurations which act as immediate first aid alarms for earthquakes and seismic jolts. The pair of devices may be identical.

14. When an earthquake or seismic jolt hits an area or land, earthquake waves are two propagate in the form of waves. The waves categorized into P-Wave and S-Wave. During P-Wave the land moves in horizontal and this is less severe. S-Wave comes after P-Wave which has a vertical and horizontal motion or randomly. To simulate the waves, we can take example of water waves on the pool of water, the waves moves the floating objects. If the earthquake happens during night time, then the P-Wave may not be identified by people during their sleep. After few seconds of P-Wave, S-Wave comes and devastates the land and surface, and many lives lost during the S-Wave.

15. If an immediate alarm during P-Wave weaksup the users and announce them to vacate or take certain actions could aid immediately. The language of the instructions may be depends on the user choice, country, region, or pre configured settings. For example, an serious announcement could wakes up the users, and within seconds they can come outside of their home. Especially during sleep, people are don’t pay much attention few small jolts for their walls and windows. They get surprised, and shocked by looking at the walls moving for the seismic jolts. This is a good opportunity to escape. The human emotions like surprise and shock leave them in a in active or frozen state. A quick immediate alarm which confirms the seismic waves can make people take actions according to the announcement, they look for shelter or go out of the buildings. After a severe earthquake, the witnessed people spend their time in panic and

helpless. A live monitoring solution could make them informed during and after the quake.

16. The embodiments of earthquake alarm as detailed in this paper functions as an alarm, announces users immediately after few seismic jolts, and provide instructions to escape. Announcements may be audio, visual, Users can access live visual view of current jolts on their mobiles, tablet or computers. Users can also access aiding material available offline. These materials may be videos, audios, images and text representation.

17. A detailed description of one or more implementations is provided in this paper along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such implementations, but the invention is not limited to any implementation. The scope of the invention is limited only by the claims and the invention encompasses numerous alternatives, modifications and equivalents. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of example and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

18. When an earthquake occur, the first few seconds are very crucial to escape. P-Wave travels faster than any other types of waves. P-Wave is less severe than the S-Wave which comes after several seconds which gives few seconds time for people to escape. The S-Wave is a high energy wave, which comes later point and devastates the areas. The P-Wave leaves a minor number of jolts. These waves produce jolts on the surface which are high energy shakes that move the earth's surface in all directions. We can observe this pattern on the water waves in a silent water pond. Different parts points in a single wave moves the surface in a same time. By positioning two distant points of a wave gives accurate wave confirmation. In a building, the two points could be two different walls that move or vibrate in the same time as the a wave received from earthquake. During regular time, there could be vibrations due to human activity, these vibrations can be eliminated by keeping keeping a second point on a non adjacent wall as a reference point. A comparative matching the of jolts readings can eliminate false alarms.

19. This subject matter describes about a pair of devices which can observe earth waves through the walls or surfaces of a premise in a building or a construction. Consumers may stick these two devices to their building walls, ceilings or grounds in a recommended distance.

20. Fig. 1A shows an illustration an of an alarm setup of wall mounted devices in an imaginary floor sketch of a premises. In this embodiment is a Primary Device (P-Device 1A.1) and Secondary Device (S-Device 1A.3). P-Device 1A.1 mounted on P-Wall 1A.2 of a building and S-Device 1A.3 mounted on S-Wall 1A.5. P-Wall 1A.2 and S-Wall 1A.5 are different walls and they are non adjacent walls.

21. Consumers can stick the P-Device 1A.1 and D-Device to two different walls. in two different rooms. When earthquake/seismic vibration happens, the devices observe the vibrations for the walls and register and compare. When earthquake/seismic vibration happens, both the devices in the same building receive the vibrations simultaneously.

22. The non-adjacent surfaces receive the earthquake shakes in the same time frame. When a seismic jolt hits, the P-Device 1A.1 and S-Device 1A.3 absorbs the kinetic energy from the wall and transform into a digital data. Users may mount the devices on two non-adjacent surfaces such as walls, ceilings or floors, or like a fixed surface. P-Device 1A.1 may act as

wireless router accepting network connections. S-Device 1A.3 connects to P-Device 1A.1 and shares information continuously through a live wireless connection. P-Device 1A.1 and S-Device 1A.3 may be an identical pair of hardware. P-Devie and S-Device 1A.3 maintain a live connection. The P-Device 1A.1 may host a live wireless service such as Wireless Hotspot 1.2 and S-Device 1A.3 connects to P-Devie through the Wireless local area network (WLAN).

23. Fig. 1B shows an illustration of P-Device 1A.1's wireless signal spread between P-Device 1A.1 and S-Device 1A.3. S-Device 1A.3 is positioned at Optimal yielding distance (OYD) 1B.8 from P-Device 1A.1. From point 1B.2, 1B.3 the signal strength is at a good enough value. Beyond 1B.5 wireless signal strength is weak and not adequate for live and fast data communication. From points 1B.1 to 1B.2 the signal strength is more than good enough, but produces more false alarms due to human activity.

24. Fig. 2 illustrates a method according to an embodiment of the disclosed subject matter. This figure illustrates a method of finding the P-Device 1A.1 and S-Device 1A.3 are at Optimal Yielding Distance (OYD) by using Wireless signal strength. OYD is the distance between devices that is good enough to get wireless signal strength for communication and accurate seismic wave readings. This method generates recommendations in step 2.8, and 2.13. distance between the devices can eliminate false anomaly detection from human activities. This technique helps to reduce the number of false sensor readings due to vibrations or jolts coming from human activity other than seismic activities. When earthquake P-Wave hits, the shock wave shakes all parts of the building, such that it each block vibrates simultaneously. The Wireless signal strength may be determined by executing instructions by the processor S-Device 1A.3.

25. In step 2.1 S-Device 1A.3 reads signal strength from Wireless adapter. The Wi-Fi Wireless Strength may be available in dBm. At 2.2 S-Device 1A.3 computes Space Proximity Factor (SPF) from Wi-Fi signal strength. At 2.5, the Max-Threshold check concludes to notify the user to position the devices far from each other, by connecting to different surface/walls of different rooms which are not-adjacent to each other in step 2.13.

26. At the decision point 2.3 the method decides on a Min-Threshold check to notify the user to plug in different surface/wall devices. The steps. 2.3. 2.5 are notifications that may be a visible light using LED in the P-Device 1A.1 and S-Device 1A.3 status panel 11.1. 2.5, 2.3 - Min and Max threshold values are been configured as constants in the program

27. In case of Max-Threshold < SPF < Min-Threshold the control goes back to 2.1 where the S-Device 1A.3 repeats the process. This complete check can take place in repeated loops inside S-Device 1A.3.

28. Fig. 3 Shows an illustration of a Computer on Modules (COM) board 3.1 and not meant to give more details than needed. Within this drawing, we can see different electronic components required to develop the system. COM board 3.1 is exemplary board which contains a computer embedded inside a single module. Both the devices (P-Device 1A.1, S-Device 1A.3) may be manufactured using the similar components. In P-Device 1A.1 and S-Device 1A.3 the functionality is defined and differentiated by the software and configurations installed inside the devices. With the preinstalled configurations, software and data user may plug and use the devices. P-Device 1A.1 and S-Device 1A.3 can be manufactured using inexpensive COM systems such as Raspberry Pi or likewise. COM board 3.1 come with built in Ethernet port 3.2, known as RJ-45 type which is commonly used for ethernet connectivity. Part 3.3 is an

electronic speaker, connected to COM board 3.1. External audio sources can also be connected using General Purpose Input Output Pins (GPIO) 3.13. The COM board 3.1 gets power from Micro USB 3.5. There may be a backup battery for uninterrupted availability. The COM board 3.1 has MicroSD Card slot. Memory Card (MicroSD Card 3.8) may be inserted. This stores all the long term memory. All software related data can be persisted in this memory card. Manufacturers may manufacture and distribute the P-Device 1A.1 and S-Device 1A.3 with preinstalled operating system, software, configurations needed for the system described in the disclosed subject matter. For example, manufacturer may choose Linux distribution and its corresponding firmwares. The Button panel 3.21 that contains buttons for user input and connected to GPIO 3.13. Info panel 3.34 is a simple sequence of LEDs that are used to show device related informations such as network communication, battery life, OYD validation and likewise information.

29. The Status panel 3.55 is a visual panel with LEDs with multiple colors representing the status of the anomaly received, network connection and likewise. Manufacturers may choose COM modules with external or inbuilt jolt sensors 3.89. Jolt sensors 3.89 are attached to GPIO 3.13. Sensors like accelerometer, gyrometer, optical sensors, laser sensors, CMOS sensors and likewise may be used as jolt sensors. Plurality of jolt sensors may be used. Each time when the P-Device 1A.1 and/or S-Device 1A.3 receives a jolt, the jolt sensors 3.89 receives the motion. Device‘s Processor records the readings from jolt sensors 3.89 into volatile and long term memories.

30. The COM board 3.1 may also equipped with inbuilt wireless (Wi-Fi, Bluetooth) IEEE 802.11u chip 3.144. This chip may be utilize as Wireless Hotspot router. To attain this, COM Processor 3.377 may execute instructions, such that Wireless 3.144 chip act as wireless router. The USB ports 3.233 may be used used for attaching, additional external wireless adapter. Optionally internet connection may also connected by ethernet cable to Ethernet port at 3.2. For this alarm system, the internet connectivity is optional. User may opt for more additional internet connectivity for add on features and system updates. On internet connection, P-Device 1A.1 can send alarm related data to external systems and services such as cloud, mobile, digital community networks and likewise. .

31. The COM board 3.1 may manufactured with combined CPU and Memory 3.377 into single chip embedded into the board. Memory is a Random Access Memory which a volatile memory. Stores and retrieves data much faster than long term memory (MicroSD Card 3.8).

32. Fig. 4A and Fig. 4B illustrates the software architectural view of P-Device 1A.1 and S-Device 1A.3. This representation is not limited to any frameworks, programming language, operating system and firmware.

33. Anomaly Background Server (AB-Server) 4A.1 process runs in P-Device 1A.1. Anomaly Detection Process (AD-Process) runs in S-Device 1A.3. AB-Server opens a TCP/IP port and accepts connections. AD-Process 4B.1 connects to AB-Server 4A.1 and maintains live connection, may use Socket connection, or WebSocket for live connections.

34. Local Sensor Monitoring Component (LSM-Component) 4.2 is a software module which collects data from sensors in a periodical manner. P-Device 1A.1 and S-Device 1A.3 both has In-Memory Cache (IM-Cache) 4.3. IM-Cache which stores run time data in the volatile memory, and provide access to Web Application Server 4A.8, AB-Server 4A.1. In P-Device 1A.1 it act as shared cache among multiple processes. Even in S-Device 1A.3, the IM-Cache 4.3 used for

storing data. IM-Cache is a executable software and runs as a separate process or embedded inside AB-Server 4A.1, AD-Process 4B.1. Every Jolt sensor 3.89 has its own monitoring component. On data collection, it sends to information to corresponding (AB-Server) or AD-Process which. Persistence 4A.5 represents long term storage for system data. Static files, configurations, database come under Persistence 4A.5. Persistence 4A.5 may be stored in MicroSD Card 3.8. Web Application server 4A.8 serves static and dynamic content through a TCP/IP port through HTTP or HTTPS protocol. Users can connect to the P-Device 1A.1's and access the web content as described in Fig. 6.

35. The Static files 4A.13 represent as images,helpline content, web pages. Dynamic Web Components 4A.21 may be HTTP supported Web Application programing interfaces (Web-API) and Data Access Objects. Collectively Web Application server serves both static files 4A.13 and dynamic components 4A.21 used for the website to show the live charts and graphs. In both the devices the Processors 3.377 stores continuous RPW in IM-Cache 4.3, which is present inside RAM/Volatile memory 3.377.

36. Fig 5A illustrates method runs inside P-Device 1A.1. The steps 5.1, 5.2 and 5.3 are common in both the devices. Processor 3.377 in each device executes instructions of LSM-Component 4.2 to read jolt sensors in 5.1 in a periodic manner independently. In step 5.2 each device computes Recent Peak Window (RPW) based on the sensor reading collected in step 5.1 and updates the IM-Cache 4.3.

37. Fig 5B illustrates method runs inside S-Device 1A.3. S-Device 1A.3 perform analysis on the collected RPW and if any anomaly suspected 5B.5, S-Device 1A.3 sends the RPW wirelessly 5B.8 to P-Device 1A.1 which is collected in step 5C.1.

38. Fig 5C shows the method followed by P-Device 1A.1 on the jolt information coming from the S-Device 1A.3 on step 5.B8. 5C.1 and checks the matching its own RPW (P-RPW) in step 5C.2. If the P-RPW and S-RPW matches approximately then the P-Device 1A.1 executes instructions for anomaly confirmation 5C.3 and send the confirmation report to S-Device 1A.3 in step 5C.8. The step 5C.3 instructions may include activation of visual and audible alarms and announcements, saving the reports to persistence and notifying user based on the configurations and as such. On receiving anomaly confirmation report, S-Device 1A.3 activates the alarms which is the similar. If the P-Device 1A.1 does't find the match between P-RPW and S-RPW in step 5C.2 then P-Device 1A.1 executes anomaly rejection instructions, which may be informing the user about false positive confirmation 5C.5 such as saving in persistence. During this time also P-Device 1A.1 may send the anomaly confirmation report to S-Device 1A.3 with false positive and S-Device 1A.3 acts similar to P-Device 1A.1.

39. Fig. 6 shows a mockup screenshot of P-Device 1A.1 hosted website. This site may have pages to show live information, configurations, wizards, news, maps, helpline material, maneuver materials and likewise content accessible through web browser. The users may access the website by connecting to WLAN and typing the url in the browsers applications 6.1 from their mobiles or computers. A live data from graph shown in 6.2. This could be just P-Device 1A.1 jolt readings. If any recent RPW from S-Device 1A.3 then that will shows up in this graph along with P-Device 1A.1 jolt line. A recent activity and P-RPW and S-RPW charted on the region 6.3 graphical representation of the recent jolts. An archive table 6.5 shows snapshots of past earthquake details in a chronological order. News and announcements panel 6.8 shows live news. Hosted site header 6.13 which may have navigation links to other pages included in

the web application.

CLAIMS

40. 1. An earthquake alarm system comprising of:

A. Two wirelessly connected devices

B. Both the devices have visual and audio sources

C. Both the device comprises of processor, memory

D. Plurality of different jolt sensors employed in each device

41. 2. A method to generate device recommendation for optimal yielding good enough position:

A. Method uses wireless signal strength to determine an approximate distance between primary and secondary device

ABSTRACT

42. Earthquake is one of the top natural phenomena that kills thousands of people every year. Earthquake produces seismic waves that jolt the living areas. If earthquake occurs in the night time, then the death rate will be more. An immediate alarm aids people to wake up and perform escape maneuver. Seismic waves may be detected and alert surrounding humans without false alarms. A pair of wireless devices are enough to provide an alarm during earthquakes within three seconds of primary earthquake wave (P-Wave). And this system does not need internet connectivity which makes this system work in any part of world. Proximity of the devices can be determined by the wireless signal strength. Within yielding position devices can sense the seismic waves simultaneously. On confirmation this system triggers alarm with visual and audible announcements. Primary device provides a inbuilt dynamic website with content for escape maneuver.