Reporting earthquakes using web based API

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ABSTRACT

This paper provides the implementation of the concept of earthquake detection on smartphones using a web based API. This concept has been transformed into an android app fetching its data from the USGS web API. Seismology is the scientific study of earthquakes & the propagation of seismic waves through the earth. The large improvement has been seen in seismology from around hundreds of years. The seismic data plays important role in the seismic data acquisition. This data can be used for analysis which helps to locate the correct location of the earthquake.

Keyword: - *Earthquake detection , Web API, USGS, JSON parsing, HTTP Networking*

1. INTRODUCTION

One of the most frightening and destructive phenomena of nature is a severe earthquake and its terrible aftereffects. An earthquake is a sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free. If the earthquake occurs in a populated area, it may cause many deaths and injuries and extensive property damage.

Today we are challenging the assumption that earthquakes must present an uncontrollable and unpredictable hazard to life and property. Scientists have begun to estimate the locations and likelihoods of future damaging earthquakes. Sites of greatest hazard are being identified, and definite progress is being made in designing structures that will withstand the effects of earthquakes.

The scientific study of earthquakes is comparatively new. Until the 18th century, few factual descriptions of earthquakes were recorded, and the natural cause of earthquakes was little understood. Those who did look for natural causes often reached conclusions that seem fanciful today; one popular theory was that earthquakes were caused by air rushing out of caverns deep in the Earth's interior.

1.1 Where Earthquake occur?

The Earth is formed of several layers that have very different physical and chemical properties. The outer layer, which averages about 70 kilometers in thickness, consists of about a dozen large, irregularly shaped plates that slide over, under and past each other on top of the partly molten inner layer. Most earthquakes occur at the boundaries where the plates meet. In fact, the locations of earthquakes and the kinds of ruptures they produce help scientists define the plate boundaries.

There are three types of plate boundaries: spreading zones, transform faults, and subduction zones. At *spreading zones*, molten rock rises, pushing two plates apart and adding new material at their edges. Most spreading zones are found in oceans; for example, the North American and Eurasian plates are spreading apart along the mid-Atlantic ridge. Spreading zones usually have earthquakes at shallow depths (within 30 kilometers of the surface).

Transform faults are found where plates slide past one another. An example of a transform-fault plate boundary is the San Andreas fault, along the coast of California and northwestern Mexico. Earthquakes at transform faults tend to occur at shallow depths and form fairly straight linear patterns.

Subduction zones are found where one plate overrides, or subducts, another, pushing it downward into the mantle where it melts. An example of a subduction-zone plate boundary is found along the northwest coast of the United States, western Canada, and southern Alaska and the Aleutian Islands. Subduction zones are characterized by deep-ocean trenches, shallow to deep earthquakes, and mountain ranges containing active volcanoes.
Earthquakes can also occur within plates, although plate-boundary earthquakes are much more common. Less than 10 percent of all earthquakes occur within plate interiors. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust. The New Madrid earthquakes of 1811-1812 and the 1886 Charleston earthquake occurred within the North American plate.

2. Methodology

This project integrates the earthquake web api and mobile application so as to provide the right information to the smartphone user at the right time. The data has been taken from the United States Geological Survey's web based API in JSON format. JSON parsing is used to convert the information provided to us in JSON format and incorporate it into a listview in android application to make it user friendly.
The application will provide a way to get the relevant information about earthquakes happening around a set of provided regions. Users will also be able to view the graph of the earthquake over years.

2.1 JSON Parsing

JSON stands for JavaScript Object Notation.It is an independent data exchange format and is the best alternative for XML. An JSON file consist of many components. Here is the table defining the components of an JSON file and their description −

Table -1: JSON elements

Sr.No	Component & description
1	Array([] In a JSON file , square bracket ([) represents a JSON array
2	Objects({) In a JSON file, curly bracket ({) represents a JSON object
3	Key A JSON object contains a key that is just a string. Pairs of key/value make up a JSON object

4	Value Each key has a value that could be string , integer or double e.t

For parsing a JSON object, we will create an object of class JSONObject and specify a string containing JSON data to it. Its syntax is −

```
String in;
JSONObject reader = new JSONObject(in);
```

The last step is to parse the JSON. A JSON file consist of different object with different key/value pair e.t.c. So JSONObject has a separate function for parsing each of the component of JSON file. Its syntax is given below −

```
JSONObject sys = reader.getJSONObject("sys");
country = sys.getString("country");

JSONObject main = reader.getJSONObject("main");
temperature = main.getString("temp");
```

The method getJSONObject returns the JSON object. The method getStringreturns the string value of the specified key.

2.2 HTTP Networking

The HTTP request is like an envelope with a destination and a return address. After the request is packaged, Android offers functionality to help a sender message over the network to the correct web server. We haven't officially defined the word network yet, but you can think of it as a digital postal service. A network is really just two or more computers connected in some way that lets them communicate. The internet is a large scale network consisting of many computers around the world. And we can use the HTTP protocol to route our request from one computer to the other. To communicate to a computer on a different location, we must establish communication channel, also known as a network connection, across the internet. Then we can exchange messages with the other computer. So they probably have a whole group of computers who are responding to requests. A single computer wouldn't be able to handle requests from all over the world for the US geological data.. You can refer to the USGS computers that are providing data as the USGS Web Server. A web server is simply another computer or a group of computers on a network running a program that responds to HTTP requests. On the other hand, your phone can be referred to as the client. The client requests the information from the server and then displays the results to the user. Often, many different clients would be connected to the same server, but each client may display the data in different ways. For example, a mobile client may show information that is more convenient to viewing in a small mobile screen. A web client on a desktop, for instance, might show more detailed information taking full advantage of the larger screen size. Each client sends out a request to the server. When the web server receives the request, it may compose an HTML web page to return to the sender for display, or it might return structured data that we can use in an app we're building in a format such as JSON or XML. Once the clients receive the response from the server, they control how the data gets displayed to the users. For example, a web browser can render a web page to the screen or a mobile app can parse out the bits of data that it needs to show useful information on the device screen. In this lesson, we'll zoom in on major steps for the data exchange process. First, we'll talk about how to form a proper HTTP request based on the information we want and from where we want to get it. Second, we'll send the request to the server, which will process it and figure out a proper response to send back. Third, we'll talk about how the client can process or parse

this response and convert it into a format that it understands. Then lastly, we can update the UI in our app to show the results to the user.

2.3 Multithreading

The Android system is capable of running more than one thread at the same time, so that two or more sets of tasks can be processed independent of each other. If there are many threads that need to be run, Android also prioritizes which ones will run at what time and for how long. A thread also knows how to save its place. It records the values of all variables, and remembers what series of function calls resulted in it getting to the instruction it's currently executing: everything it needs to be able to pick up its work again. The goal of building any multithreaded application is to run two or more processes at the same time. Modern programming languages and CPUs are designed to take advantage of multithreading, and building apps on the Android platform is no different.

3. LITERATURE REVIEW

There are many examples of location based applications that use some sort of geo-fencing techniques to provide information in the right place and even at the right time. They are

[1].”Earthquake Risk Assessment, Loss Estimation and Vulnerability Mapping for Dehradun City, India ”

This research considers its earthquake hazard application for assessing buildings at risk. The study is mainly divided into three parts as ward wise statistical sampling of buildings for complete city, damage assessment of buildings and risk mapping considering various scenarios.

[2]. “Seismic Hazard Assessment in India”

A preliminary site-specific probabilistic seismic hazard assessment (PSHA) has been carried out to review the potential risk of seismic source zones and the latest earthquake information.

4. CHALLENGES AND LIMITATIONS

The challenge with this project is whether the application would provide the notification at the right time or not.

The limitation with this project is that it requires persistent presence of good internet connectivity for the proper functioning of the application.

5. EXPECTED RESULT

Our expected result for this project is a smartphone application that would enable users to get a better sense of the seismic activity near them or around the world.

6. CONCLUSIONS

The paper provide detail description of developing a earthquake reporting application in android using a web based API. This application enable users to get a better sense of the seismic activity near them or around the world we display a list of earthquakes and we highlight the magnitude of each one and we share some important information about where and when it occurred.

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