Natural Disaster Tracking System

SE 133

Abstract

Goals / Purposes:

• To build a successful tracking system, that tracks natural disasters with a fair degree of accuracy and precision.
• To minimize the loss of life in the event of natural disasters
• To minimize the costs that are associated with natural disasters, by involving different agencies.

Motivations:
It is a well-known fact that natural disasters can strike countries, both developed and developing. These become the essential reasons for causing massive destruction and creating human sufferings, and also producing harmful impacts on national economies. Due to the different climatic conditions that are present in different parts of the globe, various types of natural disasters like floods, droughts, earthquakes, cyclones, landslides, volcanoes, etc. strike according to the susceptibility of the given area.

Brief Description:
A natural disaster tracking system, which aids scientists, media, government agencies and the general public to be more aware and prepared, to face the difficulties of catastrophic events.

Challenges:

• To gather all the necessary data and to interpret them in real-time.
• To accurately estimate time and place of natural disasters.
• To communicate critical information with external entities.

Accomplishments:

• Reduce loss of life
• Better evacuation plans
• Better informed populace

Project Results:

• Successfully track all natural disasters
• Successfully involve all external entities by including scientists, media, government agencies and the general public.

Description of the domain
Various types of natural disasters like tornados, hurricanes, floods and Tsunamis occur every year, throughout the world. Some of them have been explained below diagrammatically:

The following diagram shows a volcanic eruption in 1991, from Mount Pinatubo in the Philippines. (Source: Wikipedia.com), A **volcano** is mainly an opening (or rupture) in the Earth's surface or crust, which allows hot, molten rock, ash, and gases to escape, from deep below the surface. Volcanic activity involving the extrusion of rock, tends to form mountains or features like mountains over a period of time. (Source: Wikipedia.com)
A **tornado** is a natural disaster resulting from a thunderstorm. Tornadoes are very violent, rotating columns of air, which can blow at speeds between 50 and 300 mph, and possibly higher.
(Source: http://www.bbc.co.uk/science/hottopics/naturaldisasters/hurricanes.shtml)

**Hurricane**, tropical cyclone, and typhoon are different names for the same phenomenon: a cyclonic storm system that forms over the oceans. It is caused by evaporated water, that comes off of the ocean and becomes a storm. (Source: Wikipedia.com)

**Block Diagram**
Figure Description:

The block diagram above, shows an overview of the NDTS, and how it interacts with the outside entities, should a large natural disaster occur. On the top level, the NDTS communicates with an external data base system, which is in charge of storing, deleting, and updating sensitive information that are obtained from the NDTS. The NDTS is further divided into internal and external subsystems. The internal subsystem is in charge of the core activities of the NDTS, such as data management, local data backup, aerial remote sensing and real time monitoring. The external subsystem is in charge of information/data analysis and information storage that are obtained from the internal subsystem. On the lower level of the diagram, there is real time information exchange with the government and federal agencies, and the media to inform the public, should the possibility of a disaster becomes eminent.
## Use Case Diagrams

### Use case: Gather Satellite Information

**ID:**
UC 01

**Brief Description:**
1. Communication established with the satellite
2. Images and data gathered by the satellite, as per request
3. Images transferred to NDTS
4. System stores the updated information
5. NDTS process the information received by the satellite

**Actors:**
1. Scientists
2. NDTS
3. Satellite

### Use case: Communicate with Media

**ID:**
UC 02

**Brief Description:**
1. Effective Communication with the local and national Television and Radio.
2. Verification by NDTS
3. Communication with newsgroups.
4. Newsgroups inform general public

**Actors:**
1. Newsgroup
2. NDTS
3. External Tracking System
4. Government Agencies
### Use case: Manage and Model Data

**ID:**
UC 03

**Brief Description:**
1. Provides detailed information about the solar winds, sea magnitude level and global climate.
2. Saving and loading of updated information.
3. Predictions based on data processing.
4. Updating current status of information like forecasts.
5. Raw information sent to and received by external tracking system.

**Actors:**
1. Database Administrator
2. Scientists
3. External Tracking System

### Use case: Backup and Transfer Information

**ID:**
UC 04

**Brief Description:**
1. Backup critical information and electronically transfer it to other locations in the country, with a low risk of an impact.
2. Validation of Data
3. Database administrator archives the data.
4. Data transferred electronically, in case of a possible urgent situation.
5. Validation of backed up data.

**Actors:**
1. Database Administrator
2. External Tracking System
## Use case: Monitor in Real Time

**ID:**
UC 05

**Brief Description:**
1. Monitoring the planet for its changes on a real time basis, to ensure that during unpredicted event, critical information is always available.
2. Acquire all information from latest point of interests.
3. Update and store all new information and details.
4. Generate new models on the basis of the newly gathered information
5. Update Front-ends

**Actors:**
1. Scientists
2. NDTS
3. External Tracking System
4. NDTS Employees

## Use case: Gather Remote Aerial Sensor Data

**ID:**
UC 06

**Brief Description:**
1. Allow us to gather data much faster than ground-based observation. It will help in obtaining photographs from sensors, in order to predict the early set in of a disaster.
2. Request information from aerial transmitters.
3. Information along with images sent to NDTS.
4. Processed information verified and stored.

**Actors:**
1. Scientists
2. NDTS
3. External Tracking System
### Use case: Correlate Information

**ID:**

UC 07

**Brief Description:**

1. Correlation of information to obtain better and enhanced data, and communicating this information with external systems.
2. Save the updated information.
3. Correlate the information to external systems to allow constant updates.
4. Validation of co-related information by external systems

**Actors:**

1. Scientists
2. News Groups
3. Government Agencies

### Use case: Allocate and Manage Resources

**ID:**

UC 08

**Brief Description:**

1. Properly allocate resources and investments to acquire maximum system throughput.
2. Allocation of resources.
3. Depending upon the allocated resources, system performance is maximized.

**Actors:**

1. System Administrator
2. NDTS
3. Government Agencies
Requirements

Non-Functional Requirements

Financial Requirements

In the United States, the direct cost of carrying out natural damage repair is over 20 billions dollars per year. One of the main reasons for such an enormous expense is the perceived inability to correlate and communicate the information or details that are gathered from the research and forecasting system to the general public, Federal government and emergency services. As a result, more harm is done, even though the severity of natural disasters, hasn’t increased dramatically for over a decade.

Since it has become extremely necessary to increase public awareness, our novel proposal for implementing a Natural Disaster System would not only decrease the damage repair cost in a dramatic manner, but also, reduce the total number of causalities by at least 10 to 20 percent. Our system would also be able to help decision makers to properly allocate resources and investments to acquire maximum system throughput and results.

Functional Requirements

Technological Requirements

The Natural Disaster Tracking System or NDTS has to have the following criteria:

1. In the event of an upcoming natural disaster, the system shall be able to communicate effectively with the local and national Television and Radio media. This is particularly very useful and beneficial because, local and national media could effectively communicate the upcoming incidence of danger to the general
public, so that further actions such as evacuation plan could be easily accommodated.

2. The NDTS shall also incorporate the Satellite Orbiting System. The Satellite Orbiting System provides scientists and researchers with useful information, statistics and images, that could precisely foretell an upcoming natural disaster with extremely precise probability.

3. The NDTS also shall also incorporate the Hydrologic Prediction System. The Hydrologic Prediction System or HPS is a real time data management and modeling system, that provides detailed information about the solar winds, sea magnitude level and global climate.

4. In the event of an emergency, the NDTS shall also able to backup critical information and electronically transfer it to other locations in the country with low risk of an impact.

5. Our system would be more sophisticated and multi disciplinary in providing analysis of disasters, before their occurrence compared to other existing tracking systems.

6. The capacity of our system also extends to monitoring the planet for its changes on a real time basis, to ensure that during unpredicted events, all the critical information required is available, when it is most needed.

7. Our system will also have the capability of Remote Sensing, which will allow us to gather data much faster than ground based observation. Aerial Remote Sensing will also help in obtaining photographs from sensors, in order to predict the early set in of a disaster.

**Interface**

The Natural Disaster Tracking System is required to interface with various devices and sensors that are used in the field to gather necessary data. This interface is very critical to help predict and locate natural disasters, therefore it needs to be reliable, useful and performance oriented.

The NDTS is also required to interface with the media, scientists and general users. It is therefore critical to have an easy-to-use interface, which brings the interpreted, but also raw data to them. A web enabled interface would be able to reach all these users and would therefore be needed.

The NDTS also needs to communicate with other tracking systems, and again a web interface seems to be the most logical solution. It is critical to always be connected and sharing information.
References

- "Natural Disaster." Wikipedia. 12 Feb. 2007
- "Why the United States is Becoming More Vulnerable to Natural Disasters." AGU. 3 Nov. 1998. 12 Feb. 2007

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