GPS Applications in Different Disasters
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Introduction

- Disaster could be a natural or man-made hazard that has adverse effects and can cause significant damages to local environment.
- Natural disasters usually occur abruptly, affecting large areas – ex. Earthquakes, Tsunamis, and Tornados etc.
- Flood and Landslide can be predicted and mapped.
- Also potentially affected people within the known vulnerable areas can be alerted in advance to prevent more damages.
• The importance of GPS application in monitoring and managing disaster events cannot be exaggerated.

• This is because GPS will only give real-time information of location.

• Precise position from GPS can help in managing each of the processes of disaster event starting from pre-disaster, during disaster and post-disaster event.

• With the help other geospatial technologies like RS and GIS which can easily integrated can help to mitigate the effect of any natural disaster.
GPS is an integral part of emergency response systems

• Helping stuck motorists find assistance or guiding emergency vehicles

• Location information provided by GPS, coupled with automation, reduces delay in the dispatch of emergency services

• Incorporation of GPS in all smart phones places an emergency location capability in the hands of everyday users

• Today, many ground and maritime vehicles are equipped with autonomous crash sensors and GPS.
Application of GPS

- Surveying and mapping
- Transportation
- Forest and Agriculture
- Marine
- Aviation
- Time
- Public safety and disaster relief
Disaster Management

- Are associated with **readiness** and **mitigation** measures usually involves **landslide** and **flood disaster** prevention.

- Mitigation involves activity that minimizes the impacts of disaster within potentially vulnerable areas like identifying the mud slide prone area, flood inundation area etc.

- Readiness involves the activities that facilitates the preparation for response to disaster occurrence. If occurs how to safe guard like identifying elevated area during flooding.
Public Safety and Disaster Relief

- Time is a critical component of any successful rescue operation.

- To know the precise position of any landmarks, streets, buildings, emergency service resources, and disaster relief sites, we should have accurate GPS position to reach in time.

- GPS has played a vital role in relief efforts for global disasters like hud-hud, guno etc. Search and rescue teams used GPS, geographic information system (GIS), and remote sensing technology to create maps of the disaster areas for rescue and aid operations, as well as to assess damage.
GPS Disaster Management Process

Disaster Event

Pre-Disaster

During Disaster

Post-Disaster

Prediction and Monitoring of Vulnerable area

Detection and Monitoring events

Damage Assessment

Disaster Management processes

Transforming Business - Enriching Lives
Monitor Earthquake Prone Area

• In earthquake prone areas, GPS is playing an prominent role in helping scientists to anticipate earthquakes.

• Using the precise position information provided by GPS, scientists can study how strain builds up slowly over time in an attempt to characterize, and in the future perhaps anticipate, earthquakes.
Continuously Operating Reference Station (CORS)

- https://geodesy.noaa.gov/CORS_Map/
• The National Geodetic Survey (NGS), manages a network of CORS

• Provides Global Navigation Satellite System (GNSS) data consisting of carrier phase and code range measurements in support of three dimensional positioning, meteorology, space weather, and geophysical applications throughout the US, its territories, and a few foreign countries.

• As of November 2015, the CORS network contains over 2000 stations, contributed by over 200 different organizations, and the network continues to expand.
CORS

• Normally GPS will give position but we cannot use it for the survey purposes, can be used only for navigation.

• To get good (mm) accuracy for survey, geodetic survey purposes we need to correct our data with other nearby reference stations.

• CORS data may also, used for generation of precise satellite ephemerides and clock correction data, crustal motion monitoring and atmospheric and earth rotation studies.

• Many seismologist, continental drift study and researchers are using this data for interpretation.

• 95% of them are located in US only
Applications of CORS

• Can post processes our data using this data

• Multipath study

• Crustal evolution

• Sea-level changes

• Ionosphere studies

• Tropospheric studies
Landslide Study Using GPS Technologies

Landslide Monitoring Process.

(Source: Abidin et al 2004)
Tsunami Monitoring Process

(source: Geogarage 2012)
Forest Management
GPS Application in Flood Management

• Utilization of Geomatic technologies i.e GPS, RS and GIS is being used increasingly for flood assessment.

• Integration of inventory mapping, location of surface structures and roughness providing information on flow emplacement parameters (i.e. rate, velocity and rheology), and factors such as lithology, location of faults, slope, vegetation and land use.

• To manage flood disaster, GPS and Synthetic Aperture Radar (SAR) imageries are very important to estimate water depth from SAR images.
How Meteorologists use GPS?

• Role of meteorologists: storm tracking and flood prediction also rely on GPS.

• They can assess water vapor content by analyzing transmissions of GPS data through the atmosphere.
Time

- Addition to longitude, latitude, and altitude, the GPS also provides a critical fourth dimension – **Time**

- GPS satellite contains more precise clocks (multiple atomic clocks) that contribute very precise time data to the GPS signals.

- GPS receivers decode these signals, effectively synchronizing each receiver to the atomic clocks.

- Without paying any money you can determine the time to within 100 billionths of a second.

  - **You** must be wondered why precise time required?

  Communication systems, electrical power grids, and financial networks all rely on precision timing for synchronization and operational efficiency.
• Wireless telephone and data networks use GPS time to keep all of their base stations in perfect synchronization. This allows mobile handsets to share limited radio spectrum more efficiently.

• Similarly, digital broadcast radio services use GPS time

• Companies worldwide use GPS to time-stamp business transactions, providing a consistent and accurate way to maintain records and ensure their traceability.
References

• https://www.gps.gov/applications/safety/


• http://blog.geogarage.com/2012/05/gps-on-commercial-ships-could-improve.html?m=1 12:00pm 23/08/2015

• https://www.ajouronline.com/index.php/AJAS/article/viewFile/3597/1881
GPS modernization translates to more lives saved and faster recovery for victims from the tragedies.

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