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Safety Disaster Management Model through Multi Sensor Data Fusion and Prediction

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Abstract: Disaster is an uncontrollable natural or manmade activity which results in many losses of their life and property. By seeing these last years the people around the world faces lots of problem related to disaster from the nature or mankind activity. This paper shows how can we manage, predict the disaster for that we designed a system which is having multi sensors, computer system and an awareness model. The algorithm used here is SVR algorithm. Instead of using single sensors we are using multiple sensors here.

Keywords: Internet of Things, multi -sensor data fusions, SVR algorithm, situation awareness, prediction.

I. INTRODUCTION

Disaster is most haunting one, which threatens to the life and property of the people. The studies show that in every year the natural disasters kill around 90 000 people around the world, and which affect close to 160 million people in worldwide. In recent decades we face a major problem is flood, tsunami, earthquake, soil erosion etc. As a result of this there are some loss of life and property for many people, but if we have a correct precaution measure, we can avoid loss as much as possible. In this model we are explaining some precaution measure for defeating the natural disasters like earthquake, flood, soil erosion etc. One of the major precautions measures is to set up real-time monitoring of disaster with a number of different sensors. Single sensor which features weak, unstable, and noisy signal is prone to raise misjudgment leading to non-linearly correlated data coming from different sensors. This paper unfolds with a theoretical introduction to the situation awareness of data from sensors in the Internet of Things, covering theories including the Internet of Things, multi-sensor data fusion, and situation awareness. Subsequently, we construct a framework for the situation awareness system based on multi-sensor fusion with Internet of Things. The data coming from multiple sensors are pre-processed, weighted and predicted. In addition, SVR is introduced to weight the data varying with attributes. An SVR-based model is constructed to accomplish data fusion and determine situation levels as well. The output of the SVR-based model is a prediction. It convinces that forecast results made by the model are valid, indicating that the multi-sensor signal fusion which is effective and efficient provides support to disaster situation forecast and emergency management.

II. DESIGNED SYSTEM

In this we have 3 stages for explaining the disaster measuring system.

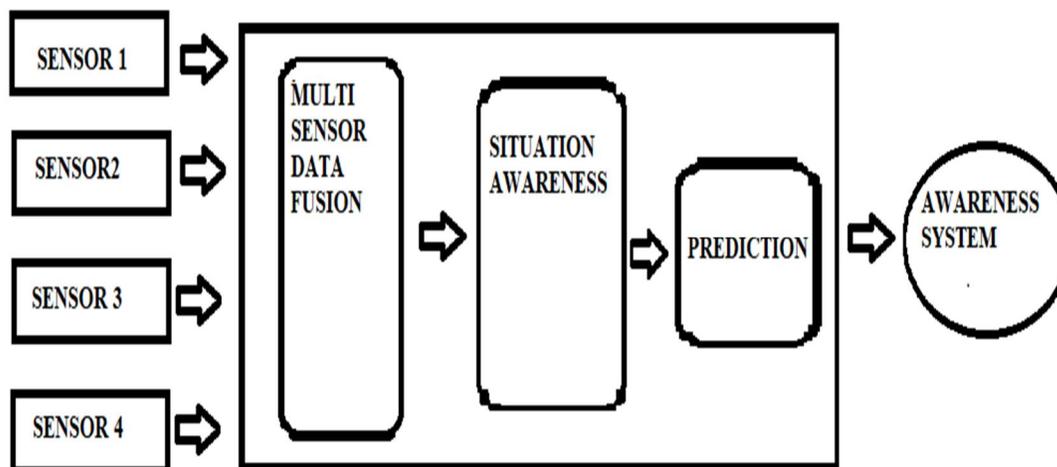


Fig.1 Disaster management system

A. *First Stage*

1) *Sensors*: A sensor is a device that measures a physical quantity (stimulus) and transmits this measurement so that a computer, instrument, or observer can read it.

Different Sensor System

a) *Tsunami Sensor System* explains that Tsunami is a series of waves caused by the earthquakes. It can be detected with help of Tsunami Sensor System. It contains mainly 2 parts

- i) *Tsunami meter*: Detects earthquake under the ocean.
- ii) *Surface Buoy*: Detects Tsunami waves at the surface of the ocean.

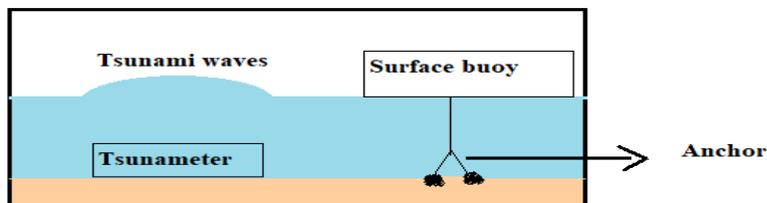


Fig. 2 Tsunami sensor system

- b) *Earthquake Sensor System* used during the time of earthquake it produces a seismic wave and it can be detected by using a seismic sensor. After monitoring the seismic waves, it can be recorded by a seismograph which contain the richer scale which measures the intensity of the earthquake.
- c) *Flood Sensor System* used in this system it contains a thermal camera which captures the thermal image and by analyzing this image we get a data.
- 2) *Internet Of Things (IoT)*: It is a physical object/ thing which senses and controlled remotely existing infrastructures. It is embedded with electronics, software, sensors, and connectivity to enable object to exchange data with operator or other connected devices.

B. *Main Stage*

The main stage is a computer system which is programmed with a SVR algorithm. It is mainly classified into 3 parts Multi Sensor Data Fusion, Situation Awareness, Prediction.

- 1) *Multi Sensor Data Fusion*: Multi Sensor Data Fusion is a process of combining the data after filtering and extracting the common features from different sensors using fusion rule then gives a combined output. There are different types of multi sensor data fusion are there example for that is Data Level Fusion, Feature Level Extraction, Decision Level Fusion.
- 2) *Situation Awareness*: In previous stage we collected the common features, then now we have to recognize the situation of the environment that we want to study. For that we have 3 phases:
 - a) Situation perception is a process of recognizing and understanding the environment and identifying the key elements which helps in further processing.
 - b) Situation comprehension is a process of comparing the current information and the previous information and it is taken as the reference for situation forecasting.
 - c) Situation Forecasting process is proceeded based on the changes taken in between the previous stage and current stage. If any change occurred, then the situation is forecasted.
- 3) *Prediction*: For multi sensor data fusion and prediction we use a strong algorithm called as SUPPORT VECTOR REGRESSION ALGORITHM (SVR).

Steps

- a) Calculate the original information (sensor data).
- b) Calculate the conditional information from each sensor and taking the probability relationship between original information and conditional information's.
- c) Taking difference between original information and conditional information.
- d) Now calculating the weightage vectors.
- e) Predicting output.

C. Awareness System

The awareness system is activated depending upon the prediction output. If the prediction is true then the awareness system is activated and giving as messages, alarm, SMS etc.

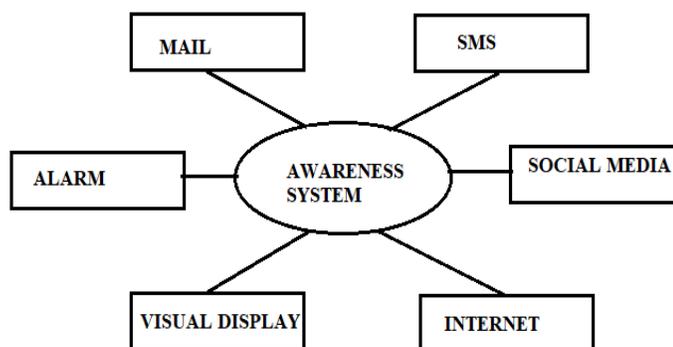


Fig. 3 Awareness system

III. CONCLUSION

The value of the life is not replaceable, so the system like this is necessary for the life of the people. For defeating such a problem, we use 3 steps sensor signals, data fusion, and predicting the output. By using multiple sensors, the data are sensed and monitored then after preprocessing the data, the common features are extracted and giving an efficient, dynamic and timeliness prediction. So, through small precaution measure we can save lots of life.

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