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Flood Detection System Using Wireless Sensor Network

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Abstract— Environmental monitoring usingWireless sensor network (WSN) is one of the most challenging bustles handled by the research community.Hence it is decisive to employ the contemporary sensing and communication equipment to observe and identify flood incidences.Terrestrial wireless sensor networks are subject to extensive research and development. Numerous applications take advantage of low-cost, small-sized, easily configurable and scalable TWSN nodes to monitor, detect, and track various environmental phenomena and events. The recent advancement in electronics and sensor miniaturization and low-power technologies enabled TWSNs to extend their reach to underwater applications. The role of the designed Flood Monitoring and Evasion System based on WSN is to continuously monitor, detect and report the environment's status to a control unit using relative water level, thrust and intensity of water as flood indicators, whose values are gathered by sensors in the sensor field. The flood monitoring and evasion system monitors and computethe status of floods and sends flood notification message to the base station of such zones for necessary action. The system is composed of three major modules which are the sensor module, observation module and the transponder module. The developed system is stout and gives well-timed alert of flood occurrences and controls the flood gate to avoid flood in coastal area.

Keywords—Wireless Sensor Networks (WSNs), Environmental Monitoring (EM), Tide, TWSN.

I. INTRODUCTION

There is a growing interest in obtaining oceanographic data due to the importance of the ocean to different features of human life expectancy. Steering, fishing, environmental science, and weather impact are some examples of this import. However, even thoughcasing more than 70% of earth surface, the oceans are not well known due to their dimensions, complications of data acquisition and the high costs of maritime equipment and operations[5].

Precise tidal estimate is an important problem for creationevents in coastal area. Tidal data is vital for the construction of docks and direction finding. In offshore areas, accurate tidal data is helpful for successful and safe operations. The application of Wireless Sensor Networks (WSN) contains a wide variety of scenarios. In most of them, the network is composed of a significant number of nodes deployed in a targeted area in which all nodes are indirectly connected. Further the data exchange is carried by multi-hop communication system.

Environmental calamities are essentiallyrandom and risein very short periods of time. Hence technology has to be developed to capture suitable signals with tiniestobservinginterruption. Wireless sensor is one of the modern technology that can quicklyact in response to rapid variations of data and send sensed data to a data analysis center in areas where cabling is not possible. WSN technology has dexterity of quick capturing, processing and broadcast of critical data in real time with high resolve. However, it has its own constraint such as relatively low amount of battery power and low memory availability compared to many existing technologies. It does, though, have the pros of deploying sensors in hostile atmospheres with a bare minimum of maintenance. This fulfills a crucialrequisite for any real time monitoring, especially in unsafe or remote scenarios [4].

The usualpractice for data acquisition and monitoring is based on many sensors congregated in one station operating on exterior power supply. This post is left in the water in the place of curiosity and hold onto recording data during some stipulated time, which may last for longer period of time. At the end the stipulated time the station is mend for datatransfer, dispensationexamination, and to perform predefine set of action.

This paper discusses the design and implementation of flood detection and evasion system using WSN system at costal area. The system is built to sense abnormal behavior of tide intensity within sea. The augmented number of incessant depressions in sea has also lead to upsurge in the height and velocity of the sea waves, which can cause increase tides on the sea, The leftovers of the paper is drafted as follows, Section two describes Application scenario. In Section ThreeProposed method is discussed. In section FourDistributed Algorithm is discussed. In Section Five Simulation, Tests and Results are shown. Section Six contains Conclusion and Future work. Section Seven comprises of References Section.

II. APPLICATION SCENARIO

A. WIRELESS SENSOR NETWORK TECHNOLOGY

WSN technology has producedgusto in many research scholars to learn and understand other domain areas which have helped them to propose or develop real deployments. One of the major areas of the focus is Environmental Monitoring,

(EM), Detection and prediction. Draught Forecast and Alert System (DFAS) has proposed and developed in[2]; uses mobile communication to alert the users, whereas the deployed system uses real time data collection and transmission using the wireless sensor nodes. An experimental soil monitoring network using a WSN is presented in [3], which explores real time measurements at temporal and spatial granularities.

B. UNDERWATER SENSOR NETWORKS

UWSN are based on battery-operated nodes furnished with sensor and communication properties. The nodes can wirelessly communicate amongst each other to exchange data and commands for operation.These grids may be composed of stationary nodes, transportable nodes or a mix of them. A good approach of these possibilities may be seen on Akiylidiz, Pompili, and Melodia(2005).

The UWSN may be used for real time data monitoring with sensors communicating all the time with control station. This type of operation spends too much energy with transmissions and, especially if the data packets are large and generated at high rate, it is applicable only to short term cases.

III. PROPOSED METHOD

We formulate the mechanism using grid pattern of local sink on the surface and static sensors under the surface.Figure 1 shows the architecture which depicts the position of local sinks and sensors on the surface of the sea/ocean. The local sinks are static in nature in the form of grid pattern. These local sinks are able to communicate using both acoustic as well as radio frequency modes to communicate with base station. They use acoustic as well as radio frequency modes. They are use acoustic mode to communicate

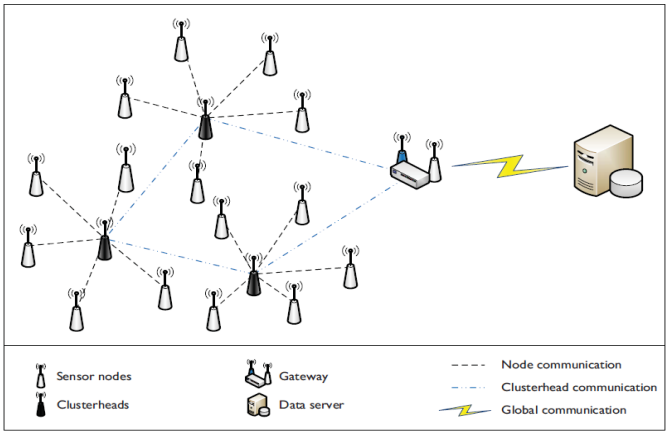

Fig. 1.Typical network architecture of environmental monitoring applications under scope

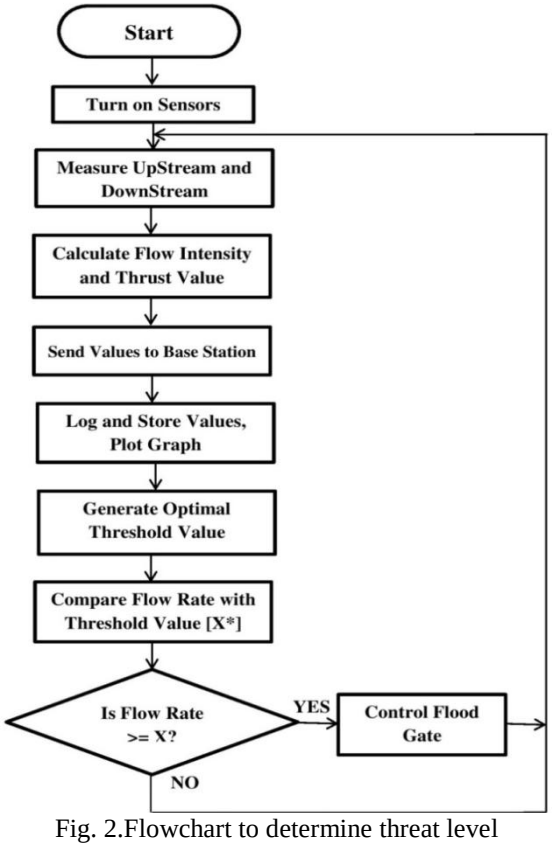

Fig. 2.Flowchart to determine threat level

Fig. 2 Show the flowchart to determine threat level. Where sensors will sense current's intensity. These sensed values will be transmitted on regular basis. Once the value is received it will be stored in local dataset for future references. With the each received value threshold value will get optimal to ensure that the algorithm is enabling with self-learning capability based on the experience.

Since the learning is purely automatic it is unsupervised learning algorithm. This algorithm will be obliging to determine threat of flood at any point of time.

IV. DISTRIBUTED ALGORITHM

For the actual implementation, entire mechanisms have to be distributed on each sensor node. In this section we present detailed algorithm description for operation.

Procedure determine_flood_level() – Triggered when detecting tide with specified intensity.

1. Start
2. Turn on Sensors.
3. Repeat Step 4 to Step 10 Throughout.
4. Measure UpStream and DownStream.
5. Calculate Tide Intensity and Thrust Value.
6. Send Data to Base Station.
7. Store Data and Plot Graph.
8. Generate Optimal Threshold value
9. Compare Flow Rate with threshold value.
10. If (flow_rate OR Threshold_Value>= Category 1)
    a. Mark Risk as Negligible.
11. else if (flow_rate OR Threshold_Value>= Category 2)
    a. Mark Risk as Marginal.
12. else if (flow_rate OR Threshold_Value>= Category 3)
    a. Mark Risk as "Critical".
13. else (flow_rate OR Threshold_Value>= Category 4)
    a. Mark Risk as "Catastrophic".
14. Go to Step 4

V. SIMULATION, TESTS AND RESULTS

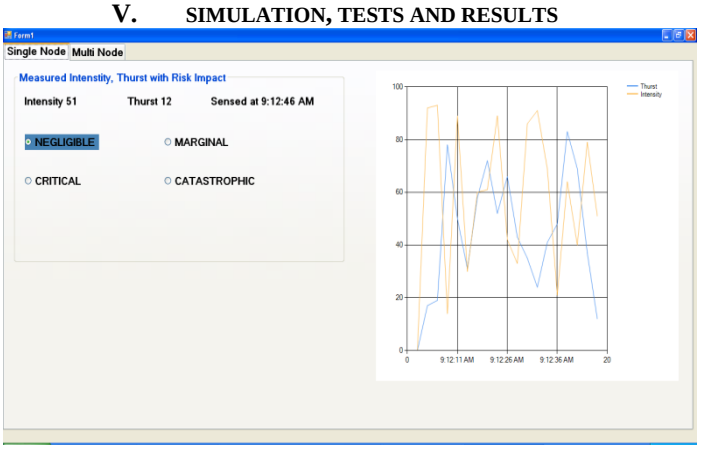

Fig 3.Single Nodes Monitoring Flood Detection and Evasion System (Negligible State)

Fig. 3 shows simulation result where thrust of water current belongs to first category hence threat level is marked as *"negligible"*. Depending on received value of thrust threat level is determine.

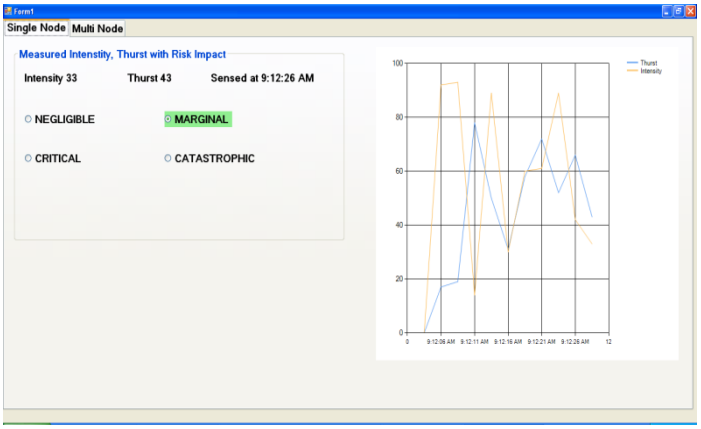

Fig 4.Single Nodes Monitoring Flood Detection and Evasion System (Marginal State)

A. Simulation Based Evaluation

Node Density: As the node density increases System efficiency is increase and Average delay is decreases considerably, because an increasing numbers of nodes will preemptively stimulated the track.

Localization Error: Weobserve that the impact of localization error may deviate from awakened nodes which may leads to wrong value and results in unsuccessful resolve of threat level.

Level of Deployment: The level of deployment ensures proper coverage of each node is achieved to receive the data from remote place.

VI. CONCLUSIONS AND FUTURE WORK

The main objective of this project work is to develop a real-time flood monitoring and warning system for a selected coastal area. The system employs the use of advance sensing technology in performing real-time monitoring of water information. The developed system is composed of three major components: 1) sensor network, 2) processing and transmitting modules, and 3) database and base station server. The sensor network will be implemented at remote sites, where network infrastructure is not available. The connectivity is done through the wireless tunnels. The sensor network measures water related data while the processing and transmission module is used to transmit measured data to the database and application server. The database and application server is implemented as an application to allow users to view real-time water-related data as well as historical data. The application server is also able to send warnings to the responsible authorities in case of emergency. We conclude with a brief discussion on some issues

The forecasting and early warning systems will continue to play a vital role in providing accurate and reliable warning information for the coastal provinces to enable them to better prepared for unnecessary damages and losses. Our flood monitoring system is adequate in terms of real-time data acquisitions. However, in order to enhance efficiency of flood prevention, the system could be integrated with modern space technologies and Geographical Information Systems (GIS). Today, space technologies are considered an efficient tool for risk assessment and emergency management systems. The integration of the system with these technologies will enable the system to determine the flood affected areas by exploiting the collected flood-related data and different image processing techniques such as data merging, segmentation and classification to enhance the authorities to make better decisions on managing flood.

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