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Natural Catastrophe Alert System using Embedded Systems based on Wireless Network

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Abstract:- **The systems provide distributed network and access to sensors, controls, and processors intensely embedded in alleviate, equipment, and surrounding. The sensor network provided new applications in area such as environment, industrial purpose and health care, for monitoring and control for determination of safety and security. Wireless sensor networks(WSN) is the technology used to provide effective solution natural disaster management. The current systems for TWS are bulky, very costly and difficult to maintain. A Embedded controlled wireless sensor network is used for monitoring the impact of earthquake and tsunami damage. The sensor nodes are custom-developed float sensors and acceleration sensors and a low power readout ASIC circuit for a long life. The accelerometers are used to measure the seismic response of the an earthquake. They detect vibrations during an earthquake event and send data to remote base station where multiple sensors data across the town is collected. A RF module provide low power network architecture is implemented over an 802.15.4.**

Keywords- Accelerometer, Arm7, RF, GSM, Embedded Wireless Sensor Network.

INTRODUCTION

The earthquake, caused by 6 to 9 meters up thrust on a 175-185km wide seabed at 55-65km offshore from the east coast of Tohoku, resulted in a major tsunami that brought devastation along the Pacific coastline of northern islands of Japan. Thousands of lifes were lost when whole towns were desolated. The tsunami propagated throughout the Pacific ocean region reaching the entire Pacific coast of North and South America from Alaska to Chile. Warnings were issued and evacuations carried out in many countries following the Pacific ocean . However, the tsunami affected many of these places, the extent was minor.
The tsunami that struck Southeast Asia in December 2004 reminded the world of the destructive power of tsunamis. Tsunamis often result from underwater earthquakes which displace huge amounts of water. This displacement creates a force that travels through the surrounding water at over 500 miles per hour.
A earthquake detection system & tsunami warning system (TWS) is used to detect tsunami in advance and issue warnings to prevent loss of life and damage. It is made up of two equally important components: a network of sensors to detect tsunamis and a communications infrastructure to issue timely alarms to permit evacuation of the coastal areas. We can cove a large area by Wireless sensor network with master and slave combination. There are two distinct types of tsunami warning systems: international and regional. When operating, seismic alerts are used to instigate the watches and warnings; then, data from observed sea level height (either shore-based tide gauges or dart buoys) are used to verify the existence of a tsunami. Other systems have been proposed to augment the warning procedures.

EXISTING SYSTEM

With the speed at which tsunami waves travel through open water, no system can protect against a very sudden tsunami, where the coast in question is too close to the epicentre. This tsunami struck just three to five minutes after the quake, and most victims were caught while fleeing for higher ground and secure places after surviving the earthquake. This was also the case in Aceh, Indonesia. While there remains the potential for sudden devastation from a tsunami, warning systems can be effective.

PROPOSED SYSTEM:

Here we making RF based network for Tsunami Identification and Alert system. Here we have master and slave structure for the Application .The range of RF is about 30 meters. So, the whole area cannot be covered by a single Master slave combination. For this we can cove a large area by Wireless sensor network with master and slave combination.
We have a main PC master terminal which has the VB software on it .The PC master terminal is used to monitor the status of all the slaves which covers the whole area. Here we are using a master Request and slave response protocol .In this system the Master sends the request to the all the slaves. In the request frame the master mentions the slave ID. The request frame is received by all the slaves which are in range .The slave who are in range receive the incoming frame and store it in its internal RAM memory .Then they check for the slave ID. If the incoming slave ID matches with their own slave ID then they Accept the frame and send the parameter back to the master .If the ID does not match then the slave discards the frame. So in total we have 1 / 2 slave .The Idea is that if the one slaves goes out of range of the PC then the communication fails

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.So we are placing 2 slaves which will be placed in such way that they will be always in range of the PC master. Therefore the PC master will communicate to the slaves via Wireless RF module. The slaves are equipped with tsunami detecting sensors Such as High tide, Earth- quake, temperature etc. when any of the slave detects the tsunami like conditions it sends a warning frame with the sensor data to Master. On master we have VB software which will show the data on its Graphical user interface. Also, we are sending Mass SMS to the nearby residents to alert them on time so that a large number of people can be saved.

IV. OPERATIONS

System consists of following things:
- ARM 7(LPC2138)
- RF MODULE
- GSM 900
- ACCELEROMETER
- LEVEL SENSOR
- TEMPERATURE SENSOR

In this proposed system, consist of one master and two slave module. Master modules are designed using Arm controller, GSM module, RF module and data base is maintained on computer. In two slave modules we have designed module which consists of Arm microcontroller, sensors and RF module. Remote sensor node circuit is designed to provide the measure of the seismic response of the earthquake and tsunami.system block diagram is shown in fig.2.

In master module we have used arm 7 (lpc2138) microcontroller.LPC2138 is 32/16 bit controller with embedded high speed flash memory, 10 bit inbuilt ADC and 3 UART port for serial communication[7]. RF module is used for wireless personal area networking. RF module offers simplicity and a cost effective approach to building, construction and remodelling with wireless technology. RFmodule architecture is implemented over an 802.15.4 protocol[6]. We have used SIM900 For GSM communication, which is a tri band GSM/GPRS engine. The SIM900 is integrated with the AT commands and are developed to use TCP/TP protocol easily, which is very useful for data transfer applications.GSM uses AT commands via its serial interface to control the devices.

FIG. 1. BLOCK DIAGRAM OF A SENSOR MODULE.

In the circuit diagram of the master module we have used ARM microcontroller RF module, GSM module and RS232 module for PC communication. On PC we maintaining data base of sensor node which is collected by master module via RF module from sensor network designed using the ARM microcontroller. computer-based decision making to deliver alert signals GSM module is use to send sms alert natural disaster management from base station. The circuit diagram is shown in figure 2. Slave module consists of arm microcontroller along with RF module and sensors for monitoring the environment. The various sensors which are connected with the slave module are level sensor, accelerometer and temperature sensor. The circuit diagram is shown in figure 2. The devices which are to required to be controlled remotely can be connected with the slave module. In master module we have used arm 7 (lpc2138) microcontrollers. The distance between two slave module are kept at 30 meters. Real time date is provided by time to time with the help of RF module to the base station to get actual information of current condition at slave module. For lowest power consumption in the sensor modules, the network is implemented using indirect data transfer using polling on top of a standard 802.15.4.
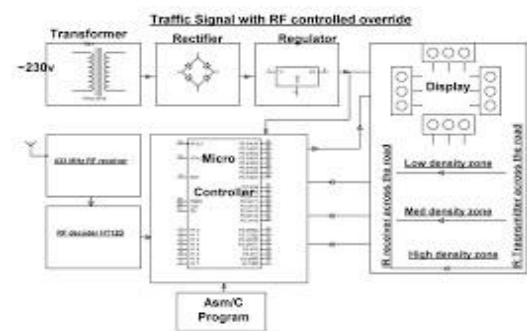

FIG: 2 SIMULATION DIAGRAM OF A MODULE.

In this way, the end nodes radio is powered down most of the time. Only the node and base station have their receivers constantly on.
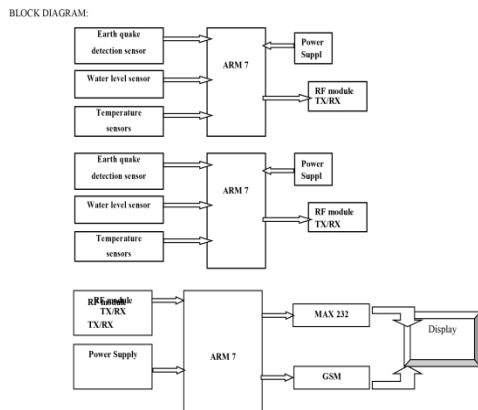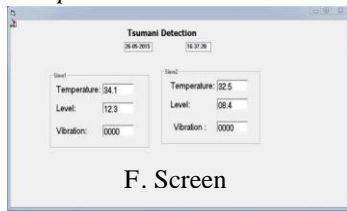

FIG: 3 PROJECT PHOTO.

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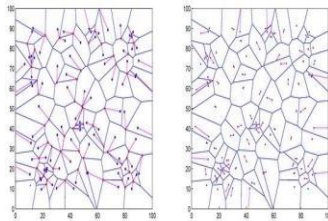## V. RESULTS
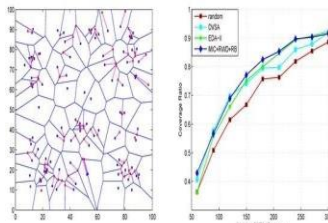
Samples

F. Screen

(a)   (b)

(c)   (d)

CONCLUSION

This paper demonstrates designing of embedded controlled sensor networks used for monitoring the environmental parameters. The features of RF module and GSM module are explored to design the system for long distance as well as short distance. Embedded controlled sensor networks have proven themselves to be a reliable solution for natural disaster management systems. Three commercial sensors had been integrated with the system to monitor and compute the level of existence level sensor, accelerometer and temperature in atmosphere. This earthquake and tsunami alert systems senses earthquake waves, transmits these data to a base station via RF and from base station via GSM module and uses computer-based decision making to deliver alert signals to the identified receivers placed at different towns and cities for both public and government consumption.

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