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Early Warning System to Predict Tsunami Based on Iot

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ABSTRACT

Internet of Things (IOT) is a new technological paradigm that can connect things from various fields through the Internet.IOT based tsunami prediction system is a smart IOT device that acts as an alarm and monitoring system during tsunami that operates by communicating over internet.Here for the IoT application, a Raspberry pi 3 model B module is used. It comes with wifi support for internet connectivity and uses an IOT cloud platform which helps to control, monitor and manage the device. ZigBee is a wireless technology developed as an open global standard to address the unique needs of low cost, low-power wireless sensor networks. Here ZigBee is used to create a wireless mesh network. Each node consist of a pressure sensor, temperature sensor, altitude sensor, and vibration sensor.The device senses its local environment using onboard sensors and sends early warnings immediately when it finds a dangerous situation. It is also able to receive such warning alarms from other similar devices available on internet and provide the user with voice, flashing light,sms and email alarm notifications. The ultimate aim of the project is to the tsunami warning information quickly through internet and makes it available to those who need it as early as possible.The fact that the internet is faster than the tsunami waves helps the device to deliver the alert message much before the actual calamity reach the users location giving that vital extra time to take those precautionary emergency measures.

Keywords:- *IOT,SMS, BSN,WI-FI,SENSOR*

1. INTRODUCTION

One third of earth's surface is covered by water which we call as oceans,rivers,lakesseas and ponds in which ocean contribute the major share.So, it's important to study its behavior. It is also important to take into concern the amount of destruction that could be caused by natural disasters like cyclones,floods and tsunamis.26 Dec 2004 stands as grim remainder of the amount of destruction that

could be caused by such a disaster. So it is essential to provide some kind of warning system to notify people on coastal regions in order to start evacuation procedures effectively reducing collateral damage. This could also be used for research by implementingtemperature, pressure and vibration sensors to the system. Another feature that can be added onto this system is that it could be used to relay distress messages sent by boat or ship in case of emergency along with the number of first node receiving the message. This could be very helpful in identifying the location of that vessel and location of the buoy is known. Buoy will also be having beacon lights which could warn vessels regarding the depth of the sea bed.

ZigBee- The standard takes full advantage of the IEEE802.15.4 physical radio specification and operates in unlicensed bands worldwide at the following frequencies: 2.400-2.484 GHz, 90-928 GHz and 868.0-868.6MHz.The 802.15.4 specification was developed at the Institute of Electrical and Electronics Engineers (IEEE). Here ZigBee is used to create a wireless mesh network.

Wi-Fi - The device uses Wi-Fi communication to connect to the internet. Wi-Fi is a local area wireless computer technology that allows devices to connect to the network using 2.4GHz radio band. It connects to the internet through a wireless access point. Typically we need a wireless router to act as the wireless access point.

Cloud Platform- An IoT cloud platform is a server based system that is used to connect and manage an IoT product using web services that enable the device to communicate between each other and also between other web applications over internet.

Here for the IoT application, a Raspberry pi 3 model B module is used. It is a third generation Raspberry pi. This powerful credit card sized single board computer can be used for many applications and supersedes the original Raspberry pi 2 model B+ and Raspberry pi 2 model B. It is 10 times faster than first generation Raspberry pi. It adds wireless LAN and Bluetooth connectivity making it the ideal solution for powerful connected designs.

Our device acts as a client and sends its data to the cloud platform through a data source channel. Any device that needs this information must subscribe to this data channel and can receive and act upon it. The communication between the cloud and the device happens through HTTP application layer protocol.

The majorobjectives are,

1. Increase the warning time for tsunami

2. To increase global awareness of hazards.
3. To significantly increase ability to save lives around the world by providing warnings.
4. To create viable, self sustain and permanent entity in the field of tsunami.
5. To understand what a tsunami is and why is it a secondary effect of earthquake.
6. To know the causes, effect and response of a particular tsunami.

2. LITERATURE REVIEW

The paper of GeoffriBlewittproposes that earthquake true size and tsunami potential can be determined using GPS data only up to 15meters after earthquake initiation by tracking the mean displacement of earth's surface associated with arrival of seismic waves. Within 10 minutes displacement >10 mm are detectable, consistent with results using datas of weeks after the event. . These displacements imply Mw 9.0+-0.1 indicating a high tsunami potential. This suggests existing GPS infrastructure could be developed into an effective component of tsunami warning system.[3]. But this system is completely complicated and costly due to usage of complicated techniques1The paper proposed by Hiroaki Tsushima propose thatnear fieldTsunami forecasting can be performed form data acquired from cabled offshore ocean bottom tsunami meters.Fist invert Tsunami wavform recorder at ocean bottomsto estimate the spatial distribution of initial sea surface displacementin the Tsunami source region without making any assumptions about fault geometry and earthquake magnitude.The the coastal Tsunami waveforms are synthesized from thgerestimated sea surface displacement..To increase the reliability updated OBTM data to repeat the forecasting calculation at 1-min interval.Theaccuracy of the coastal Tsunami amplitudes can be affected by spatial relationship between the Tsunami source and offshore observation stations.The numerical simulation showed thateven more accurate tsunami amplitude forecast could be achieved by deployement of additional offshore stations separated by a distance comparable to the trenche parallel length ofTsunami source.[1]. This system as using OBTM it is high cost system and here it does not use any IoT or easy methods to provide alert to the people.It takes more time for warning the occurrence of Tsunami even after prediction,this may lead to unhappy things.

3. PROJECT DESCRIPTION

3.1 PROPOSED SYSTEM

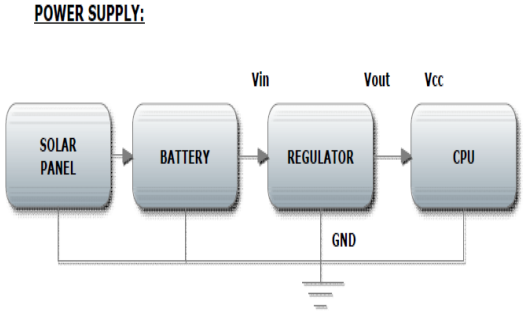
Place the nodes in water floating buoys which will be anchored to ocean floor at different locations. Once this process is completed, the system forms a wireless Adhoc mesh network with its coordinator node at the ocean research station.ZigBeemodules are used to create a wireless mesh network. Each node consists of a pressure sensor, temperature sensor, altitude sensor and vibration sensor. Pressure, temperature and altitude is measured by using BMP085 sensor, which is connected to the ARDUINO microcontroller. The vibration sensor used is accelerometer, it will sense X,Y and Z plane vibration. It is very sensitive so that it can sense very small vibrations too. Accelerometer is connected to the analog pin of ARDUINO microcontroller.

It will be also interfaced with a beacon light to warn ships nearby. The speciality of mesh network is that ,message originated in any node will be wirelessly relayed to the centralnode., from the central node information will be send to Raspberry pi which will monitor and send the data to the server.

It is designed in such a way that there will be only one central node. What the nodes do is that they send the average sensor readings periodically to the central node.(coordinator)along with their node number. This helps studies conducted on ocean behaviour.

Another important feature of this device is to act as an early warning system to people on land which also helps to alert emergency services in case of impending disaster Thisis done with the help of altitude sensor. In case of tsunami or cyclone there will be greater chance of the buoy to be raised to a higher altitude, which exceeds the threshold height which triggers an alert message to the research station along with the node number. This helps researchers to predict area that are about to get affected.

3.2 BLOCK DIAGRAM



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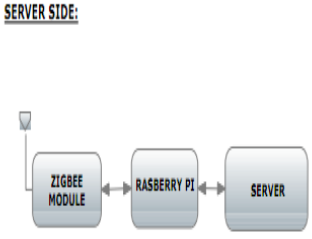

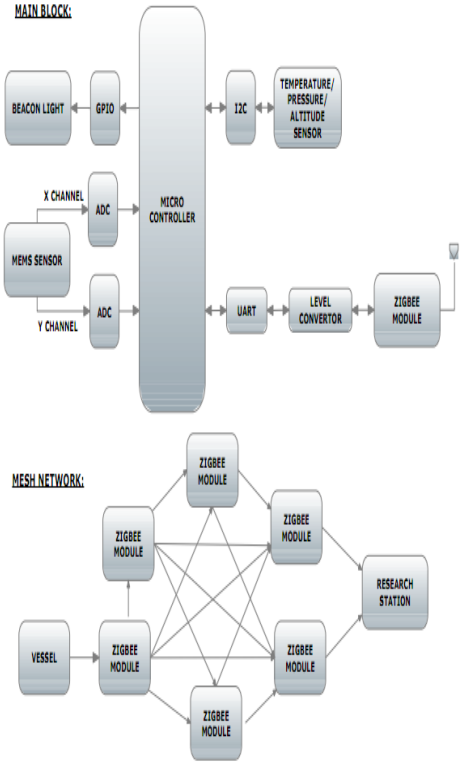

4. RESULT AND DISCUSSION

The proposed system of ZigBee based Tsunami prediction systemis having sensor networks such as temperature sensor for temperature measurement ,pressure sensor for pressure measurement ,potentiometer for altitude measurement and vibration sensor for vibration measurement. The system provides complete measurement of characteristics of sea waves and this helps to decide whether precautions are to be taken or not.Ultimately, the usage of Raspberry pi which provides the IoT platform helps to monitor, control and manage the device. The ultimate aim is to spread the tsunami warning quickly through internet to reduce the amount of destruction.

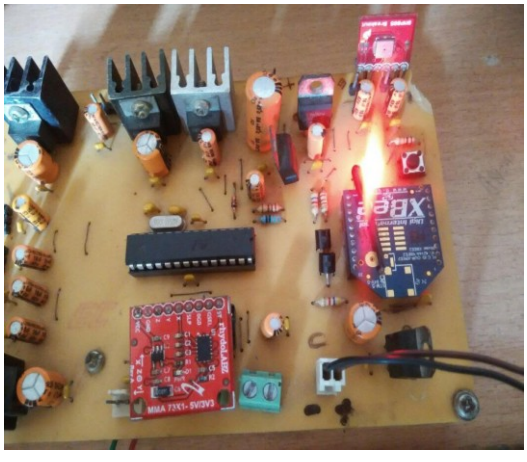

FIGURE: THE PROPOSED SYSTEM OF ZIGBEE BASED TSUNAMI DETECTION SYSTEM BY IOT APPROACH

5. CONCLUSION AND FUTURE WORK

The project on ZIGBEE based Tsunami prediction system by IOT approach helps researchers to predict areas that are about to get affected thus enabling them to evacuate as much people as possible and issue warning to all nearby areas. This greatly helps in reducing collateral damage caused by the disaster. This mesh network

could also be used to relay a distress message from vessels in case of emergency if it is within range of any node in the mesh network. Then this message will be relayed to the research station along with the first node to intercept this message. This will help authorities to know where to conduct search and rescue operation. Hereby to overcome certain problems during a tsunami a few seconds extra notice can be the difference between life and death. Take for instance the Tsunami that struck our country where none of these unfortunate souls had received any advanced warning .Had an early detection system been in place, many lives and valuable properties could have been saved. This is actually a global problem and not confined to the borders of our country alone. Although a Tsunami cannot be prevented, the impact of them can be mitigated through community preparedness, timely Warning and effective response.

In future Tsunami occurrence can be decided and alarm can be raised after checking more criteria like the tide level, sea shore level, and biological changes in the marine living organism.

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