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Development of an IoT-Based Bridge Safety Monitoring System

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***Abstract* – In countries like India there is powerful focus on national infrastructure. New bridges are built each year and the maintenance of those bridges is frequently ignored. The present structures uses very complex and excessive fee wired network and it additionally required high upkeep for optical fiber machine. So the primary objective of this task is to build a cheap bridge tracking machine for developing international locations like India. This project aims to simplify the system for selecting bridge tracking devices. Many bridges within the India are obsolete or structurally deficient to safely increase the life of those bridges, inspection would be vital. Bridge engineers have many duties and it's far not possible to expect one to know. Our system will sense the crack inside the bridge and signal might be given to govern room immediately to stop vehicles.**

General Terms: Arduino Uno, DHT11 sensor, Soil moisture sensor.

Keywords- Internet of Things (IOT), Bridge Safety Monitoring.

1. INTRODUCTION

Transportation plays a major role in today's life. In that bridge is one of the important transportation infrastructure for social and economic activities of country which has a long rivers. There are five long rivers in Indonesia where long suspension bridges are used as transportation over those rivers. The construction of such long bridges must be very strong and structural health status monitoring for such bridges is necessary. Bridges faces structural deficiency because of overloading, ageing, bending and many other improper maintenance. There are more than 89000 bridges are there in world, few of them are managed by regional management, few of them are managed by national management, rest of them are long span suspension bridges. The main objective of the system are as follows:To avoid accidents in case of heavy rainfall or other natural disaster.To provide safety for bridges.To overcome the difficulties in manual monitoring of bridges.Alert during the unsafe conditions ,saves the life of people.The system describes the purpose of the system and the requirements it will fulfil, and presents the general system layout, a description of the equipment and the technical solution for data transfer. A special focus is given to the subject of data management, which includes the archiving, analysis and presentation of the recorded data. In addition to the compulsory control room devices, the system will include a user interface which allows secure internet access to the monitoring data and results, from any location at any time.

1.1 PROBLEM STATEMENT

To develop a pervasive system to monitor and sense the conditions of bridge and share this information with admin to generate the alert.

2. LITERATURE SURVEY

[1] A new cable-stayed bridge is currently under construction across the River Yamuna in Wazirabad, Delhi. The bridge will have a total length of 675 m, with a main span of 251 m. Its steel-concrete composite deck, with a total width of 35.20 m, will carry four lanes of traffic in each direction. Its dramatic inclined steel pylon, with a height of 154 meters, and elegant stay cable design, will make it a particularly attractive and imposing addition to the Wazirabad skyline. The bridge will be equipped with a sophisticated structural health monitoring system, supplied by a joint venture of Mageba India, Mageba Switzerland and Vienna Consulting Engineers. The paper describes the purpose of the system and the requirements it will fulfill, and presents the general system layout, a description of the equipment and the technical solution for data transfer. A special focus is given to the subject of data management, which includes the archiving, analysis and presentation of the recorded data. In addition to the compulsory control room devices,

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the system will include a user interface which allows secure internet access to the monitoring data and results, from any location at any time.

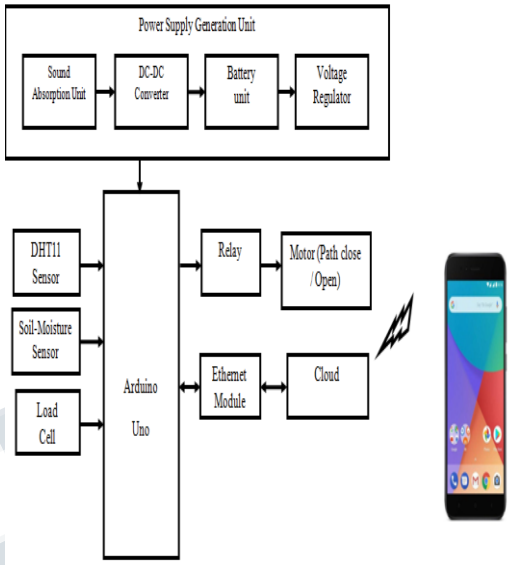
[2] With Japan facing the recent social infrastructure issue of aging infrastructure, NTT DATA developed a solution which remotely monitors bridges in real time to provide valuable information for maintaining bridge structures, and estimating the extent of structural fatigue. NTT DATA helped the company by implementing the bridge monitoring system- BRIMOS with the support of ODA (Official Development Assistance) and successfully took the first step to expanding market share in SouthEast Asia. Challenge: The Cau Can Tho Bridge is a newly constructed bridge built over the Mekong Delta basin where the foundation is naturally very soft. The client was concerned about the possibility of adverse influences of ground subsidence on the bridge's foundations (such as unexpected large-scale deformation). The bridge is used by a particularly high number of large vehicles carrying unusually heavy cargo as the logistics industry in vietnam that is still under development.

[3] The grant, entitled "A Remote Bridge Health Monitoring System Using Computational Simulation and GPS Sensor Data" is collaborative effort with Cranfield University, Railtrack, W S Atkins and Pell Freischman. The work expands and carries forward previous work started at the University of Nottingham in 1994. The work focuses on using kinematic GPS to create and validate finite element models of bridges, allowing the deflections and vibrations of the structures to be analyzed for any uncharacteristic movements. The paper details the progress of the work to date, including the way in which the field data gathered and analyzed by the Nottingham group is used by the Cranfied Group in order to assess the quality of structures. In addition, the use of a Cyrax laser scanner to create a finite element model of a bridge is discussed.

[4]In bridge health monitoring system, sensors and ZIGBEE modules are combined to be ubiquitous-node (u-node,) which are installed on the members of bridges and sends data to the u-gateway (ubiquitous gateway) that sends data to the management center wirelessly over CDMA technology. Based on the currently installed sensors on Yong-Jong Bridge, total 66 locations were carefully selected for four types of sensors.

3. SYSTEM ARCHITECTURE

The overall architecture of development of an IOT based bridge safety monitoring system which is as follows, explains the functionality of the project, various modules and their respective functions are given. The overall architecture diagram is shown in the figure. There are three different modules in this project.



Architecture Diagram

The bridge safety monitoring and tracking system will sense various factors like soil moisture, temperature, humidity and load on the bridge. At critical conditions an alarm will be generated and the roads will be closed using the "AUTO-BARRIER" the bridge might be given t the governing room to stop vehicles immediately. Power required to perform the above operations will be taken from the sound energy generated from the vehicles. The overall system includes the following modules.

Sensor interface with Arduino:

It consists of two sensors –DHT11 sensor senses the temperature and humidity. It uses a capacitive humidity sensor and a thermostat to measure the surrounding air and sends a digital signal on the data pin. Soil moisture sensor – It is used to measure the volumetric content of water inside the soil and gives us the moisture level as output. It consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value.

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Cloud Interface:
This module uses the Ethernet module for remote monitoring and controlling and the collected data is stored in cloud for later usage.

Application development:
This module consists of an application through which the data notification is sent to the admin's mobile device.

4. EVALUATION OF SYSTEM

4.1 ADVANTAGES

It generates the alert if flow, water level, and the load are increased. It saves the life of people. It provides live data of the load, water level, and pressure. Quick action and responses. Reducing resources.

4.2. APPLICATIONS

To monitor the bridges in real time and to generate the alert in case of any damage.

5. CONCLUSION

Bridge health condition monitoring in real time has been popular issue. The sensor technology is continuously advancing and condition monitoring has never been accurate and easier before. With the help of wireless technology and water level transmitter sensor, smart system is developing for securing bridge. This system checks the water level and the position of bridge for safety purpose. In the emergency conditions like earthquake, flood, etc. the facility of broadcasting the message is added. This System is unique in its ability to monitor the bridge environment; it transmits environmental data through wireless communication and sends alerts to the bridge management staff i.e. Monitoring Centre in real time for prompt action also to user's. Thus this system saves the lives of the people, to protect from accident.

6. FUTURE ENHANCEMENTS

In future this system can be extended to perform additional activities like recording vibrations at the foot of the bridge using ses70 sensor and implementation of lcd projection on the bridge used to indicate critical conditions for people near the bridge.

7. REFERENCES

[1]Peter FURTNER, Danilo DELLA CA', Chinmoy GOSH, "Structural Health Monitoring of Signature Bridge in Delhi - the Bridge - Structural - Health - Monitoring - System for the Wazirabad Bridge Project".

[2] Client of NTT Data, Implementation of bridge monitoring system in Vietnam

[3] Gethin Roberts, Xiaolin Meng, Michele Meo, Alan Dodson , Emily Cosser, Emanuela Iuliano, Alan Morris (2003), A REMOTE BRIDGE HEALTH MONITORING SYSTEM USING COMPUTATIONAL SIMULATION AND GPS SENSOR DATA.

[4] Chae M.J.,Yo H.S., Kim J.R, Cho M.Y, 2006, Bridge Condition monitoring system using wireless network (CDMA And ZIGBEE)