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Pontem Monitoring using IoT

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ABSTRACT

In recent years, many of the bridges are monitored using non-destructive testing methods. These methods are used for checking the structural damage, wreckage, strength of the bridges. To reduce the human losses, economic losses, protect the strength and structure of bridge we are introducing a smart bridge monitoring using sensors where it gives high and low values depending upon the problem occurred in the bridge. Now a day we are in hike of power supply, so we are using Wireless Sensor Networks (WSN) technology for regular monitoring of the bridge which consumes less power with accurate values. This project describes the real time working and getting real time values. Outcome of the project is to bring a product based module.

Keywords: *WSN; SHM; Nodes; Methodology;*

1. INTRODUCTION:

Health is an important issue not only for human beings, but also for civil infrastructures. Bridge collapses often result in a large number of casualties, as well as negative social and economic consequences, as was seen in the I-35W bridge collapse in Minneapolis, MN, in2007. Structural health monitoring (SHM) of civil infrastructures can mitigate problems. The monitoring system can estimate the bridge's various physical states. To determine structural performance and find possible damage locations. Cable tension force, one of the most important integrity measures for cable-stayed bridges, is estimated automatically using a vibration-based method. We also could assess deck-cable interaction, which may cause dynamic instability of the bridge. Aerodynamic and aero elastic properties of bridges are estimated based on synchronized wind and acceleration data. The measured data from the wireless monitoring system enables comprehensive assessment of the bridge's health.

2. WIRELESS NETWORKS:

Wireless network is drastically evolved in the present century. As the wired connections are complicated in case of a large network, wireless communications are preferred in many areas. Thus in our project Wireless communication plays a major role in transferring the sensed data values of the bridge to the cloud storage. In order to store the data in cloud we are designing a web page using PHP web language. Using this webpage, can be opened across the globe by providing a separate ip address.

3. WSN TECHNOLOGY:

Wireless sensor networks (WSN), sometimes called wireless sensor and actuator networks (WSAN), are spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, etc.

It is built of "nodes" from a few to several hundreds or even thousands, where each node is connected to one sensor.

3.1 Each such sensor network node has typically several parts:

1. A radio transceiver with an internal antenna or connection to an external antenna
2. A microcontroller
3. An electronic circuit for interfacing with the sensors and an energy source

The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an[1] advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

If a centralized architecture is used in a sensor network and the central node fails, then the entire network will collapse, however the reliability of the sensor network can be increased by using distributed control architecture. Distributed control is used in WSNs for the following reasons:

1. Sensor nodes are prone to failure,
2. for better collection of data,
3. To provide nodes with backup in case of failure of the central node.

There is also no centralized body to allocate the resources and they have to be self-organized.

Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored.

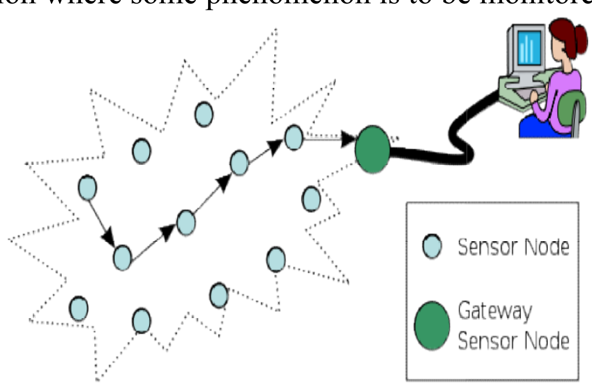

Fig 1.1 WSN Network

The wireless sensing platform was developed to address real-time, lossless acquisition of structural vibration, strain, and temperature measurements with a specific emphasis on highway bridge monitoring. However, as evidenced by the open architecture of the sensor interface and flexibility of the embedded software, the platform is capable of addressing a variety of wireless applications utilizing a wide range of both analog and digital sensors. Consequent to the far reaching application, the requirements have chosen to refer to the system design as Wireless Sensor Solution, or WSS.

4. TESTING OF LARGE STRUCTURES:

Some types of destructive testing:

1. Stress tests
2. Crash tests
3. Hardness tests
4. Metallographic tests

Destructive[2] testing is generally most suitable and economic for mass produced objects, as the cost of destroying a small number of pieces is negligible. The samples are put under different loads and stress. That way we can analyze in which point your material eventually gives up and cracks. The results gained are then compared to regulations and/or quality guidelines. Destructive tests are best when used together with our non-destructive methods: this combination gives the best information on materials and welds. Non-destructive tests show if cracks, corrosion or other faults exist. Destructive tests in turn indicate how and when the objects are in danger of breaking down or failing.

Some types of non-destructive testing:

1. Magnetic Particle Testing (MT)
2. Liquid Penetrant Testing (PT)
3. Radiographic Testing (RT)
4. Ultrasonic Testing (UT)
5. Electromagnetic Testing (ET)
6. Visual Testing (VT)
7. Acoustic Emission Testing (AE)
8. Guided Wave Testing (GW)
9. Laser Testing Methods (LM)
10. Leak Testing (LT)
11. Magnetic Flux Leakage (MFL)
12. Neutron Radiographic Testing (NR)
13. Thermal/Infrared Testing (IR)
14. Vibration Analysis (VA)

Nondestructive testing (NDT) [3] is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used. These destructive tests are often used to determine the physical properties of materials such as impact resistance, ductility, yield and ultimate tensile strength, fracture toughness and fatigue strength, but discontinuities and differences in material characteristics are more effectively found by NDT. Today modern nondestructive tests are used in manufacturing, fabrication and in-service inspections to ensure product integrity and reliability, to control manufacturing processes, lower production costs and to maintain a uniform quality level. During construction, NDT is used to ensure the quality of materials and joining processes during the fabrication and erection phases, and in-service NDT inspections are used to ensure that the products in use continue to have the integrity necessary to ensure their usefulness and the safety of the public.

5. METHODOLOGY:

5.1 Construction:

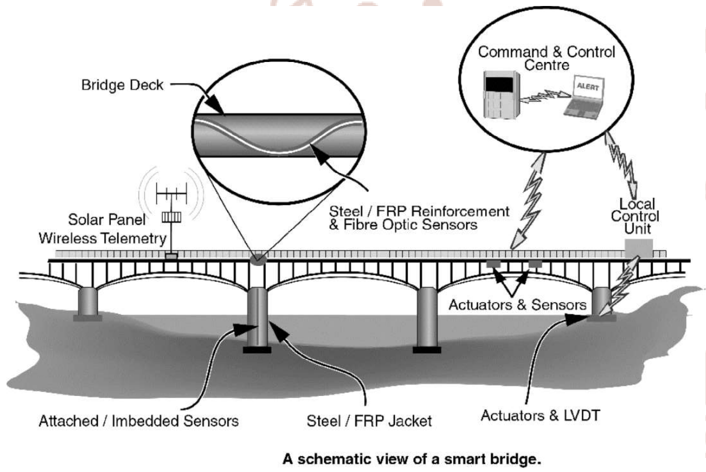

Fig 1.2 schematic view of smart bridge

5.2 Bridge Instrumentation:

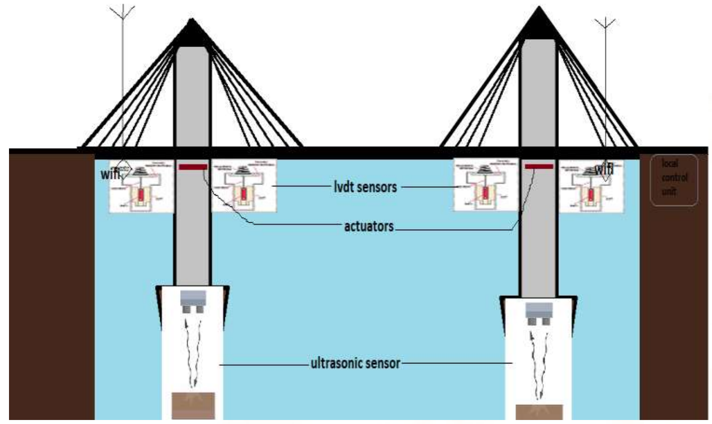

Fig 1.3 Proposed Methodology

Here we are using different types of sensors where each detects the different problems. The ultrasonic sensors are used to detect the natural disasters. For air disasters we can use other sensors because to protect the hanging bridges too. Other sensors are of common as they monitor the strength and wreckage in the bridge. The data values from other sensors will be sent to the common sensors where these sensors analyze all the data values and the analyzed values are sent to the database. The values in the database are further sent to the higher officials and to the common public.

CONCLUSION:

The proposed idea will give you the information in your hand to make an informed decision. It gives you flexible and analyzed data in the real time. This technique will be more useful in monitoring the condition of bridge, dams and also provide better support during disasters. This technique can be further used in various applications. Now a day's many people lose their lives because of sudden wreckage, improper strength and due occur of natural disasters. To avoid loss of lives we can implement this technology. The various data values obtained are commonly analyzed and gives us the final decision whether the bridge is in safe condition or not.

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