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IOT based Bridge Safety Monitoring System

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ABSTRACT

Advancements in sensor technology have brought the automated real-time bridge health monitoring system. Many long span bridges in Korea and in Japan have adopted this real-time health monitoring system. In this, a new idea of bridge health monitoring system is introduce. For short distance (among sensors in the bridge) TCP/IP wireless network is tested, and CDMA for long distance (between the bridge and the management center) data communication is tested. This system composed of: (1) Monitoring devices installed in the bridge environment. (2) Communication devices connecting the bridge monitoring system and cloud based server. (3) A dynamic database that stores bridge condition data. (4) A cloud based server that calculates and analyzes data transmitted from the monitoring devices. This system can analyze and monitor in real time the conditions of a bridge and its environment, including the waters levels nearby, pipelines, air and other safety conditions. The detected data and images are transmitted to the server and database to the users to have real time monitoring of the bridge conditions via mobile telecommunication devices.

Keywords: Monitoring Centre, TCP/IP, IoT, WI-FI Module, Sensors

I. INTRODUCTION

Now a day it is very essential to monitor, the bridges in our country or state as there were incidences happen earlier. The reason behind the these incidents as there is no such type of system, which will give information to the peoples if the bridge is not in good condition when sudden situations may occurs like flood, earthquake [1]. It means that the bridge is not in safe condition. When such situation arises, bridge may be collapse, which causes much kind of losses like accidents, human deaths, etc. This happens because there is no efficient system in existence, which will provide notification about conditions about current condition of bridge when bridge is not in safe mode.

In the existing systems, Zig-Bee technology was used which is cost consuming and quite time consuming, but this system used the TCP/IP protocol which is suited for all types of bridges.

Therefore in this study, the IOT wireless sensor network and smart building technologies are adopted to solve the various problems of bridge safety information transmission and management by developing an IOT based bridge safety monitoring system capable of monitoring the environmental data of a bridge and transmitting the data to the mobile devices of bridge safety management staff for reference and documentation.

The water level sensor is used through which system has to check manually the level of water. So for this the system is being developing an application in which everything is automated so less human efforts are required and this application is very much useful

in the emergency condition like prevent from flood, earthquakes. The system developed in this study can help to promote the advancements of bridge safety management. This system aims at developing an application that is useful for the people working at the bridge department or for bridge engineers.

The main objectives of the Bridge Monitoring System is:

- To provide safety for bridges.
- To avoid accidents in case of heavy rainfall.
- To improve the bridge efficiency.
- To overcome the technical and cost obstacles.

II. SYSTEM ARCHITECTURE

This system consists of following parts:

1. Wi-Fi Module - Through Wi-Fi module the status of the overall bridge will be sent to the monitoring system.

2. Vibration sensor – Vibration sensor senses the condition of bridge, whether it is in better condition or not.

3. Water level Transmitter sensor – It is used to sense the water level status.

4. Barriers with servo motor – If water level increased or the bridge becomes vibrate then barriers with servo motor will close.

5. Management Centre – All the necessary information related to status of the bridge is send to and monitor by Management centre.

As shown in the Figure 1 the communication between bridge and monitoring Centre is takes place via WI-FI module. The WI-FI module itself act as sever through which status of condition of bridge is transmitted to the monitoring Centre. The Monitoring devices like water level transmitter and vibration sensor are continuously monitoring the structural health of bridge. If water level increased and if bridge is being vibrated then barriers with servomotor will close and at the same time, status of bridge condition is directed to the monitoring Centre.

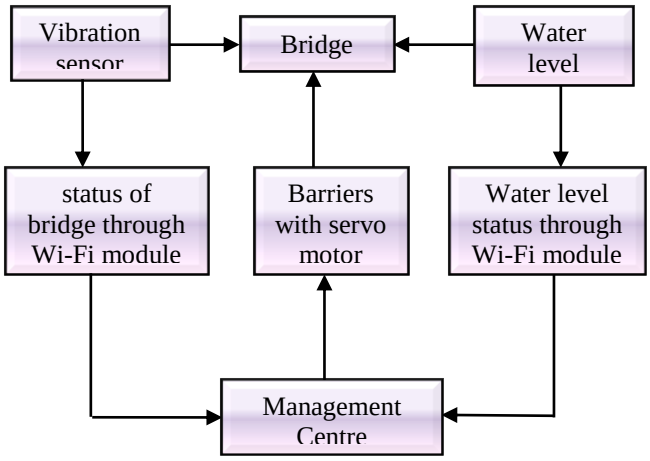

Figure 1. Architecture of Bridge Monitoring System

It has a technology called MBM (Monitoring Based Maintenance) that enables maintenance engineers to monitor the condition of the bridge in real time. The components that which are used to detect the strain, acceleration, cracks etc. The System includes the desktop application which is useful for the engineers working in the bridge department to monitor the current position of bridge.

There are two important chunks in the system i.e. Vibration Sensor and River water level Transmitter, which sends the details of bridge strength to the Management Center. All the collected environmental data sent to the server system. So that as per situation Management Center takes immediate action for bridge safety and security. For example if water level increases beyond the default settled water level then security alarm alerts the management center and barriers of bridge will automatically close by management center.

III. METHODS AND MATERIAL

A. The methodology implemented includes:

1. Structural Design Components
2. WI-FI Module & TCP/IP protocol
3. IoT Components
4. Experimental Setup

1. Structural Design Components

1. Design of Vibration sensor and Water level transmitter which is the Assembly of communicating devices.
2. Water level transmitter senses the water level.
3. Vibration sensor detect the motion of bridge in case of flood.
4. The output value or status is collected on arduino.

2. WI-FI Module & TCP/IP protocol

I. WI-FI module itself act as a server which is connected to the arduino.

II. Through WI-FI module the status or condition of bridge is transmitted to the monitoring Centre.

III. This transmission is done through TCP/IP protocol in the form of packets.

IV. TCP/IP protocol is the transmission control protocol and internet protocol through which the transmission of data is easily possible without any interruption.

3. IoT Components

There are three layers in the architecture of an IoT:

1) Sensor layer: The sensor layer leads to detect or collect all kind of necessary information from physical world like physical, identification, audio, video data.

2) Network layer: The network layer mainly responsible for transmitting data reliably and safely through wider and faster networks connections like TCP/IP.

3) Application layer: Application layer performs the function to support information coordination, sharing and interconnection across monitoring centre and bridge.

4. Experimental Setup

Figure 2 specifies the exact details about the actual setup of the Bridge Monitoring System.

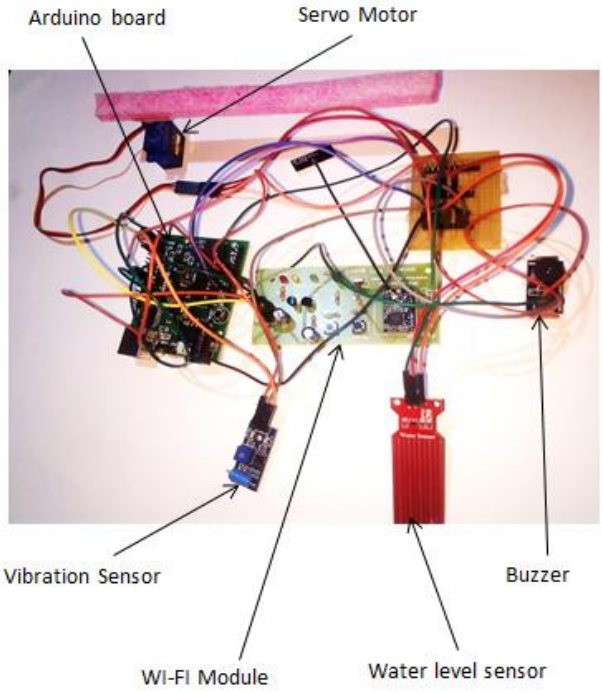

Figure 2. System Setup

B. Material Used:

Hardware required for implementation:

1. Arduino Board:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

2. Water Level Sensor:

Water Level sensor is use to detect the level of substances that can flow. These kinds of substances include liquids, slurries, granular material and powders. These measurements can be used to determine the amount of materials within a closed container or the flow of water in open channels.

3. Vibration Sensor:

Vibration sensor is use for measuring, displaying, and analysing linear velocity, displacement and proximity, or acceleration.

4. Servomotor:

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. Servomotor is use in applications such as robotics, CNC machinery or automated manufacturing. [3]

IV. 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 bridges.

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. The main aim of Bridge Monitoring System is to save the lives of the people, to protect from accident.

V. REFERENCES

[1]. Jin-Lian Lee, Yaw-Yauan Tyan, Ming-Hui Wen, Yun-Wu Wu "Development of an IoT-based Bridge Safety Monitoring System" Proceedings of the 2017 IEEE International Conference on Applied System Innovation IEEE-ICASI 2017.

[2]. Y. Sun, "Research on the Railroad Bridge Monitoring Platform Based on the Internet of Things," International Journal of Control and Automation, vol. 7, no. 1, pp. 401–408, 2014.

[3]. A.Praba Asst. Prof., Civil Engineering Department, VCET, Madurai, India "IoT of Civil Infrastructures, International Journal of Research in Advanced Technology-IJORAT Vol. 1, Issue 6, JUNE 2016 .

[4]. Chae, M. J., Yoo, H. S., Kim, J. R., Cho, M. Y. "Bridge Condition Monitoring System Using Wireless Network (Cdma And Zigbee)" ISARC, 2006 .