

Bridge Safety Monitoring System Using Internet Of Things

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Abstract : In developing countries like India there is strong focus on national infrastructure. New bridges are built every year. The maintenance of these bridges is many times overlooked. Whenever bridge collapses so many people lose their family member. This happens because there is no application which will send the alert message to the user when the movement of the bridge is detected or when the bridge is collapsed. And because of this the amount of accidents happened because of the collapsing of the bridge never decreased. As the bridge is so much important, because of the bridge the people can reach to their home, cross the rivers etc. So the safety of that bridge and the people who are using that bridge is also important.

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 introduced. For short distance (among sensors in the bridge) TCP/IP wireless network is tested, and CDMA/GSM for long distance (between the bridge and the management center) data communication is tested.

Keywords : Internet Of Things, Arduino, Sensors.

I. Introduction

State bridge engineers are responsible for many aspects of bridge networks. Due to the large number of systems that are available, it is impossible for an engineer to sort through all these systems without knowledge of: (a) the capabilities of a particular system and (b) which companies offer particular systems and services. This report briefly explains the concepts, advantages, and disadvantages behind commercially available health monitoring systems. It simplifies the task for system selection, from the large number of commercially available systems that exist, using a computer program to find the system that best fits the needs of a specific bridge..

II. Objectives

The main objectives of the Bridge Safety Monitoring System is:

- Device that will give the current condition of the bridge in real time.
- Reduce the work of the maintenance engineers.
- Alert the nearby localities in case of a bridge fall.
- Stop vehicles which are already on the bridge.

The result of this study will be valuable to the State bridge Engineers which will help them to minimize their workload and will also help in alerting the nearby localities about the bridge condition in case of bridge fall.

III. Problem Statement

To develop an IOT based Bridge Safety Monitoring system, to improve the safety for bridges and to detect and send alert in case of bridge fall.

IV. Methods And Materials

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 Accelerometer sensor, Ultrasonic sensors and Wifi module which is the Assembly of communicating devices.
2. Accelerometer sensor senses the vibration of the bridge.

3. Ultrasonic sensor detects the distance of bridge surface in case of bridge fall.
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.

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. **Accelerometer Sensor:** ADXL335 is a Breakout board based on 3 axis ADXL335 IC from Analog Devices. The Accelerometer Module require no external devices and works on 5V power supply. It can be directly interfaced to ADC of a microcontroller without any external components.
3. **Ultrasonic sensor:** Ultrasonic sensors module includes ultrasonic transmitters, receiver and control circuit. It provides 2cm-400cm non contact measurement function. Ranging accuracy may reach 3mm.
4. **GSM module:** This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily

IV. Proposed system

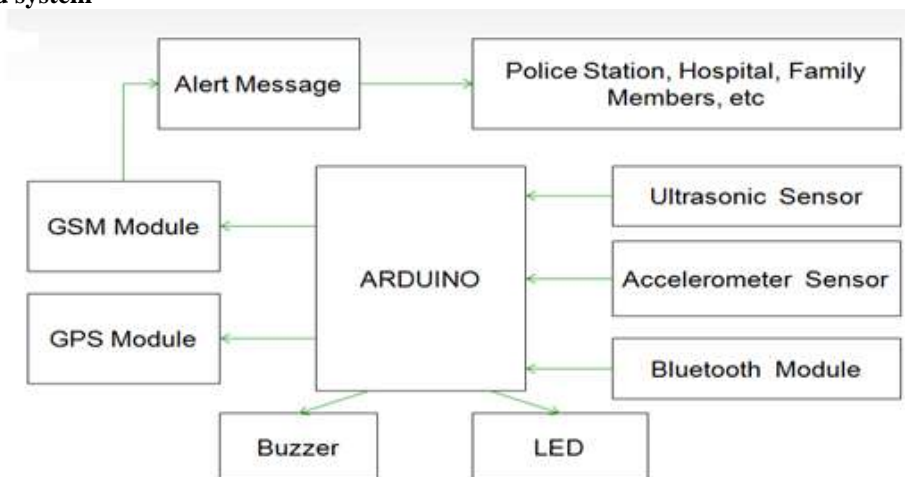


Fig.1 block diagram for the proposed system

Here, various output to various modules and buzzers and LEDs for indicating thereby nearby locality about the incident. Sensors will give input to Arduino based on certain conditions and Arduino will drive output to various modules and buzzers and LEDs for indicating thereby nearby locality about the incident.

V. 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.

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