International Journal of Research in Engineering, Science and Management
Volume-3, Issue-4, April-2020
www.ijresm.com | ISSN (Online): 2581-5792


# Bridge Health Detection System

Namrata Rade[1], Chavan Mayuri[2], Ghadge Pragati[3], Lonkar Shweta[4], Shelke Dipti[5]
[1]*Professor, Dept. of Electronics & Telecommunication Engg., Keystone School of Engineering, Pune, India*
[2,3,4,5]*Student, Dept. of Electronics & Telecommunication Engg., Keystone School of Engineering, Pune, India*

***Abstract*: This project system uses wireless network on real time basis for bridge health monitoring purpose. It can transmit the data continuously for several minutes. Currently bridge inspection is done by manually. Also takes lots of time to find and detect any fault. It requires specialized or experienced man for inspection. Our proposed project research is focusing of implementation of system having sensors which informs bridge condition to nearby local monitoring station.**

***Keywords*: PIC Controller, Accelerometer sensor, Ultrasonic sensor, RF Zigbee, MAX232.**

## 1. Introduction

The most common reason for bridge collapse are tilt of columns. The element of bridge and angle of columns at the base of bridge Monitoring. The bridge health condition is an increasing concern for the benefit of all living beings. Our proposed system uses the advanced technique for saving the life of living beings.

This system comprises of sensor technology and RF Zigbee technology. Our proposed systems have many different types of sensors. The data or information of bridge health condition is collected by sensors. According to that data is processed through the programmed PIC controller. If any fault arises or not in the health of bridge at the time of inspection or detection. It sends the data to local monitoring station. The Result of processed data is displayed on the LCD, which is placed on the both side of bridge for understanding of people [1].

The role of bridge is very important in the nation's economic and infrastructure development for the conveniences to the people, transportation and for connecting and communicating two areas. Bridge health detection system is designed for detect the fault and alert the people. In this project information about bridge condition is displayed on both side of bridge as well as this is given to the webspace. People can access this information on web space on own PC. This information is every time updated through Visual basic software [2].

## 2. Literature survey

Vinodini R (May 2013), In this paper, The Zigbee protocol is used for monitoring the bridge damages that exist in civil infrastructure, these damage are identified by using three sensors namely flex sensor, load cell and vibration sensor. The load cell is used to find capacity of bridge. The flex and vibration sensor is used to identify the internal and external damage. If damage is detected via zigbee communication the damage detection is informed to the base station [3].

Atharva kekare, Pranit Huddedar (May-June 2014), In this paper,4sensors are used namely temperature sensor, Anemometer Accelerometer and strain gauge. These 4 sensor are interfaced to the microcontroller through a signal conditioning circuit. The signal conditioning circuit is used to make the output of sensor compatible with microcontroller. the alarm is triggered when the value of sensors exceeds the threshold value. All parameter are constantly transmitted through RF module to remote PC. On receiver side use RF module for receive a data. Visual basics is used for making a module which display all the parameter in a systematic way. Here TRMINAL version 1.9b is used to connect RF module to PC [4].

Anand Kumar Jha (2016), Zigbee used as wireless network and GSM is used for long distance (between the bridge and the management center) data communication. This technology can be called MBM (Monitoring Based Maintenance) that enables the bridge maintenance engineers monitor the condition of the bridge in real time. The sensors installed on various parts of the bridge monitors the bend, traffic. At any point of time of these parameters cross their threshold value the communication system informs the management center giving an alarm for taking precautionary measures. The complete parameters of the bridge are taken by an ARM processor and sent to another module which is located in a short distance. Here the communication established is using Zigbee that uses wireless transmitter and receiver circuitry [5].

Himalay B. Swant, Shivdas H. Shinde (2018), This proposed system has many type of sensor that of bridge condition is collected by sensor. According to that data is processed through the programed microcontroller. If any fault arises in the health of bridge at the time of inspection data send to nearby RTO. We use this technique but only replace microcontroller to PIC controller. we implement system which take each condition if fault is detect or not this all data send on webspace.so any one access data from VB software [6].

## 3. Block diagram and description

1) *Power supply:* we use 5v power supply for pic controller, Accelerometer, Ultrasonic sensor and Zigbee.
2) *PIC Microcontroller:* It has wide operating range (2.0 V-5.5 V). It has sinking and sourcing capability of 25 mA. We are

using PIC16F877A microcontroller. It is the heart of circuit. The system consists of a controller equipped by RF zigbee module. Here use pin no.RB5 to give info about water level. Which is connected to ultrasonic sensor.pin no.AN0and AN1 is connected to accelerometer to measure a tilt angle. Pin no.RC6 is used to transmit data from PIC to RF zigbee and pin no. RC7 is used to receive a signal from RF zigbee to PIC.

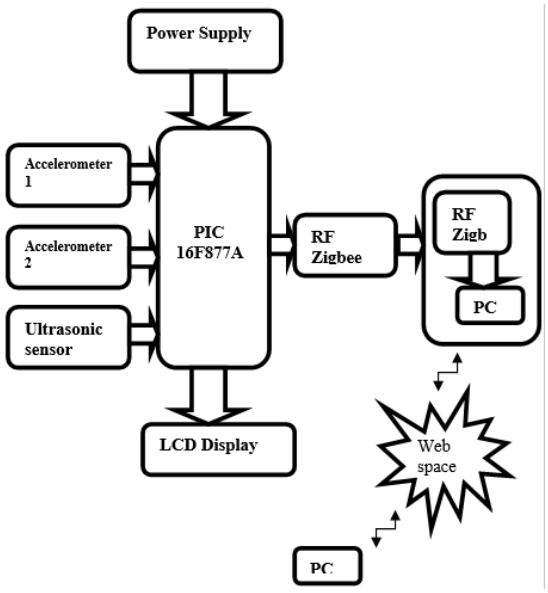


Fig. 1. Block diagram


Fig. 2. PIC16F877A Controller

3) *Ultrasonic sensor (HCSR04):* The timing diagram of HCSR04 is shown. To start measurement, Trig of SR04 must receive a pulse of high (5V) for at least 10us. This will initiate the sensor will transmit out 8 cycle of ultrasonic burst at 40kHz and wait for the reflected ultrasonic burst. When the sensor detected ultrasonic from receiver it will set the Echo pin to high (5V) and delay for a period (width) which proportion to distance. To obtain the distance, measure the width (Ton) of Echo pin.

Fig. 3. HCSR04 Ultrasonic sensor

4) *Accelerometer (ADXL 335):* The ADXL335 is a complete 3-axis acceleration measurement system. It contains a polysilicon surface-micromachined sensor and signal conditioning circuitry to implement open-loop acceleration measurement architecture. The output signals are analog voltages that are proportional to acceleration. The accelerometer can measure the static acceleration of gravity in tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration


Fig. 4. ADXL 335 Accelerometer

5) *RF Zigbee module:* Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distance. Zigbee is typically used in low data rate. It applications that require long battery life and secure networking (Zigbee networks are secured by 128-bit symmetric encryption keys). Zigbee has a defined rate of 250 kbit/s, best suited for intermittent data transmissions


Fig. 5. RF Zigbee module

6) *MAX232 (Driver IC):* The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels.

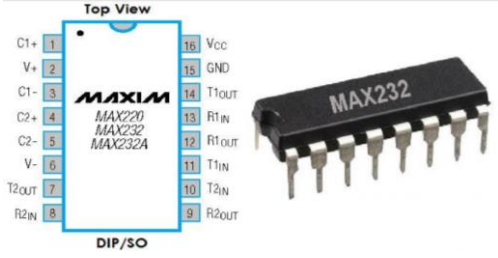


Fig. 6. MAX232 Driver IC

7) *LCD (16X2):* LCD screen is an electronic display. This is used which displays the status of the system. It also displays the when the fingerprint is added or successful authentication. A 16x2 LCD display is very basic module that has 2 controllers with 16 pin which is very commonly used in various devices and circuits.

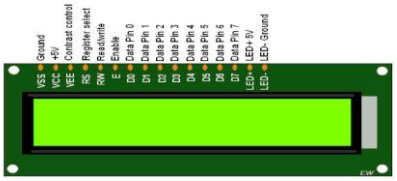


Fig. 7. LCD Display(16x2)

8) *Visual basic software:* Visual basics software is used to update the data and transmit to the web space through internet access. Here Tag ID and Tag name is important parameters.by using particular Tag ID and Tag name we can access information about bridge on any other computer through visual basics software. From a sensor or input device.

Fig. 8. Visual basic software window

## 4. Flowchart

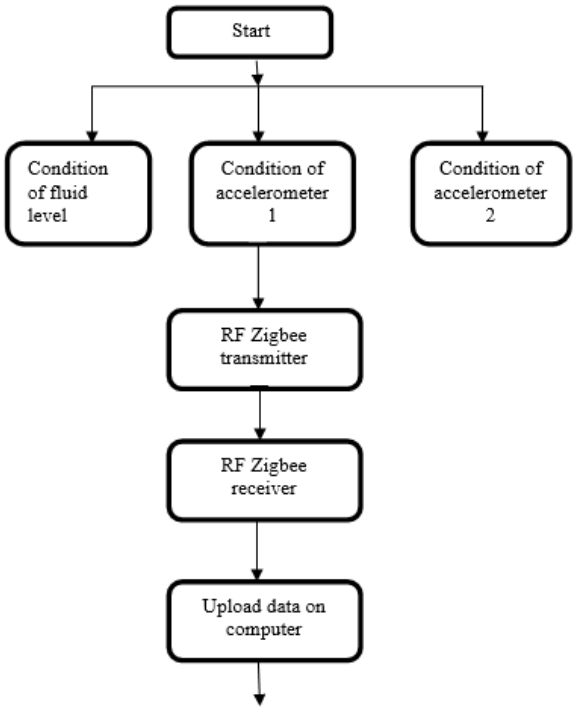


Fig. 9. Flowchart

## 5. Observations and Result

### A. *Accelerometer*

*Observation:* Accelerometer is placed perpendicular to base of column. Normal position of accelerometer is at 90 degree.at this position it gives 75 ADC Count.one ADC count changes at 20mv so it gives 75x20mv=1.5 volt. This is the normal position means there is no any problem. We set a threshold levels. 93 degree and 87 degree is the threshold levels and it gives 78 and 72 ADC Count respectively.so the voltages are 1.56v and 1.44v.

*Result:* If accelerometer tilts above these levels it displays Column is not ok on screen.

### B. *Ultrasonic Sensor*

*Observation:* Normal ultrasonic sensors are gives PWM output which is depend on velocity of sound wave and frequency.

So distance = velocity of sound wave *frequency/2.

But here we use PIC controller to convert this PWM output into digital form. this ultrasonic sensor checks the water level up to 60cm. and we gives the threshold level is 30cm.if any abstract is detected above 30cm then it changes the width of pulse. According that changes the pins output that is either 0 or 1.

*Result:* If output of controller pin is logic 0 then water level is ok so there is no display on screen. But output is logic 1 then it displays fluid level is detected on LCD Screen.

## 6. Advantages and Application

1) Improves Security
2) Low cost system, providing maximum automation.
3) Reduction in manpower.
4) Industrial Application
5) Disaster management system.
6) Fluid level detection system.

## 7. Conclusion

By this work, we treated an example of detection tilt angle of column and fluid level detection application. we investigated the case of bridge health detection application. In this paper, Our principal objective is to detection of tilt angle of column and detection of fluid level. Internet of things presents a solution for damage in bridge of health detection. In this paper, we implement such a system in which data related bridge is send to local monitoring station by using RF Zigbee module and then data is send to webspace for the accesing purpose

In future we can develop application on cell phones which makes system more effective.

## Acknowledgment

We thank the Department of Electronics and Telecommunication Engineering, Keystone School of Engineering Pune, Savitribai Phule University, Pune, Maharashtra, India for permitting to use the computational

facilities by providing us most suitable environment for research and development.

## References

[1] Edward Sazonov, Haodong Li, Member, Darrell Curry, and Pragasen Pillay, "Self-Powered Sensors for Monitoring of Highway Bridges," Sensors Journal, IEEE, vol. 9, 2009, pp. 1422-1429.

[2] Arunkumar G. C, Chandrakanth S. R, Chethankumar M, Karthik V, Santosh Chavan, "Bridge Condition Monitoring System Using Wireless Network,"

[3] Vinodini R, Nalini S, Muthumurugesan D, "Detection of Structural Damages in Bridge Based On ZigBee Networks Using Sensors," IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 3, No 1, May 2013.

[4] Atharva Kekare, Pranit Huddedar, "Structural Health Monitoring of Signature. Bridge in Delhi - The Bridge-Structural-Health-Monitoring-System for the Wazirabad Bridge. May-June 2014.

[5] Anand Kumar Jha, "A remote bridge health monitoring system using computational simulation and GPS sensor data," 2016.

[6] Himalay B. Swant, Shivdas H. Shinde, "Bridge Condition monitoring system using wireless network (CDMA and Zigbee)," 2018.