International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 04 | Apr -2017 www.irjet.net p-ISSN: 2395-0072

Bridge Disaster Tracking System Using GSM and GPS

Akash Lad[1], Rishabh Waykole[2], Pravin Mahajan[3]

[123]*Dept. of Electronics and Telecommunications, Pimpri Chinchwad College of Engineering, Maharashtra, India*

Abstract - *Many of the bridges last over decades and centuries, these brides are never looked over when it comes to their condition monitoring and maintenance. This stands as the primary cause for bridge disasters which leads into heavy death toll. This death toll increases all the more as there is no proper communication between social organizations such as Police stations, Fire Brigade stations, Zonal authorities and Hospitals. Thus Bridge Disaster Tracking System helps to communicate properly between these major organizations so that rapid help is provided to the victims. Also the real time behavior of the system helps in the pre indication of the disaster. This system can be implemented using simple PIC microcontroller rather than going into deep complexity of various other systems. This implementation is based upon interfacing various sensors like Richter scale, water flow meter, ultrasonic sensor and modules like GPS and GSM with PIC microcontroller by considering threshold of various climatic parameters acting on the bridges using Bridge analysis.*

Key Words: **PIC microcontroller, Victims, Social Organizations, GPS, GSM, Richter scale, Water Flow meter, Bridge analysis.**

1. INTRODUCTION

Many highly advanced Bridge Monitoring systems are available to look upon the condition of the bridges but the major drawback being that these systems are never taken care of by the concerned authorities and hence disasters occur even after their existence. The main aim of this system is to provide a rapid aid to the disaster hit victims with the help of proper coordination between the government organizations.

The current system [Bridge Disaster Tracking System Using GSM and GPS] will give a real time response due to its effective means of communication with precise coordination describing the impact and alerting the commuters who are about to cross the bridge.

1.1 Bridge site investigation and planning

The below figure describes the structural components of bridge:

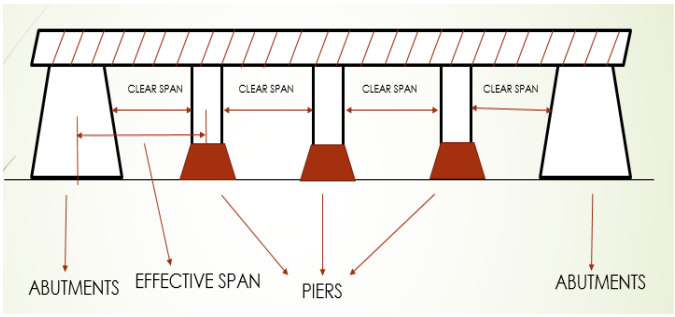

Figure-1: Bridge analysis

1. **Abutments**:
They are the end supports of the superstructure.

2. **Piers**:
They are the intermediate support of bridge superstructure and maybe of solid or open type.

3. **Effective span:**
The centre to centre distance between any two adjacent supports is called as an effective span of a bridge.

4. **Clear span:**
The clear distance between any two adjacent supports is called as an effective span of a bridge.

Suitable unyielding and non-erodible material for foundation should be available for short depth for abutments and piers of the bridge. The bearing strata should be free from tendency to slip or slide or sink under loads. The stream at the bridge site should be well defined and as narrow as possible.
There should be a straight reach of stream at bridge site. The site should have firm, permanent, straight and high banks. It should be reliable, have straight approach roads and square alignment.

1.2 Flood analysis

Floods play a major role in catastrophic disaster for bridges.

During floods, the rapidly fast flowing stream of water has an impact on the piers of the bridges which leads to devastating disasters and results in the bridge collapse.

Flood analysis requires a huge backdated data which helps in development and building of the bridge.

The data includes:
1. The average rainfall for last 20 years.
2. Catchment area of river on the bridge site.
3. Average discharge.

1.2 Earthquake analysis

The extensive damage of the recent earthquakes have led to a significant damage of bridge structures.

The cause is often the error of conceptual design, i.e the choice of the structural and foundation system, spacing of piers and connections between them, deck and abutments, the spacing of joints, etc.

1.2.1Design criteria

1. Time period of vibrations:

Time period of vibration, T of such structures when fixed at base, shall be calculated using the following formula given. Time period of structure, if available, through vibration measurement on similar structure and foundation soil condition can also be adopted.

$$T = C_T \sqrt{\frac{W_t h}{E_s A g}}$$

where

C_T = coefficient depending upon the slenderness ratio of the structure given in Table 6,

W_t = total weight of the structure including weight of lining and contents above the base,

h = height of structure above the base,

E_s = modulus of elasticity of material of the structural shell,

A = area of cross-section at the base of the structural shell,

For circular sections, $A = 2\pi rt$, where r is the mean radius of structural shell and t its thickness, and

g = acceleration due to gravity.

Figure -2: Mathematical analysis to find time period

2. BLOCK DIAGRAM EXPLANATION

The following figure shows the block diagram of the transmitter and receiver section.

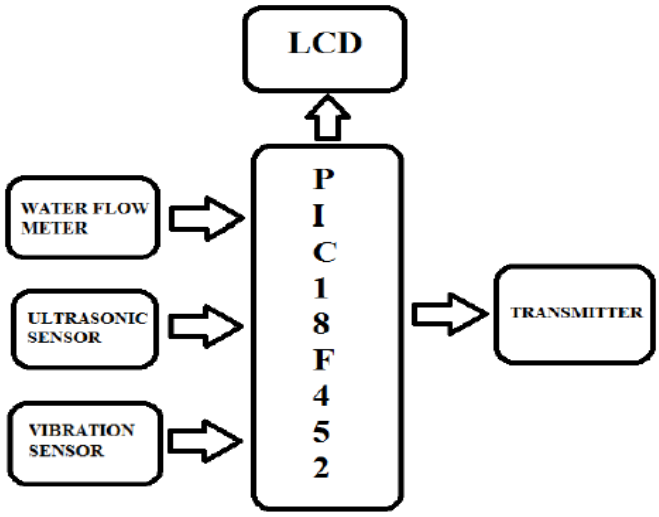

Figure-3: Transmitter section

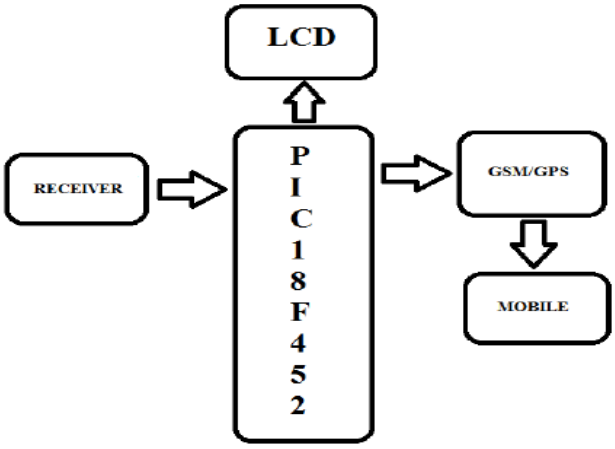

Figure-4: Receiver section

This design consists of three sensor, GPS and GSM module. The sensors used are water flow meter, Richter scale sensor, and ultrasonic sensor. Once the microcontroller is initiated all these three sensors interfaced at the transmitter of PIC will collect the data and compare it with the threshold data which is pre fed in the microcontroller. This pre fed value is obtained from the bridge analysis. Now if any of the sensor crosses its threshold value using the receiver section of PIC it would be send to the concerned authorities using GSM and GPS.

2.1 Transmitter Section

Pic18f452a: pic18f452a microcontroller has five ports (Port A, B, C, D & E). It has 40 pins on it and 33 of them can be used as IO. Port A issued to connect the sensor output, Port B is used for LCD, Port C is used to control RF module. Port D is used to connect the motor, GSM and LED. Port E is used to connect the key.

Ultrasonic sensor: The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It is used in this project to detect the level of water so as to provide the distress message in case of emergency if the water level goes up the danger level.

Water flow meter: Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse Signal.

Richter scale sensor: A simple Richter scale sensor that is sensitive to up-down motions of the earth can be understood by visualizing a weight hanging on a spring. The spring and weight are suspended from a frame that moves along with the earth's surface. As the earth moves, the relative motion between the weight and the earth provides a measure of the vertical ground motion. If a recording system is installed, such as a rotating drum attached to the frame, and a pen attached to the mass, this relative motion between the weight and earth can be recorded to produce a history of ground motion. Any movement of the ground moves the frame. The mass tends not to move because of its inertia, and by measuring the movement between the frame and the mass, the motion of the ground can be determined.

2.2 Receiver Section

GSM: GSM wireless communication technology used to send the alert message to the responsible authority if the sensor is activated.

LCD: LCD displays the real time information. Large LCD panels can be mounted on the bridge for public addressing and alerting them in advance.

RECEIVER (MOBILE PHONE): The receiver i.e. the mobile phone receives the, alerts and messages via GSM and GPS.

2.3 Circuit Diagram

1. Power Supply:

The Power Supply was designed in the NI Multisim Software. The schematic is as shown below:

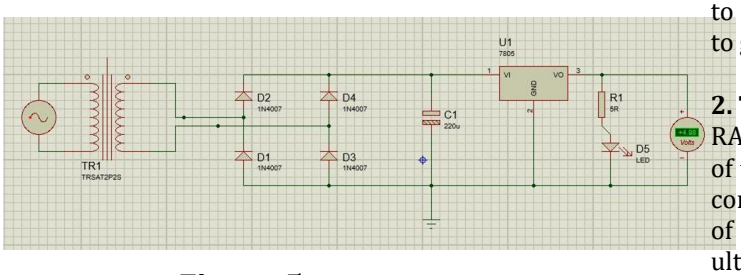

Figure-5: Power Supply

2. Main Circuit Diagram:

The final circuit for the project was prepared in the OrCad Software. The final circuit interfacing has the following connections:

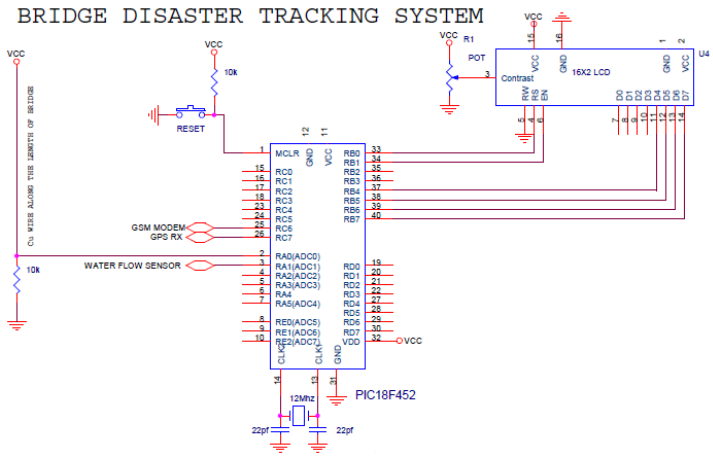

Figure-6: Main Circuit Diagram

3. PCB Designing: done using Express PCB Software.

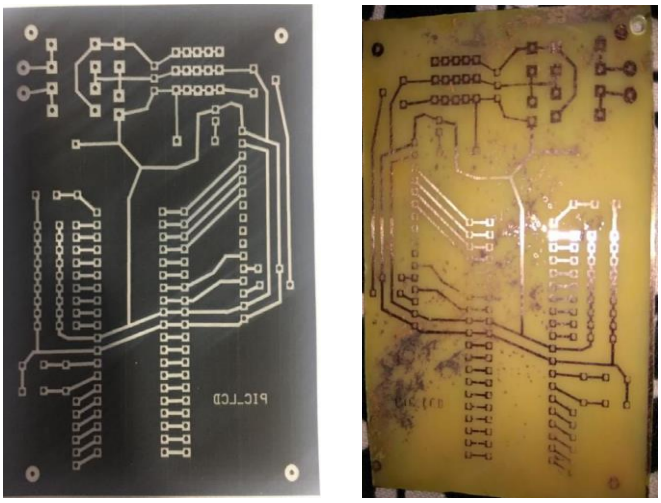

Figure-7: PCB Board

1. The power supply is used to down convert the 230V, 50Hz AC input to 5V DC input. As shown in the circuit diagram, a bridge rectifier is used to get the pulsating DC signal. Following the rectifier, a capacitive filter is present to remove the ripples. Then, LM7805 regulator IC is used to get 5V at the output.

2. Transmitter Section

RA0 of PIC microcontroller is connected to the output pin of the wire mesh sensor. RA1 pin of PIC microcontroller is connected to output pin of the water flow sensor. RA2 pin of PIC controller is connected to output pin of the ultrasonic sensor. RA3 pin of PIC microcontroller is connected to output pin of the vibration sensor. So that sensed value is read by controller and it compares some

threshold value. RB4 to RB7 pins of PIC microcontroller is connected to the LCD. In 4 -bit mode of operation, for the sake of saving valuable I/O pins of the microcontroller, there are only 4 higher bits (D4 -D7) used for communication, while other may be left unconnected.Pin13 and pin 14(OSC/CLK) is connected to crystal oscillator to generate clock frequency of 20MHz. RC6 pin of microcontroller is connected transmitter part RF module for transmitting the signal to receiver section.

3. Receiver Section

The transmitted signal is received by RF receiver that is connected to the pin RC7 of microcontroller. The received data is given to PIC microcontroller. GSM is connected to it in order to send the alerting message. RD2 and RD3 pins are connected to the LED. LCD is connected to the PORT B of PIC controller in order to display the alerting message.

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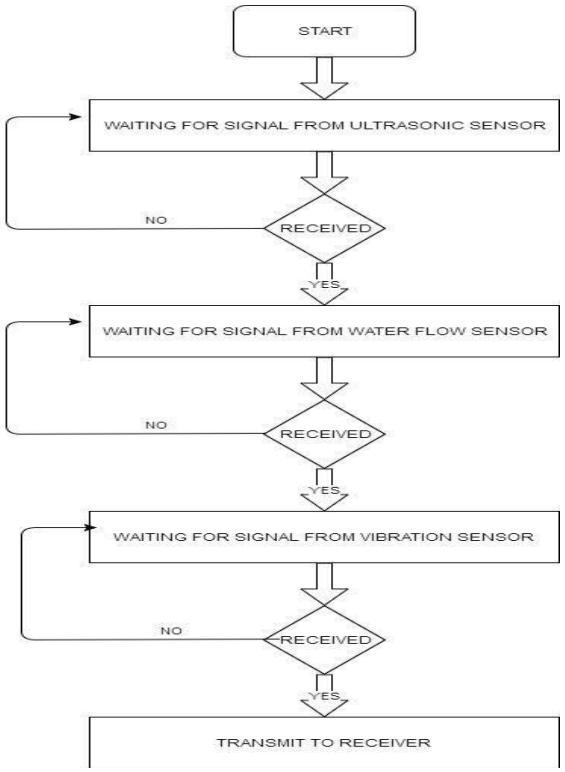
3. SOFTWARE IMPLEMENTATION

The flowchart shows two parts one transmitter and second receiver. The transmitter flowchart shows that the process starts it waits for the signal from the ultrasonic sensor if it receives the signal it goes to the next step or returns back to step one. The same steps are repeated for the vibration and water flow sensor and sends the signal to transmitter to transmit. In the receiver flowchart it waits for the signal from the transmitter, if it receives the signal it goes to next step and sends notifications to the mobile numbers that are provided if not it waits for the signals until they receive it.



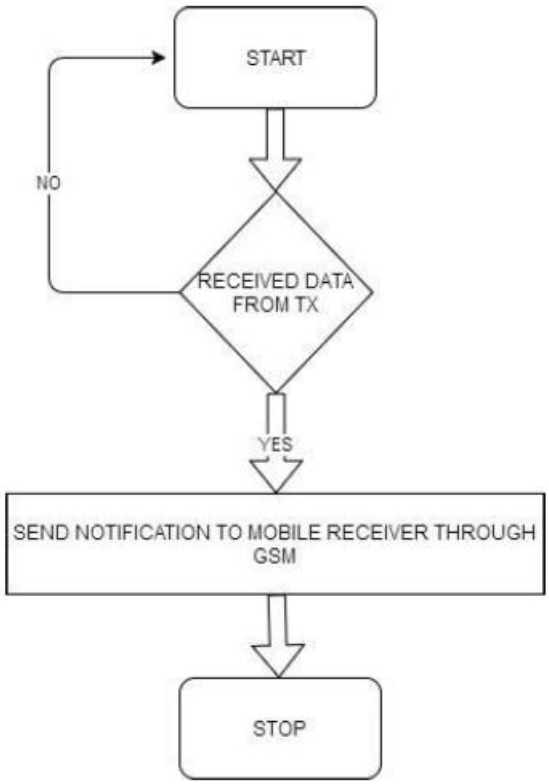


Figure-6: System flowchart

4. ADVANTAGES AND APPLICATIONS

4.1 Advantages

The following are the advantages of the system:

1. Multi sensors are used for detecting the different disaster, it is one of the advantage of this system compared to other system that uses multi sensors to detect the single disaster.
2. GSM module is used for sending the alerting message to the base station authority.
3. It reduces the huge complications because of wireless connections
4. Low cost wireless network between the bridge and the management centre, which decreases the overall cost of installation and maintenance cost of system.

4.2 Applications

The following are the applications of the system:

1. It can avoid accidents caused by the extreme weather conditions.
2. Key solution for pre and post disaster occurrence.

5. CONCLUSION

The real time system designed for the detection of tsunami and earthquake which have been the major hazards. This system is developed using PIC18F542 microcontroller. The main components used in this system are sensors, GSM, GPS. In the proposed project, various types of real time conditions are tested. In the transmitter section, sensors are connected to PIC processor. If any sensor detected any disturbance, transmitter transmits the signal to the receiver and it display the alerting message in LCD at receiver using GSM, it can send the message to the authority in the base station. Finally, this project works as per the specification. In future, to increase the performance of this project, the database system can be included to store the real time data.

ACKNOWLEDGEMENT

All the accomplishments in the world require the effort of many people and this project is no different. Regardless of the source, we wish to express our gratitude to those who have contributed to the success of this project. We would like to express our gratitude to S.D Nagrale Sir our Internal Guide, for his consistent guidance and inspiration throughout the project work, which we are sure, will go a long way in our life.
We also owe a sincere thanks towards Dr. N.B. Chopade Sir, Head of Department, Electronics and Telecommunications Engineering, PCCOE as all the success is the result of his affectionate encouragement. We are grateful to our Principal Dr. A. M. Fulambarkar Sir for his encouragement and guidance throughout the engineering course.
Finally, we are grateful for the many useful comments and suggestions provided by reviewers, especially our external Guide, A.B Patil Sir which have resulted in significant improvements in project.

REFERENCES

[1] Mr.M.V.N.R.P.Kumarv,Ms.B.Hombal,Miss. J.D. Kadam, Mr. A. B. Yadav, Mr. B.M. Pawar," Bridge Condition Monitoring System Using PIC Microcontroller" International Journal of Research in Advent Technology, Vol.3, No.5, May 2015 E-ISSN: 2321-9637

[2] Prof. Shoba Krishnan, Gunjan Vijan, Dolly Dhanwani, Neha Sakhalkar, Sagarika Madnani," GSM Based Tsunami Detection and Alert System", ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 5, Issue 4, April 2015

[3] Arathi H, Archana M S, ParvatiMadevaGond, Shayana A Hegde," Disaster Management System Using GSM", International Journal of Innovative Research in Electronics and Communications (IJIREC) Volume 2, Issue 4, June 2015, PP 35-45

[4] Principle and practices of bridge engineering S.P.Bindra

[5] Essentials of bridge engineering. -D.Jhonson Victor

[6] IS 1893-4 (2005): Criteria for earthquake resistant design of bridges