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Bridge Crack Monitoring System

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Abstract: Bridges are essential links in any surface transportation network. A damage to an important bridge may result in enduring economic loss due to partial or complete closure of the route in addition to the cost of repair or replacement. Survival of bridges are of most importance in the aftermath of a flood in order to facilitate rescue operations. Load on bridge is also an important parameter which is to be monitored so that the bridge does not collapse due to heavy load. Therefore, it has become important to carry out a critical assessment of safety and integrity of bridges in regular intervals. The main objective of this project is to provide a System that will ensure the safety and integrity of Bridges and will increase the life spam of the bridge.
Keywords: GSM Module, LED, Micro-controller, Load Cell.

I. INTRODUCTION

Health is an important issue not only for human beings, but also for civil infrastructures. Bridge collapse often result in a large number of casualties as well as economic consequences. Structural health monitoring of civil infrastructures came into existence over the past two decades. A long-term, dense deployment of smart sensors on a full-scale bridge demonstrates the potential to monitor civil structures. Every year new bridges are build. The health care of these bridges are most of the times neglected. Also the existing models use complex and heavy price wired system as well as high servicing optical fiber systems. The main motivation behind this venture is to develop a reliable, cheap and more efficient bridge condition monitoring system by means of Wired Sensor Network for the developing countries. Smart sensors communication capability reduces installation cost to great extent and help to create dense array of sensors. Such systems could extend the life span of numerous structures by enabling earlier damage detection, eliminate the cost of routine inspections and, most critically of all, improve public safety.

Nowadays, many bridge monitoring systems are present to help monitoring the condition of the bridges for example:

1) Panvalnadi Bridge, by Konkan Railways.
2) Akashi Kaikyo Bridge, Japan.
3) Tongtai Bridge, China.
4) New I35W Bridge in Minneapolis.
5) The RioAntirrio bridge, Greece.
6) Millau Viaduc , France.

Several long span, bridges in Korea and in Japan have received this real-time condition monitoring system. Nevertheless, existing system uses complex and heavy priced wired system amongst sensors in the bridge and heavy price optical cable between the bridge and the administration centre, which surges the overall expense of installation and maintenance expense of bridge condition monitoring system. The complex system also makes the installation and repair/ substitution procedure challenging and way expensive. This project aims to provide sensor Network based bridge condition monitoring system, there are three sensors being used in this venture which monitors the condition/health of the bridge and these four sensors are interfaced to the micro-controller , alarm and a LCD are associated to the micro- controller.

The alarm is initiated when the values of the sensors surpasses the threshold value. The LCD is utilized to show the parameters/values of the sensors. There is a GSM module which will be utilized if there is any need to warn or notify any consultants who are responsible for the maintenance or servicing of the bridge

Some problems are unexpected and take their time. Bridge Monitoring can be very beneficial in providing an alarm system for avoiding both types of failure conditions.

Bridge Engineers require scientific resources or tools which can give them fast data about the condition of a bridge. Such instruments need periodical manual examinations. But when problems occur with any type of framework there is loss of individual lives, money and many more, utmost of the times. Hence to ensure the safety and cost factor, the Bridge crack Monitoring System is being introduced.

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II. LITERATURE SURVEY

Sl. no	Paper name	Author Name	Published Year	Advantages	Diadvantages
1	IOT based Bridge Safety Monitoring System	Charusila D. Bhadane	2018	improves bridge efficiency.	crack Detection is not used.
2	Health Monitoring Of Civil Infrastructure Using Wireless Network	Sukun Kim ,et.al.	2016	data with low jitter and time synchronised Sampling.	faced difficulties when applied in real condition.
3	Smart Structural Monitoring	Shamshaad Ali, et. Al.	2014	Eliminate the cost of Routine inspection.	Less flexible to wear.
4	Monitoring of Bridge to Detect Changes in Structural Health	J.M. et, al.	2012	low cost structural Health monitoring.	Subjected to high load condition.
5	Design of Wireless sensor network for Structural Health monitoring of bridges	M. Reyer, et,al.	2012	Useful in sacrificial layer technology for fabrication.	Requires high budget.
6	Energy efficient clustering for WSN Based Structural Health Monitoring	Xufeng. Lui ,et al.	2011	Real time pressure data by pressure map.	Complicated to Design.
7	Wireless system for structural Health time Synchr-onization accuracy	Alvaro Araujo ,et al.	2011	used for distance covering pressure measurement.	focused only on pressure measurement cell.
8	Time Synchronized wireless sensor network, vibration measurement	Yutuka Uchimura, et,al.	2008	cost-effective	Less Flexible
9	Wireless Sensor network,Structural health Monitoring	Chulsung Park,et,al.	2006	dual microcontroller ,shared FIFO memory	High Power consumption
10	Structural Damage Detection, Location using NETSHM	K. Chintalpudi, et,al.	2006	continuos Data collection	High cost

III. EXISTING SYSTEM

There are few bridge monitoring systems which are currently being used, but every single one of them are having some limitations which is the reason these systems are not being used on large scale. Some of the most common limitations with these systems are as follows:

A. They require high installation cost.
B. They generate huge amount of data.
C. They require human efforts to process these data.
D. Complexity is very high.

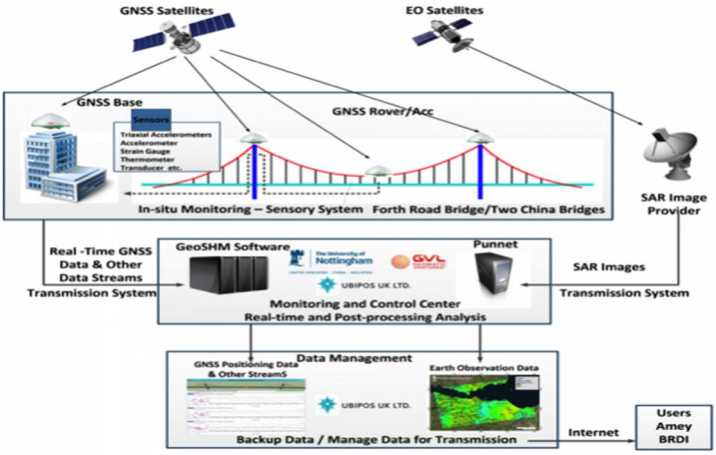

Fig 1. Existing system

IV. PROPOSED SYSTEM

In order to overcome the limitations of the existing system we propose a system that will help us ensure the public security and will enhance the life span of numerous bridges. In proposed system, we are using different sensors like water sensor, load cell, etc. All these sensors are responsible for sensing data (condition of bridges in terms of some parameters like water level below bridge, load on the bridge and crack occurrence). These data are then transferred to micro-controller, which is responsible for taking actions on the basis of data received. The moment sensed data increases threshold value micro-controller activates Buzzer, display warning message on LED Display and will send an alert message to the nearest municipal corporation with the help of GSM Module.

This System will reduce the installation cost as we are not storing any data. We are using micro-controller that will reduce the complexity of the system on large scale.

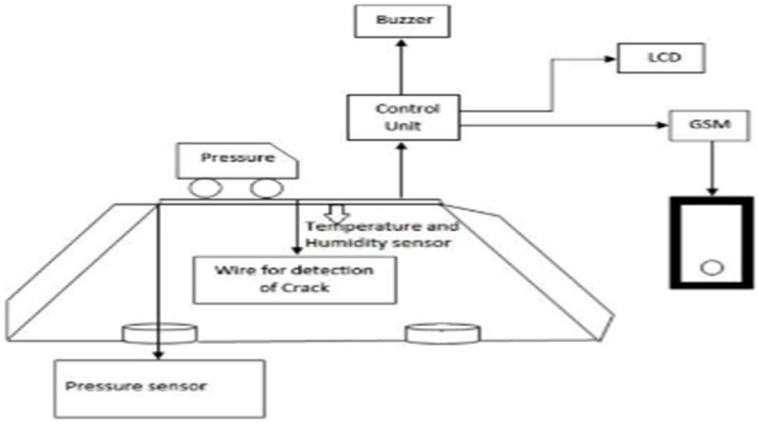

Fig 2. System architecture

A. Algorithm

1) Input: Sensed Data

2) Output: Activate Buzzer, Display message on LED, Send message through GSM Module.

a) Step 1: Sensor senses data.

b) Step 2: Data is sent to micro-controller.

c) Step 3: micro-controller compares sensed data with threshold values.

d) Step 4: If sensed data is greater than threshold data do.

e) Step 5: Activate Buzzer.

f) Step 6: Display warning message on LED Display.

g) Step 7: Send alert message to municipal corporation using GSM Module.

h) Step 8: Repeat steps 2-7 every time a data is sensed.

B. Advantages

1) Low Installation Cost.
2) Requires no human efforts.
3) There is no generation of any kind of data.
4) Easy to use
5) Provides real time monitoring of bridge.
6) Ensures public security.

C. Methodology

1) GSM Module: GSM is a mobile communication modem; it stands for global system for mobile communication. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operations.

Fig.3 GSM Module

2) Load Cell: Most of the Bridge failure is due to heavy load on the Bridge. We are using Load Cell to make sure the load on bridge never increases the threshold value. Load Cell is used to measure the pressure on the bridge with the help of which we can prevent the public from using bridge if the bridge is already heavily loaded.

3) Water Sensor: We are using Water sensor to know the presence of water. We will place this sensor below the bridge at some critical height, if the water below bridge touch water sensor micro-controller will come to know that flood may occur and it will warn people from using this bridge.

4) Crack Detection: In this system, we are using thin strings to detect Cracks. We tie these strings parallel to the edges of the bridge, in case of any twist and turn due to natural disasters these strings will break first and micro-controller will come to know about the number of strings broken. If the number of broken strings is more than threshold value than it is considered as detection of Crack. As soon as the crack is detected Buzzer is activated, message is displayed on LED and finally alert message is sent with the help of GSM Module.

V. CONCLUSION

Here we conclude that we have developed a system that is reliable, cheap and more efficient for native Indian bridges. This technique will not only be useful for the road and foot bridges but also for railway bridges. This system will extend the lifespan of numerous structures by enabling earlier damage detection, eliminate the cost of routine inspections and, most critically of all improve public safety.

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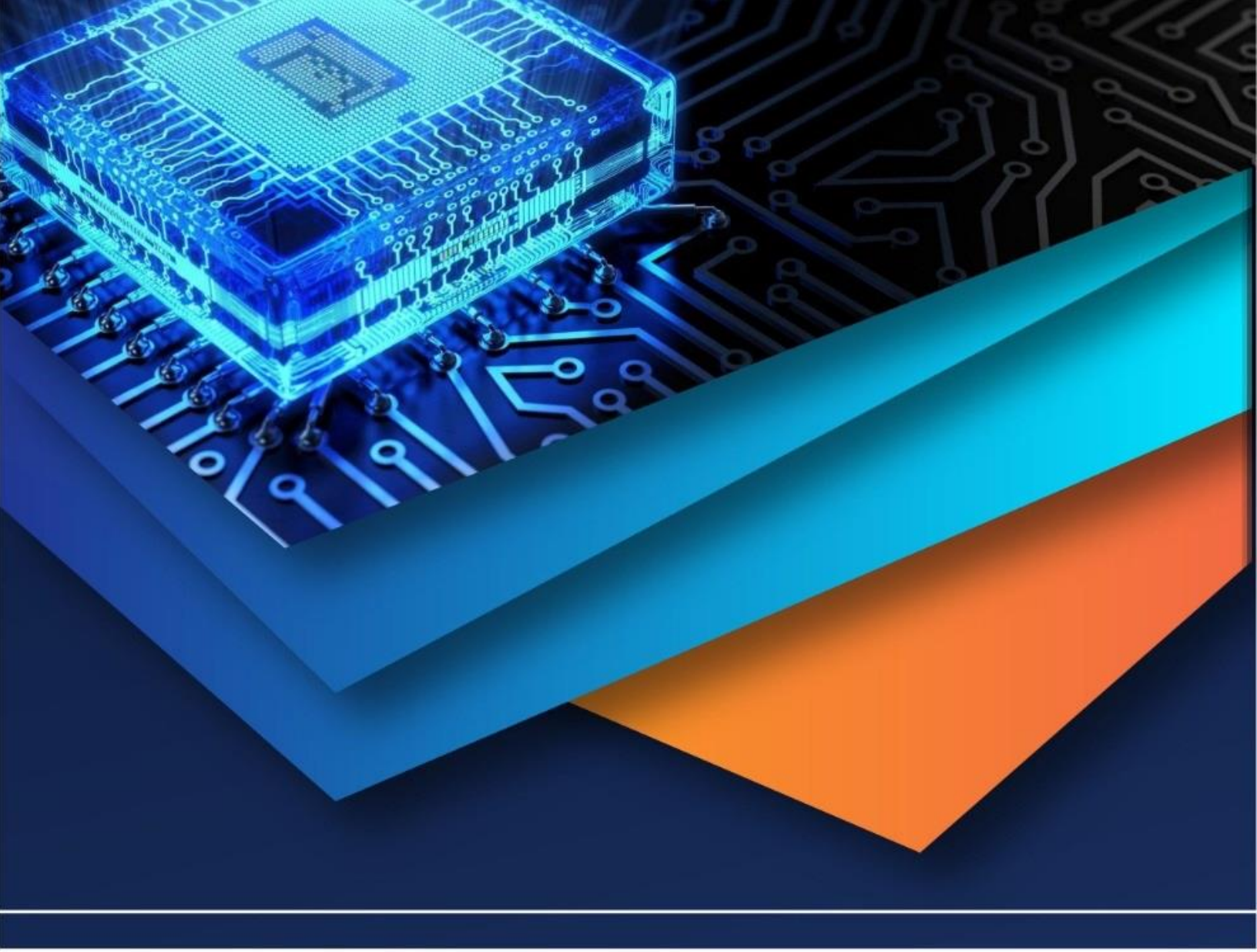

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