IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 4 ISSUE : 12 Print / Issue Publication Date: 10-Jun-2020

ISSN : 2455-2143

DOI : 10.33564/IJEAST.2020.v04i12.081

Indexed In

WWW.IJEAST.COM

editor@ijeast.com

International Journal of Engineering Applied Sciences and Technology, 2020
Vol. 4, Issue 12, ISSN No. 2455-2143, Pages 464-467
Published Online April 2020 in IJEAST (http://www.ijeast.com)

IOT BASED BRIDGE MONITORING SYSTEM AND BOAT HEIGHT PREDICTION

Gayana J R, Jeevana N, Lekhana V B, Nandan Gowda S U
Students, Dept. of Computer Science and Engineering, Vidya Vikas Institute of Engineering and Technology, Mysuru, Karnataka, India

Prof. Ramya M
Assistant Professor, Department of Computer Science and Engineering,
Vidya Vikas Institute of Engineering and Technology, Mysuru, Karnataka, India

Abstract— Bridge monitoring system is significant to health diagnosis of railway bridges. This paper proposed and developed a novel architecture for large span bridge monitoring. A 3-level distributed structure is adopted in the monitoring system which includes central server, intelligent acquisition node and local controller. Acquisition nodes are located across the bridge. All the acquisition nodes are managed by one local controller. Every acquisition node has 8 channels which can sample displacement, acceleration and strain of bridge. To get high precision data, a 10 bits Analog to Digital converter is used. Compared to the traditional method, the proposed architecture has two features. First, the acquisition node is a smart device based on powerful DSP processor. Signals of field sensors are analyzed and real time compressed in the acquisition node. Only the processing results are sent to local controller through IEEE802.11 wireless network. This operation can relieve load of central server and decrease demand of communication bandwidth. Second, 2G wireless network is utilized to provide enough bandwidth for real-time data transmission between local controller and central server. The intelligent monitoring system has run on a large span railway bridge for six months. Running results show that the proposed system is stable and effective

Based on the evaluation of bridge-waters area safety and the analysis of safety influence factors, this can used to study the bridge-waters area ship safety and developed the ship safety navigation system by GPS, wireless networks, embedded and predictive control technologies, which could lead the ships to navigate safely by recognizing the channel.

***Keywords*— Acquisition node (AN), 2G wireless network and A/D converter, *GPS*.**

I. INTRODUCTION

In this project an idea of bridge health monitoring system using wireless is proposed. For short distance (among sensors in the bridge) RF module is 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, beam sustainability, weight of the Train etc. At any point of time if any 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 RF module that uses wireless Transmitter and Receiver circuitry. The receiver module takes the parameters from the transmitter and sends a message with all the parameters to a database center. The communication established between the intermediate module and the database center is using GSM technology. The sensory inputs are process to represent the condition of the bridge against seismic loads, loads etc.

II. PROBLEM STATEMENT

- The research community has been developing Structural Health Monitoring (SHM) techniques to aid in the ongoing bridge management efforts of local bridge authorities.
- The current standard bridge inspection practice is based on biannual visual inspections, which are subjective by nature.
- The transition of the traditional SHM techniques from the research community to the practical field implementation still needs to overcome difficult

International Journal of Engineering Applied Sciences and Technology, 2020
Vol. 4, Issue 12, ISSN No. 2455-2143, Pages 464-467
Published Online April 2020 in IJEAST (http://www.ijeast.com)

challenges due mainly to technical and economic considerations.

A. Aim

Aim of our project is to develop an IoT-based bridge safety monitoring system which is composed of monitoring devices installed in the bridge environment, communication devices connecting the bridge monitoring devices and the cloud based server, a dynamic database that stores bridge condition data, cloud based server that calculates and analyses data transmitted from the monitoring devices. This system shall monitor and analyse in real time the condition of a bridge and its environment, including the water levels and other safety conditions.

III. EXISTING SYSTEM

Bridge Structural Health Monitoring (SHM) has been an intense research area for some time. Traditional, direct approaches are to collect acceleration signals by installing sensors on a bridge. The drawback of such direct approaches is that they require a sophisticated and expensive electronic infrastructure with installation, maintenance and power support. Moreover, although it is easy to get a large number of data samples, it is expensive to label them, which involves physical inspection of the bridge and determining its health; thus, very few data samples are actually collected. This real-world constraint turns the indirect bridge SHM into a semi-supervised classification problem.

A. Limitations Existing System

- Fails to collect data or monitor on-site conditions in real time.
- Data collection through visual assessments or use of large size electronic equipment has higher cost or higher power consumption. This often results in inaccurate data.
- They require a sophisticated and expensive electronic infrastructure with installation, maintenance and power support.
- It also involves physical inspection of the bridge and determining its health.
- Very few data samples are collected.

IV. PROPOSED SYSTEM

The sensors installed on various parts of the bridge monitors their respective parameters. Crossing their threshold value, the communication system informs the management center giving an alarm. The complete parameters of the bridge are taken by a PIC microcontroller and sent to user control room. ZigBee is used for communication. Bridge overflow is detected using Water Level Sensors. Crack detection is done using Image Processing and intimated to the concerned authority if the cracks diameter is found to be more than the specified threshold and take actions accordingly. Seismic sensors are also used to record any ground motion. Also, the IR sensor detects the vehicles that enter the bridge and keeps count of it.

Proposed System mainly deals with Height of prediction of bridges, water level monitoring ,pressure below the bridges. It deals with comparison between bridge height and the boat height and predicts weather boat can cross the bridge or not. It also deals with measurement of flow sensors i.e to predict pressure below bridges and intimates the boat owners weather it is safe to cross the bridge or not. It even measures overflow condition and also the earthquake parameters and closes the bridge if it is not a safe condition.

V. METHODOLOGY

A. Different sensors used

- **Vibration sensor:**

It is an instrument used to measure the ground motion when it is shaken by a perturbation. The waves are measured such that which are sensors converting the acquired data into electrical voltage

- **IR sensor:**

It keeps count of the vehicles that enter the bridge. If in case the count of the vehicle increases the threshold then the gate is closed and the gate is opened once the vehicles are out of the bridge by performing increment and decrement operations.

- **MEMS sensor:**

Micro-Electro-Mechanical-Systems form the heart of network nodes. Sensing of moisture, temperature, strain and other data continuously can be achieved using these sensors.

- **ZigBee:**

It is used as wireless network for short distance data communication among the various sensors used in the bridge.

- **LCD:**

It displays the condition of the bridge constantly. It is easy to interface with a micro-controller because of an embedded controller.

B. Digital Image Processing(DIP)

Images refers to two-dimensional intensity function f(x,y), where x and y denotes spatial coordinates and the value of f at any point (x,y) is proportional to the brightness of the image at that point.

International Journal of Engineering Applied Sciences and Technology, 2020
Vol. 4, Issue 12, ISSN No. 2455-2143, Pages 464-467
Published Online April 2020 in IJEAST (http://www.ijeast.com)

A digital image is a representation of two-dimensional image as a finite set of digital values, called picture elements or pixels.

Digital image processing focuses on two major tasks:

1. Improvement of pictorial information for human interpretation.
2. Processing of image data for storage, transmission and representation for autonomous mission perception.

There are mainly three levels of processing images as shown in below figure:

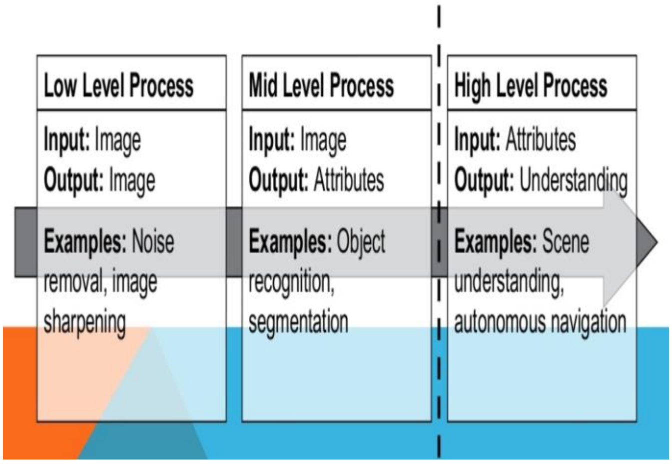

Fig-1: Digital image processing

VI. IMPLEMENTATION

A. Hardware Requirements

- Sensor
- Flex Vibration Sensor
- Load cells
- IR sensors
- Automated gating system with Stepper motor
- ARM (Advanced RISC Machine) processor
- Voltage regulator for power supply
- ARM (Advanced RISC Machine) processor
- RF Module
- GSM Module
- LCD display

B. Software Requirements

- Kiel Compiler
- Embedded C
- Flash Magic

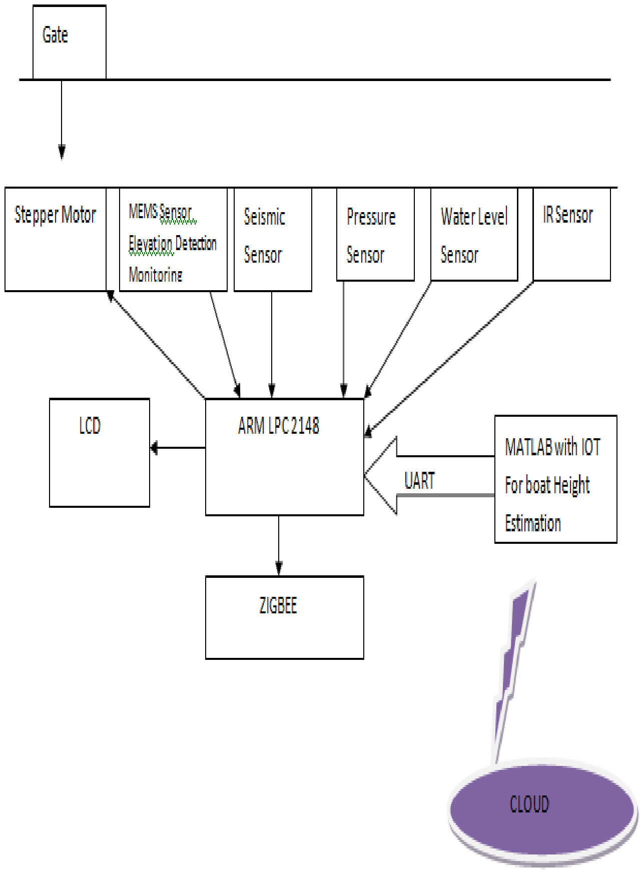

Fig-2: Block Diagram

VII. CONCLUSION

This paper presents a prototype of a novel self-powered wireless system for applications of structural health monitoring of bridges. Conducted theoretical analysis facilitates selection of a natural frequency with the highest energy content and quick estimation of parameters for an electromagnetic harvester. Field tests sensor show the feasibility of the proposed approach for applications of structural health monitoring.

VIII. REFERENCES

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

[2] Sun Yi;Xu Chengwen,2010. "Notice of RetractionThe research of Bridge state monitoring system based on IOT technology"

[3] Arunkumar.G.C, Chandrakanth .S. R, Chethankumar.M, Karthik.V, Santosh Chavan "Bridge Condition Monitoring System Using Wireless Network" Dept. of ECE, RRCE, Bengaluru.
[4] Mr.M.V.N.R.P.Kumar,Ms.B.Hombal, Miss. J.D. Kadam, Mr. A. B. Yadav, Mr. B.M. Pawar.Vol.3, No.5, May 2015. "Bridge Condition Monitoring System Using PIC Microcontroller" Dept. Of E&TC,L.N.B.C.I.E.T.Raigaon,Satara.(Maharashtra) International Journal of Research in Advent Technology.
[5] Vinodini R , Nalini S, Muthumurugesan D,", Vol. 10, Issue 3, No 1, May 2013. Detection Of Structural Damages In Bridge Based On ZigBee Networks Using Sensors" IJCSI International Journal of Computer Science Issues.
[6] Merit Enckell , Branko Glisic ,Frank Myrvoll ,Benny Bergstrand Received: 29 October 2010 / Accepted: 6 February 2011 / Published online: 3 March 2011."Evaluation of a large-scale bridge strain, temperature and crack monitoring with distributed fibre optic sensors"
[7] Andrew Gastineau,Tyler Johnson,Arturo Schultz, September 2009. "Bridge Health Monitoring and Inspections –A Survey of Methods"
[8] Christian Lazo, Paulo Gallardo, and Sandra Cespedes, 2015 "A Bridge Structural Health Monitoring System Supported by the Internet of Things", IEEE COLCOM
[9] Ms.Arohi. D. Sonawane, Ms.Pooja. P. Vichare, Mr.Shubham. S. Patil, and Mr.Nitin. P. Chavande, 2018, "Bridge Monitoring System Using IOT", Journal of Advances in Electrical Devices Volume 3, Issue 2
[10] VarshaKusal, Amrita Argade, SanikaChiplunkar, RohiniKumbhar, Swati A. Khodke, 2017, "Bridge Monitoring and Alert Generation System Using IOT", International Journal of Advance Research, Ideas and Innovations in Technology.
[11] Amro Al-Radaideh, A. R. Al-Ali1, SalwaBheiry, Sameer Alawnah, 2015, "A Wireless Sensor Network Monitoring System for Highway Bridges", IEEE, International Conference on Electrical and Information Technologies ICEIT
[12] SnehalSonawane, Nikita Bhadane, SayaliZope, AshitoshPangavhane and V. S. Tidake, June 2018 "Design of Bridge Monitoring System based on IoT", MVP Journal of Engineering Sciences.
[13] Jin-Lian Lee, Yaw-YauanTyan, Ming-Hui Wen1, Yun-Wu Wu, 2017 "Development of an IoT-based Bridge Safety Monitoring System", IEEE, International Conference on Applied System Innovation.
[14] Jihong Zhang1, Wenchao Chen2, 2014,Design of a Monitoring System of Airport Boarding Bridge Based on ZigBee Wireless Network",26th chinese control and decision conference.
[15] Ittipong Khemapech, Watsawee Sansrimahachai, and Manachai Toahchoodee,"A Real-time Health Monitoring and Warning System for Bridge Structures",IEEE Region 10 Conference(TENCON)
[16] Felix Sawo;Eckhard Kempkens, 2016 "Model-based approaches for sensor data monitoring for smart bridges",Multisensor Fusion and Integration for Intelligent Systems (MFI)
[17] Christian Lazo, Paulo Gallardo, and Sandra Cespedes, 2015, "A Bridge Structural Health Monitoring System Supported by the Internet of Things", IEEE COLCOM,
[18] Y.R.Risodkar;A.S.Pawar, , 2017, "A survey:Structural health monitoring of bridge using WSN", International Conference on Global Trends in Signal Processing, Information Computing and Communication.

IJEAST

INTERNATIONAL JOURNAL OF ENGINEERING APPLIED SCIENCE AND TECHNOLOGY

ABOUT IJEAST

International Journal of Engineering Applied Science and Technology (IJEAST) is a peer-reviewed, open access journal that publishes high-quality research papers in the field of Engineering, Applied Science and Technology.

IJEAST aims to provide a platform for researchers, academicians, and professionals to share their innovative ideas, research findings, and practical experiences with the global scientific community.

FOCUS AREAS

- Engineering
- Applied Science
- Technology
- Innovation & Development
- Interdisciplinary Studies

PEER REVIEWED
All submissions are rigorously peer reviewed to ensure quality.

OPEN ACCESS
Free and unrestricted access to research for all.

GLOBAL REACH
Connecting researchers and professionals worldwide.

TIMELY PUBLICATION
We ensure a swift and efficient publication process.

For more information, visit our website
www.ijeast.com

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE AND TECHNOLOGY

editor@ijeast.com
www.ijeast.com
India

2455-2143