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A Review Paper on "BRIDGE MONITORING SYSTEM"

Mr. Bikramjit Singh[1], Mr. Amar Shivkar[2], Mr. Atish Bankar[3], Mr. Sagar D. Dhawale[4]

[1.2.3]Student, Department of Electronics and Telecommunications, Dr. D. Y. Patil School of Engineering and Technology, Lohegaon, Pune
[4]Assistant Professor, Department of Electronics and Telecommunication, Dr. D. Y. Patil School of Engineering and Technology, Lohegaon, Pune

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Abstract- 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, new idea of bridge health monitoring system is introduced. This system can analyze and monitor in real time the conditions of a bridge and its environment, including the waters levels nearby and other safety conditions. By the use of wireless sensor nodes, various types of data can be collected like vibration, water level and Bridge weight. The main moto of this paper is to develop a system that can prevent accidents or structural disasters of flyovers and bridges.

Index terms **– Bridge monitoring system (BMS), Internet of Things (IOT), Cloud server, Sensors etc.**

I -INTRODUCTION

Bridges are continuously subjected to destructive effects of material aging, widespread corrosion of steel reinforcing bars in concrete structures, increasing traffic volume, overloading. These factors, combined with defects of design and construction and accidental damage. Many of the bridges in cities built on the river are subject to deterioration as their lifetime is expired but they are still in used. They are dangerous to bridge users. Due to heavy loads of vehicles, high water level or pressure, heavy rains these bridges may get collapse which in turn leads to disaster. Bridge monitoring system (BMS) provides previous indication to us where we can easily save too many lives and we can avoid the loss. BMS is a tool to improve the safety and maintainability of bridge. BMS provides real time and accurate information about the structural health condition. It is a process of non-destructive evaluations to detect location and extent of damage, calculate the remaining life, and predict upcoming accident. The system developed in this study can help to reduce the accident and provide the advancement of bridge safety monitoring from different disaster like-flood, wind, earthquake, heavy load, vibration. We propose an integrated bridge monitoring system using IOT that can be used to prevent accidents or structural disasters of flyovers and. All sensors get the real-time value and send it to the server. If the sensor value is above then the limit then the system will play the buzzer and notify the peoples. Structural health monitoring system is one of the best popular systems which is monitoring and detect the environmental condition. The bridge structure may vibrate under the action of such dynamic load as moving vehicles, crowds, wind and earthquake. The analysis is an important content of bridge structure analysis. The data can be used for bridge safety management and in the occurrence of disaster, for disaster rescue. For its monitoring and information communication the system uses the WSN technology.

II -AIM

- The objective of the system is to continuously monitor the bridges, sense the environment and send the data to web application through the server, generate the alert with the help of buzzer and auto-barrier if load of vehicles and level of water in river crosses its threshold value.
- Aim of our project is to develop an 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 – WORKING PRINCIPLE

Bridges are continuously subjected to destructive effects of material aging, widespread corrosion of steel reinforcing bars in concrete structures, corrosion of steel structures and components, increasing traffic volume and overloading, or simply overall deterioration and aging. These factors, combined with defects of design and construction and accidental damage, prompt the deterioration of bridges and result in the loss of load carrying capacity of bridges. The condition of heavily used urban bridges is even worse: one in three are classified as aging or unable to accommodate modern vehicle weights and traffic volume. Therefore, a significant number of these structures

need strengthening, rehabilitation, or replacement, but public funds are not generally available for the required replacement of existing structures or construction of new ones. Many sensors are being used to monitor the bridge remotely and using various sensors and Latest Technology which is internet of things which will help us directly to connect with sensors and also the heart of our project is the Arduino Uno which will be used to connect all the sensors and link everyone together. A WI-FI (Wireless Fidelity) Module which esp2866 Is used to connect all the sensors to the data centre and helps to manage the bridge Remotely. A barrier system is been used so that whenever the parameters of the bridge cross the value the barrier will close and the bridge traffic will be stopped. So, considering these parameters the bridge monitoring system will work and give the desired output.

IV- PROPOSED SYSTEM

The sensors and the LCD are interfaced with the Arduino UNO. The sensors used are Flex and Water level. The Flex sensor measures the angle of tilt of the bridge as well as cracks. The value is set so that if there is any sort of tilt or little crack and if it crosses our set value then the crack is detected. The water level sensor will be placed below the bridge and within the gaps. When the water touches the sensor, it will give alertness to the Arduino UNO. Then the alarm will beep. An LCD is kept so that if there is any danger and if the system finds the fault then the LCD will display “DANGER”. Servo motors are also there to closed the roads so that no vehicle reach the bridge. It is placed before the bridge. A buzzer is also used to spread alertness when the danger is detected. The wi-fi modem is used to send the data to the server. In this research work used “THINGSPEAK” were we can see the reading of the sensors.

V – METHODOLOGY

Different disasters and damaged sites require different professional disaster rescue knowledge and equipment in order to achieve optimal rescue results. However, lack of information about the damage site can impede information management at the rescue centre and rescue operation, resulting in poor rescue efficiency or even preventable causalities. Therefore, in this study, the IoT, Wireless Sensor Network (WSN) and smart building technologies are adopted to solve the above-mentioned problems of bridge safety information transmission and management by developing an IoT-based bridge safety monitoring system capable of monitoring the environmental data of a bridge and transmitting the data to the mobile devices of bridge safety management staff for reference and documentation1.The method we are using different sensors and different technology such as various sensors:

- Arduino UNO (using IOT)
- Vibration sensor
- Load cell
- Hx711
- Ultrasonic sensor
- Servo motor
- Barriers

Description of sensors:

- ARDUINO UNO:

Arduino Uno is an open-source electronics platform based on easy to-use hardware and software. It has a wide range of applications and is a major microcontroller board because of its small size and flexibility. It has 22 input/output pins in total,14 of these pins are digital pins,8 analogue pins, 6 PWM pins among the digital pin. It also has a mini USB Pin which is used to upload code and Reset button. It is used in Embedded systems, automation, robotics, etc.

- ULTRASONIC SENSOR:

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal.

- Working Voltage: DC 5V
- Working Current: 15mA
- Working Frequency: 40KHz
- Max Range: 4m
- Min Range: 2cm

- VIBARATION SENSOR:

Vibration Sensor (SW-420) is a high sensitivity non-directional vibration sensor. When the module is stable, the circuit is turned on and the output is high. When the movement or vibration occurs, the circuit will be briefly disconnected and output low. At the same time, you can also adjust the sensitivity according to your own needs.

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Dimensions 40mm x 20mm x 7mm
- Weight G.W 10g N.W 4g
- Battery Exclude
- Operating Voltage3.3V / 5V

- LOAD CELL:

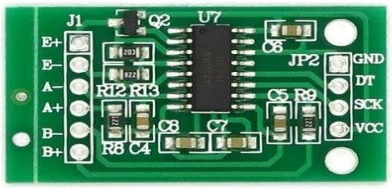
A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally.

- Model – YZC-133
- Material – Aluminum
- Weighing range – 1-10Kg
- Dimensions – 80*12.7*12.7
- Operating Temperature Range (°C) = -20 to 65
- Weight (gm) = 29

- HX711:

HX711 is a precision 24-bit analog to digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor.

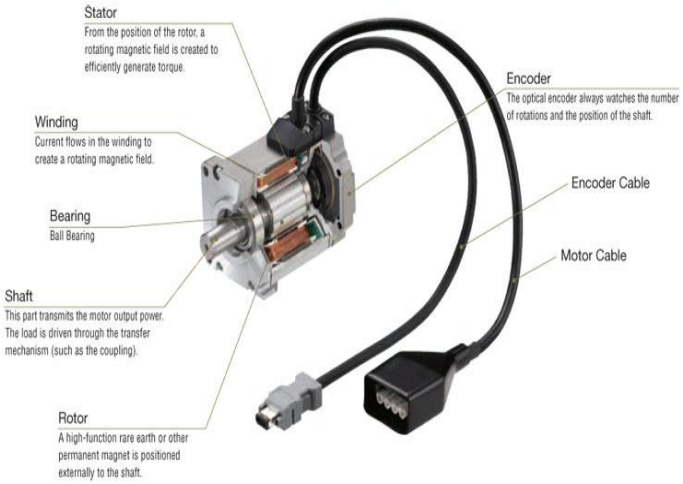
- Operation supply voltage range: 2.6 ~ 5.5V
- Operation temperature range: -40 ~ +85°C
- power supply regulator normal operation < 1.5mA



- SERVO MOTOR:

The servo motor is a closed-loop mechanism that incorporates positional feedback in order to control the rotational or linear speed and position. The motor is controlled with an electric signal, either analog or digital, which determines the amount of movement which represents the final command position for the shaft.

- Model – SG90
- Weight – 9 gm
- Operating Voltage – 3 -7 V
- Rotational Degree = 90
- Operating Temperature (°C) = -30 to 60



- BARRIERS:

In Bridge monitoring system new idea is proposed by using of barriers. As this research work considered almost all the parameters by using specific sensors. So, this barrier is also a new innovative idea to increase the safety of the travelers as well as taking in consideration the safety of bridge.

- IOT(Internet of Things):

The IoT brings the power of the internet, data processing and analytics to the real world of physical objects. For consumers, this means interacting with the global information network without the intermediary of a

keyboard and screen; many of their everyday objects and appliances can take instructions from that network with minimal human intervention. The enormous amount of data generated by the devices will obviously need to be stored and processed in Data Centers.

- Optimizing storage
- Security and data privacy
- Data Center locations
- Cost efficiencies

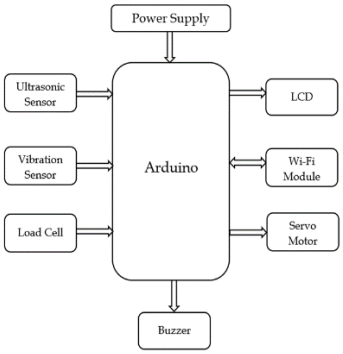


Fig. 1 Bridge Monitoring System Block Diagram

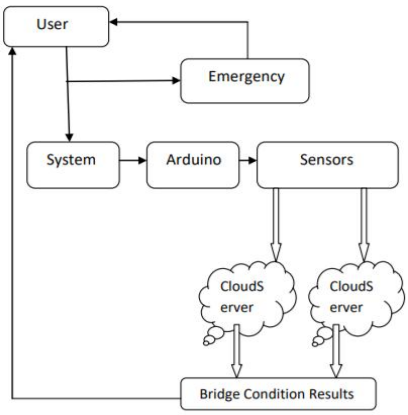


Fig. 2 Flow Chart of Bridge Monitoring System

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