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IoT Based Bridge Health Smart Monitoring System

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***Abstract*—**Now a days, various types of disaster is happening mostly in all over the world. This is because of change in natural conditions. These types of disasters will destroy the many structure like bridges and this will damage the life. Hence to continuously verify and monitor the conditions on bridge we make the system called bridge monitoring system. Bridge monitoring system will help to know the current conditions on bridge like wind speed, temperature, weight etc. and inform us. According to the readings of different sensors we can compare it with fixed values and we will get alert before any disaster.

Keywords —Bridge health, Crack detection, water level, Arduino Nano, Vibration detector etc.

I. INTRODUCTION

The mishap happened on The Colonial-era Bridge on the Mumbai-Goa Highway caved in around Tuesday midnight owing to an incessant down- pour, which lashed the Konkan, causing the river to swell and maul the weather-beaten bridge. Two State Transport buses, and a number of private vehicles, unable to see the ruptured span, plunged into the raging wood waters below. To overcome such incident, we can have data- acquisition systems are used in structural projects ranging from simple beam-fatigue analysis, to structural mechanics research, to continuous monitoring of large, complex structures. Our systems provide remote, unaltered, portable way to monitor the bridges. They are compatible with a wide variety of sensors and peripherals to your exact needs.

This report can be used for the process of selecting bridge health monitoring systems by the bridge engineer. Hundreds of bridges in the state on Maharashtra are obsolete or structurally deceit. These inspections are both costly and time consuming. However, the field be able to relieve some of the cost and burden on the respectable engineer. Our system will sense the water level angle if crack in the bridge will be sensed and signal will be given to the vehicles to stop and will automatically give red signal that will close the gate by sending details of sensor to control room.[1][6][7].

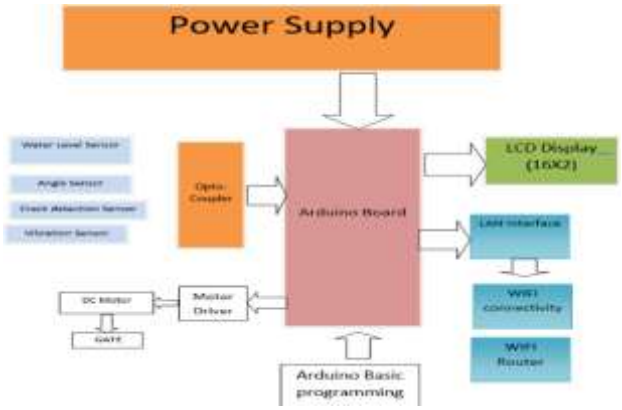
II. LITERATURE SURVEY

According to paper "Wireless Sensor Network Based Crack Detection on Concrete Bridges/Buildings "The method of Detection and Recognition of Bridges' Cracks Based on Deep Belief Network adopts Raspberry Pi to collect and pre- process images, to transmit images data by the GPRS / 3G or wired networks. And it uses high-level servers to make analysis of image. According to the characteristics of bridges cracks" images, this method selects and improves the best processing algorithm, as well as detects and recognizes the true bridges cracks

So, these bridges require continuous monitoring. So, we are proposing a system which has weight sensor, water level contact sensor, Wi-Fi module, and Arduino micro-controller. This system detects the load of vehicles, water level, and pressure. If the water level, pressure and load of vehicle on the bridge cross its normal value then it produces the alert through buzzer with auto barrier. If it is necessary, then the admin can give work of bridge maintenance to the employees.

III. DESIGN SYSTEM

A. Block Diagram



B. System Specifications and working

The entire system consists of an Arduino Nano which controls the interface between the different components of the system i.e. sensors, motor driver, LCD Display, Wi-Fi Modem . The power supply is given to Arduino Board which is smaller in size and has a microcontroller. The board is connected to the Opto- Coupler, LCD Display, LAN interface and Motor Driver. Here we have used LCD 16x2. The opto-coupler is connected to the sensors i.e. water level sensor, angle sensor, crack detection sensor, vibration sensor to have interfacing between two or more devices. The function of opto- coupler is to prevent high voltages from affecting the system receiving the signal. Here for angle sensor we are using accelerometer and for crack detection we are using wire mesh.

Thus, when the sensors sense some harm or detect values above the threshold value, it sends signals to the Arduino Board through opto-coupler. The program installed in the Arduino will start to execute and according to the flow of the program it will send the signals to the respective components. Arduino Board sends warning signal to the motor driver. The motor driver has been attached to a boom barrier which blocks the vehicles from moving ahead to prevent accidents from happening. All sensors get the real- time value and send it to the server and android through the Wi-Fi modem to the cloud. The analyst is already logged in to the android device and analyze the data that was sent to the control room by the system. It sends the data to the user. User can see the data who has been already registered in the database and can see this data. This data will help the user to see the details of the bridge. These data can be helpful to avoid accident from happening and all that data will be display on the LCD so that the coming vehicles could see the information from not so far distance and inform the other passage vehicles.

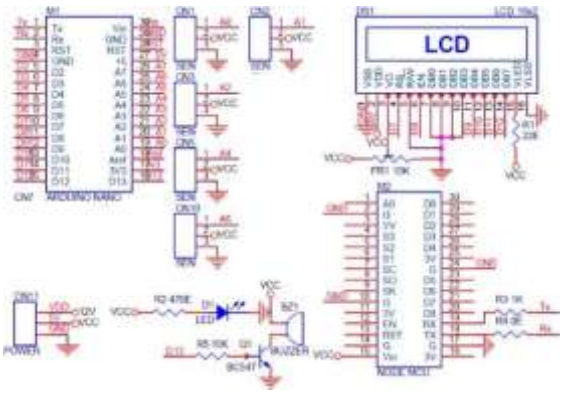


Fig 1: Circuit Diagram

C. *Components list and Specification.*

1. Accelerometer

Accelerometers have multiple applications in industry and science. Highly sensitive accelerometers are used as inertial navigation systems for aircraft and missiles. Accelerometers work is to detect and monitor vibration with rotating machinery. Basic structure of accelerometer consists fixed plates and moving plates (mass). Acceleration deflects the moving mass and unbalances the differential capacitor which results in a sensor output voltage amplitude which is proportional to the acceleration. By the amount of sense of acceleration, users can come to know how the device is moving.

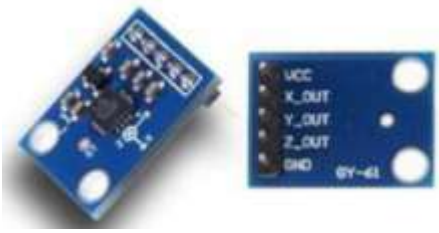


Fig 2: Accelerometer

2. Vibration Sensor

Vibration sensor is different from resistive. When the piezo film is bent from mechanical neutral axis which occurs due to earthquake, produces vibration. This voltage is created only as the sensor is deformed. The sensor produces positive voltages when they're deformed in one direction, and negative voltages when deformed in the other. As in other project we have used piezo sensor for sensing the impact of high tsunami waves. A piezoelectric sensor is a device which uses piezoelectric effect to calculate pressure, acceleration, strain or force by converting them in electrical signal.

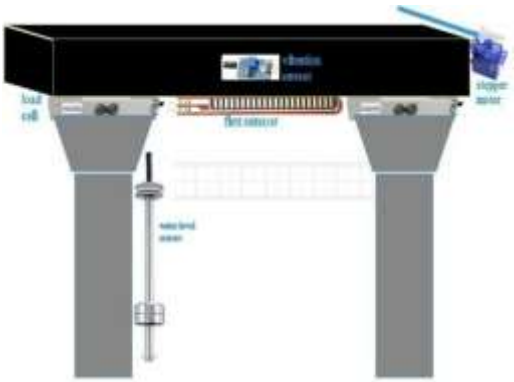
Fig 3: Vibration Sensor

3. Crack Detection Sensor

The crack or wire mesh collects data in digital form. The data from sensor is sent to base station database through Wi- Fi modem. The base station database stores the value obtained from sensor which can be imagined in a cloud dashboard. The cloud dashboard has data from the sensors which is collected every time, on the spot with data and time. Values are monitored continuously and when the threshold is reached, a warning message is sent to authorized person as well as to the public.

4. Water Level Sensor

The sensor probe actually act as their own sensors and does not pass electricity via the probes which keeps them from polluting, degrading and deteriorating. All of the electronics are built into the head so that you can connect directly to your control panel. Once the water level is detected by one of the sensors, this causes one of six alarms to be triggered, high, and low, fill start, fill stop, etc. Depending on the type of float switch you have, there can be single point alarm or a multipoint alarm that is triggered. Different alarms control separate start and stop mechanisms.



5. Arduino Nano

which is a microcontroller designed by Arduino.cc. The microcontroller in the Arduino Nano is Atmega328, the same which is used in Arduino UNO. 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 pins.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.

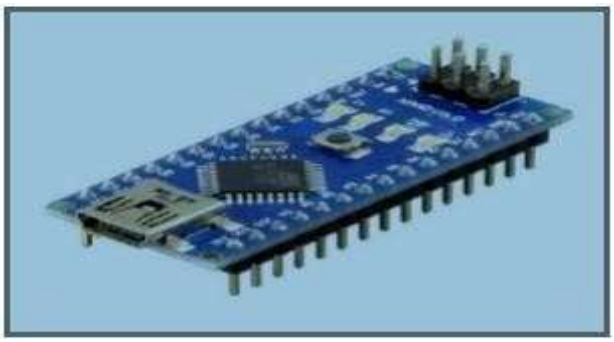


Fig 4: Ardiuno Nano

IV. EXPECTED RESULTS

The system collects the data from sensors and the status is collected by the controller and is transferred to wireless network. This data at transmitter is sent to the receiver and is analysed by the Arduino. Analysed data is sent to the management centre and an alert message is sent to the operator mobile number. The data sensed by sensors will get converted into an electrical signal. The devices which generate output are generally called as sound buzzer. Both sensor and actuator are collectively known as a transducer. The electrical signal will get passed on to the Arduino. All sensors get the real-time value and send it to the server and android. The analyst logs in the android device and analyse the data that was sent by the system. It sends the data to the user. User can see the data which are already registered in the database these data will help the user to see the details of the bridge. This data can be useful to avoid accident and all the data will display on the LCD. If the sensor value is above then the limit then the system will play the buzzer and notify the peoples.

V. FUTURE SCOPE

1. System can be implemented at a global level in which different countries can manipulate data of their bridges at a single server.
2. Implement on high cost suspension bridge.
3. Monitoring Structural Performance and Applied Loads.

VI. CONCLUSION

In this paper, the working principle of Bridge Monitoring and alert generation system using IoT, we display data using LCD display and IOT when there are signs of collapsing the bridge. This system will help to reduce big disasters in future. This system can save the lives of many people.

VII. REFERENCES

- R. Al-Ali, S. Beheiry, A. Alnabulsi, S. Obaid, N. Mansoor, N. Odeh, and A. Mostafa, "An IoT-Based Road Bridge Health Monitoring and Warning System," *Sensors*, vol. 24, no. 2, pp. 469, 2024.
- X. Tong, H. Yang, L. Wang, and Y. Miao,"The Development and Field Evaluation of an IoT System of Low-Power Vibration for Bridge Health Monitoring," *Sensors*, vol. 19, no. 5, pp. 1222, 2019.
- S. V. Jawne, P. R. Harale, K. S. Khandekar, and L. S. Kumbhar, "IoT Based Bridge Health Monitoring System Using Sensors," *International Journal of Future Management Research (IJFMR)*, vol. 8, no. 1, 2026.
- A. Dhuri, P. Jogale, S. Kadam, L. Kawade, and S. Kore,"IoT Based Bridge Health Smart Monitoring System," *International Journal of Engineering Research & Technology (IJERT)*, 2020.
- H. Salave, J. Khude, N. Salave, S. Jadhav, A. Jamale, and S. Chavan,"IoT-Based Bridge Monitoring System," *IJRASET Journal for Research in Applied Science and Engineering Technology*, 2025.
- P. Mhetre, A. Sontakke, A. Rupnar, and Y. Dubbewar,"IoT- Based Bridge Health Monitoring System," *International Journal of Scientific and Advanced Research in Technology (IJSART)*, 2025.
- J. Park, J. Shin, and J. Park,"Development of IoT Sensor and Cloud-Based Server for Long-Term Bridge Monitoring," *arXiv*, 2022.
- A. Moallemi et al.,"Scalable Real-Time Anomaly Detection for Bridge Health Monitoring Systems," *arXiv*, 2022.
- D. S. Gadiraju et al.,"Blockchain-Based IoT for Bridge Health Monitoring," *arXiv*, 2024.