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IOT based Bridge Health Monitoring System

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Abstract: ***Now a days, natural disaster is happening mostly in all over the world. This is because of change in natural conditions. These type of disasters will destroy the many structure like bridges and this will damage the life. Hence to always monitor the conditions on bridge we use the system called bridge monitoring system. Bridge monitoring system will help to know the current natural conditions on bridge like wind speed, temperature, weight etc. and inform us. According to the readings of different sensors the system will compare the obtained values with critical values and will alert the people before any disaster.***
Keywords: Bridge health monitoring system(BHMS), Sensors, Arduino NANO, LM35, LCD Display, Motor driver module, Angle sensor, Water level sensor.

I. INTRODUCTION

The mishap happened on The Colonial-era bridge on the Mumbai-Goa Highway owing to an incessant downpour, 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 floodwaters below [1].

To overcome such incident we can have data-acquisition systems are used in structural and seismic monitoring projects ranging from simple beam-fatigue analysis, to structural mechanics research, to continuous monitoring of large, complex structures. Our systems provide remote, unattended, portable monitoring for and bridges. They are compatible with a wide variety of sensors and peripherals to fit your exact needs. This report aims to simplify the process of selecting bridge health monitoring systems for the bridge engineer. Hundreds of bridges in the state on Maharashtra are obsolete or structurally deficient. To safely extend the life of these bridges, rigorous inspection would be necessary [2].

These inspections are both costly and time consuming. However, the field of bridge health monitoring may be able to relieve some of the cost and burden on the bridge engineer. Bridge engineers have many responsibilities and it is impossible to expect one to know. Our system will sense the water level angle if crack in the bridge will me sensed and signal will be given to the vehicles to stop and will automatically give red signal and will close the gate and will send details of sensor to control room[3].

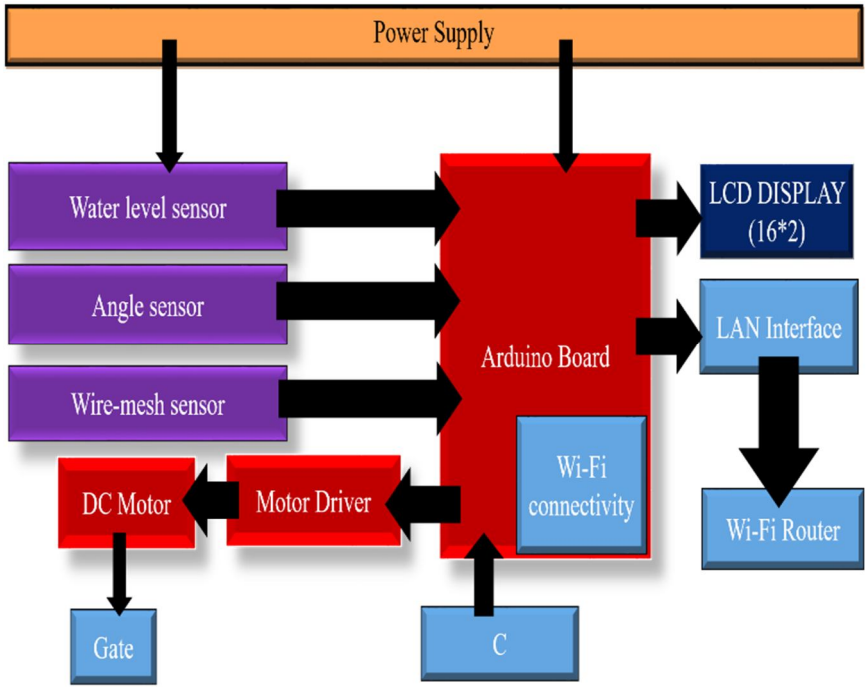

Fig. 1. Block Diagram.

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II. PROPOSED DESIGN

The public or government can use this bridge monitoring system for bridge monitoring which will provide bridge condition as well as safety to public. In this system we are going to design login interface using which user can login to system. If user fails to login then emergency option is provided by our system. Arduino is to be connected with sensors using TCP/IP protocol and by using Wi-Fi module it will send real time monitor data to cloud server as well as to system server for backup purpose, in case of failure of cloud server .

The above block diagram shows the working of our project. Firstly, the sensors take inputs from environment and surrounding in the form of float values.Then these inputs are given to Arduino Nano to perform operations of comparation with respect to the values that are set as maximum values.The Wi-Fi module helps the Arduino by providing Wi-Fi connection.Then after comparison the values are passed on to the cloud services so that these values will be stored to the cloud storage.And if these values are more than maximum values ,then the output in the form of binary digits i.e. (1=yes and 0=no) are sent to motor driver module which allows the motor to close the gate ,in an emergency case.Side by side Power supply is connected to all these components.These float values are displayed on the Led screen as a message for public .A LED is connected to power supply to indicate that a power supply is still working.

III. ALGORITHMS

1) *Water level Sensor:* A water sensor is a device used in the detection of the water level.
2) *Wire Mesh Sensor:* It detects the wires in the bridge.
3) *Accelerometer Sensor:* It detects the shakes and tilts of bridge during the earthquake.
4) *Wi-Fi Module:* Wi-Fi module is used to make connections between the cloud server and Arduino.
5) *Motor Driver Module:* Allows the motor to rotate in any of the two directions based on the data.
6) *Arduino:* It is Micro controller device that will be used to connect database with bridges data.

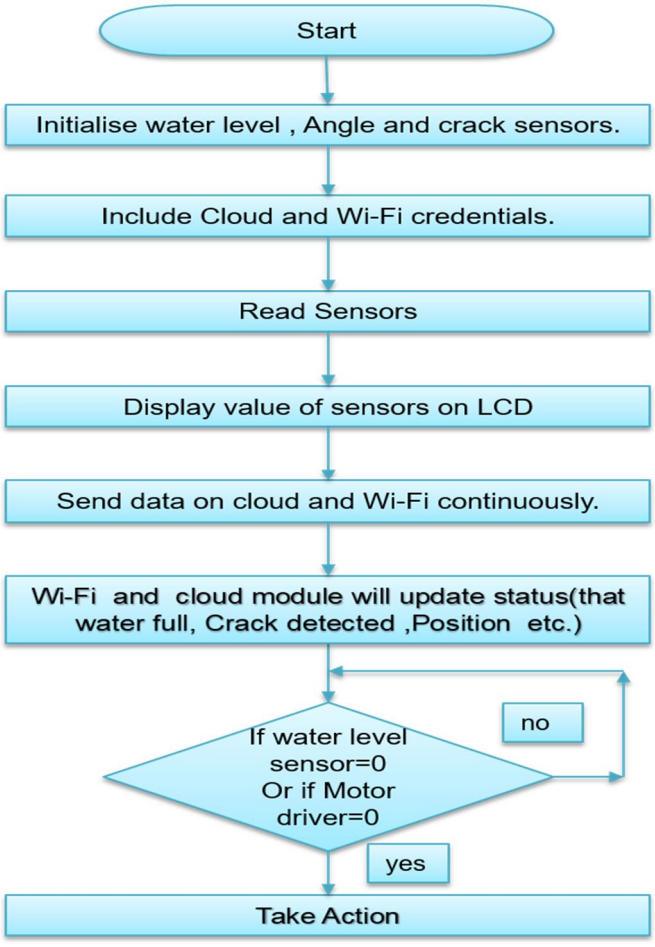

Fig. 2. Flow chart

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IV. RESULT

A. Water Level Sensor

Water Level Detection Sensor works on the basic principle of conduction through the water. It can be used for water level detection, rainfall detection, water leakage detection, etc. The sensor has been divided into two parts, a sensing module also known as brick and a circuit module.

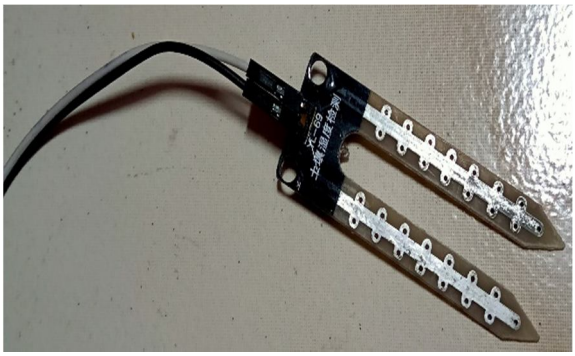

Fig. 3. Water-level sensor.

Fig. 4. Water-level detected.

Fig. 5. LCD shows message water level detected.

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B. Angle Sensor

An Angle sensor is an instrument that is used for measuring the tilt in multiple axes of a reference plane. Tilt sensors measure the tilting position. Angle sensors are devices that produce an electrical signal that varies with an angular movement.

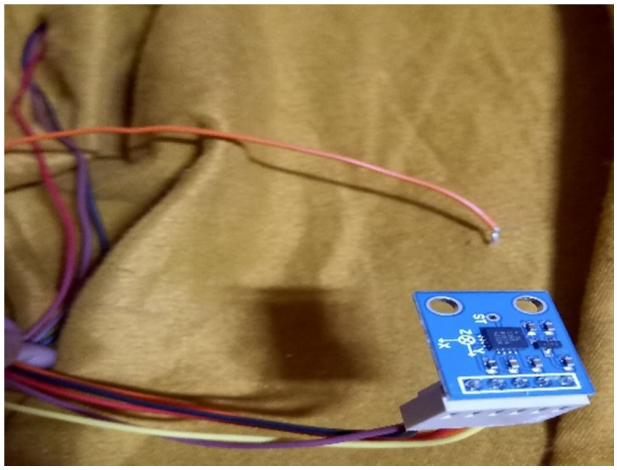

Fig. 5. Angle sensor.

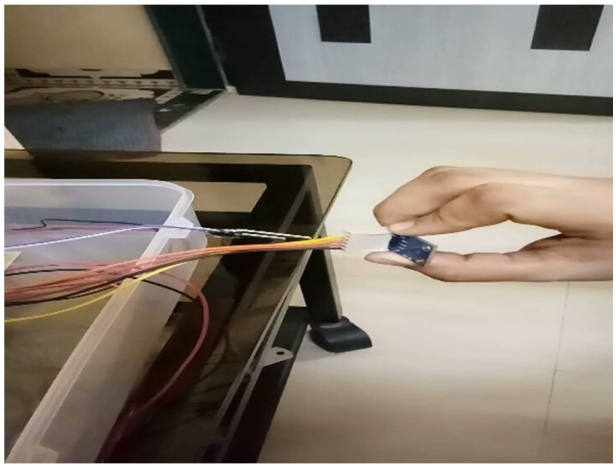

Fig. 6. Angle changed.

Fig. 7. LCD shows the message angle changed.

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C. Crack Detection Sensor

There are many sensor available to detect the crack but as per our project requirement we are not using any type of sensor instead of that we have made one connector which will be having two pin one out and other ground which is connect to one of the port of Arduino, if suppose the connection is loose or disconnected it will be assumed as cracked detected

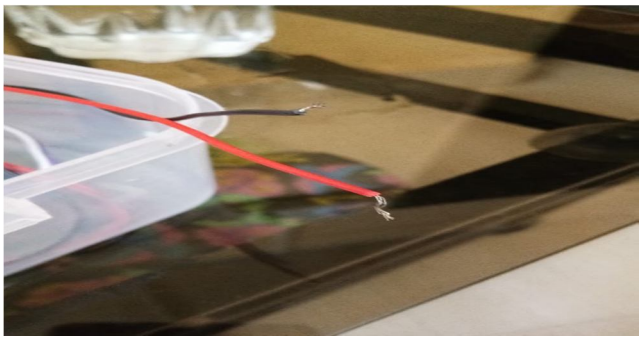

Fig. 8. Crack sensor.

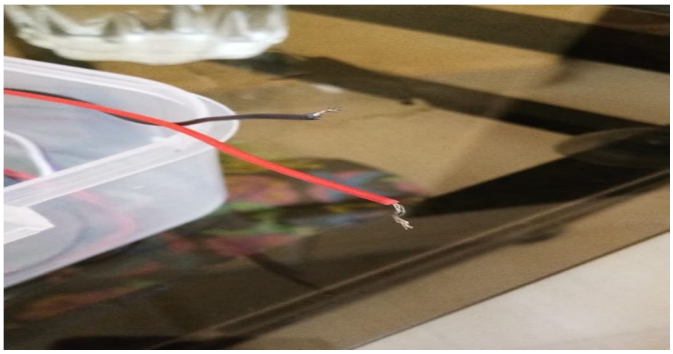

Fig. 9. Crack detected.

Fig. 10. LCD shows the message crack detected.

V. APPLICATIONS

Bridges like:-

A. Footover Bridge.
B. Movable Bridge.
C. Cable slayed Bridge.
D. Arch Bridge.
E. Suspension Bridge

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VII. CONCLUSION

A. A bridge monitoring system is needed for public safety.Such system can be designed using TCP/IP protocol for connection between sensor and Arduino, Wi-Fi module to send data on the cloud server.

B. The system can also save data about tiltness of bridge and some concrete problems time to time which will help for maintenance. In future similar system can be designed for building and railway monitoring.

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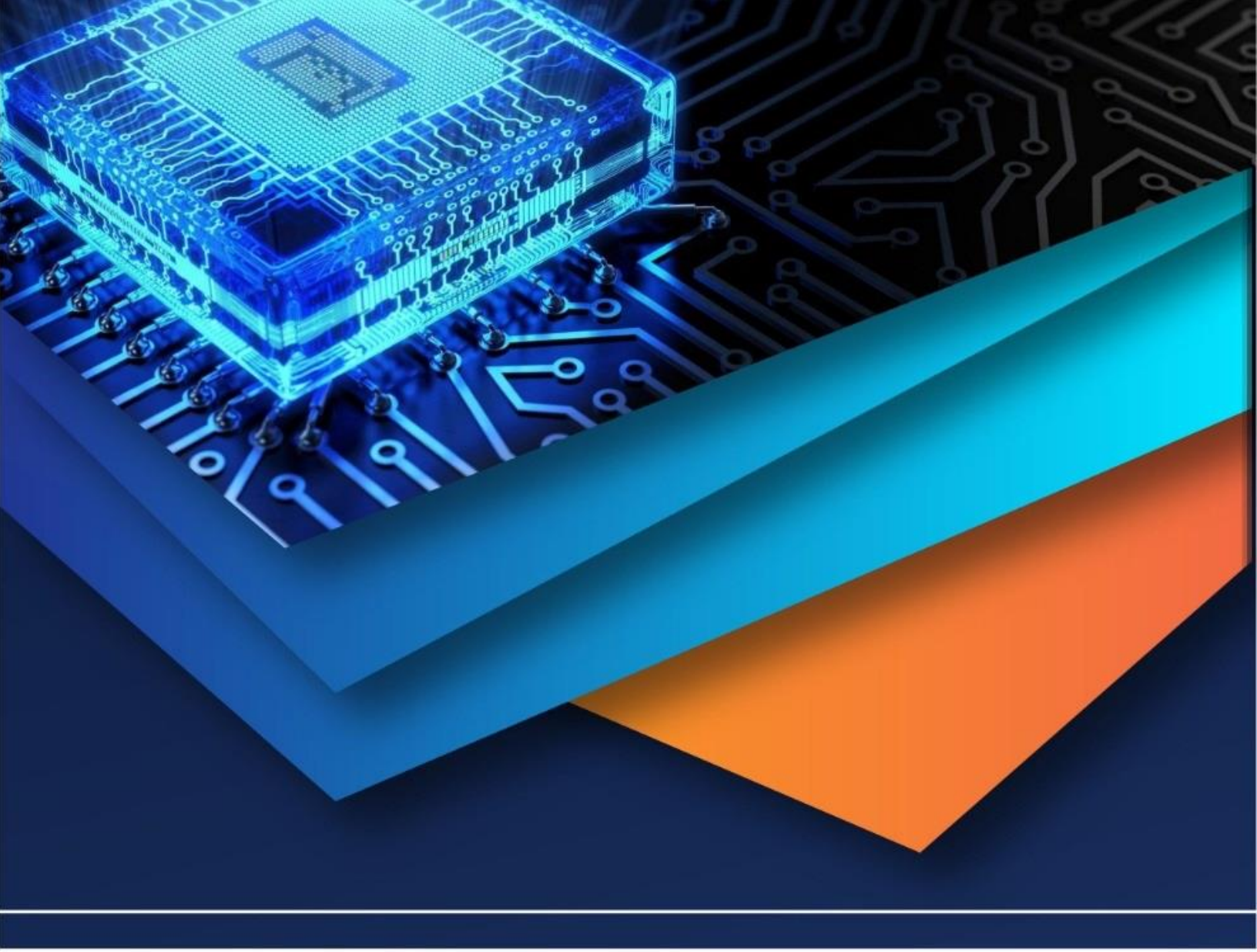

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