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REAL TIME MONITORING OF BRIDGE USING WIRELESS TECHNOLOGY

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Abstract- The bridges get damaged due to aging or damage due to natural calamities, the people will remain unnoticed of it. Then the bridges will be a danger to travel as it can collapse anytime and leads to disaster. So, continuous bridge checking must be done for better bridge health. For solving this problem, a design for continuous bridge monitoring has been proposed using wireless IoT technology. This proposed design helps in monitoring bridges and can also be applied for flyovers. The design consists of monitoring devices as sensors like load sensor, water level sensor, vibration sensor and tilt sensor which are interfaced with communication devices. For storing the status of a bridge, a database is used. The processor is being used for calculation and analyzing the data which is received by the monitoring devices. The design monitors the real-time condition of bridges and flyovers. The proposed is implemented at a low cost.

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I. INTRODUCTION

The engineers are building structures like buildings, dams, bridges etc which are used by the people in their everyday life, they indirectly effect the environment. The major cause of bridge failure is the scour. In the year 2016, sudden floods in the Mahad district on Savitri river which lead to a bridge collapsing. There are many cases of airport bridges getting collapsed. There are bridges all over the world that are used for several decades. Those bridges must be continuously monitored. The existing system uses a wired network which is complicated and high cost. It is using an optical cable of a wired network. This designed system focuses on the health monitoring of the bridges using sensors with the wireless network. The sensors real-time data is stored onto the server which can be accessed by the user. The multiple bridges are connected with a common server. This common server stores all the real-time data that is received by the sensors. The server sends an alert signal to the company head if there is any sensor data which is greater than the threshold. The company employee will be assigned the task of servicing that particular bridge. The user can decide the status of the bridge because in the server an alert message is displaced in front of bridge.

II. PROPOSED METHEDOLOGY

The block diagram is as shown in fig 1 It has a Raspberry pi 3 module which is the processor which is interfaced with a load sensor, ultrasonic sensor, vibration sensor, water level sensor, servo motor, wi-fi module. At any real time, the load sensor measures the amount of pressure that is applied by vehicles; the vibration sensor measures the varying strength of the bridge that can happen due to high wind speed, cyclone or hurricane; the water level sensor measures the amount of water level rising; the flex sensor measures the bending of
the bridge with respect the normal position; the servo motor is used to close the gates of the bridge gate1 and gate2 if the bridge readings cross the threshold set for the bridge. It provides safety to the travellers who use that bridge. The coding for the processor raspberry pi is done using the python language. The sensor data are collected by the processor. It checks with the threshold values set for the bridge, a buzzer turns on. The real-time data's are sent to the cloud/ server. If an alert message is received by the server then the company head assigns the task to a particular department worker to repair the bridge. The user can access the status of the bridge using the application on mobile.

Ultrasonic level sensor:

It is used to measure water levels from a bridge by sending out sound waves. It measures the time taken for the echo to hit the target and return to the sensor.

Load Cell:

A load cell is a type of transducer specifically a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. The load sensor measures the loads of the vehicles that are crossing the bridge. The load values are continuously sent to the processor.

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Raspberry pi 3:

This module allows the users to build computer programs which are complex. The coding in the proposed design is done using the python.

Vibration sensor:

This sensor has a piezo sensor, a filter, capacitor and a bridge rectifier. It generates an output voltage which is proportional to the applied pressure. When a natural calamity like earthquake occurs then vibrations are detected by the sensor which generates an output voltage proportional to the vibrations sensed.

Wi-fi module:

This module is used for transmitting the data received from the sensors to the server. It is interfaced with raspberry pi 3 modules.

Water level sensor:

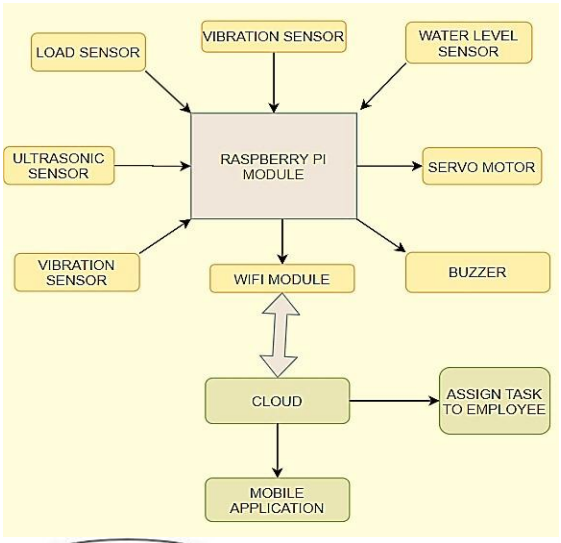
This sensor detects the water level. It is used in sensing the amount of rainfall, liquid leakage and water level. It has 3 pins power supply, signal input and ground. The water level sensor is placed below the bridge. If the bridge is covered with water, then the water level tells the level of water that the bridge is held with. This sensor is fixed at the bottom of the bridge and the top of the bridge.

Servo motor:

It is used for closing the gates of the bridge. The main function is to receive the control signal for the desired output position of the servo shaft. It uses Pulse Width Modulation (PWM) as a control signal.

III. BLOCK DIAGRAM AND FLOW CHART

Figure: 3.1general block diagram



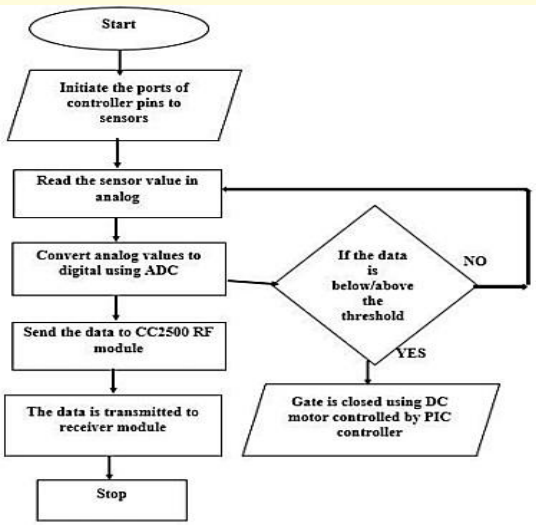


Figure: 3.2 general flow chart

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IV. RESULTS

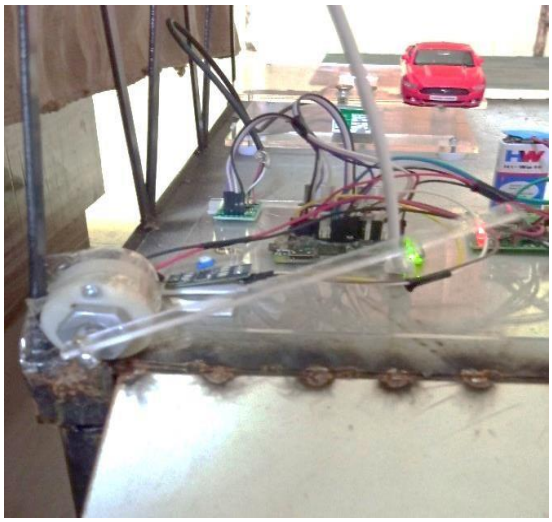


Figure 4.1.1 : When the load on the bridge is greater than the threshold value gate will close

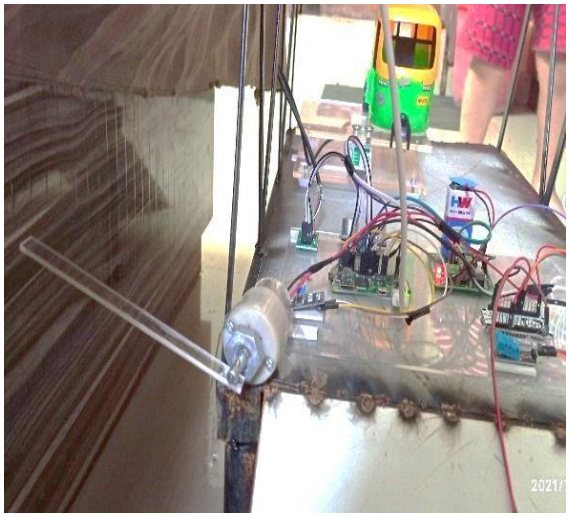
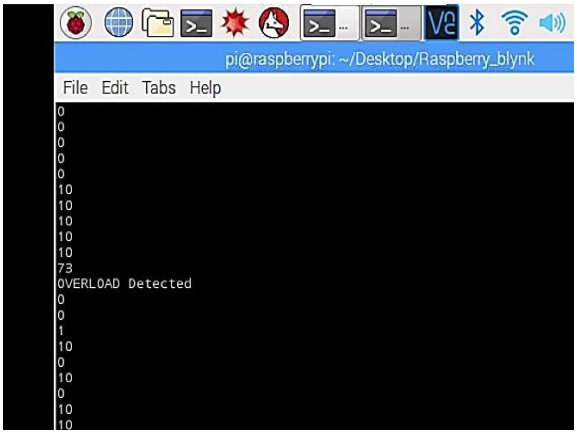


Figure 4.1.2: when the load on the bridge is less than the threshold value gate will open



Output 1: When the load on the bridge above the threshold overload will be detected

Fig 4.1.3: Sensor showing high water level increases

Output 2: Blynk application detects high Vibration

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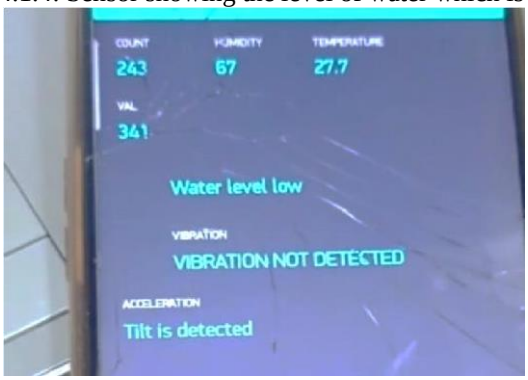
Output 3: Blynk Application showing that the water level is low and the tilt is normal

Fig 4.1.4: Sensor showing the level of water which is low



Output 4: Blynk application showing that the tilt detected and also vibration which is not detected

V. CONCLUSIONS

Bridge health monitoring is a concern in the world. The proposed system manages to collect the data from all the sensors. The real-time sensors data is sent to the server using the wi-fi module. The processor and server both come to know if the bridge needs any servicing when the sensor data crosses the threshold. The server data can be accessed by the user using an application. The server sends the alert message to the company head of the company which constructed the bride if the bridge needs any servicing with the help of real-time sensor data. Many bridges sensors are continuously monitored and the data are stored in the server. If any bridge sensor data needs alertness then the alert signal is sent to the company head of that particular bridge. The gates of the bridges get closed by servo motors if the bridge needs servicing and sensor data crosses more than the peak value.

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