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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.

Keywords: Sensors, Internet of Things, Wireless, Bridges, Raspberry pi, Data analysis.

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. LITERATURE SURVEY

[1] Sun Yi et al. proposed a design which was targeted about cloud computing and interfacing with the data communication. The paper proposed to provide bridge safety by checking the basic factors of the bridge using Zigbee technology. The drawback was the speed of communication was slow by using Zigbee technology.

[2] Arohi et al. proposed a design to find the cracks in the bridges, sending information to the server using IoT. The cracks are detected by using flex sensors. If the sensor reading crosses the threshold then crack is detected. The people can stop the vehicle if they are going through that bridge.

[3] Divya Muddala et al. proposed a three-level structure for the monitoring of bridge which has a local controller, central server and intelligent acquisition mode. Using a water level sensor, the water level parameter was verified for the design.

[4] Ashwini Ret al proposed a design for monitoring the cracks, beam and bends on the railway tracks. IoT was used for communicating through a large distance from the local controller to the server.

[5] Jian Lian Lee et al proposed a design for monitoring the bridges. The water level situations, air, pipelines are monitored for the bridge. The images of the bridge are continuously taken and are sent to the server for analysis.

[6] Pooja K P et al proposed design using two wireless sensors which collect the information about the bridge structure. The sensors used are ultrasonic and accelerometer sensors. The sensors collect the data and are sent to the central station.

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[7] Digambar A J et al. proposed a system for monitoring the bridges. The system designed to measure wind speed, vibration and temperature using sensors and generating an alert for the sensor reading above a threshold.

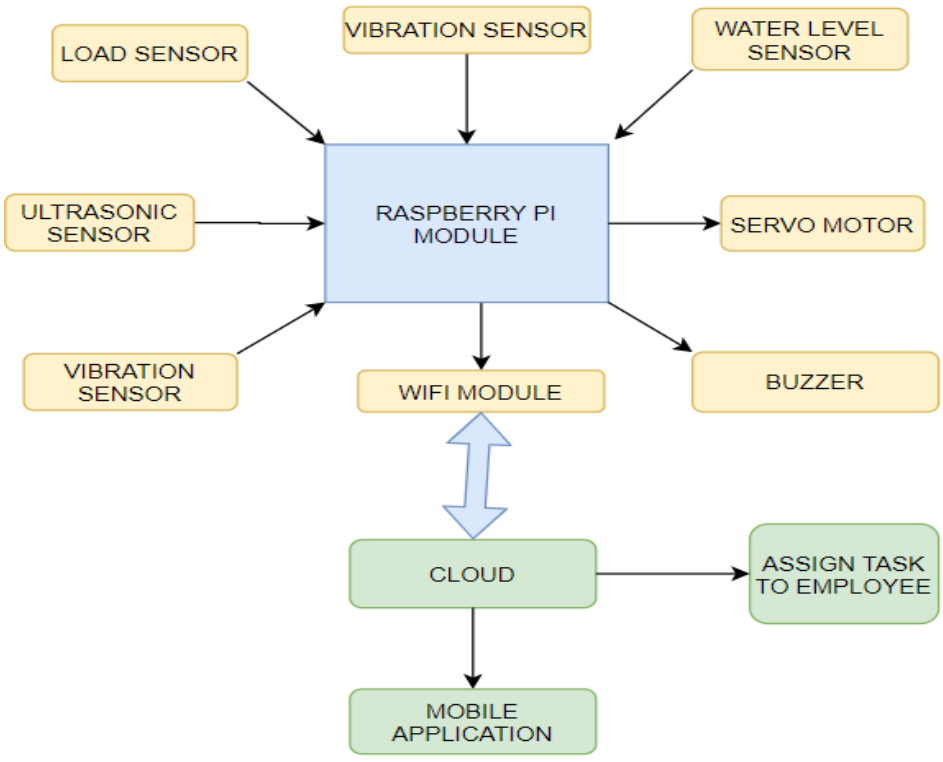
[8] Amrita A et al proposed a system for measuring the weight and water level. The data is transmitted using wi-fi module. The alertness is indicated by an auto barrier and a buzzer.

[9] Y. T. Liu et al proposed a cost-effective and real-time monitoring technique is adopted to trace the scouring depth of bridge pile foundation. A simple mechanical principle combined with a digital I/O switch forms a scour-sensing device. The digital sensing devices are embedded in the river bed. The scouring depth can be identified by monitoring the responses of these digital devices. The mobile wireless techniques (Wi-Fi and 3G) make the scour monitoring job safe and real-time. The proposed system was applied successfully in the field during Morako typhoon in 2009 in Taiwan. This demonstrates the capability of the system for real-time scouring-depth measurement .

[10] Khemapech et al proposed this design SPANNeT system development. It aims at providing a real-time monitoring and warning mechanisms for bridge structures by applying wireless sensor network, real-time data stream processing and Weighted Attack Graph based upon the measured bending strains. Major contributions include an effective, accurate and energy-aware data communication and damage detection of the engineering structure. The warning policies are based upon bending strain and simply supported girders.

III. METHODOLOGY

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.



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IV. CONCLUSION

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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