International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

National Conference on Recent Advancements in Communication, Electronics and Signal Processing-RACES'20
Organised by: Department of ECE, Velammal Engineering College, Chennai-66

IOT BASED BRIDGE SAFETY MONITORING SYSTEM

Radhakrishnan K [1], Suresh Kumar M [2], Akshai J [3], Lokeshwaran K [4]

[1-4]*Department of Electronics and Communication Engineering, Velammal Engineering College, Chennai*

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, a new idea of bridge health monitoring system is introduce. For short distance (among sensors in the bridge) TCP/IP wireless network is tested, and CDMA for long distance (between the bridge and the management center) data communication is tested. This system composed of: (1) Monitoring devices installed in the bridge environment. (2) Communication devices connecting the bridge monitoring system and cloud based server. (3) A dynamic database that stores bridge condition data. (4) A cloud based server that calculates and analyzes data transmitted from the monitoring devices. This system can analyze and monitor in real time the conditions of a bridge and its environment, including the waters levels nearby, pipelines, air and other safety conditions. The detected data and images are transmitted to the server and database to the users to have real time monitoring of the bridge conditions via mobile telecommunication devices.

Keywords **- internet of things (iot), bridge safety monitoring system, data analysis**

I. INTRODUCTION

With the development of information technology, the Internet of Things has the characteristics of strong permeability, large use of action and good comprehensive benefits. It promotes the development of the Internet of Things technology in the detection of structural engineering. It is conducive to the development of intelligent, refined and networked structures. Crack is the most common threat to the safety of bridges. Historical data show that the safety accidents caused by cracks account for more than 90% of the total bridge disasters. After a long period of engineering practice and rigorous theoretical analysis, it was found that 0.3 mm is the maximum allowable for bridge cracks. If the width exceeds the limit, the integrity of the bridge will be destroyed, and even a collapse accident will occur. Therefore, it is very important to identify cracks in bridge structure effectively and provide effective information for structural disaster reduction projects in time.

Based on the structure of the Internet of Things and the structural characteristics of the bridge engineering, this paper analyzed the practical application value of the Internet of Things technology in the crack identification of bridge structures and established a bridge structure health monitoring system based on the Internet of Things technology.

II. RELATED WORKS

With the development of information technology, the Internet of Things has the characteristics of strong permeability, large use of action and good comprehensive benefits. It promotes the development of the Internet of Things technology in the detection of structural engineering. It is conducive to the development of intelligent, refined and networked structures [1]. Crack is the most common threat to the safety of bridges. Historical data show that the safety accidents caused by cracks account for more than 90% of the total bridge disasters. After a long period of engineering practice and rigorous theoretical analysis, it was found that 0.3 mm is the maximum allowable for bridge cracks. If the width exceeds the limit, the integrity of the bridge will be destroyed, and even a collapse accident will occur. Therefore, it is very important to identify cracks in bridge structure effectively and provide effective information for structural disaster reduction projects in time.[1]

Generally, in the process of filling the water container, we forgot to close the valve or pump so water is overflowing and the water is wasted. That is why we propose to use the Internet of Things concept that can solve the problem [2]. Our approach utilizes a controller of ESP8266 that can provide monitoring level of the water container. That controller will open and close the pump or valve automatically so that the water is not overflowing and wasted. We use an ultrasonic sensor to sense the level of the water. We utilize the Blynk IoT service incorporated with PHP web programming in providing water level monitoring and control. We have tested the system on a 64 cm water container. The system has an error of 2 cm in controlling the water level.

The transportation of China developed [3] rapidly at present. The number of various types of bridges, ship's tonnage and the speed of navigation had

been continuously increasing, and the collision accidents of ship and bridge frequently happened. The objective was to establish a bridge-waters area ship safety navigation system to automatically identify the ships sailing track and guide the navigation using GPS, wireless network, embedded technology and predictive control technologies on the basis of bridge waters safety environmental assessment and analysis [4] of the factors affecting the ship safely through the bridge, which can be used to positively prevent and avoid the accidents.

III. SYSTEM MODEL

In the existing system humans has monitor safety parameters of the bridge periodically. So it is difficult to check the safety parameters up to date. It requires man power to check the status of the bridge and the system is complicated to ensure the safety of the bridge. Thus human errors may occur which may lead to increase in accidents and other disasters. The current system requires maintenance charges.

IV. WORKING METHODOLOGY

In the proposed system we can monitor as well as control safety of human being. The safety status of bridge is up to date and the necessary action to be taken via data or controlled by IOT. In this study an IOT based bridge safety monitoring system is developed using WSN technology. Advancements in sensor technology have bought the automated real time bridge health monitoring system which will help in disaster management such as flood, earthquakes. The main aim is to reduce the accidents and save many human lives. The detected data are transmitted to the server and database for users to have real time monitoring of the health conditions.

The system can be operated automatically. Forecasting of the status of the bridge and immediate action to be taken. The system has the intelligence to avoid accident and measure the water level in river. It is much faster as it uses wireless communication networks. It reduces the risk of human error as it works automatically. In this system, we use ARDUINO UNO (ATmega328P) microcontroller which acts as brain of the system, because the entire system program stored in it. Fig.1 Here we have used water level and water flow sensor to monitor the water level and flow of river. Servo motor use to keep a barrier to the bridge as well led and buzzer.

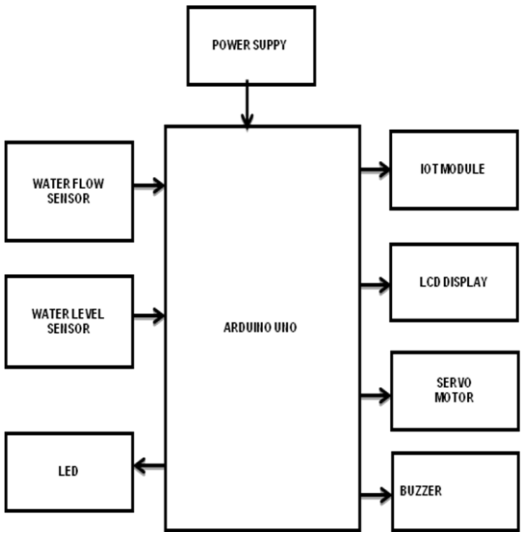


Fig 1.Proposed model block diagram

We use here to give the alarm light and sound respectively. All the operation as well as the entire system function status can be monitored and control by IOT. The ARDUINO UNO is the central control for the entire module. There are two sensors namely water flow sensor and water level sensor. Normally ultrasonic sensors are used. The water flow sensor measures the speed of water and the water level sensor detects the level of water. The power supply is provided through dc power through a 12 amps adapter. The servo motor is used to control the opening and closing of the gate under critical conditions. The IOT module sends the status of the bridge to a webpage where the user can see them. The LED buzzer is used to inform the people about the safety of the bridge to the public LCD are used to display the people about the safety of the bridge. The ultrasonic sensor is placed under the bridge which continuously monitors the distance between the water and the bridge .If the distance goes below the limiting value then the flow sensor calculates the speed of the water. If the speed also goes high then the LCD displays flood alert and uploads the data to the webpage. Then the motor closes the gate and the buzzer indicates the people not to enter the gate which is in danger.

The main advantage of this proposed model is It can be controlled automatically and The status of the bridge are up to date and are controlled via IOT.

V. RESULTS

In the existing system humans has to monitor safety parameters of the bridge. In the proposed system we can monitor as well as control safety of human being. It alerts the public in case of any emergency.

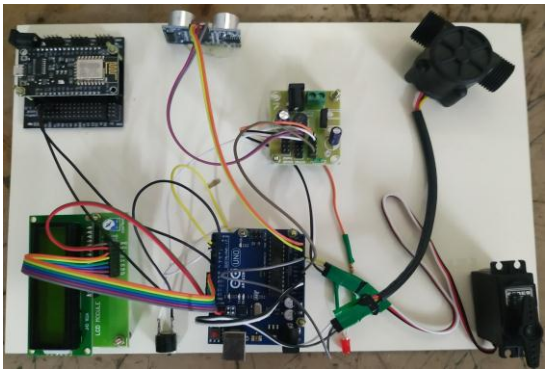


Fig 2.bridge

Fig 3.Waterlvel Indication

Fig 4.Waterflow indication

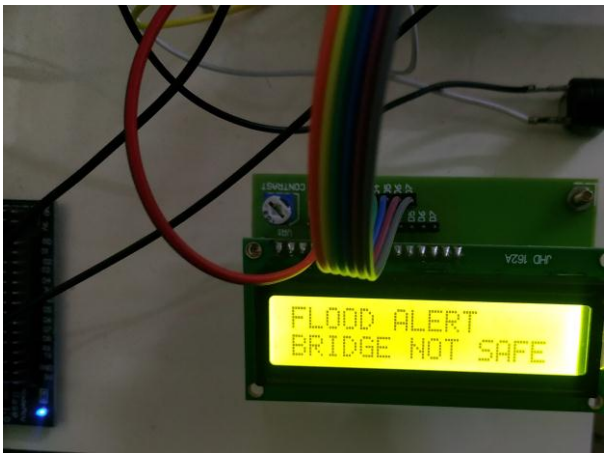


Fig 5.Flood alert indication

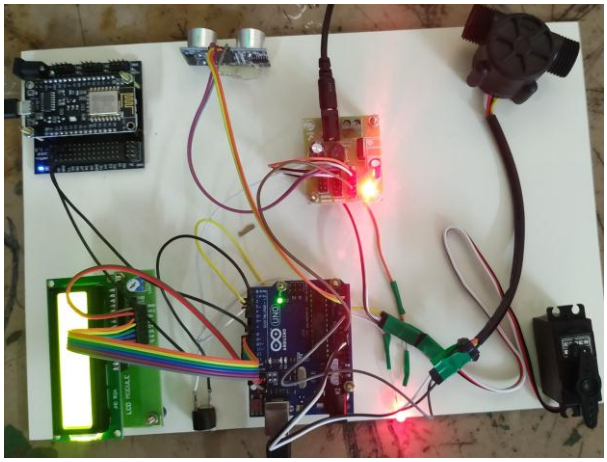
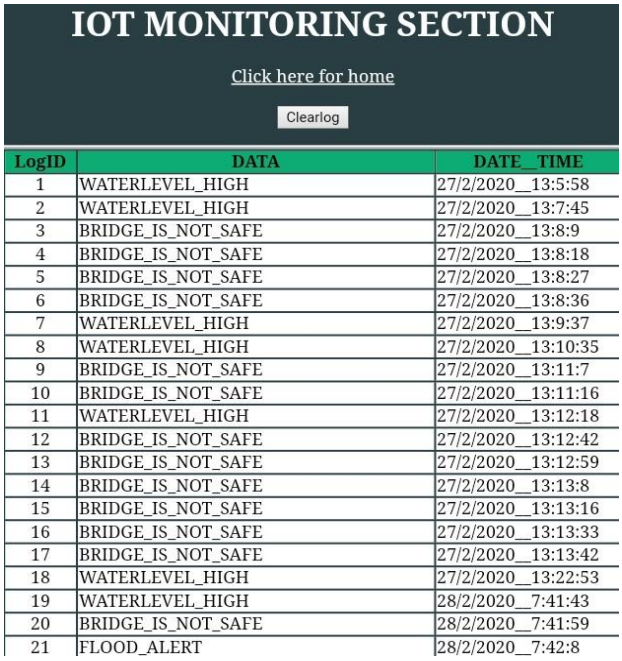


Fig 6. Buzzer indication



IOT MONITORING SECTION

Click here for home

Clearlog

LogID	DATA	DATE_TIME
1	WATERLEVEL_HIGH	27/2/2020_13:5:58
2	WATERLEVEL_HIGH	27/2/2020_13:7:45
3	BRIDGE_IS_NOT_SAFE	27/2/2020_13:8:9
4	BRIDGE_IS_NOT_SAFE	27/2/2020_13:8:18
5	BRIDGE_IS_NOT_SAFE	27/2/2020_13:8:27
6	BRIDGE_IS_NOT_SAFE	27/2/2020_13:8:36
7	WATERLEVEL_HIGH	27/2/2020_13:9:37
8	WATERLEVEL_HIGH	27/2/2020_13:10:35
9	BRIDGE_IS_NOT_SAFE	27/2/2020_13:11:7
10	BRIDGE_IS_NOT_SAFE	27/2/2020_13:11:16
11	WATERLEVEL_HIGH	27/2/2020_13:12:18
12	BRIDGE_IS_NOT_SAFE	27/2/2020_13:12:42
13	BRIDGE_IS_NOT_SAFE	27/2/2020_13:12:59
14	BRIDGE_IS_NOT_SAFE	27/2/2020_13:13:8
15	BRIDGE_IS_NOT_SAFE	27/2/2020_13:13:16
16	BRIDGE_IS_NOT_SAFE	27/2/2020_13:13:33
17	BRIDGE_IS_NOT_SAFE	27/2/2020_13:13:42
18	WATERLEVEL_HIGH	27/2/2020_13:22:53
19	WATERLEVEL_HIGH	28/2/2020_7:41:43
20	BRIDGE_IS_NOT_SAFE	28/2/2020_7:41:59
21	FLOOD_ALERT	28/2/2020_7:42:8

Fig 7 .Cloud based server

VI. CONCLUSION

The proposed system is the development of bridge safety monitoring system using IOT. The system continuously monitors the bridge condition using an ultrasonic sensor. All sensors get the real time value and send it to the server and android. The data can be useful to avoid accident and all the data will be displayed on the digital display. If the sensor value is above the limit the system will play the buzzer and notify the people.

REFERENCES

[1] Liyan Zhang, Guanchen Zhou, Yang Han, Honglei Lin, Yuying Wu, "Application of Internet of Things Technology and Convolutional Neural Network Model in Bridge Crack Detection", IEEE Access (Volume: 6), Page(s): 39442 – 39451, ISSN: 2169-3536.

[2] Dianhu Du, "Study on the bridge-waters area ship safety collision avoidance navigation system", 2018 Chinese Control And Decision Conference (CCDC), ISSN: 1948-9447

[3] Dianhu Du, "Study on the bridge-waters area ship safety collision avoidance navigation system", 2018 Chinese Control And Decision Conference (CCDC), ISSN: 1948-9447.

[4] Y. R. Risodkar; A.S. Pawar,"A survey: Structural health monitoring of bridge using WSN"2016 International Conference on Global Trends in Signal Processing, Information Computing and Communication, 2017