Bridge Health Monitoring System

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ABSTRACT

Bridges may get collapsed or tilted due to flooding or some concrete problem, natural calamities. So there is a need to design a system which will continuously monitor condition of bridges. It is useful for public safety and reduction in human losses. Such system will help in disaster management and recovery. IoT-based bridge safety monitoring system is developed using the WSN Technology. This system is composed of: Monitoring devices installed in the bridge environment, communication devices connecting the bridge monitoring devices and the cloud based server, a dynamic database that stores bridge condition data, cloud based server calculates and analyse data transmitted from the monitoring devices. This system can monitor and analyse in real time the crack detection of a bridge using the image processing based on raspberry-pi and its environment, including the water levels, load, gate open/close and other safety conditions.

Keywords: IoT, bridge safety monitoring system, WSN Technology, controller, sensors.

ARTICLE INFO

I. INTRODUCTION

Now-a-days because of incidents of bridges or bridge piers severely damaged by typhoon floods and earthquakes are frequently reported each year. In addition to floods, typhoons and earthquakes may also cause disastrous accidents of fires, explosive gas leakage and liquid chemical leakage. Different disasters and damaged sites require different professional disaster rescue knowledge and equipment in order to achieve optimal rescue results. However, lack of information about the damage site can impede information management at the rescue centre and rescue operation, resulting in poor rescue efficiency or even preventable causalities. Engineering structures are responsible for economical growth, development and evolution of the nation. The structure includes buildings, dams, roads and bridges which affect day to day a life of people. Along with their own weight they are also affected by the environment. Scour is also one of the major causes for bridge failure. In 2016, a bridge collapsing incident occurred on Savitri River in Mahad district due to sudden floods in the river. Apart from this, problem of collapsing may arise on airport boarding bridges. This paper introduces bridge monitoring system which monitors the bridges through sensors and generate the alert. It mainly focuses on aging bridges.
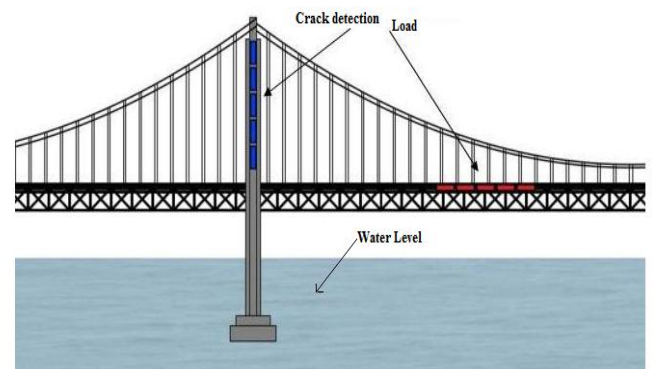

Fig 1. Simple bridge monitoring structure

II. PROBLEM STATEMENT

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Here we monitor the bridge using the IoT and image processing based system to minimize the bridge damage.

III. LITERATURE SURVEY

[1] Complete Internet of Things (IoT) Platform for Structural Health Monitoring (SHM)   Md   Anam Mahmud, Kyle Bates, Trent Wood, Ahmed Abdelgawad, Kumar Yelamarthi, 2018.
In this paper, a complete IoT SHM platform is proposed. SHM is a nondestructive evaluation technique to monitor the integrity of civil structures such as bridges, aircraft, etc. SHM is a vital tool to be implemented in old buildings, bridges, etc., to ensure the safety of human beings. In this paper, the chosen approach was to develop a technique to analyze signals (electrical) and implement the proposed technique on an embedded platform.

[2] Application of Internet of Things Technology and Convolutional Neural Network Model in Bridge Crack Detection   Liyan Zhang1, Guanchen Zhou1, Yang Han1, Honglei Lin1, Yuying Wu1, 2018.
Crack is the most common threat to the safety of bridges. 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. On this basis, this paper also studied a digital and intelligent bridge crack detection method to improve the efficiency of bridge safety diagnosis and reduced the risk factor.

[3] Development of an IoT-based Bridge Safety Monitoring System, Jin-Lian Lee, Yaw-Yauan Tyan, Ming-Hui Wen, Yun-Wu Wu., 2017.
An IoT-based bridge safety monitoring system is developed using the ZigBee technology. This paper describes about, it can monitor and analyze 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 for users to have real-time monitoring of the bridge conditions via mobile devices.

[4] Application of Damage Detection for Bridge Health Monitoring Amira Zrelli, Hacen Khlaifi and Tahar Ezzedine 2017.
In this paper, The principal objective is to locate and to detect damages in bridges by the use of wireless sensor network. Internet of things presents a solution for damage in bridge of health monitoring.

[5] The Research of Bridge State Monitoring System Based on lOT Technology SunYi, XuChengwen, 2010.
The system is consisted of the forward sensor cells, data collecting & transmitting equipment and Hand-held Terminal. The ZigBee technology is used between sensor cells and data collecting & transmitting equipment, the Wi-Fi technology is practiced to access the upper network by data collecting & transmitting equipment, meanwhile the expert system is responsible for the deep data analysis. Through the long-term monitoring of the basic data such as the deformation of the bridge, this convenient and reliable means provides a scientific decision for the long-term bridge safety maintenance.

IV. PROPOSED SYSTEM

In proposed system we will be using raspberry pi board as processing unit, which has camera and sensors connected as shown in below figure,
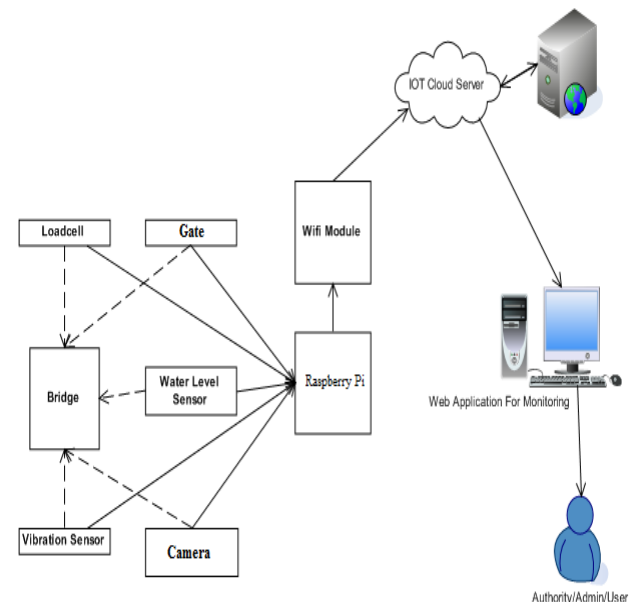

Fig 2. System architecture

Bridge is connected with several sensors like load cell for weight analysis, vibration sensor for detection vibrations in bridge, water level senor for flood detection. All sensors continuously take values from structure of bridge and recorded by raspberry pi microcontroller and sent to cloud server through IOT using ESP8266 Node MCU wifi module. Users/Authorities will have a web application with dashboard and user interface. This web application will show real time values and will take critical decision based on various algorithms. If flooding condition is detected the auto barriers will close the bridge for transportation.

The raspberry pi uses SD card as storage device, camera is sued for taking live streming and of hand gestures, speakers are used to speak out the gesture recognized. Overview of raspberry pi is as shown in below figure,
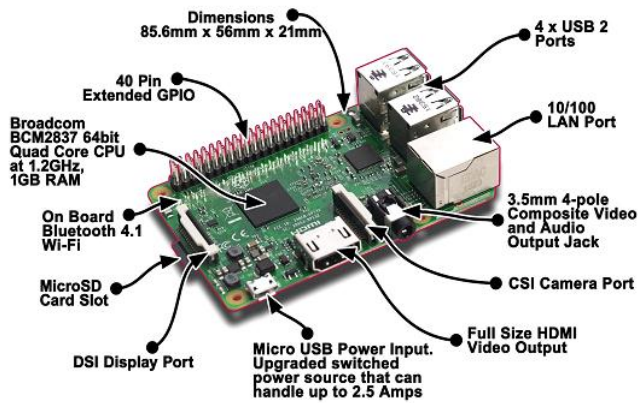
Fig 3. Raspberry Pi 3B Model Board

Raspberry pi uses Raspbian OS which is a type of debean linux. It has open cv libraries installed for image processing and all the execution code is written in python programming. For convolutions and CNN algorithm tensor flow is installed.

V. CONCLUSION

The system continuously monitors the bridge parameter value and judges whether the bridge is safe or not for traveling. In case the parameter values are beyond the threshold values then an alert generate is given to the people. This implementation is greatly useful provide safety for the human.

REFRENCES

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