Journal of Management & Entrepreneurship
ISSN 2229-5348
UGC Care Group I Journal
Vol-11 Issue-02 Dec 2022

Monitoring and Alerting System for Bridges Based on the Internet of Things

Mr. KURADA VEERABHADRACHANDRA SEKHAR RAO[1], Mr. G. ASHOK JEEVAN[2],
Mrs. A S N V LAKSHMI KANTHAM[3]ASSOCIATE PROFESSOR[1], ASSISTANT PROFESSOR[2,3],
DEPARTMENT OF ECE, SWARNANDHRA COLLEGE OF ENGINEERING AND TECHNOLOGY, NARASAPUR

Abstract

We construct an IoT-based bridge safety monitoring system using wireless technologies. Devices for monitoring, devices for communicating between those devices and a server in the cloud, and a server in the cloud for processing and interpreting data are the components of the system. This technology has the potential to monitor and analyze a variety of safety concerns, including water pressure levels, vibration, and others, in close proximity to a bridge. By transmitting the found data to a server and database using mobile communication devices, users are able to monitor the bridge's condition in real time. Numerous river bridges are common in urban areas, and due to their age, many of these structures need frequent repairs. Due to the weight of vehicles using it, the amount of water running under it, or both, a bridge's collapse might result in a disaster. Hence, these bridges require ongoing monitoring. This is why the research recommends a certain configuration that comprises a scale, vibration and water force sensors, a Wi-Fi module, and an ARM CPU. When the load detection mechanism of the system detects that a vehicle's load exceeds a certain threshold, an alarm will go out and the relevant staff members will be assigned the task of fixing the vehicle.

Key words

Connected devices, ARM microcontrollers, load, force, and vibration are all phrases that are nearby.

INTRODUCTION

A cloud-based analysis server, a database that keeps track of the bridge's status in real-time, communication devices that connect the monitoring devices to the server in the cloud, and monitoring equipment that is customized to each bridge make up this system. In real time, this system can monitor and analyze the environment around a bridge, including water levels, pipelines, air, and other safety considerations. The data and images are uploaded to a server and database so that users may monitor the bridge's condition in real time using mobile communication devices. Both catastrophe rescue and the administration of bridge safety measures may make use of the data. Specifically, this system's monitoring and data exchange make use of Wi-Fi technology, which is renowned for its large number of supported network jobs, low power consumption, and great safety. The system also makes use of solar energy as a secondary power source. Bridge safety management and control might benefit from the proposed system from this study as it addresses the problems encountered by conventional methods.

Evaluation of Results

In 2017, Jinn-Lian Lee et al. detailed the use of ZigBee technology to create an Internet of Things–based bridge safety monitoring system. The components of this system include bridge-specificmonitoring devices, communication devices for exchanging data between the monitoring devices and the cloud-based server, a dynamic database for storing information about bridge conditions, and a cloud-based server for performing calculations and analyses on the data that is transmitted from the monitoring devices. This technology is able to analyse the current circumstances of a bridge and its surrounding environment, such as water levels, pipes, air quality, and other safety factors, in real time. To allow people to keep tabs on the bridge's status in real time via mobile communication devices, the collected data and photographs are uploaded to a server and database. A study by Pradeep Kumara V. H. D. C. Shebang (2020) found that when bridges deteriorate with age or are destroyed by natural disasters, few people take attention. Then crossing bridges is risky since they might give way at any moment. If we care about the long-term condition of our bridges, we need to conduct regular inspections. As a potential solution, a plan for wireless Internet of Things-based 24/7 bridge monitoring has been presented. The suggested layout is useful for monitoring bridges and may be adapted for use with flyovers as well. Specifically, the layout is made from of

apparatus for monitoring objects

interconnected sensors that register variables such as gravity, depth, vibration, and tilt. It is possible to keep track of a bridge's status in a database. Numerical calculations and data analysis from sensors are putting processing power to use. This architecture allows for the real-time monitoring of bridge and flyover conditions. Easy and inexpensive execution of the plan is possible. The academic and commercial sectors of civil engineering and computer science have shown an increasing interest in Bridge Structural Health Monitoring (BSHM) based on the Internet of Things (IoT), according to Lingzi Yi et al. (2020). Experts in computer science and civil engineering worked together to write this paper, which addresses a fundamental question motivated by practical deployments of IoT-based BSHM: how to effectively prolong the lifetime of a network while preserving the coverage it needs.

By combining the Confident Information Coverage (CIC) model with the promising reinforcement learning model known as Learning Automata, this study provided a way to guarantee network coverage and prolong the lifetime of IoT-based BSHM systems. The proposed method schedules the wake/sleep states of deployed nodes alternatively to guarantee network connection and partial coverage ratio via the use of collaboration. To specifically extend the lifetime of the network and adaptively find the optimal sensor scheduling approach, the suggested method heavily employs the learning automata model. The suggested method's efficiency and effectiveness are shown by a set of comparison simulations using real data sets acquired by a working BSHM system. We are unaware of any previous studies that have investigated the possibility of extending the lifespan of an IoT-based BSHM's network by combining the reinforcement learning process with partial coverage.

HOW IT WAS DONE

In order to monitor the bridge and trigger an alert in the event of an issue, this article outlines a circuit that utilizes Internet of Things and wireless sensor network technologies.

Uno, an Arduino

You may purchase an Arduino from the seller or build one yourself using the components; it's open-source hardware, so you can use it however you choose. Its principal uses are in the realms of communication and device management. It was started in 2005 by Massimo Bansi and David Cuartillas. The Arduino Uno is a microcontroller board that uses the ATmega328 as its foundation. It has 14 digital I/O pins, including 6 that may be used as PWM outputs, a reset button, a power connection, an ICSP header, and a USB port. A 16 MHz crystal oscillator is also included. All you need is a computer, the accompanying AC-to-DC converter, or the battery to get going. The USB cable is all you need. Unlike its forerunners, the Uno doesn't come with an FTDI USB-to-serial driver chip. Instead, a USB-to-serial converter included within the Atmega8U2 is used. The name "uno" was selected to represent the impending release of Arduino 1.0 since "one" signifies "one" in Italian. Arduino 1.0 and the Uno will be the de facto standards moving forward.

An Instrument for Identifying Vibrations

Vibration sensors are used in a wide variety of projects, technologies, and applications. If you want to know how fast a car is going or how powerful an earthquake is about to hit, you may use a vibration sensor. Some may be self-sufficient, while others need an additional power source. Temperature, magnetic field, vibration, frequency, electromagnetic compatibility (EMC), electrostatic discharge (ESD), and essential signal quality are just a few of the many potential machine-related hazards that need specialized sensors.

Implementing a Resistive Load Cell

The piezo-resistance principle is the basis for how a load cell operates. When subjected to shocks or loads from outside sources, the sensor's resistance varies. The output voltage changes as a result of the introduction of an external voltage because of the change in resistance. Load or force cells come in a variety of configurations, each with its own set of scientific and industrial applications. The sensing element in many contemporary systems are strain gauges, which may be foil or semiconductor based.

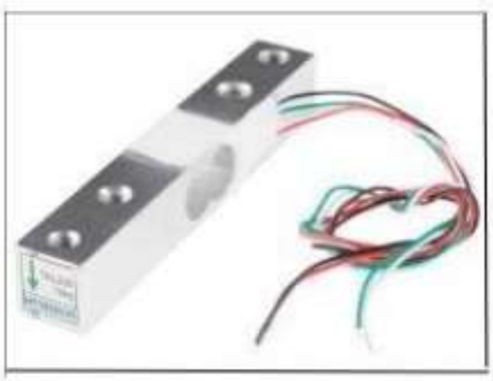

Fig .1 Load Cell

Pressure Indicator

A force-sensing resistor is a material whose resistance changes when pressure or force is applied to it. One kind of resistor that may modify its resistance in reaction to external forces is the force-sensitive resistor, or FSR. For this reason, force-sensing resistors often make use of conductive polymers, whose resistance changes in a predictable manner in response to surface pressure. Polymer sheeting or screen-printable ink 31 are common packaging options. The sensing film is composed of a matrix of insulating and conductive particles. Reduced temperature dependence, improved mechanical properties, and increased surface life are the goals of producing particles of sub-micron size. Particles shift closer to the conducting electrodes on the sensing film when you push down on its surface, changing the film's resistance. Force-sensing resistors, like other resistive-based sensors, may be easily used in fairly hostile environments. The tiny size, low cost, and great shock resistance of FSRs make them superior to other force **sensors.**

Fig .2 Force Sensor

BLOCK DIAGRAM

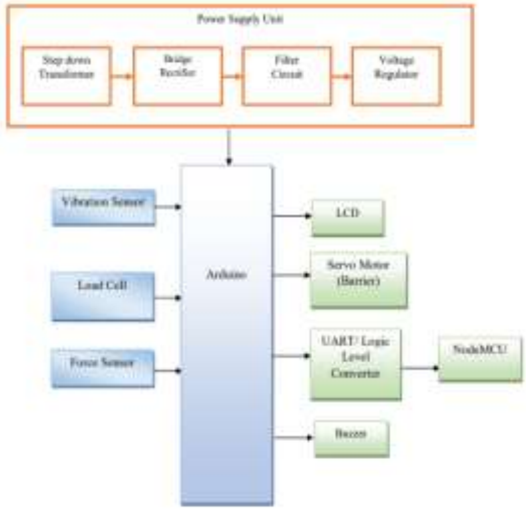

Fig .3 Block Diagram

OUTCOMES AND FACTORS

An Operational Arduino

The fourteen digital I/O pins of the Uno may each supply or drain forty milliamperes. The first two pins are for serial data reception and transmission, the second and third are for external interrupts, the fifth, sixth, ninth, and eleventh provide pulse width modulation (PWM) output, and the thirteenth is for an LED connection. One possible use of a polarizer is to manipulate the light beams passing through an LCD in order to activate and highlight certain text. A +5v power source with no transients over 10mv is ideal. You may adjust the display's contrast by adjusting the voltage at pin 3. The ground connection of the power source has to be sufficiently isolated in order for voltage to be created there. In order to avoid a flickering display caused by stray voltages, the module must have sufficient insulation. The electronic controller, gear set, potentiometer, and DC or AC motor are the four main components of a servo. To begin, a gear assembly is used to slow down the motor's RPM and enhance torque. For the sake of argument, let's say the potentiometer is adjusted to a zero-voltage output and the servo motor shaft is at the beginning position. Next, current is supplied to the second input terminal of the error detection amplifier. In order to generate an error signal, the feedback mechanism will now subtract the other signal from the potentiometer signal. This error signal initiates motor rotation upon input to the motor. The signal generator will react to the rotation of the motor now that the shaft is connected to the potentiometer. At some point, you should be able to adjust the potentiometer so that the signal you input is exactly matched by its output. The output signal from the amplifier to the motor's input becomes null and the motor ceases to operate when the signal from the external source is identical to the signal from the potentiometer.

Results

The many methods the scientist used to monitor the bridge's condition have already been discussed. In the event of an emergency, this technology may help save lives and save financial losses by precisely controlling the bridge's dynamic features. This innovative system can keep tabs on a bridge's surroundings, relay that data to other devices via wireless connection, and alert the bridge's administration staff instantly to any issues. With this innovation, bridge safety monitoring might be possible at all hours of the day and night. What to do when disaster strikes. In order to ascertain whether it is safe to cross, the technology continually monitors the bridge's characteristics. An alert will be triggered if the parameter values go above the predetermined boundaries. That this was put into place is very useful. The proposed solution was built using IoT and Wireless Sensor Network technologies. A number of sensors, such as a scale, vibration, water force, Wi-Fi, and an ARM CPU, make up the hardware module of the suggested system. This system is designed to sound an alarm if the weight of a vehicle goes beyond a certain threshold. An alarm is triggered and the data is shown on the LCD screen when the value above the threshold. A DC motor will close the barrier gate in the event of a bridge emergency.

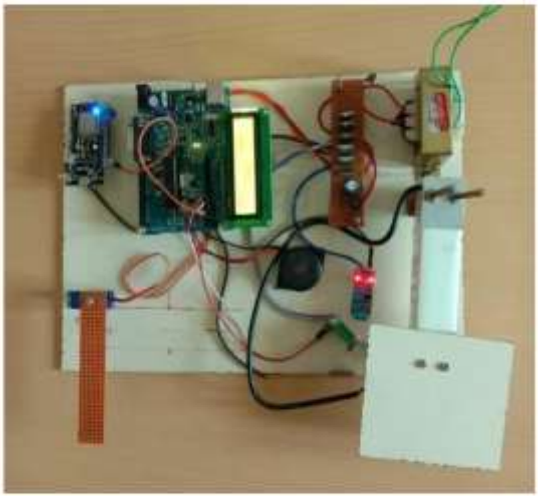

Fig. 4 Prototype Model

CONCLUSION

Based on the findings of this research, it is possible to use the Internet of Things and an LCD panel to display warning signs of a bridge approaching collapse. This strategy will help prevent future catastrophic disasters. Thanks to this method, a lot of lives may be saved. Together, sensors and the Internet of Things (IoT) make it possible to detect bridge deterioration. The proposed technique may be able to measure the angular displacement of the bridge. A monitoring system is necessary due to the significance of bridge safety. A network connection between the sensor and the Arduino Wi-Fi module may be established using TCP/IP in the building of such a system. The main objective is to detect bridge deterioration using sensor networks. When sensors are coupled with the Internet of Things, they provide a solution to the problem of damage in bridge health monitoring.

REFERENCE

[1In 2014, Y. Sun published an article in the International Journal of Control and Automation titled "Research on the Railroad Bridge Monitoring Platform Based on the Internet of Things." The article runs from pages 401-408.

2. P. Kinney, "ZigBee technology: Wireless control that simply works, 2003." 2003.

The authors of the 2009 article "A zigbee-based home automation system" (K. Gill, S.-H. Yang, F. Yao, and X. Lu) were published in the IEEE Transactions on Consumer Electronics.

The article "The Computer for the 21st Century—Scientific American Special Issue on Communications" was published in 1991 in the September issue of Computers and Networks and can be found on pages 94–104.

The article "Hot topics-ubiquitous computing" was published in Computer in 1993 and can be found in volume 26, issue 10, pages 71–72.

In their 1995 article "The road ahead," B. Gates, N. Myhrvold, P. Rinearson, and D. Domonkos discuss this idea.

[7] "A robust, adaptive, solarpowered WSN framework for aquatic environmental monitoring," published in 2011 in the IEEE Sensors Journal, by C. Alippi, R. Camplani, C. Galperti, and M. Roveri.

[8] Article published in 2013 by M. T. Lazarescu in the IEEE Journal on Emerging and Selected Topics in Circuits and Systems, titled "Design of a WSN platform for long-term environmental monitoring for IoT applications," has the following page numbers: 45–54.

"LACAS: learning automata-based congestion avoidance scheme for healthcare wireless sensor networks," published in the 2009 edition of the IEEE Journal on Selected Areas in Communications, was written by S. Misra, V. Tiwari, and M. S. Obaidat.

[10] "Ubiquitous WSN for healthcare: Recent advances and future prospects," published in the 2014 edition of the IEEE Internet of Things Journal, by Y. Zhang, L. Sun, H. Song, and X. Cao, pp. 311–318.

In their 2010 article "Using heterogeneous wireless sensor networks in a telemonitoring system for healthcare," J. M. Corchado, J. Bajo, D. I. Tapia, and A. Abraham published in the IEEE transactions on information technology in biomedicine, the authors discuss the use of wireless sensor networks in different healthcare settings.

[12] Published in 2007 in the IEEE Transactions on Consumer Electronics, the article "Design of a networked

monitoring system for home automation" was written by G. Song, Z. Wei, W. Zhang, and A. Song.

In the 2011 International Conference on Future Computer Sciences and Applications (ICFCSA), J. Zhang, G. Song, H. Wang, and T. Meng presented their work titled "Design of a wireless sensor network based monitoring system for home automation." The paper can be found on pages 57-60.

[14] In the paper "Adaptive traffic light control in wireless sensor network-based intelligent transportation system," published in the 2010 IEEE 72nd Vehicular Technology Conference (VTC 2010-Fall), B. Zhou, J. Cao, X. Zeng, and H. Wu discussed the topic on pages 1-5.