ISSN 2454-8065

International Journal of Applied Theoretical Science and Technology
Volume 16, Issue 04, pp01-07 February 2023

PRE WARNING SYSTEM FOR WEAK HOUSES AND BRIDGES USING IOT

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Abstract— **In this project the alert is made about weak bridges and Houses that may destroy and having a risk of collapsing. The main aim of the project is to avoid hazards. Early warning systems are the systems by which people receive relevant and timely information in systematic way. Early action can often prevent a hazard turning into a human disaster by preventing loss of life and reducing the economic and materialimpacts.**

In this bridge or House monitoring system is significant to the structural health monitoring of both old/new bridges and flyovers an infrastructure daily used by citizens of their respective countries. In this system we use MEMS sensor for Dislocation or uneven movement of the bridge or house, flex sensor is used to crack detection, and a NodeMCU micro controller is used for processing the data and to react according to the instructions and alert the system whenever there isa un even conduction occurred.

Keywords—MEMS Sensor,Flex Sensor Green and Red LED's ,blynk IOT app,Node Mcu ESP8266 Micro Controller

I. INTRODUCTION

Human beings need shelter to live, so they have started building houses and buildings. A Bridge is a structure which connects two places. A bridge is a structure built to span a physical obstacle, such as a body of water, valley, or road, without closing the way underneath. It is constructed for the purpose of providing passage over the obstacle, usually something that is otherwise difficult or impossible to cross. Two things should be considered when you are building the foundations - the solidarity of the soil and the heaviness of the building and its contents. The causes of weak building or houses may be weak foundations, poor soil condition, poor materials - Materials that just aren't strong enough to withhold the load used in construction, unskilled or semi-skilled workers - Even when workers are given the right materials to makethe concrete, they mix them incorrectly. This results in concrete, which is not of the sufficient strength to hold the load, the load is heavier than expected, the strength isn't tested and to cover a waterbody such as well, lake etc. and build a house or a bridge. In this system, we use MEMS sensor for dislocation or uneven movementof the bridge or house, flex sensor is used to crack detection, and a Atmega328 micro controller is used for processing the data and to react according the instructions and alert the system whenever there is an uneven conduction control.

This system can monitor and analyses 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 telecommunication devices. The data can be used for bridge safety management and, in the occurrence of a disaster, for disaster rescue. For its monitoring and information communication, this system uses the Wi Fi technology, a technology characterized by low power consumption, high safety and support of a large number of network works. In addition, solar energy is used as a supplementary power source for the system to reduce its costs The system developed in this study can help promote the advancement of bridge safety management and control by providing breakthroughs to the above-mentioned problem of conventional systems , publications committee as indicated on the conference website

II. LITERATUR SURVEY

Jin-Lian Lee et al (2017) explained about that an IoT-based bridge safety monitoring system is developed using the ZigBee 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, and a cloud-based server that calculates and analyses data transmitted from the monitoring devices. This system can monitor and analyse 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 telecommunication devices. Pradeep Kumara V. H. D. C. Shubhangi (2020) discussed the impact of 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 analysing 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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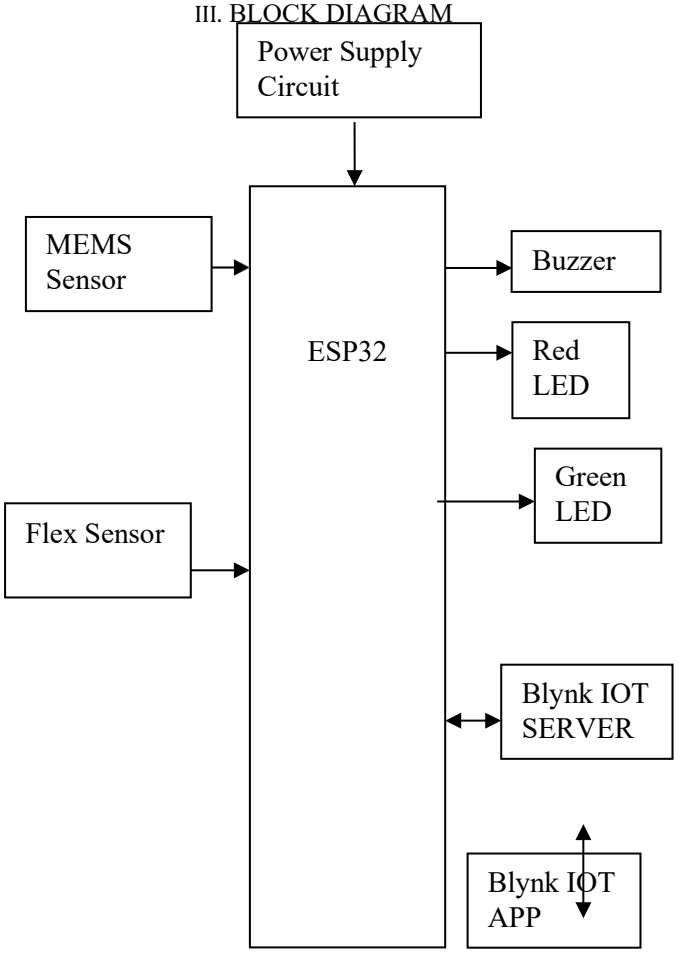
Lingzhi Yi et al (2020) suggested that the Internet of Things (IoT) based Bridge Structural Health Monitoring (BSHM) has recently attracted considerable attention from both academic and industrial communities of civil engineering and computer science. In conjunction with researchers from civil engineering and computer science, this paper studied a fundamental problem motivated from practical IoT-based BSHM: how to effectively prolong network lifetime while guaranteeing desired coverage.

Integrating a promising reinforcement learning model named Learning Automata with Confident Information Coverage (CIC) model, this paper presented an energy-efficient sensor scheduling strategy for partial CIC coverage in IoT-based BSHM system to guarantee network coverage and prolong network lifetime. The proposed scheme fully exploits cooperation among deployed nodes and alternatively schedules the wake/sleep status of nodes while satisfying network connectivity and partial coverage ratio. Specially, the proposed scheme takes full advantage of the learning automata model to adaptively learn the optimal sensor scheduling strategy and significantly extend network lifetime. A series of comparison simulations using real data sets collected by apractical BSHM system strongly verify the effectiveness and energy efficiency of the proposed algorithm. To the best of our knowledge, this is the first study on how to combine the reinforcement learning mechanism with partial coverage for maximizing the network lifetime of the IoT-based BSHM.

III. BLOCK DIAGRAM



In this bridge or House monitoring system is significant to the structural health monitoring of both old/new bridges and flyovers an infrastructure daily used by citizens of their respective countries. In this system we use MEMS sensor for Dislocation or uneven movement of the bridge or house, flex sensor is used to crack detection, and a ESP32 micro controller is used for processing the data and to react according to the instructions and alert the system whenever there is a un even conduction occurred.

IV. HARDWARE DESCRIPTION

NODEMCU:

The Node MCU is an open-source firmware and development kit that helps you to Prototype your IOT product within a few Lua script lines. The ESP8266 is the name of a micro controller designed by Espressif Systems.
This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect Node MCU dev kit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboardfriendly.
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Features of Node MCU:

- Open-source
- Interactive
- Programmable
- Low cost
- Simple
- Smart
- WI-FI enabled

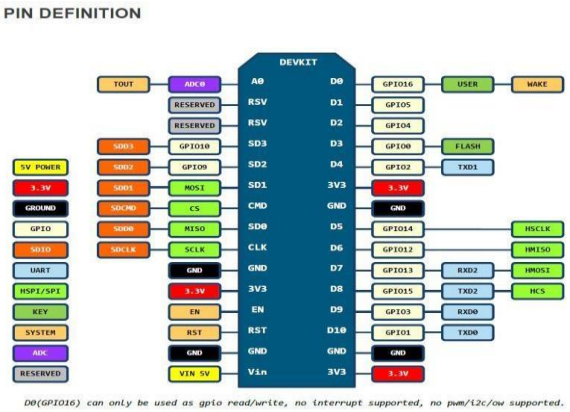

Fig 1 Pin definition

A. *Wi-fi Module (ESP8266)*:

INTRODUCTION:

The ESP8266 is a low cost MCU with built in Wi-Fi. It can be paired with another host micro controller, like an Arduino, to provide Wi-Fi networking capability for a basic IoT development platform. Additionally, the ESP8266 can be used as a stand-alone MCU, as it includes a 32-bit 80 MHz processor, 16 GPIO pins (4 PWM enabled) and a built in Analog-to-Digital converter, SPI and I2C interfaces and more. The MCU has a n operating voltage of 2.5V – 3.6V and averageoperating current of 80 ma An open source, full development board around ESP8266 has been designed by the Node MCU team that includes additional USB to Serial UART adapter, a micro USB port for programming and a 3.3v regulator. The Node MCU board comes ready out-of-the-box for you to connect to your

ISSN 2454-8065

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computer, install USB drivers, and start writing programs that connect to your Wi-Fi network! All of that at an average price of about $4 USD on eBay.

Fig.2 ESP8266 – ESP-12E version

ESP8266 is the most popular and low cost Wi-Fi Soc with TCP/IP stack and a low power 32 bit microcontroller manufactured by Espressif, a Shanghai based Chinese manufacturer. Nowadays IoT (Internet of Things) is an emerging field. This is the one of the most popular and low cost solution for connecting 'Things' to internet via Wi-Fi.

B. Features of ESP8266:

- 802.11 b/g/n
- Integrated low power 32-bit MCU
- Integrated 10-bit ADC
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units

V. SENSORS

A. *FLEX Sensor*

Fig.3 Flex sensor

A property of bend sensors worth noting is that bending the sensor at one point to a prescribed angle is not the most effective use of the sensor. As well, bending the sensor at one point to more than 90˚ may permanently damage the sensor. Instead, bend the sensor around a radius of curvature. The smaller the radius of curvature and the more the whole length of the sensor is involved in the deflection, the greater the resistance will be (which will be much greater than the resistance achieved if the sensor is fixed at oneend and bent sharply to a high degree). In fact, Infusion System define the sensing parameter as "flex angle multiplied by radius".

Specifications

A typical bend sensor has the following basic

1. uni- vs. bi-directional sensing
2. uni- vs. bi-polar sensing
3. range of resistance (nominal to full-deflection)
4. range of deflection

Range of deflection: Determines the maximum angle of deflection that can be measured (as opposed to the maximum angle the sensor can be bent).

Uni- vs. bi-directional sensing: Some flexion sensors increase the resistance when bent in either of two opposing directions, however there is no difference in the measurement with respect to the direction.

Uni- vs. bi-polar sensing: A bi-polar flexion sensor measures deflection in two opposing directions yielding different measurements.

B. MEME Sensor

MEMS (micro electro-mechanical systems) technology has gone from an interesting academic exercise to an integral part ofmany common products. But as with most new technologies, the practical implementation of MEMS technology has taken a while to happen. The design challenges involved in designing a successful MEMS product (the ADXL2O2E) are described in this article by Harvey Weinberg from Analog Devices.

Fig.4 MEMEsensor

specifications:

ISSN 2454-8065

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MEMS design software is still in its infancy, and most MEMS manufacturers develop part or all of their CAD and simulation software to suit their particular needs.

The fabrication process design challenge is perhaps the greatest one. Techniques for building three-dimensional MEMS structures had to be devised. Chemical and trench etching can be used

Even mundane tasks, such as cutting the wafer up into single die, becomes complicated. In a standard IC the particle residue created by the sawing process does not effect the IC. In a moving MEMS structure these particles can ruin a device. The Users Challenge

MEMS sensors, like almost all electronic devices, do not exhibit ideal behavior. While most designers have learned how to handle the non-ideal behavior of op-amps and transistors, few have learned the design techniques used to compensate for non- ideal MEMS behavior. In most cases, this type of information is not available in textbooks or courses, as the technology is quite new. So generally designers must get this type of information from the MEMS manufacturer.

Analog Devices, for example, maintains a web site with design tools, reference designs, and dozens of application notes specific to its MEMS accelerometers to ease the users work.

ISSN 2454-8065

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VI. PIEZO-BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

Fig.5 Piezo-buzzer

VII. POWER SUPPLY CIRCUIT

As in below figure this circuit is an approach to obtain both 12V and 5V DC power supply. The circuit uses two ICs 7812(IC1) and 7805 (IC2) for obtaining the required voltages. The AC mains voltage will be stepped down by the transformer T1, rectified by filtered by capacitor C1 to obtain a steady DC level .The IC1 regulates this voltage to bridge B1 and obtain a steady 12V DC. The output of the IC1 will be regulated by the IC2 to obtain a steady 5V DC at its output. In this way both 12V and 5V DC are obtained. Such a circuit is very useful in cases when we need two DC voltages for the operation of a circuit.

The LM78XX series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation

A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

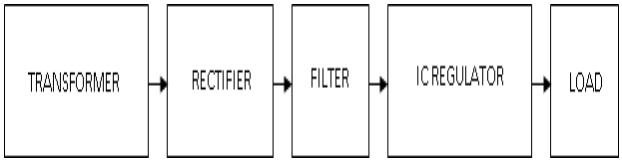

Fig.6 Block Diagram Of Power Supply

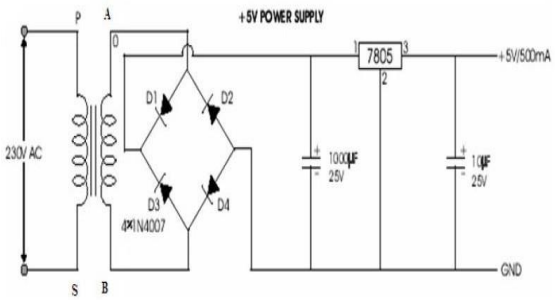

Fig.7 Circuit Diagram of Power Supply

VIII. LIGHT EMITTING DIODE(LED)

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern.

The wavelength of the light emitted, and thus its color, depends on the band gap energy of the materials forming the p-n junction. In silicon or germanium diodes, the electrons and holes usually recombine by a non-radiative transition, which produces no optical emission, because these are indirect band gap materials. The materials used for the LED have a direct band gap with energies corresponding to near-infrared, visible, or near-ultraviolet light.

LED development began with infrared and red devices made with gallium arsenide. Advances in materials science have enabled making devices with ever-shorter wavelengths, emittinglight in a variety of colours.

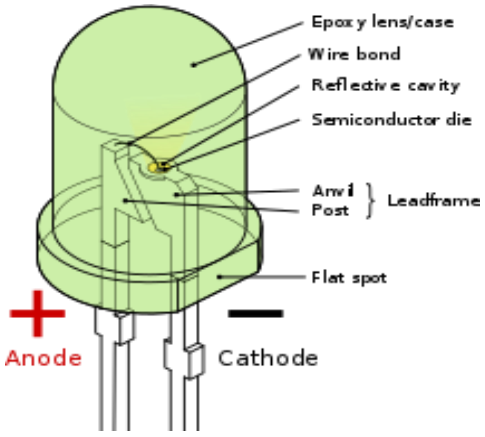

Fig.8. LIGHT EMITTING DIODE(LED)

ISSN 2454-8065

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IX. Advantages and Applications:

1. This system can be used in old monuments.
2. This system can be used as a earth quake detection system.
3. This system is used for the maintenance purpose.
4. This is economical and fast in response.

X. RESULT

By this project we can void hazards. Early warning systems are the systems by which people receive relevant and timely information in systematic way. Here we are using 2 sensors MEMS sensor and flex sensor ,and we use blynk app to monitor and check the condition of weak bridges and houses

XI. CONCLUSION

The bridge health and house health system used several sensors to detect the behavior of a bridge and house such as bridge deformation and damage. The sensors connected to the data logger and subsequently sent the information data such as coordinates and crack to the microcontroller. The data is used as input by microcontroller within the system and gives as a command to the alerting unit.

XII. FUTURE SCOPE

This system can be enhance by implementing the prevention mechanism like automatic closing of gates on the bridge

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