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Bridge Collapse Detection

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ABSTRACT: The development of a real-time wireless network for bridge monitoring has paved the way for a novel self-powered wireless system that can be used to monitor the structural health of bridges. This system enables lossless data transmission over extended periods, allowing for accurate crack inspection and maintenance. By utilizing wireless transmission technology GSM, the system can transmit data from remote locations to the army base station in real-time, providing the ability to track the system from anywhere, at any time. This setup is not only highly capable and effective, but it also has a wide range and low operating costs, making it an ideal solution for structural health monitoring. Additionally, its strong expandability and ease of use ensure that it can be easily upgraded and adapted to future requirements, enhancing its overall efficiency.

KEYWORDS: Arduino UNO R3, Vibration Sensor SW-420, GSM SIM 800C, LCD Display I2C, Soil Moisture Sensor, Force Sensor, Ultrasonic Sensor HCSR-04.

I.INTRODUCTION

Monitoring the damages in the bridge is an increasing the concern for the benefit of public. The major challenge is to ensure that the condition of the civil infrastructure bridge is capable of withstanding the cumulative weight of all vehicles that travel in the bridge. The vibration sensor is used to identify the vibration on the bridge. When vibration is high than the threshold value of the sensor. If damage is detected via GSM communication the damage detection is informed to the base station. Monitoring of the nations` transportation infrastructure using electro-mechanical sensor has long been proposed for complementing the current visual inspection program for condition assessment of Bridge Failure Analysis Methods: Current bridge risk analysis methods and tools developed are: visual bridge simulations, and computerized knowledge-based systems. The purpose of the visual inspections is to look for signs and symptoms of deterioration that could lead to failure. Structural health monitoring tools look for symptoms using sensors inspections, Structural Health Monitoring (SHM) sensors, computerized located on the bridge that can be connected to a computer network. Computerizedmodels and simulations were created to predict failure based on historical data and trends.

II.OBJECTIVE

The objective of this research is to develop a bridge risk assessment process that can predict failure and its key initiators prior to the occurrence of failure symptoms, such as cracks, large deflections and corrosion.

Due to the ability of fault-tree analysis (FTA) to qualitatively and quantitatively assess bridge failure, it is utilized to develop the risk assessment process for this research. An advantage of FTA qualitative assessment is its ability to visually model events leading to failure and their relationships, which can be used to define the most likely events to cause failure.

III. LITERATURE SURVEY

Bridge Engineers need scientific tools which can give quick information about the health of a bridge. Such instrument shall supplement the periodical manual inspections. But when failures happen with any kind of structure there is loss of human lives, money and many more, most of the times. For example, during the bridge construction boom of the 1950's and 1960's, little emphasis was placed on safety inspection and maintenance of bridges. This changed when the 2,235-foot Silver Bridge at Point Pleasant, WV, collapsed into the Ohio River, on Dec. 15, 1967. 46 people were killed.

Author: Prof. Ms. B. Hombal,
Abstract: Prof. Ms. B. Hombal developed by Bridge Condition Monitoring System using micro-controller. In this paper they describe as per with the help of wireless technology many problems due to data cables and expensive optical cable are now minimized and eliminated GSM is proved to be excellent solution for data communication. Edward Sazonov developed by Self Powered Sensors for Monitoring of Highway Bridges.

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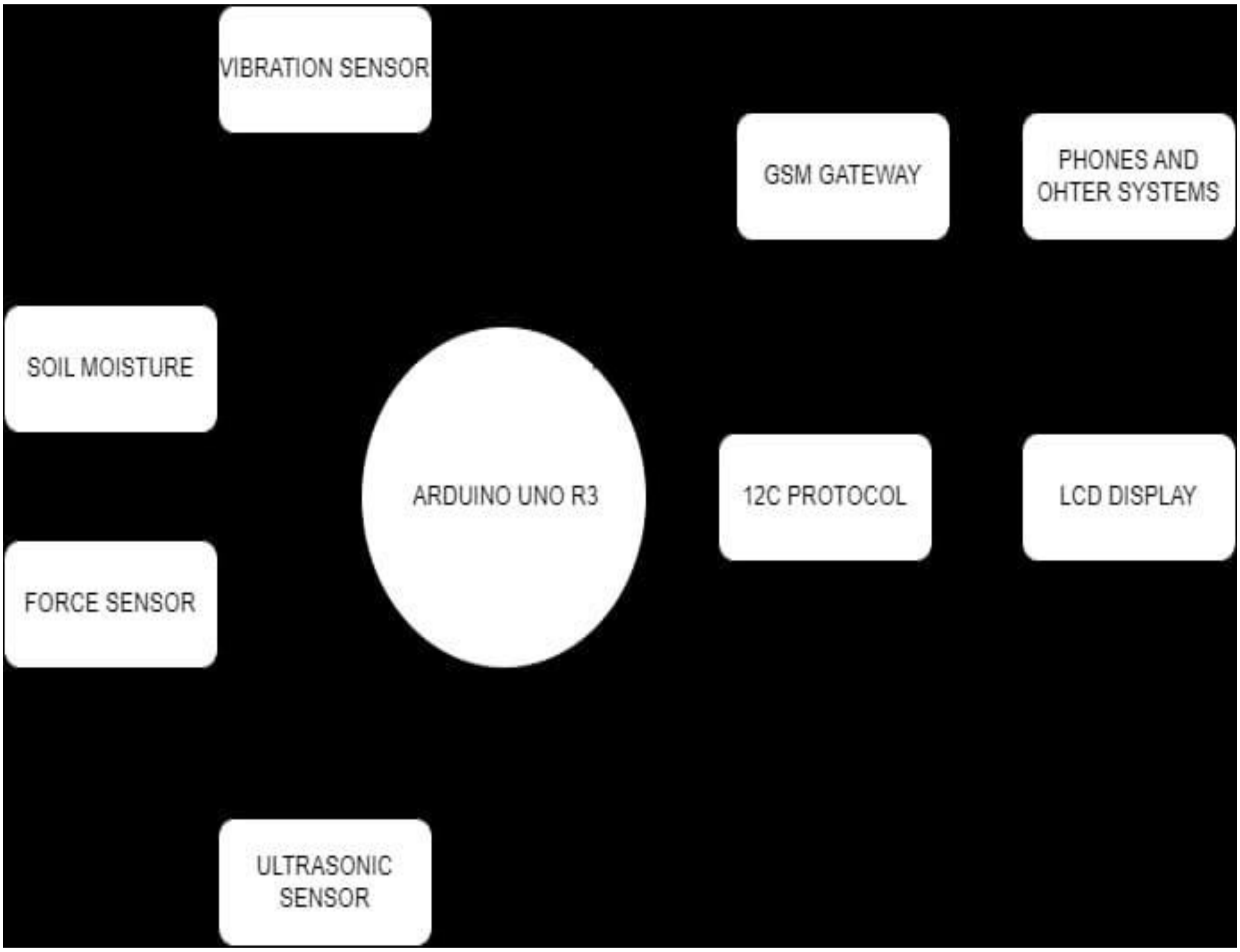
In this paper he describes Structural Health Monitoring(SHM). Hence to ensure the safety of bridges, the Bridge collapse detection System was introduced. Some of the existing technologies/methods for Bridge collapse detection System are as described.

We see the recent news of bridge collapse due to some weather conditions and massive traffic. We see the bridge collapse in Mahad(Maharashtra) due to sand mining, Shimla (Himachal Pradesh) due to massive traffic and Kolkata (West Bengal).

IV. SYSTEM DESCRIPTION

Block Diagram:



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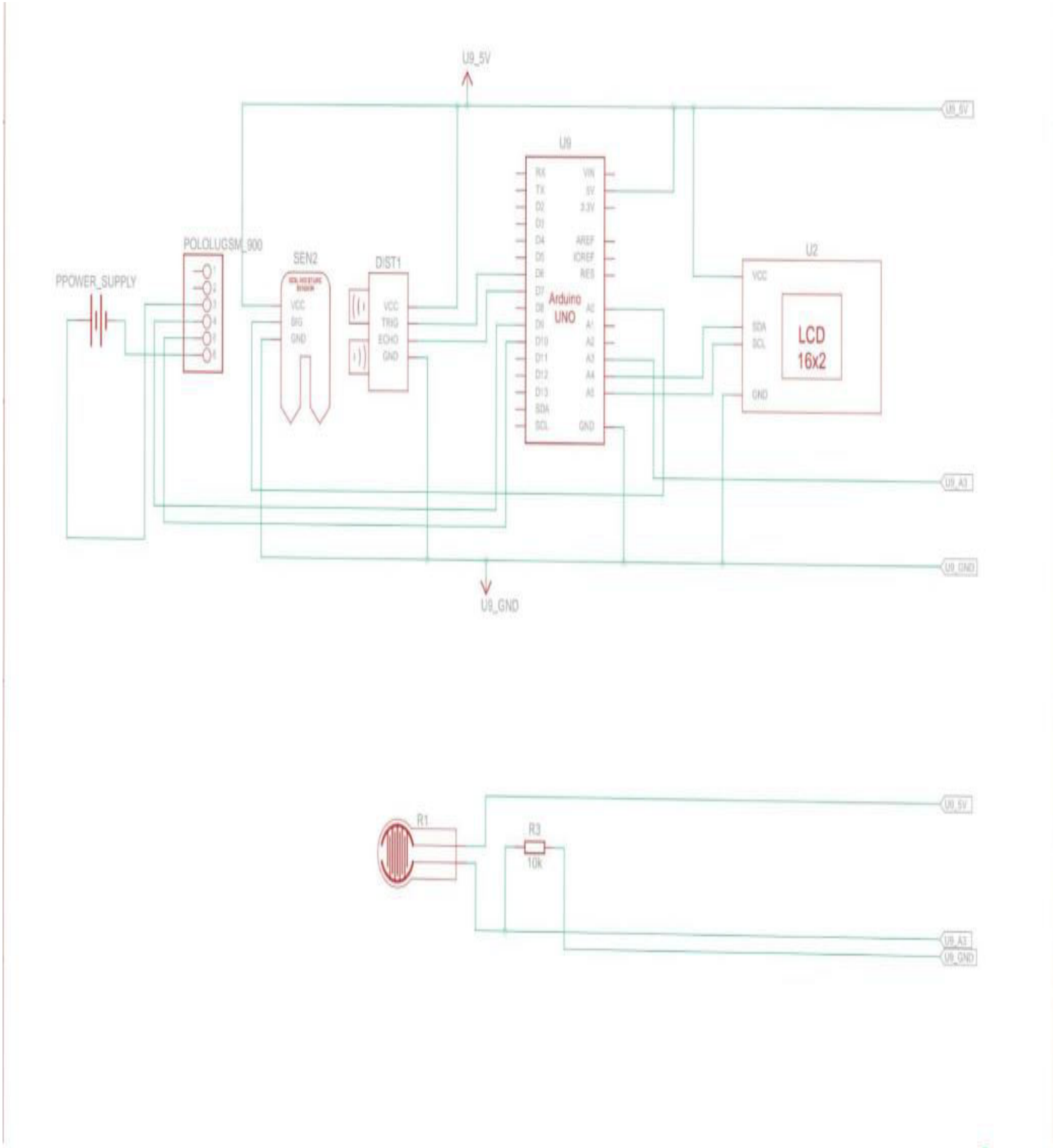
Circuit Diagram :



V. WORKING

Components:

1. Arduino UNO R3
2. Vibration Sensor SW-420
3. GSM SIM800C module
4. LCD Display I2C

5. Soil Moisture Sensor

6. Force Sensor

7. Ultrasonic Sensor HC-SR04

Working Principle:

1. Sensor Integration:

• Connect the Vibration Sensor SW-420 to the Arduino UNO R3. Use the sensor's digital output pin and connect it to any available digital input pin on the Arduino.

• Connect the GSM SIM800C module to the Arduino using the appropriate serial communication pins (e.g., TX and RX).

• Connect the LCD Display I2C to the Arduino's I2C pins (SDA and SCL).

• Connect the Soil Moisture Sensor to an analog input pin on the Arduino.

• Connect the Force Sensor to an analog input pin on the Arduino.

• Connect the Ultrasonic Sensor HC-SR04 to the appropriate digital pins on the Arduino for triggering and echo detection.

2.Initialization:

•Set up the Arduino IDE and install the necessary libraries for the sensors (if required).

•Initialize the GSM module, LCD display, and other sensors in the Arduino code.

3.Monitoring Vibration:

•Read the output of the Vibration Sensor SW-420 connected to the digital pin of the Arduino.

•If the vibration exceeds a predefined threshold, it indicates potential bridge movement or instability.

4.Soil Moisture Monitoring:

•Read the analog value from the Soil Moisture Sensor.

•If the moisture level is too high or too low, it could indicate soil erosion around the bridge supports, potentially leading to collapse.

5.Force Sensing:

•Read the analog value from the Force Sensor.

•A sudden increase or decrease in the force could indicate abnormal loads on the bridge structure.

6.Ultrasonic Distance Measurement:

•Trigger the Ultrasonic Sensor HC-SR04 to emit an ultrasonic pulse.

•Measure the time taken for the pulse to bounce back after hitting an obstacle (e.g., water level below the bridge).

•Calculate the distance based on the time of flight.

•If the distance is below a certain threshold, it indicates the water level is dangerously high, compromising the bridge's stability.

7.Alert and Communication:

•When any of the monitored parameters indicate a potential bridge collapse, trigger the GSM module.

•Send an emergency alert message to pre-configured phone numbers, providing details about the detected issue.

•Display the alert message on the LCD Display I2C for local notification.

8.Continuous Monitoring:

•Repeat the above steps in a continuous loop to monitor the bridge's condition in real-time.

The Bridge Collapse Detection System continuously monitors vibration, soil moisture, force, and water levels around the bridge. If any parameter exceeds a predefined threshold, indicating potential bridge instability, the system triggers an emergency alert through the GSM module, notifying authorities or concerned individuals. The LCD display provides local visibility of the alert message. This system helps in early detection of bridge collapse risks, enabling timely preventive actions to ensure public safety.

VI.CONCLUSION

This project presents a prototype of a novel self-powered wireless system for application of structure health monitoring of bridges. From the above designed project**.** it can be concludedThat we are able to transmit the data which is sensed from remote soldier to the army base station by using wireless transmission technology GSM. It is completely integrated so that it is possible to track anytime from anywhere. Upgrading this setup is very easy which makes it open to future a requirement which also makes it more efficient.

REFERENCES

[1] Vinodini R, Nalini S, Muthumurugesan D, "Detection Of Structural Damages In Bridge Based On ZigBee Networks Using Sensors" ICSI International Journal of Computer Science Issues, Vol. 10, Issue 3, No 1, May 2013.

[2] Arunkumar.G.C, Chandrakanth S. R. Chethankumar.M, Karthik. V, Santosh Chavan "Bridge Condition Monitoring System Using Wireless Network" Dept. Of ECE, RRCE, Bengluru.

[3] Andrew Gastineau, Tyler Johnson,Arturo Schultz "Bridge Health Monitoring and Inspections-A Survey of Methods" September 2009.

[4] Merit Enckell, BrankoGlisic,FrankMyrvoll,BennyBergstrand "Evaluation of a large-scale bridge strain, temperature and crack monitoring with distributed fibre optic sensors" Received: 29 October 2010/ Accepted: 6 February 2011/ Published online: 3 March 2011.

[5] Edward Sazonov, Member, IEEE, Haodong Li, Member, IEEE, Darrell Curry, and Pragasen Pillay, Fellow, IEEE Self-Powered Sensors for Monitoring of Highway Bridges" Sensors Journal, IEEE, vol. 9, 2009, pp.

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