Smart Bridge Using Arduino Uno

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***Abstract*— This project explores the development of a smart bridge system utilizing Arduino uno to enhance structural monitoring and safety. The smart bridge integrates various sensors including strain gauges, temperature sensors and accelerometers to continuously monitor key parameters such as load, stress and environmental condition conditions. Data collated is processed in real time and transmitted wirelessly to a centralized system for analysis. The implementation of alerts for structural anomalies allows for timely maintained and reduces the risk of failure. This innovative approach aims to improve the resilience and longevity of bridge infrastructure while ensuring public safety and efficient management of resources.**

***Keywords*- Arduino UNO, Servo motor, Soil moisture sensor, Arduino IDE Software, Embedded C.**

I.INTRODUCTION

A Smart bridge equipped with IOT(internet of things) technology can dynamically adjust its height based on real-time environmental conditions particularly in flood events. The bridge is embedded with various sensors including sensor including sensors and water level sensor. These sensors continuously monitor the surrounding environment, detecting changes in soil moisture and water levels. When heavy rain fall occurs the sensor detect increased moisture level, While water level sensors monitor rising water level in near by bodies. The Smart bridge is designed with a mechanism that allows it to increase its height when flood conditions are detected. Once the flood waters recode and levels return to normal, the control system commands the bridge to lower its height, returning to its standard position. This dynamic adjustment enhances safety for vehicles pedestrians using the bridge, While also maintaining the structural integrity of the bridge during flood events

LITERATURE SURVEY

Smart bridge is increasingly being equipped with sensor to monitor various environmental and structural parameters. Several studies have been conducted to incorporate different types of sensors (eg. Accelerometers, temperature sensor, humidity sensor and moisture sensor) for continuous data acquisition and health monitoring. Shao, Let al. (2018) this study discusses the integration of multi-sensors system in bridge monitoring using IoT and Arduino platforms. The focus was on detecting temperature changes load effects, and vibrations, which are essential in the assessment of the assessment of the, bridge's structural integrity.Zhang,Zet al, (2020). explore the use of sensor network and microcontroller like Arduino to monitor the conditions of bridges in real-time this study emphasizes real-time data transmission and the role of embedded system in creating costeffective, scalable solutions for bridge monitoring A smart bridge with embedded moisture sensor could provide early warnings of potential risks related to soil saturation and erosion around foundation

EXISTING SYSTEM

Smart bridge typically integrates various advanced technologies to monitor, maintain, and improve the safety and efficiency of bridge infrastructure. This system can include a combination of sensors, real-time data analytic, communication system, and predictive Maintenace tools. Here’s an overview of the key components is embedded within the bridge structure to monitor vibrations, stress, strain, temperature, displacement and other physical factors. These sensors can detect early signs of wears damage, such as cracks or material fatigue.

PROPOSED SYSTEM

A smart bridge system using an Arduino uno and soil moisture sensor that can automatically adjust the bridge height when flooding is detected is a more advanced concept. The bridge system uses soil moisture sensors and other environmental inputs (such as water levels or flood sensor) to detect when flooding is imminent. When flooding is detected, the bridge height is automatically adjusted to allow water to flow underneath without damaging the structure. The Arduino uno would act as the central controller,

processing sensor inputs and controlling the actuation system that adjusts the bridge's height.

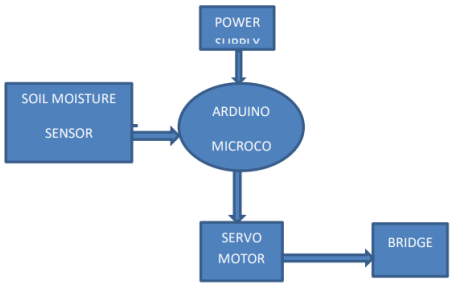
ADVANTAGES OF PROPOSED SYSTEM

Reduced maintenance and repair costs.
Optimized traffic flow and management.
Monitoring and reduction of environmental impact.
Reduced risk of accidents and incidents.
Ability to integrate with other smart city infrastructure.
Remote monitoring and control.

METHODOLOGY

Initially we need to make sure all the components are connected and give power through an external device. This Smart bridge project aims to create a bridge system that can automatically adjust its height during floods using a soil moisture sensor to detects floods like a condition, the bridge will elevate or adjust itself to prevent damage The following methodology outline design components and implementations steps .

BLOCK DIAGRAM



System for a bridge during flooding. Arduino uno is used as control system which is responsible for processing the sensor inputs and making decisions based on the water level data. It typically consists of a microcontroller or a programmable logic control that runs the necessary algorithm to control the height adjustment mechanism. Soil moisture sensor is used to detect the water level rise and provide input to the controller system. Servo motor are used to raise or lower the bridge based on the Arduino uno instructions. The system requires a stable power supply to operate the Arduino uno, servo motor and water level indicator, this can be provided through a dedicated power source or by tapping into the existing electrical grid.

WORKING

The basic idea is that the soil moisture sensor will detect when the water level increases, and the Arduino will control the servo motor to adjust the height of the bridge . As the water level Decreases , the bridge will move back down to its original position. Note the specifics of the project will depend on size and design of the bridge, as well as the type of servo motor and moisture sensor used. It is also important to consider safety measures, such as waterproofing the component to protect them from water damage.

HARDWARE IMPLEMENTATION

This smart bridge consists of several types of sensors and the vital part of this smart bridge is Arduino which controls all other components. Fig shoes that Arduino is used as microcontroller connected with other components. Moisture sensor is detecting the water level.it also consists of a servo motor; it helps to lift the bridge by rotating its motor shaft

1.SOIL MOISTURE SENSOR: This sensor mainly designed for detecting water level. This sensor measures the volumetric water content. As well as servo motor well respond for this sensor

2. Servo motor: It is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on current position of the motor shaft, this feedback allows the servo motor to rotate with great precision.

CONCLUSION

The smart bridge using an Arduino uno and soil moisture sensor of demonstrates a novel approach to dynamically adjust the height of a bridge –based water levels. The bridge can adapt to rising water levels in real-time, enhancing safety and reducing potential flooding risks. The soil moisture sensor effectively monitors water levels, and the Arduino uno interprets this data to trigger mechanism that control the height adjustment of the bridge. This system could based in regions prone to flooding or where water level fluctuates significantly, offering a practical solution for infrastructure that respond intelligently to changing conditions. This project highlights the potentially of combining sensors with automated systems to create adaptive infrastructure that can improve resilience to environmental challenges .

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