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SMART BRIDGE-AUTOMATIC INCREASE OF HEIGHT DURING FLOODING

[1] K.V.S.S Rama Krishna, Associate Professor, Department of IT,
Vignan's Nirula, Peda Palakaluru , Guntur
[2]K.Baranitharan, Associate Professor, Department of IT,
Vignan's Nirula,Peda Palakaluru,Guntur
[3]Konakanchi Gayathri Devi, [4]Chaganti Bhargavi,[5] Dongari Sirisha, [6] Maddi Bala Venkata Vara Shriya
[3,4,5,6] B.TECH, Department of IT , Vignan's Nirula Institute of Science and Technology for Women,Pedda Palakaluru,Guntur

ABSTRACT :

The main theme in this project is innovative design and implementation of a smart bridge of increased height, aiming at enhancing urban mobility and infrastructure resilience. The majority of the traditional bridges are constructed with serious constraints on height and cannot allow huge vehicles and ships to pass over them.The new smart sensor will monitor the movement and patterns of traffic, stress loads, and environmental factors, thus giving necessary information for maintenance and operational efficiency. Since its increase in height facilitates better connectivity and redresses congestion in urban areas, it thereby promotes economic growth.The design will definitely incorporate aggressive historical flood data research coupled with hydrological modeling to identify areas where water can be prevented from accumulating by putting up elevated bridges. Thus, the design will facilitate improving the drainage situation. It will apply sophisticated engineering techniques, including hydraulic modeling and flood-resistant materials, so that this bridge will not only resist flood conditions but also minimize nuisance to the ecosystem surrounding it.Smart technology will be implemented in the design, which will be equipped with sensors that, in real time, can monitor water levels and structural health so that proactive maintenance with timely flood event warning is possible. Solution designs of elevated bridges have the aim of protecting infrastructures, enhancing public safety, and assisting with planning efforts for urban management within flood-prone areas. This will create more resilient communities when approaching climate-related issues.This project delves into the alteration of bridge height for flood risk mitigation. With the escalating trend on impacts of climate change including floods, most of the existing bridges are found to act as barriers in the free passage of water flow thus increasing the risk of floods. The focus is to design a higher bridge, improved in flood resilience of all its structures while still safe.

KEYWORDS:

Smart Bridge,Height Adjustment,Smart Sensors,Flood Detection,Environmental Impact

1. **INTRODUCTION** :

Floods are a great cause of loss of life and property in many countries.[1-2]In undeveloped countries, insufficient technology[3-5] escalates the death toll and property destruction due to flooding.[6-7] In today's modern world, bridges are essential. Bridges enhance the beauty of the roads.[8-9] One of the most significant problems with infrastructure around the world is bridge failures.[10-12] It often leads to catastrophic consequences, loss of life, and disrupted commerce. This project monitors the flood situation. In case of a warning buzzer, lift the bridge.[13] A smart bridge is a structure that can detect some significant behavior or environmental state and take action concerning them in an automated manner.[14] Modern transport infrastructure without bridges allowing the easy passage of vehicles, pedestrians, and cargo across rocky and watery areas is impossible.[15] That would ensure The life span and[16-18] prevention of further disaster by a bridge is only supported by the structural integrity and safety of the bridges.[19] Recently, in the past years the development in technology has made smart bridge monitoring systems a breakthrough way to address such issues .These systems continuously collect and analyze data with the use of a wide array of sensors,[20] data connection technologies, and microcontrollers like Arduino .[21] Arduino is an open-source electronic platform that offers flexibility and low cost for building advanced monitoring systems, advanced alert, and other uses for bridge monitoring .An automated bridge that rises and falls with respect to water level ensures that the traffic flow is [22]always at a safe distance if it floods or rains heavily.

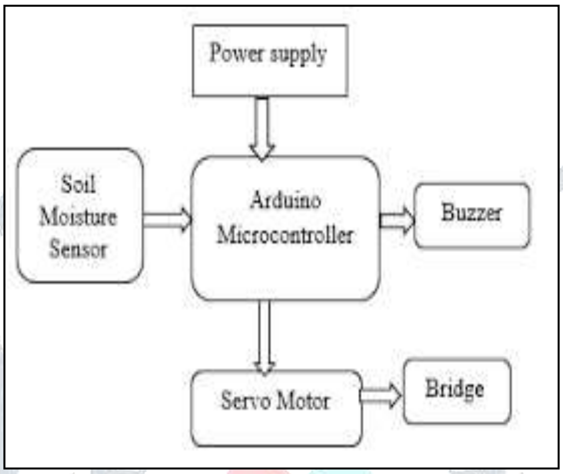

fig 1:BLOCK DIAGRAM OF SENSORS USED

Possibility of movements[23] is controlled by an Arduino board, to which there is a servo motor attached to control [24]those movements. The hydraulic system attached with the servo motor ensures that the bridge gets raised and lowered depending on the change in [25]water level. The moisture[26] sensor gauges the level of the water and translates this information to the Arduino board,[27] which then manipulates the servo motor to adjust the height of the bridge according to the information it has acquired. The moisture sensor is embedded within the water channel and wirelessly sends data through to the Arduino board.

The height adjustment[28] feature operated by the servo motor is part of a hydraulic system that raises and lowers the level of the bridge. [29]When its water level increases, the moisture sensor signals the Arduino card, which sends a signal to the servo motor in turn[30-31] to lift the bridge height. This process continues until the water level goes back to its normal level. Likewise,[32-33] when the level of the water drops, the logger moisture sensor gives the signal to the Arduino board, [34]and the board sends the signal to decrease the height of the bridge through servo motors. It will always maintain a safe height for the bridge, and hence,[35] no mishap or loss at times of heavy rain or flood.

ANCIENT CONSTRUCTIONS

Who constructed the first actual bridge structure will never be known. Our knowledge of past days fades the further we look back into time. We can but assume that man, in his search for food and shelter from the elements and with his given curiosity,began exploring his natural environment. Crossing creeks and crevices with technical means thus was a matter of survival and progress, and bridges belong to the oldest structures ever built.The very earliest bridges handmade ropes. Actually, there are only a few surviving structures which might even be considered prehistoric, e.g. the so-called Clapper bridges in the southern part of England, as Brown()notes.

fig 2:A NORMAL BRIDGE DURING FLOOD

SCOPES

The system can be implemented at the global level in which various countries can manipulate the data of their bridges at a single server.

a) A high cost suspension bridge can be implemented.

b) Structural Performance and Applied Loads Monitoring.

These applications range from facets of health and safety of bridges in this case, to an Arduino-powered smart bridge monitoring system. The goal of the system is to observe, at periodic intervals, the conditions of bridges in their safe state in order to guarantee their structural soundness and safety. Costly assessment is the problem solved by using a smart bridge monitoring system. The conventional bridge monitoring techniques that exist have a number of limitations, and these are to be addressed using Arduino. Most of the conventional methods are based on manual inspections and recurring evaluations; thus, they are rather expensive, time-consuming, and probably inefficient. They also don't give real-time information. The inability to monitor in real time might cause delays in the structural problem detection, probably endangering the bridge's safety and raising the cost of upkeep significantly.ring the bridge's safety and raising the cost of upkeep significantly.

OBJECTIVES

To ensure the safety and dependability of all users of the bridge; To preserve the integrity of the country's existing, historically significant bridges

To assist India in digitising its economy.The mission of smart cities to preserve the great number of life

2.LITERATURE SURVEY

The smart bridge is the most sophisticated bridge monitoring system.[37-38] The primary benefit or characteristic of this bridge system is that it is able to act like a repeater, therefore extending[39-40] a network. Bridges partition network communications to lower network[41] traffic on one segment.SMART[42] BRIDGE is an accessory of the in-lite SMART system that effectively creates a bridge[43-45] to the Internet.This internet connection makes it possible to couple the in-lite SMART system with 'Smart Home'[46] systems like Google Home, Apple Homekit, Amazon Alexa, and all Matter brands.The advantages of Movable bridges are: Facilitate unobstructed water traffic.[49]Advantages of Movable bridges: Provide for free passage of water traffic. Can accommodate fluctuating water level vessel sizes. [50-52]Allow efficient use of the waterway.Darshan B., Shashank M.K., Srihari K., Srinidhi K: "Smart Bridge." describes about how the bridge increases its height during flooding

3.PROPOSED METHODOLOGY

This includes several major components and steps in the proposed methodology for developing a smart bridge system, henceforth allowing for adequate height changes to match the increasing water levels. In this study, an Arduino microcontroller will be deployed as the brain of the system, where water level sensors will be attached and positioned upstream and downstream to monitor the water levels. Actuators in the form of hydraulic cylinders or electric motors, controlled by motor drivers would make the physical lift of the bridge. The Arduino would continuously receive readings from sensors and decide at what level the water crosses certain thresholds, to actuate the height adjustment mechanism. There will be a basic user interface that provides instantaneous information in real time of the levels and status through an LCD panel as well as some override controls for manual emergencies. The system will be subjected to a very controlled environment and simulated flood scenario to calibrate the thresholds on sensors and be able to observe responsiveness. Documentation will portray this aspect, citing configuration, working, and performance metrics so as to explain the overall system of functionality of this innovative flood resilience solution.A signal will then be sent to the Arduino board from the moisture sensor, thus sensing that the water level is already at a high point; this, in turn, signals another component, the servo motor, to increase the height of the bridge. It will do so until such a time when the water will have subsided to a safe level.The basic steps in developing the project are:Design and build the bridge with appropriate materials; as shown below, provide a mechanism for its platform to go up and down based on the servo motor input.Fixing the servo motor: Connect the servo motor, fixed to the bridge, to the Arduino. Moisture sensor connection: Attach the moisture sensor to the Arduino and place it near the water. The sensor detects changes in the level of the water.

4.RESULTS OF THE EXPERIMENT

The data collected, analysis, and overall impact on maintenance and safety in bridges demonstrate what can be implemented for a smart Arduino bridge monitoring system. Enabled by constant monitoring and data-driven insights, this facilitates timely maintenance that can help to elongate the life span of bridges and the safety of commuters and communities dependent on this infrastructure. Such technology can help manage the dynamic dynamics of the bridge to prevent it from collapse, therefore saving countless lives and substantial financial profits. The device is special in that it has the ability to wirelessly transfer environment data and monitor the conditions of the bridge. The execution is quite beneficial.This project uses one flood detector sensor and two servo motors ,the flood detectors sensor uses to detect the floods that is whenever it is kept in water which is connected two servo motors ,the servo motor will rotate to 90 degrees cause the sensor
detected the water and if it is taken out of the water the servo motor again goes down to 0 degrees. Because of the servo motor rotation the bridge height will be increased.

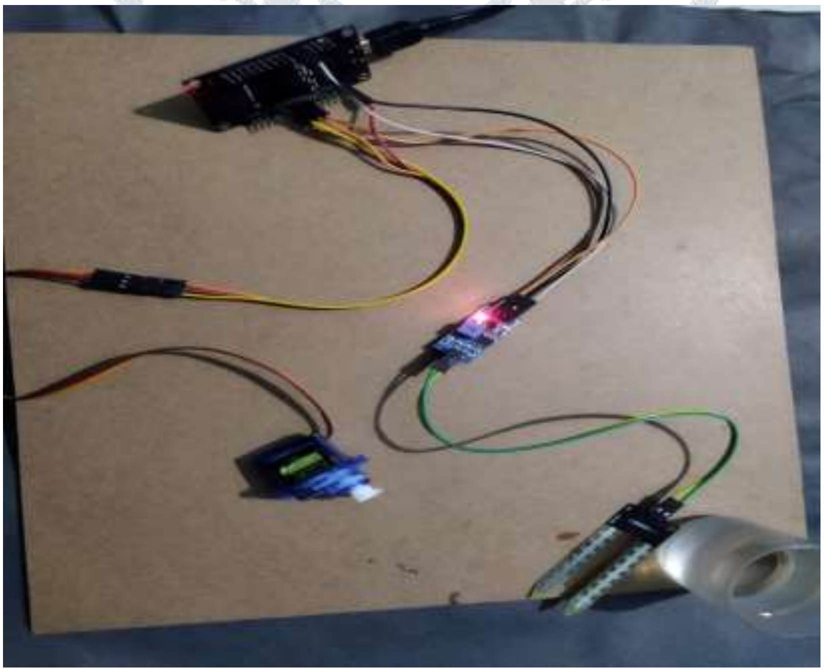

fig 3:OUTPUT OF THE SMART BRIDGE

ADVANTAGES

The design process of the smart bridge system incorporates a variety of objectives that may guarantee bridges are safe, efficient, and have a responsive system to deal with different challenges. Some of the principal objectives may include:

Real-time monitoring: the integrity of the structure is continuously monitored by means of sensor measurements for stress, strain, vibrations, and other important parameters of a bridge.

Detection of structural damage: Detection and location of likely damage or weaknesses in the bridge structure should be done early enough to avoid catastrophic events.Predictive Maintenance: Use analytics and machine learning to make informed predictions about maintenance needs before critical conditions are reached, reducing downtime and maintenance costs. Traffic Monitoring: Monitor and track the flow of traffic and the load on the bridge to help it stay within the safe limits of the operational envelope. Environmental Monitoring: Get ahead of factors in the environment, such as wind speed, temperature, humidity, and seismic activity , that may unfavourably affect the stability of the bridge.Emergency Response: Automate systems to turn in authorities and execute emergency procedures in response to a detected hazard or structural issues.Long-term Durability: Smart bridge system shall guarantee the development of lifespan bridges. Reduction in frequent repair and replacement.

APPLICATIONS

- To act in real-time
- Work under an automated control system
- You can collect data for decision making
- Monitoring the water level and managing critical situations

FUTURE SCOPE

It thus presents excellent growth opportunities for IoT-based smart bridge projects like this one, with the latest technology improvements in sensors integrated into the flood detection system. Advanced sensor technologies continue to improve in terms of their accuracy and reliability toward the flood detection system, for sure, with the use of machine learning methods that incorporate AI integration for allowing predictive modeling.Integration with Smart Cities: The smart bridges would be integrated into the greater smart city projects to ensure seamless exchange of data and communication amongst the infrastructure systems.Working: These smart bridges, while becoming autonomous, would have the ability to change their real-time response independent of human intervention. This would improve effectiveness and response time in case of any emergency.Energy saved: Through the use of energy-saving;.

5.CONCLUSION

We have created an automated river bridge control system that uses an Arduino board to open and close the bridge.The amount of labour needed for this procedure can be decreased thanks to the automated method. This project's primary goals are to reduce structural damage and safeguard people's lives and property. The fundamental idea of Bridge MonitoringWhen there are indications that the bridge may collapse, we use an LCD monitor to display data. This method will assist in lowering major catastrophes in the future. Numerous lives can be saved by this approach. Finally, an autonomous height-adjusting.An excellent use case for Arduino, servo motors, and moisture sensors would be bridges. This arrangement would be beneficial.

Avoid mishaps and offer a safer means of crossing bridges for traffic, particularly during rain or floods.Bridge MonitoringWhen there are indications that the bridge may collapse, we use an LCD monitor to display data. This method will assist in lowering major catastrophes in the future. Numerous lives can be saved by this approach. Finally, an autonomous height-adjusting.An excellent use case for Arduino, servo motors, and moisture sensors would be bridges. This arrangement would be beneficial

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