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SMART BRIDGE- AUTOMATIC INCREASE OF HEIGHT DURING FLOOD

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ABSTRACT :

In regions that do not have up-to-date technology, floods tend to inflict severe harm on infrastructure. Transport depends heavily on bridges, so it is important to take care of and protect them from different natural disasters. Floods of extreme severity may cause bridges to fall. The project aims to improve bridge safety by linking a flood monitoring system that sounds alarms when circumstances are dangerous. In developing areas, Arduino and IOT technologies are being used to offer a cost-effective system that keeps an eye on bridge safety.

Keywords: Smart bridge systems, IoT-based flood monitoring, Automatic height adjustment, Structural health monitoring (SHM), Arduino-based automation, Scissor lift mechanism.

1. INTRODUCTION

This system uses dynamic technology to boost the stability of a bridge by lifting or lowering the structure according to real-time conditions of rising water that could be harmful to people, the environment and the bridge structure. Having IoT sensors, lifting devices and an automated system keeps the bridge in contact at all times, safeguards it from flooding and deals in minimize the bridge's deterioration due to tough weather conditions.

The real-time monitoring in this system is due to the IOT sensors. These devices allow for early identification of threats such as floods that can arise in a river or sea when the water level increases. All the data is passed to the system which examines and analyzes it to determine how much the bridge needs to raise or lower.

The bridge is lifted up and down by a hydraulic or mechanical system. Pressurized fluid delivered via a hydraulic system such as pistons or jacks, is used to raise or lower the bridge with ease. With scissor lifts, different bridge designs have additional options for lifting, making the bridge run smoothly. Thanks to these mechanisms, getting around is simple and convenient.

So that the system is safe and efficient, it includes automation. If readings from the sensors reveal that the water has risen to a dangerous point, the automated adjustments ensure the bridge adjusts itself without humans controlling it. It can also be controlled from afar which means the system is flexible. This technology in bridges makes them more advantageous in a variety of ways. Thanks to it, floods and damage to bridges are prevented, allowing them to live longer. Consequently, it ensures that vehicles and pedestrians can still cross safely under all weather conditions. Additional public safety steps, for example smart traffic control and automatic alarms, lowered the possibility of accidents. Furthermore, this smart bridge system is both affordable and appropriate for many different bridges, regardless of whether they are new or have been in use for a while.

Fig. 1- Model of Smart Bridge

2. LITERATURE SURVEY

Authors Darshan B, Shashank MK, Srihari K, Srinidhi, Dr. Chanda V Reddy suggested installing modern sensors on smart bridges to monitor them in real time. It includes automatic toll gates for cars and an automatic gate for ships. Energy is saved because smart streetlights switch on only when they are supposed to. Even though the components are of high quality, the system is affordable and suitable for use in many movable bridges which makes it very important in modern bridges. During flooding, the Smart Bridge presented by Samruddhi Nilesh Kalaskar is designed to move up automatically to lessen the effects of flooding. The system is able to detect an upcoming flood and immediately lift the bridge using modern sensors which makes it convenient and cost-effective. systems that have been applied in parts of Maharashtra (Kolapur and Sangli) have been effective. In her disaster-resilient bridge design papers, Dr. S.T Patil, along with others, introduces a system that automatically changes the bridge's height during a flood by linking sensors, servo motors and the Thing speak platform for continuous monitoring. In the paper "Smart Bridge: towards robust monitoring of environmental hazards," Eftychia Koursari, S.J. Wallace, Yi XU, Pangiotis Michalis and Manoousos Valyrakis consider using sensors to assess scour and flooding which might reduce a bridge's stability. The researchers underline the use of IOT, artificial intelligence and structural health monitoring .Smart Bridge Bearing System – A Feasibility Study by City College of New York's Anil K. Agrawal investigates different ways of creating smart bridge bearings that are both reliable and useful. The study examines various types of sensors according to their price, care needs, skill level required and reliability in field use to aid in bridge monitoring. The study which is sponsored by the U.S. and the New York Department of Transportation, highlights how using smart technology can make bridges safer and more durable.

Creating a Smart Bridge – This new bridge adjusts on its own as water levels rise in the event of flooding. It relies on Arduino, servo motors and a moisture sensor to control the bridge and keep it from getting damaged. Automatic bridge adjustment – by the study, a bridge is recommended that automatically rises when soil moisture shows high levels of water under it. It relays the current information using wireless signals and alerts users with a buzzer if the reading gets too high or low. Researchers found that the use of automated bridge systems greatly improves safety and reliability of disasters and infrastructure. Wireless Smart Sensor Network System Used in Smart Bridge: This paper by J.R. Gavina, F.A. Uy and J.D. Carreon introduces an effective SHM system that gathers data from smart bridge sensors to determine the integrity of bridges instantly. The study confirms that visual observation is inefficient and uses wireless monitors to supervise the vibration, acceleration and physical changes of bridges. This System provides up-to-date observation of bridges and helps detect any floods. The device makes use of ultrasonic sensors, a crack detection module and load cells to check the height of the water column and quickly detect and monitor cracks and loading on the bridge. The solution counts on Arduino and GSM technology to warn in advance and open barrier gates when needed. The paper by Frank Stajano, Neil Hoult, Ian Wassell, Peter Bennett, Campbell Middleton and Kenichi Soga examines the problems and progress related to using Wireless Sensor Networks (WSNs) for bridges and tunnels. The paper shows that WSNs make it possible for structures to be monitored for health monitoring (SHM) at all times. According to the research, to help maintain, ensure safety and increase the efficiency of critical infrastructure, robust WSN systems that can adapt to real-world challenges and sustain data should be developed.

3) CIRCUIT DIAGRAM

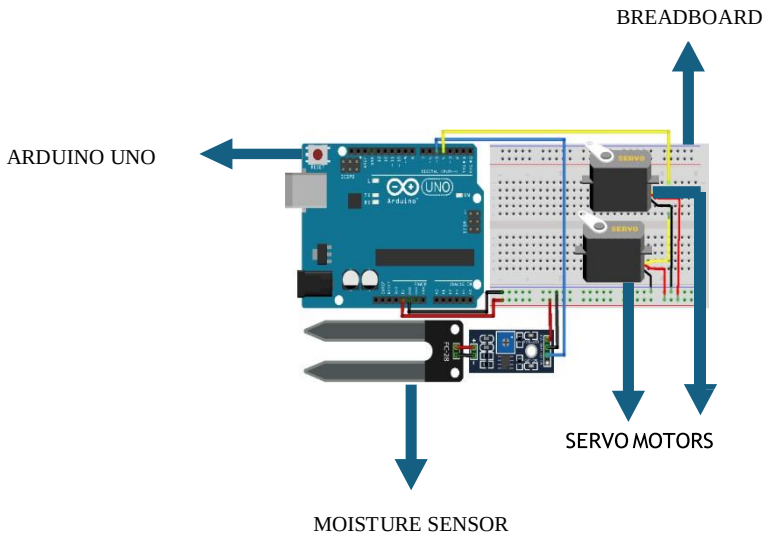

Fig. 2- Circuit Diagram

3. METHODOLOGY

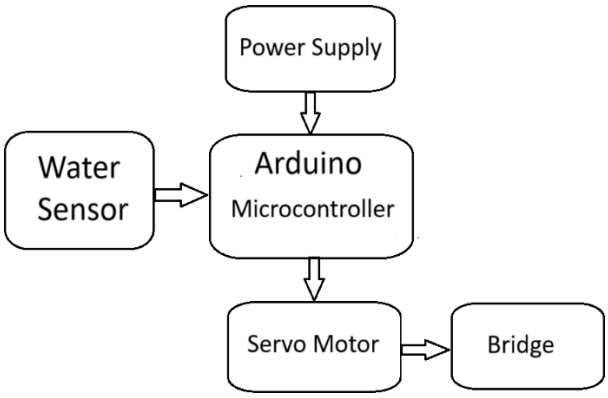

Fig. 3- Smart Bridge Monitoring System Flowchart

The process uses the following phases:
At this point, Arduino, the electronics and the batteries are powered on and get initialized.
During the data collection stage, sensors keep track of water and moisture, supplying updates on the surrounding and structural environments.
Data analysis: It reviews the data from sensors to ensure all thresholds are met. When the value is usual, surveillance keeps happening; should risks show up, the system will perform necessary activities.
If the water rises higher than the normal water level, the bridge will lift to the required height, but when it reaches normal water level, it shifts back and lets traffic pass.
The system is designed to continually watch over the sensors as they are triggered.

4. WORKING

Firstly, the smart system is designed to include the best sensors and modules needed for instant monitoring of water levels and moisture in the soil. With the help of a microcontroller, data is processed, while a communication system transmits it instantly to a central point. Integrating hardware and software is crucial for developing a system that can be used usefully in different areas. Following completion of the design, sensors are fitted at important spots on the bridge to observe flooding and any stress on the structure. An Arduino microcontroller gathers and processes data from water-level and moisture sensors. If safety levels are surpassed, the system issues alarms and launches certain actions. It makes it possible to track bridge conditions using computers and receive quick reports on their status.

All the gathered information is sent as feedback on a central system that analyses it as it occurs. New algorithms are used to identify signs of danger early such as higher flood levels or unusual pressures on various objects. If a danger is noticed, adaptive systems respond by taking preventive actions. During floods, servo motors are able to raise barriers and alerts prevent damage by letting authorities know about any stress or cracks in the structure. It keeps happening and ensures safety while lessening any chances of flooding damage.

The results of testing the smart bridge system follow below:

Fig. 4- Implementation of the set-up initially

Fig. 5 - An increased water level is detected by the soil moisture sensor

5. RESULT

The bridge system functions well because it is based on IoT, Arduino UNO and economic sensors. All of this makes the bridge smarter and better able to cope with floods. The setup of Arduino and soil sensors is always watching the water level and is saving the data. The system noticed the water level was rising and immediately turned on the safety features designed to ensure the bridge was not endangered. Managing this system is straightforward and does not cause any problems for the authorities. Old as well as new bridges can benefit from Smart Bridge which is useful in regions regularly hit by floods. This solution allows infrastructure to be safer by making disaster management possible beforehand and it is especially beneficial to developing countries. It appears that the system has the potential to make bridges more stable and secure for people living in flood-susceptible areas, although it is still having trouble staying eco-friendly and working properly.

6. FUTURE SCOPE

Tracking movement, corrosion and wearing-down through advanced systems will make the smart bridge system more reliable in the coming years. Operations where solar energy and cloud services are used can become quite dependable and can cover more ground. If bridges were linked to smart city and transport systems, they could be used more and this would strengthen and improve their reliability in many circumstances.

7. CONCLUSION

It monitors things such as water, soil moisture and reacts automatically to any possible danger that is reported to authorities. Thus, this strategy helps to lower the chances of any significant structures collapsing.

This strategy would provide a way to protect bridges from water damages at different levels. Maintenance is less costly; the bridge lasts longer and its resistance to change improves because of self-healing concrete. Overall, the smart bridge is an innovative option that helps people get around easily and ensures our cities are ready for upcoming issues. Overall, an automatic rising/lowering bridge made with moisture sensors, servo motors and Arduino would be a good example of their use. If it is raining or flooding heavily, this system will help people avoid accidents and move safely over the bridge.

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