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SMART BRIDGE

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Abstract: This paper gives a brief idea about the historical background about the development of bridges. Bridges are the foundation of a country's transport network but they are expensive to build and maintain. So, care should be taken for the bridges. For that purpose, sensors are used. The idea of controlling different parameters through proper functioning, monitoring and analysis of data is effective for preventing the bridge from damages. This project predominantly focuses about monitoring and evaluation of bridge condition through various sensors used. Advancement in sensor technology have brought the automated real-time bridge health monitoring system

Keywords: Arduino Uno, Servo motor, Smart Bridge, Automation, Sensors, User Interface

I. INTRODUCTION

Bridges are essential infrastructure that connects different areas and makes transportation more accessible. However, they can be challenging to maintain, especially when water levels increase due to heavy rainfall or floods. In such cases, bridges can become dangerous, causing traffic to come to a halt or even collapse.

To prevent this, engineers have developed an automatic height- adjusting bridge that can help maintain the safety of the bridge even during heavy rain or floods. This bridge is equipped with an Arduino, servo motor, moisture sensor, and other components that help adjust its height based on the water level. In this essay, we will discuss the automatic height-adjusting bridge and how it works.

An automatic height-adjusting bridge is designed to maintain a safe height during heavy rain or floods. It is equipped with a servo motor, which is connected to an Arduino board that controls its movements. The servo motor is attached to a hydraulic system that raises or lowers the bridge's height based on the water level.

The Arduino board receives input from a water level indicator that detects the water level and sends signals to the servo motor to adjust the bridge's height. The water indicator is installed in the water channel, and it sends data to the Arduino board through a wireless connection.

II. LITERATURE PAPER

[1] Design and Implementation of Automatic Bridge Height Adjustment System Based on Arduino. It proposes a system that uses Arduino, a servo motor, and an ultrasonic sensor to automatically adjust the height of a bridge based on the water level.

[2] An Automatic Bridge Height Adjustment System Based on IoT Technology This paper presents a bridge height adjustment system that uses an Arduino-based IoT platform and a moisture sensor to detect the water level and adjust the bridge height accordingly

[3] Development of an Automatic Water Level Controller Using Arduino This paper describes the development of an automatic water level controller using an Arduino board and a moisture sensor to detect the water level.

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III. METHODOLOGY

A. BLOCK DIAGRAM

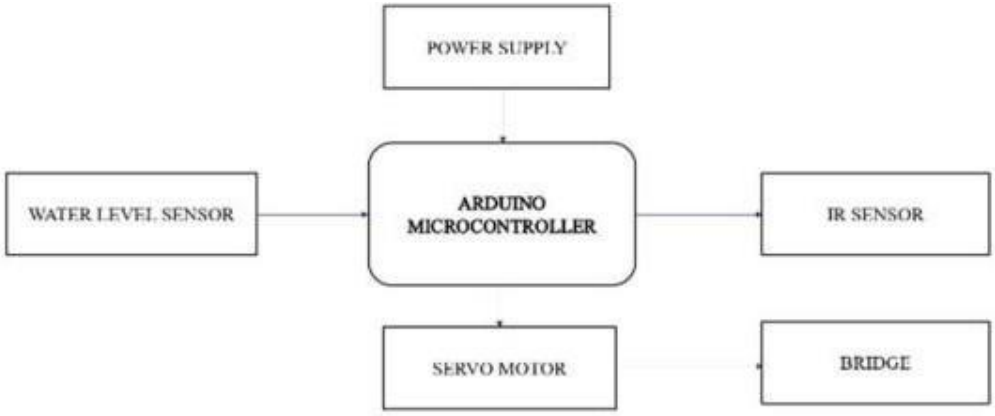

Figure 1 : Block Diagram

Figure 1 represents the block diagram of the Smart Bridge . The Power Supply is given to the Arduino Microcontroller and the readings are taken from the water level sensor and when the threshold increases the bridge elevates to a certain height and the vehicles can move freely.

B. WORKING

The water level sensor is placed at the exact location where the water level reaches the road. Then the sensor measures the water level and moves the servomotor for 180 degree which in turn pushes the hydraulics forward and the bridge is lifted upwards, as the bridge lifts upwards the red signal is turned on so that the traffic stops and waits till the bridge is uplifted totally then after a green led is turned on and traffic can pass uninterrupted.

The same ways after the water level decreases the sensor measures the water level and if it's below the threshold level the servomotor pulls back the road to the normal position with the help of hydraulics, again while the motor pulls down the road the red signal is turned on and green light is turns on after the road has come to normal position.

C. FLOWCHART

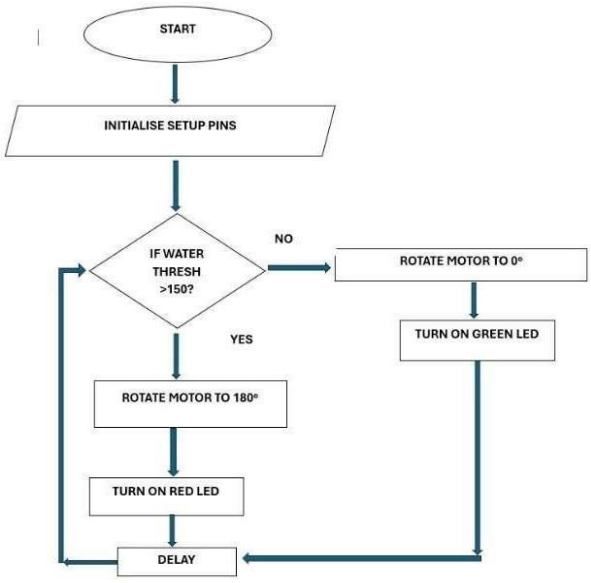

Figure 2 : Flowchart

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Figure 2 represents the flowchart of the system. The servo pins are connected to breadboard and the values of water level indicator are read from the sensor, if water threshold is greater than 150 then servo motor turns ON and RED LED Glows indicating to stop the vehicles , and bridge elevates to a certain height and once the flood is low or the water level comes down the bridge which was elevated comes to a normal position and GREEN LED turns ON and the vehicles can move freely.

IV. RESULTS

The prototype of the proposed system is shown in Figure 3.

Figure 3 : Prototype of the proposed system

Case 1: During no floods.

When there is no flood, there will be an indication of green light present, and the bridge will be in normal state, the vehicles will move freely.

Figure 4 : During no floods

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Case 2: When the Water level Increases

When the water level indicator reaches the threshold voltage i.e., 150 The servo motor starts to rotate at 180 degrees and RED LED is turned ON, ensuring that no vehicles are passed and the bridge elevates to a certain angle of 30 deg. And then the vehicles can move freely on the bridge.

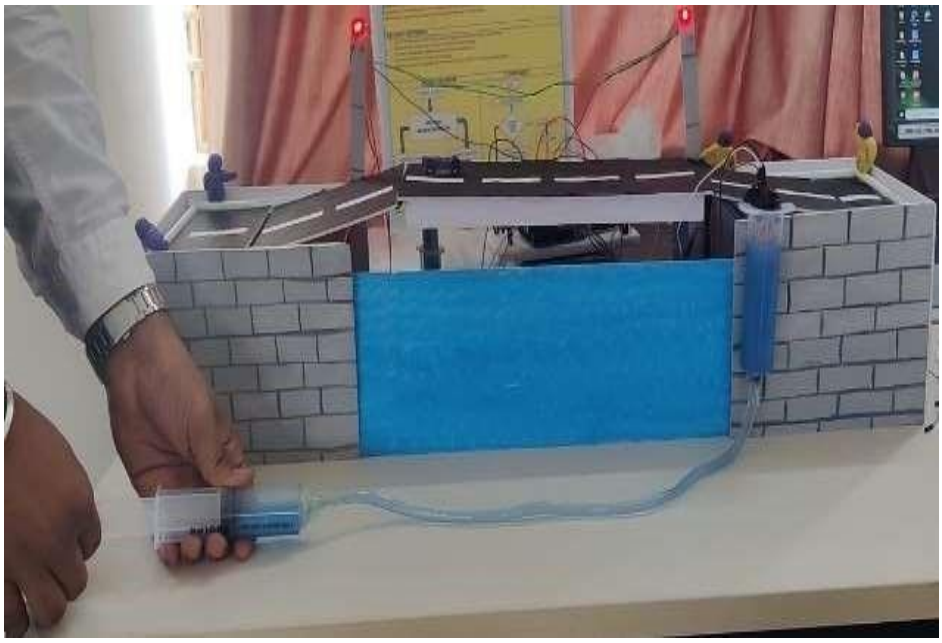

Figure 5 : When Water level Increases

Case 3: When water level Decreases

When water level decreases down the bridge which had been elevated from the water level increasing now comes to normal state when the flood has been decreased and the bridge comes to normal position and vehicles pass by it .

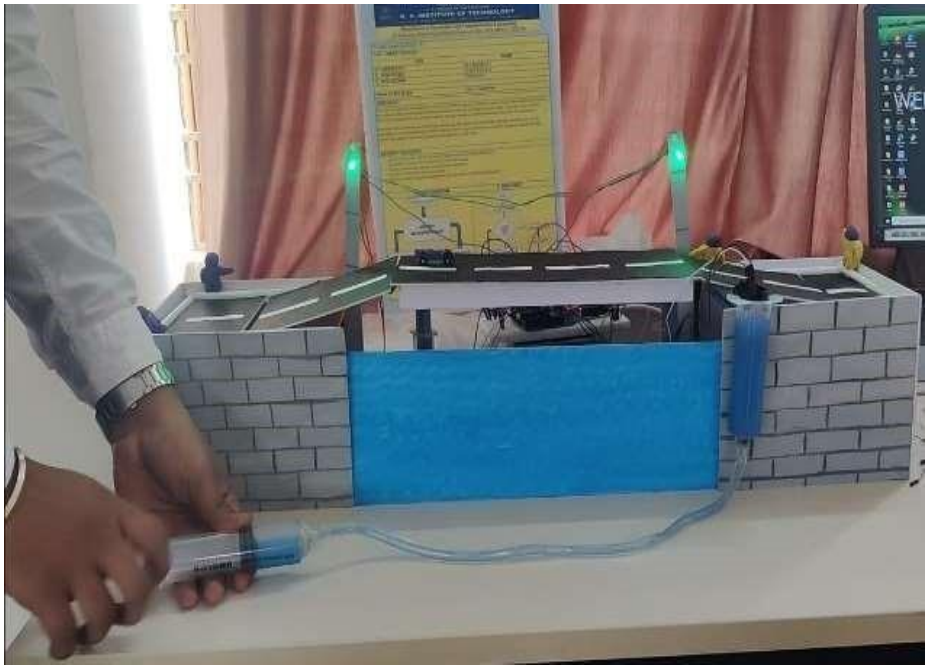

Figure 6 : When water level decreases

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V. APPLICATIONS

Urban Infrastructure

- City Bridges: Ensures city bridges remain functional during heavy rainfall, preventing traffic congestion and accidents in urban areas.

Rural and Remote Areas

- Rural Connectivity: Maintains connectivity in rural areas prone to flooding, ensuring residents can travel safely.

Disaster-Prone Regions

- Flood Management: Provides a reliable way to maintain bridge functionality during floods, facilitating evacuation and emergency services.

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