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# Adaptive Elevation System for Flood Resilient Smart Bridge

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**Abstract:** *A smart bridge that can automatically increase its height when flooding occurs. The bridge will use a soil moisture sensor to detect the level of water on the ground. When the water level reaches a certain point, the bridge will activate a motor that will raise the bridge deck. This will allow vehicles to continue to use the bridge even during flooding. This project has the potential to make bridges safer and more resilient to flooding. The smart bridge can automatically increase its height when flooding occurs, which will allow vehicles to continue to use the bridge even during flooding. This will reduce the number of bridges flooding events, and it will help to keep people and goods moving during times of emergency.During flooding would be a valuable investment for communities that are vulnerable to flooding. It would help to reduce the disruption caused by flooding and keep people and goods moving during even the most severe weather events.*

**Keywords:** Arduino, Soil Moisture Sensor, 2x Servo Motor,I2C,LCD, Buzzer.

## 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..

**The Automatic Height-Adjusting Bridge:**

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

The servo motor is connected to the hydraulic system that raises or lowers the bridge's height. When the moisture sensor detects a rise in water level, it sends a signal to the Arduino board, which then sends a signal to the servo motor to raise the bridge's height and display the bridge level Up on liquid crystal display. This process continues until the water level decreases to a safe level. Similarly, when the water level decreases, the moisture sensor sends a signal to the Arduino board, which then sends a signal to the servo motor to lower the bridge's height and display the bridge level down on liquid crystal display. This helps ensure the bridge is at a safe height, preventing any accidents or damage during heavy rain or floods..The Arduino serves as the central control unit, functioning as the brains of the operation. It processes data from the soil moisture sensor, which continuously monitors soil moisture levels, a vital indicator of potential flooding. When elevated moisture levels are detected, signifying an imminent flood, the Arduino activates the servo motors. These motors are responsible for adjusting the bridge's height, ensuring it remains above the rising water level, thus reducing the risk of flood-induced damage and preserving the bridge's critical functions.

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The "Adaptive Elevation System for Flood-Resilient Smart Bridge" project represents a pioneering effort to address the growing vulnerabilities of infrastructure toclimate-related challenges.

## II. OBJECTIVES

The main objectives of the system are to support the construction process, record the structural behavior of the bridge, and contribute to the intelligent transportation system as well as to the bridge security.

The primary objective of this project is to design, develop, and implement a smart bridge system capable of autonomously detecting and responding to impending flood events. The core components of the system include an Arduino microcontroller, a soil moisture sensor, two servo motors, I2C, LCD and Buzzer. The objective of a bridge design is to produce a safe bridge that is elegant and satisfies all functionality requirements, at a cost that is acceptable to the owner. A successful bridge design must be natural, simple, original, and harmonious with its surrounding. Smart bridge are to proactively respond to rising water levels, safeguard the bridge's integrity during floods, ensure commuter safety, maintain functionality, and minimize flood-related damage. important in modern world. Bridges add beauty to the roads. Bridge failures are one of the most infrastructure problems in the world. It often leads to the catastrophic consequences, loss of life, restricted commerce.

## III. PROPOSED SYSTEM

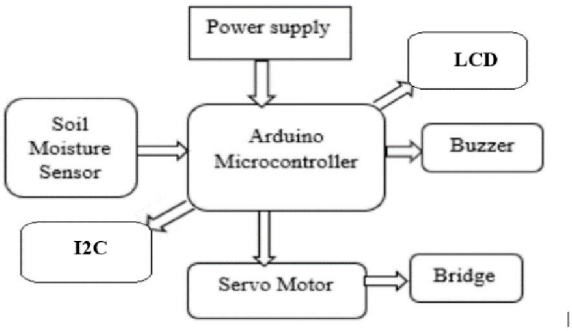


**Fig : 1.1 Block Diagram of Smart Bridge**

Smart bridge are to proactively respond to rising water levels, safeguard the bridge's integrity during floods, ensure commuter safety, maintain functionality, and minimize flood-related damage. This system aims to achieve these goals while promoting energy efficiency and seamless integration with the bridge's smart infrastructure. Floods lead to a vast loss of life and property in many countries. But in developing countries the lack of proper technology leads to more loss of life and property due to flood. Bridges are important in modern world. Bridges add beauty
to the roads. Bridge failures are one of the most infrastructure problems in the world. It often leads to the catastrophic consequences, loss of life, restricted commerce. Whenever there is a disaster there is loss of lives, damage to the public property. The objective of this project is to monitor the flood situation lift the bridge in case of danger in the form of sensor**.** Smart bridge are to proactively respond to rising water levels, safeguard the bridge's integrity during floods, ensure commuter safety, maintain functionality, and minimize flood-related damage.

## IV. WORKING

An Adaptive Elevation System for a Flood-Resilient Smart Bridge is an advanced engineering solution designed to mitigate the impact of flooding on bridges, ensuring their functionality and safety during and after flood events. This system combines various technologies and strategies to adapt to changing water levels and environmental conditions. Here's an overview of how such a system might work:

**1.Build the bridge:** Construct the bridge using appropriate materials and make sure it can move up and down based on the input from the servo motor.

**2. Install the servo motor:** Install the servo motor on the bridge and connect it to the Arduino.

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**3. Connect the moisture sensor:** Connect the moisture sensor to the Arduino and position it near the water to detect changes in water level.

**4. Write the code:** Write a program for the Arduino that wil l read the moisture sensor data and control the servo motor to adjust the height of the bridge accordingly.``

**5. Connect the LCD**: Connect the LCD and display the level of bridge.

**6. Test the system:** Test the system by increasing the water level and making sure that the bridge adjusts its height automatically. The basic idea is that the 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 that the specifics of the project will depend on the size and design of the bridge.

## V. RESULT

The testing result of the Smart Bridge system is shown below. Hardware implementation of overall Smart Bridge is in below figures 1.2

**A. Implementation of the setup Initially**

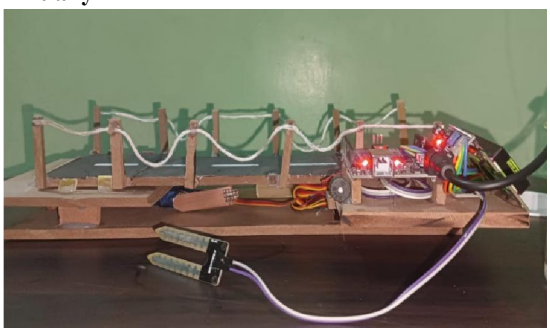

**Fig:1.2 Smart Bridge in it's Normal Position**

**B. When Increased water level is detected by Soil Moisture Sensor**

**Fig: 1.3 Soil Moisture Sensor Detecting Increased Water Level**

In the above fig 1.3 the water level is detected by soil moisture sensor i.e., the water level is beyond the normal level. As the water level is increased beyond the normal level the servo motors are activated. So the motors drive the bridge and adjust the height automatically signaling through buzzer. The increased height of the bridge is shown in the below fig.

**Fig:1.4 The increased height of the Bridge**

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In the above fig 1.4 the height of the bridge is adjusted automatically based on the water level detected by the soil moisture sensor. This increased height is maintained till the water level is decreased to the normal position. This would adjust the height of the bridge to ensure safe passage for vehicles and pedestrians. This solution would provide a more efficient and safer way to deal with changing water levels in bridges.

## VI. CONCLUSION

An automatic height-adjusting bridge could be built using Arduino, servo motors, and moisture sensors to monitor water levels. When the water level increases, the servo motors would adjust the height of the bridge to ensure safe passage for vehicles and pedestrians. The moisture sensors would continuously monitor the water level, and the Arduino would process the data and send instructions to the servo motors. This solution would provide a more efficient and safer way to deal with changing water levels in bridges. In conclusion, an automatic height-adjusting bridge would bea great application of Arduino, servo motors, and moisture sensors. This system would help prevent accidents and provide a safer way for people to travel across bridges, especially during periods of heavy rainfall or flooding.

## REFERENCES

**[1].** "Design and Implementation of Automatic Bridge Height Adjustment System Based on Arduino" by Li et al. This paper 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" by Wu et al. 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" by Hafiz et al. This paper describes the development of an automatic water level controller using an Arduino board and a moisture sensor to detect the water level.

**[4].** https://www.sciencedirect.com/topics/engineering/smart-bridge#%3A~%3Atext%3DThe%20main%20objectives%20of%20the%2Cas%20to%20the%20bridge%20security