Smart Bridge: Automatic Height Adjustment During Flooding

Overview:

Flood-prone areas face frequent damage to transportation infrastructure. This project proposes an intelligent solution: a Smart Bridge that automatically adjusts its height based on the water level. Using Arduino Uno, servo motors, and a soil moisture sensor, this model simulates how bridges can adapt dynamically during flooding events.

Objective:

To develop a smart bridge prototype that:

- Detects rising water levels.
- Automatically lifts the bridge to prevent damage.
- Lowers the bridge when water level returns to normal.

Real-World Use Case:

In flood-prone areas, rising water levels can damage bridge structures and endanger vehicles. An automated height-adjustable bridge can:

- Prevent accidents
- Minimize infrastructure damage
- Enable safer transportation during unpredictable weather conditions

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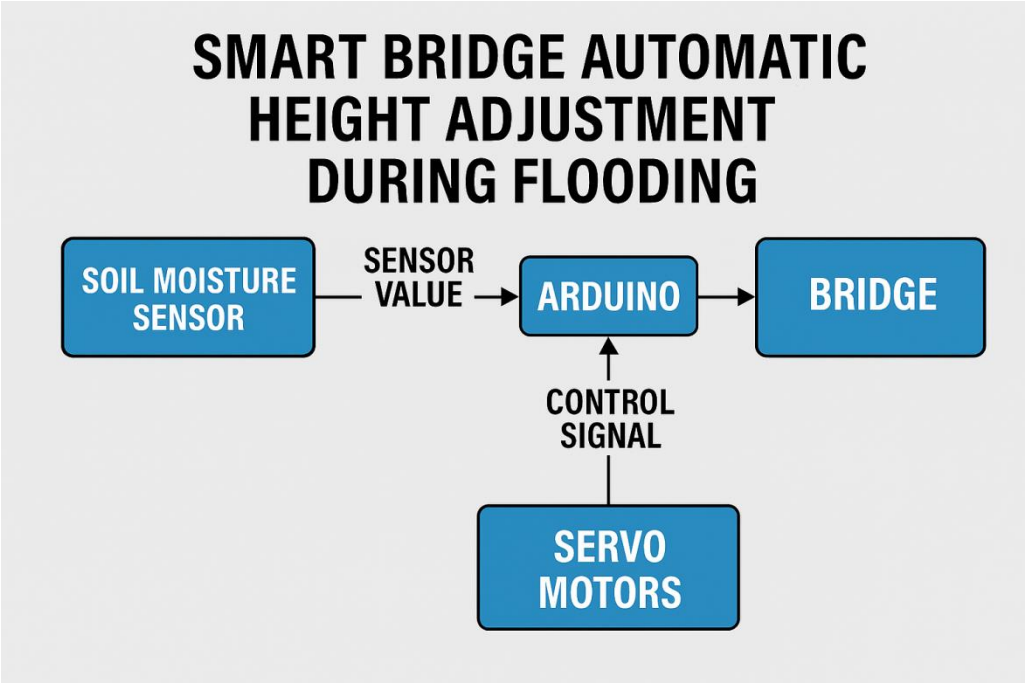
Components Used:

Component	Quantity	Purpose
Arduino Uno	1	Main controller
Servo Motors (SG90)	2	Lift and lower the bridge
Soil Moisture Sensor	1	Simulates water level detection
Breadboard	1	Circuit assembly
Jumper Wires&USB cable	Several	Connecting components
Sunboard/Cardboard Sheet	As needed	Bridge structure base
Glue Gun + Sticks	1	Fixing structure

Circuit Diagram (Basic Description):

- Soil moisture sensor output connected to **A0** of Arduino
- Servo 1 (left) connected to **Pin 9**
- Servo 2 (right) connected to **Pin 10**
- VCC and GND connected properly for all components



Working Principle:

- The sensor continuously reads soil moisture (water level simulation).
- Arduino reads this value.

1. If the water level crosses a threshold (e.g., sensor value > 600):

   Servos rotate to raise the bridge.

2. If the water level is safe (sensor value <= 600):

   Servos rotate to lower the bridge.

Arduino Code:

```
#define BUZZER 3
const int sensor=A1;
float sm;
float vout;
#include <Servo.h>
Servo myservo1;
Servo myservo2;
int pos = 0;

void setup()
{
pinMode(sensor,INPUT); // Configuring pin A1 as input
pinMode(BUZZER, OUTPUT);
Serial.begin(9600);
myservo1.attach(6);
myservo2.attach(7);

myservo1.write(0);
myservo2.write(90);


}
void loop()
{

vout=analogRead(sensor);
vout=(vout*100)/1023;
sm=vout; // Storing value in Degree Celsius

if(sm>50)
 {
  digitalWrite(BUZZER, HIGH);
  myservo1.write(90);
  myservo2.write(0);
  delay(500);
 }
 else
  {
  digitalWrite(BUZZER, LOW);
  myservo1.write(0);
  myservo2.write(90);
  delay(500);
  }
delay(10);
}
```

Step-by-Step Implementation:

Step 1: Structure Preparation

- Cut cardboard or sunboard into bridge components
- Create two parts that can lift separately (like a drawbridge)

Step 2: Circuit Assembly

- Connect soil sensor to A0
- Connect servos to pins 9 & 10
- Connect GND and VCC correctly

Step 3: Upload Code

- Open Arduino IDE
- Select Board: **Arduino Uno**
- Select Port
- Paste the above code and upload

Step 4: Testing

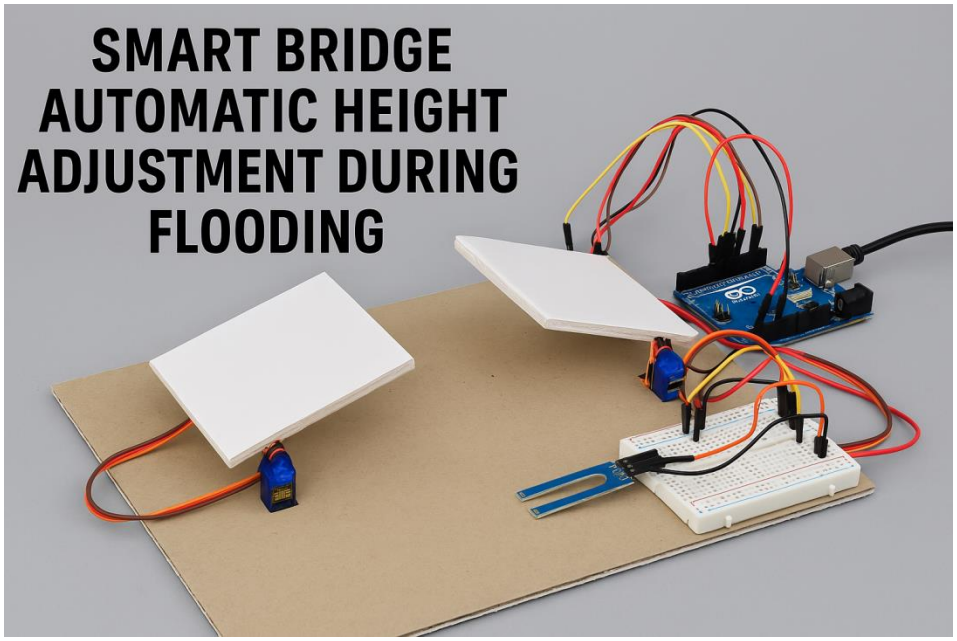
- Power the Arduino
- Simulate water level by inserting the sensor in water
- Watch the servos raise the bridge when water is detected

Applications:

- Smart city infrastructure
- Flood warning systems
- School & college project demonstrations
- Disaster response automation

Future Enhancements:

- Use **Ultrasonic water level sensor** for accurate detection
- Add **Blynk/IoT** app integration for real-time monitoring
- Implement **LED indicators** for water level status
- Use **ESP32** board for MicroPython/IoT control



Output:

Water Level	Sensor Value	Bridge Action
Normal (dry)	< 600	Bridge lowered
Flood detected	>= 600	Bridge raised

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