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AUTOMATIC RIVER LEVEL INDICATOR FOR BRIDGES

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Abstract : In many nations, floods cause a significant loss of life and property. However, in underdeveloped nations, inadequate technology increases the number of fatalities and property damage caused by flooding. In the contemporary world, bridges are vital. Roads are more beautiful with bridges. One of the biggest issues with infrastructure worldwide is bridge breakdowns. It frequently has disastrous results, including fatalities and impeded trade. Every disaster results in the loss of life and destruction of public property. This project's goal is to monitor the water condition and raise the bridge when there is a threat, indicated by a buzzer sound. A smart bridge is one that recognises a noteworthy behaviour or environmental state, then automatically reacts to that condition.

1. Introduction :

Bridges are vital pieces of infrastructure that facilitate greater accessibility to transportation by connecting disparate places. But they can be difficult to maintain, particularly when flooding or strong rains raise the water levels. Under such circumstances, bridges may become dangerous and may collapse or at least stop traffic. Engineers have created an automated height- adjusting bridge to assist prevent this, which can help keep the bridge safe even in the event of flooding or severe rain. This bridge has a moisture sensor, servo motor, Arduino, and other parts that help it change height in response to water level. We shall talk about the automatic height-adjusting bridge's operation in this essay.

2. Necessity of the Project :

The purpose of an automatic height-adjusting bridge is to keep traffic at a safe height in the event of flooding or severe rain. Its movements are controlled by an Arduino board via a servo motor that is attached to it. The hydraulic system to which the servo motor is connected allows the bridge to be raised or lowered in response to changes in the water level. A moisture sensor that measures the water level provides information to the Arduino board, which then uses that information to control the servo motor to change the height of the bridge. Installed in the water channel, the moisture sensor wirelessly communicates data to the Arduino board.

The hydraulic system that raises and lowers the bridge's height is coupled to the servo motor. The Arduino board receives a signal from the moisture sensor when it notices an increase in water level, and the servo motor raises the bridge's height by responding to the signal. Until the water level drops to a safe level, this process is repeated. Similar to this, when the water level drops, the moisture sensor notifies the Arduino board, which in turn notifies the servo motor to reduce the height of the bridge. By keeping the bridge at a safe height during periods of intense rain or flooding, this helps to avoid accidents or damage.

3. System Overview :

For bridges, automatic river level indicators usually combine sensors, data transfer networks, and monitoring stations:

A. Sensor Positioning: Place pressure transducers or ultrasonic sensors at key locations along the river to gauge the water level. The location of these sensors should be such that no silt or debris accumulation will interfere with their ability to measure the water level properly.

B. Data Collection: At regular intervals, sensors gather information on the river's water level, usually in real- time or very close to it.

C. Data Transmission: Use wired or wireless connection techniques to send the gathered data to a central monitoring station. This station may be situated far away from the bridge or on it.

D. Data Processing and Analysis: To ascertain the current river level, the received data is processed and analysed. This may entail identifying trends or anomalies by comparing the gathered data with previous records.

E. Threshold Setting: Determine appropriate water level thresholds by taking into account variables such as weather, river flow rates, and bridge design requirements. These cutoff points aid in deciding when to take appropriate action, such as stopping the bridge or enacting traffic control measures.

F. Alert System: When the water level above predetermined thresholds, put in place an automatic alert system to notify the appropriate authorities or personnel. Notifications sent by text, email, or other methods of communication fall under this category.

G. Response Protocol: Create a system for reacting to alarms that includes steps for evaluating the circumstances, putting safety precautions in place, and informing the public.

H. Upkeep and Adjustment: Make sure the sensors are operating correctly by giving them regular maintenance

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and inspections. To keep the water level readings accurate, calibrate the sensors as necessary. During times of high water or flooding, automatic river level indicators can contribute to ensuring public safety and bridge safety by using this technology.

4. System Architecture

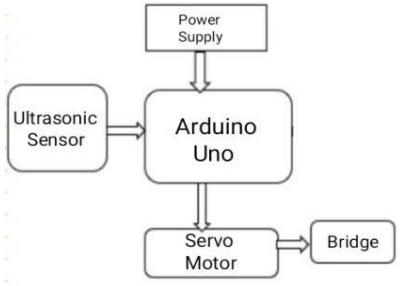

Fig 1. System Architecture

4.1. ARDUINO UNO

Arduino is an open-source platform for prototyping built on user-friendly hardware and software. Arduino boards have the ability to take inputs, such as a light from a sensor, a finger pressing a button, or a message from Twitter, and convert them into outputs, such as starting a motor, turning on an LED, or posting content to the internet. By delivering a set of instructions to the microcontroller on your board, we can instruct it what to do. We accomplish this by using the Arduino Software, which is based on Processing, and the Arduino Programming Language, which is based on wiring. An external power supply or a USB connection can be used to power the Arduino Uno. It chooses the power source on its own. Batteries or wall-warts that convert AC to DCcan supply external (non-USB) power.

To connect the adapter, insert a 2.1mm center-positive connector into the power jack on the board. The Gnd and Vin pin headers of the POWER connection can accept battery leads. An external supply of 6 to 20 volts can power the board. However, the 5V pin may only give five volts, and the board can become unstable, if the supply is less than seven volts. The voltage regulator may overheat and harm the board if more than 12V is used. A voltage range of 7 to 12 volts is advised.

Fig 2. Arduino Uno

4.2. ULTRASONIC SENSERS

Electronic gadgets that measure a target's distance are called ultrasonic sensors. They produce ultrasonic sound waves, which they then transform into electrical impulses. Moreover, sound waves travel at a faster speed than audible ones. Sound waves are used by ultrasonic sensors to measure an object's distance from them.

Additionally, a transducer is present to send and receive ultrasonic pulses. These pulses aid in the transmission of data about nearby objects. Additionally, this detail has a variety of applications, including industrial ones.

Fig 3. Ultrasonic Sensor

4.3. SERVO MOTORS

A rotary or linear actuator that enables precise control of angular or linear position, velocity, and acceleration in a mechanical system is called a servomotor, also referred to as a servo motor or just servo. It is a component of a servomechanism and is made up of an appropriate motor connected to a controller (often a specialised module made especially for servomotors) and a position feedback sensor. Even though the word “servomotor” is frequently used to describe a motor that can be utilised in a closed-loop control system, servomotors are not a particular sort of motor. Servomotors find application in automated manufacturing, robotics, and CNC machines.

Fig 4. Servo motor

4.4. JUMPER WIRES

Jumper wires An electrical wire, or group of them in a cable, with a connector or pin at each end (or occasionally without them – simply ‘tinned’) is called a jumper, jumper wire or DuPont wire. It is typically used to interconnect the internal or external components of a breadboard or other prototype or test circuit without soldering. The “end connectors” of each jump wire are fitted by sliding them into the designated slots on a circuit board, a breadboard, or a test piece of equipment.

Fig 5. Jumper Wires

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4.5. LITHIUM ION BATTERY

Lithium ion battery The most widely utilised rechargeable battery chemistry nowadays is lithium-ion. Electric cars and cell phones are among the everyday gadgets that run on lithium-ion batteries. Lithium-ion batteries are made up of a protective circuit board and one or more lithium-ion cells. Once the cell, or cells, are put inside a device with the protective circuit board in place, they are referred to as batteries.

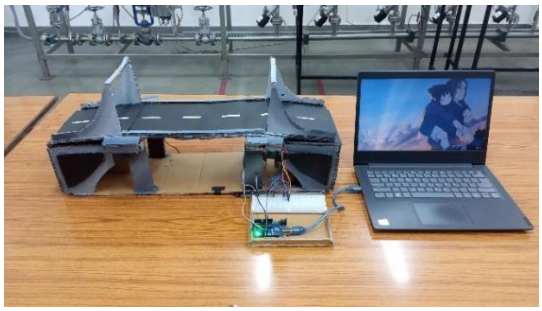
Fig 6. Lithium Ion Battery

4.6. USB CABLE

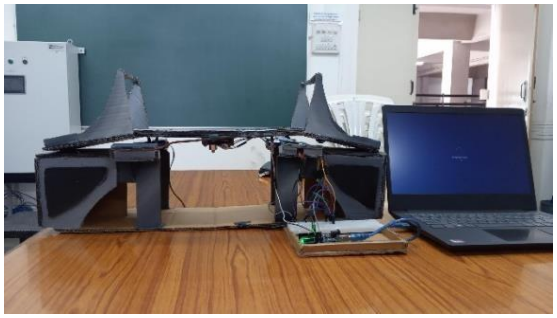
USB cables are commonly used by Arduino boards to communicate data and supply power to a computer or other devices. The USB Type-B to USB Type-A cable is the most popular kind of USB cable used with Arduino. This establishes a connection between the Arduino board and your computer's USB port for power and programming. Furthermore, you might require the appropriate cables for Arduino boards that have micro USB or USB-C connectors.

Fig 7. USB Cable

5. RESULT



A.Bridge at Normal Condition



B.Bridge after getting lifted automatically

6.CONCLUSION

It is possible to construct an autonomous height- adjusting bridge with Arduino, servo motors, and moisture sensors to track water levels. The servo motors would raise or lower the bridge as the water level rose, allowing cars and pedestrians to cross safely. The Arduino would process the data and communicate commands to the servo motors, while the moisture sensors would continuously check the water level. This approach would offer a safer and more effective means of managing fluctuating water levels in bridges. In conclusion, servo motors, moisture sensors, and Arduino would all work well together to create an automated height-adjusting bridge. People might cross bridges more safely and accident-free with the help of this device, especially during times of high rain or flooding.

7.ACKNOWLEDGEMENT

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