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# Smart Bridge

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**ABSTRACT:** This essay provides a quick overview for the background history behind the construction of bridge. A nation's transportation system is built on bridges, yet they are expensive to construct and maintain. Therefore, the bridges should be treated with care. Sensor are employed for that purpose. The concept are managing several parameters through correct operation, monitoring, and data analysis is successful in preventing damage to the bridge. The main goal of this project is to monitor and the assess the status of bridges using various sensors.

The bridge was built with the idea that only a certain number of people could cross it, and is known as the "SMART BRIDGE ". It is the most established bridge because of this. Taking into account the average weight of individuals. Bridge sensors detect when the limit of the bridge has been reached that is overloaded, at which point barricades are closed. The bridge sensor's detect when a person exit and immediately open the gate so that they can enter to meet the bridge's requirement.

Keywords: It is a modern bridge across a river. It is two-way bridge with two lanes and two tollgates on each side. Person Detection and Limiting the passenger's.

## I. INTRODUCTION

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.

A bridge is a construction made for carrying the road traffic or other moving loads in order to pass through an obstacle or constructions. The required passage may be for pedestrians a road, a railway, a canal, a pipeline etc. Bridges are important structures in modern highway and railway transportation systems and generally serving as lifelines in the social infrastructure systems. Design of bridges vary depending upon the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it. Most likely the earliest bridges were fallen trees and stepping stones, while Neolithic people built broad walk bridges across marsh land

- Real-time Monitoring: Smart bridges continuously collect data about various parameters, such as structural health, traffic load, temperature, and environmental conditions. This data is transmitted in real-time to a central control system.
- Structural Health Monitoring (SHM): SHM systems use sensors to detect structural weaknesses or damage in the bridge, allowing for timely maintenance and preventing catastrophic failures.
- Traffic Management: Smart bridges often have traffic management systems that monitor traffic patterns and adjust traffic signals or lane directions to optimize traffic flow and reduce congestion.
- Energy Efficiency: Some smart bridges incorporate energy-efficient lighting systems that adjust the intensity of illumination based on the presence of vehicles or pedestrians.
- Environmental Sensors: These bridges may also have environmental sensors to monitor air quality, weather conditions, and pollution levels. This data can inform decisions related to bridge maintenance and nearby urban planning

## II. WORKING PRINCIPLE

Bridges are continuously subjected to destructive effects of material aging, widespread corrosion of steel reinforcing bars in concrete structures, corrosion of steel structures and components, increasing traffic volume and overloading, or simply overall deterioration and aging. These factors, combined with defects of design and construction and accidental damage, prompt the deterioration of bridges and result in the loss of load carrying capacity of bridges. The condition of heavily used urban bridges is even worse: one in three are classified as aging or unable to accommodate modern vehicle weights and traffic volume. need strengthening, rehabilitation, or replacement, but public funds are not generally available for the required replacement of existing structures or construction of new ones. Many sensors are being used to monitor the bridge remotely and using various sensors and Latest Technology which is internet of things which will help us directly to connect with sensors and also the heart of our project is the Arduino Uno which will be used to connect all the sensors and link everyone together. A WI-FI (Wireless Fidelity) Module which esp2866 Is used to connect all the sensors to the data centre and helps to manage the bridge Remotely. A barrier system is been used so that whenever the parameters of the bridge cross the value the barrier will close and the bridge traffic will be stopped. So, considering these parameters the bridge monitoring system will work and give the desired output.

## III. PROPOSED SYSTEM

The sensors and the LCD are interfaced with the Arduino UNO. The sensors used are Flex and Water level. The Flex sensor measures the angle of tilt of the bridge as well as cracks. The value is set so that if there is any sort of tilt or little crack and if it crosses our set value then the crack is detected. The water level sensor will be placed below the bridge and within the gaps. When the water touches the sensor, it will give alertness to the Arduino UNO. Then the alarm will beep. An LCD is kept so that if there is any danger and if the system finds the fault then the LCD will display "DANGER". Servo motors are also there to closed the roads so that no vehicle reach the bridge. It is placed before the bridge. A buzzer is alsoused to spread alertness when the danger is detected. The wi-fi modem is used to send the data to the server. In this research work used "THINGSPEAK" were we can see the readingof the sensors.

## IV. METHODOLOGY

A bridge is a structure built to a span of physical obstacle, such as a body of water, valley or road without closing the way underneath. It is constructed for the purpose of providing passage over the obstacle, usually something that can be detrimental to cross otherwise. In our project, we are designing to ease the overcrowding and prevent any future collapse of the bridge due to one or more reasons. First we have to connect all the sensor to arduino and an IC especially for power supply of servo motor after connecting all the sensors to arduino uno we have to run a special programme from a computer whileconnecting the arduino by usb port which will help us making the smart bridge. The sensors used are capable of doing high quality work and we can rely on this type of machines. The sensors and components we used are Arduino uno motor which is the main component of the smart bridge model The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect with usb to computer. IR Proximity sensor is a sensor which can detect the object passing by the sensor. We have to connect this sensor with arduino, we have use two such sensor for each two tollgates. Servo motor - Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. LCD connection is simpler it will show us the all the information required information. Main thing after connection of all sensor and giving power supply is that we have to run a programme to count all the persons entering and exiting through the gate. In arduino programme we have to run this code lines and after successfully completing the running of code lines we have to upload this programme in the our arduino uno circuit. Now after completing all this our smart bridge model is ready. We can see the no of persons entering the tollgates on the LCD screen installed on the main gate of the bridge. The sensors will automatically force the gate to close after the no. of pedestrian who can enter the bridge is same to the limited no we have set in our programme. This can reduce overcrowding and this will help us in meeting all the safety guidelines of the bridge



Fig. 1 – Smart bridge structure

**Description of sensors:**

- **ARDUINO UNO:** Arduino Uno is an open-source electronics platform based on easy-to-use hardware and software. It has a wide range of applications and is a major microcontroller board because of its small size and flexibility. It has 22 input/output pins in total, 14 of these pins are digital pins, 8 analogue pins, 6 PWM pins among the digital pin. It also has a mini USB Pin which is used to upload code and Reset button. It is used in Embedded systems, automation, robotics, etc.

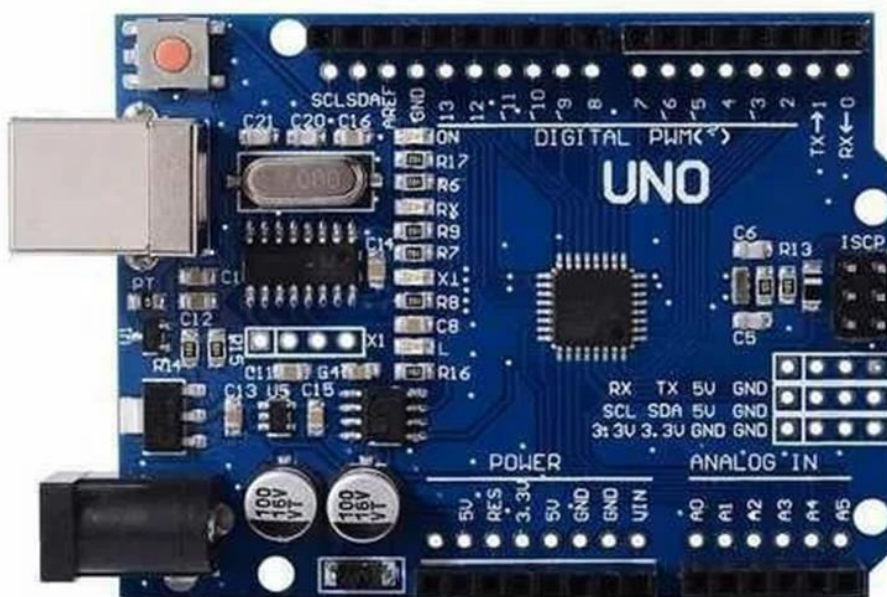


Fig.2 . ARDUINO UNO

**Servo motor**

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and

works just like the standard kinds but smaller.  
You can use any servo code, hardware or library to control these servos.

Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.



Fig.3 Servo Motor

### IR Proximity Sensor-

The Multipurpose Infrared Sensor is an add-on for your line follower robot and obstacle avoiding robot that gives your robot the ability to detect lines or nearby objects. The sensor works by detecting reflected light coming from its own infrared LED. By measuring the amount of reflected infrared light, it can detect light or dark (lines) or even objects directly in front of it.

An onboard RED LED is used to indicate the presence of an object or detect line. Sensing range is adjustable with inbuilt variable resistor.

The sensor has a 3-pin header which connects to the microcontroller board or Arduino board via female to female or female to male jumper wires. A mounting hole for easily connect one or more sensor to the front or back of your robot chassis.

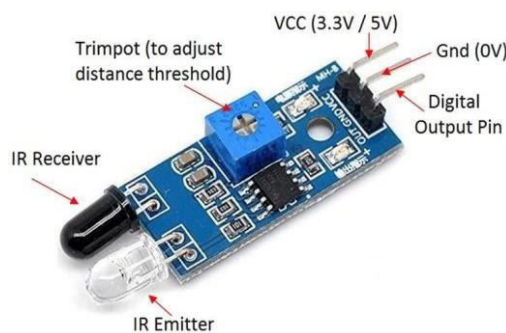


Fig.4 IR Proximity sensor

### NPN Epitaxial Silicon Transistor

This NPN Silicon Epitaxial transistor is designed, for use in linear and switching applications.

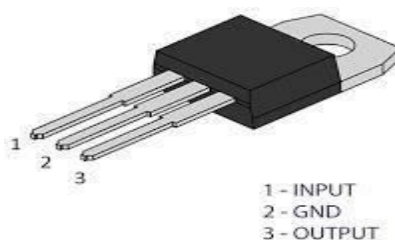
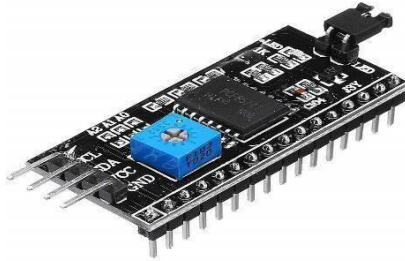


Fig.5 NPN Epitaxial Silicon Transistor

**LCD circuit** – It displays the information gathered by all the sensors and programs which is useful for administration



**Fig.6 LCD circuit**



**Fig.7 LCD – It is the LCD Screen**

## V. CONCLUSION

The smart bridge is very advance type of bridge monitoring system. The main advantage of this bridge system is that it can extend a network by acting as a repeater. Bridges can reduce network traffic on a segment by subdividing network communications. It can provide safety during natural disasters. Bridges increase the available bandwidth to individual nodes because fewer nodes share collision domain. This also reduces collision.

Even though the quality of material used and components used are of good quality, the cost of the project is not so costly and it can be used and implemented in all movable bridges without much increment of cost. This smart bridge is best in itsfield and will be most widely used and advance system.

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