# Smart System To Avoid Bridge Collapses

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*Abstract--***In India there are numerous river bridges.Those bridges have the capacity of holding only light weighted vehicles.The heavy vehicles are restricted to use those bridges.Those bridges are seen just with a warning board alone.But in most cases the drivers of the heavy vehicles may violate the rules and they may use the same bridge to cross the river.This can result in the development of cracks in the bridge which eventually causes the bridge to collapse.In Mahaath of Maharastra,a river bridge over the Savitri river collapsed weeks ago.The reason has found out be the entry of heavy vehicles on the bridge.To prevent the entry of heavy vehicles to the river bridges,an arch is built over the entrance of the bridge in some places across India.But this can increase the dead load on the bridge and this could further reduce the strength of the bridge.Thus a smart system which prevents the entry of heavy vehicles into the river bridges is proposed in this paper.This system uses a automatic checkpost in the entrance of the bridge.The weight sensor is placed on the entrance of the bridge.The vehicles when stopped at the entrance of the bridge,the weight sensor which is installed down at the road determine the weight of the vehicle being stopped at that moment.If the weight exceeds the threshold value,the entry of heavy vehicle can be found.The GSM Module is used to alert the concerned personnel.The buzzer is installed in the nearby traffic control office which sounds when the rules are violated in this case.When the entry of heavy vehicles is found,the checkpost will remain closed.In other cases the checkpost will open.This system reduces the manpower and it makes the surveillance completely automatic.This system if implemented can reduce the bridge collapses.**

*Keywords***:***river bridges,arduino,load sensor,gsm module*

## I.INTRODUCTION

The river bridges are usually constructed so as to hold only light weighted vehicles.It becomes a menace to the commuters when the heavy vehicles use the river bridges.The bridge laid over Savitri river in Mahad district of Maharashtra was collapsed.It was built in British era before 10 decades but the reason for the collapse is found out to be the usage of the bridge by the heavy vehicles.When the heavy vehicles use the light weight holding bridges the strength of the bridge will gradually decrease.This results in the weakening of the bridge which eventually results in the collapse claiming several lives.Only the warning boards will not completely stop entering of such vehicles to the river bridges.Hence the smart system to alert such entries is proposed in this paper.



Fig.1.Case study-Mahad bridge collapse

## II.EXISTING METHODOLOGIES:

There is no method to avoid such collapses currently.However the conventional method of placing warning boards is followed in several cases.In some areas,an arch is constructed over the river bridge.Some bridges are often seen with roofing with steel rods over them.In such cases,the arch or the rods constructed over the bridges may result in adding the dead load on the bridge.The unnecessary addening of load on the bridge further leads to the weakening of the bridge.

## III.CLASSIFICATION OF RIVER BRIDGES

Low level bridges are the one which are at constructed at low altitudes.They are constructed at the unimportant routes.The high level bridges are the permanent bridges.It is a bridge which does not allow the high flood water to pass over the floor carrying the communication route[1].
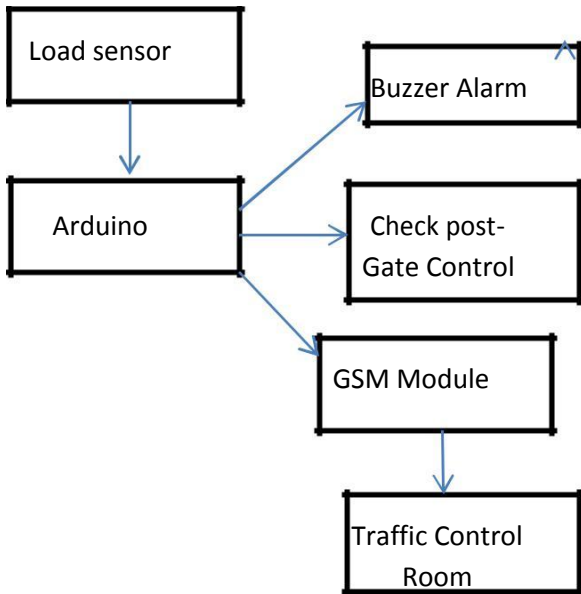
## IV.PROPOSED SYSTEM:

A.Block diagram:

Fig.2.Block diagram of the system

B.Components used:

In this system it is proposed to use a sensor,a controller to control the operations,a module to send the warning message and a alarming device.The components used are

- ➢ Arduino
- ➢ Load sensor
- ➢ GSM Module
- ➢ Buzzer Alarm

i.Arduino**:**

Arduino is an electronic prototyping platform which has the peculiarity of being open sourced. It can be used for interfacing electronic objects.It is based on easy to use hardware and software.The Arduino boards are able to read inputs and convert it into the output.Arduino is used in this system because of its flexibility.The language can be extended by using C++ libraries.
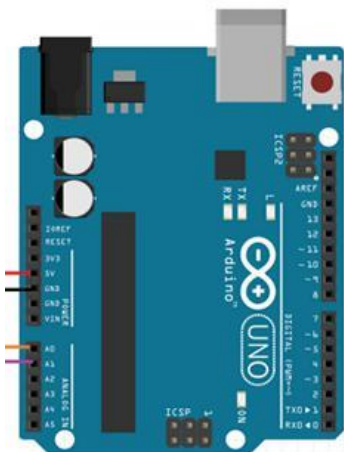


Fig.3.Arduino Uno board

ii.Load sensor:

A load sensor is a transducer that is used to convert the magnitude of the force which it measured to an electrical quantity.The various types of load sensors include hydraulic load cells,pneumatic load cells and strain gauge load cells.



Fig.4.Load sensor
iii.GSM Module:

A GSM Module is a specialized type of modem which accepts a SIM card,and operates over a subscription to a mobile phone.When a GSM Module is connected to computer,this allows the computer to use the GSM Module to communicate over the mobile network.The GSM technology contains the intelligent functions for the support of personal mobility especially with regard to user identification and authentication and for the localization and administration of local users[2].



Fig.5.GSM Module

4.Buzzer:

It is a small electronic device used for alarming.Here it is used to alarm the traffic control personnels.The input voltage accepted is +5V is been used in the proposed system.

## V.WORKING:

The system is used along with the check post in the entrance of the river bridge.A load sensor is installed near the check post.When the vehicles stop before the check post the weight of the vehicle is determined by the load sensor.The

analog value is then sent to the Arduino.If the value exceeds the minimum threshold value,the warning message is sent to the traffic control room via the GSM module.When the alert is given,the check post is closed.Also the buzzer sound is alarmed if the message in the traffic control room is neglected.This enables the heavy vehicles not to use the river bridge.When the analog value red from the sensor does not exceeds the threshold value,the check post remain open.If the traffic control room personnel doesnot possess mobile phones or in the case when they forget their phones to take with them,or if they neglect the message sent to them,the buzzer will alarm without ease.This will ensure the traffic personnel to act without negligence.
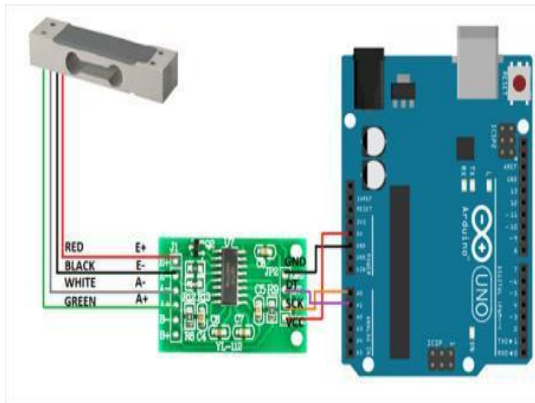


Fig.6.Arduino with load sensor

## VI.OUTCOMES

There are some cases checked to verify the outcomes of the proposed system.They are as follows.

The weight which the bridge is taken as 50 tons for reference.The check post is in closed condition initially.

- If the truck which is unloaded with its own weight of 20 tons is about to pass the bridge,the condition is checked by the Arduino.This is safe as per the program fed,so the check post will open.
- If the truck returns with load of 40 tons and halted over the load sensor, the condition is again checked by the Arduino.This is again safe as per the program fed,so the check post will open for this condition too.
- If a multi axil vehicle tries to pass the bridge with a weight of 70 tons of weight,the condition is checked and since this value measured is more than the threshold value which is fed,the decision is taken as unsafe.Thus the Arduino instructs the GSM module to send the warning message.The check post is closed and the buzzer is sounded.
- If a vehicle with a 50 tons of weight is about to pass the bridge,since the weight is equal to the

reference weight,this also considered as unsafe condition. Thus the

Arduino instructs the GSM module to send the warning message to the

concerned personnel.It also closes the check post as in the previous case and the buzzer is sounded to alarm the personnel for quick action.

A.Advantages:

➢
    Reduces manpower
➢
    Continued surveillance
➢
    Durability
➢
    Less power consumption
➢
    Reliable

B.Applications:

➢
    River bridges
➢
    Light weight holding bridges

C.Factors influencing the system functioning:

➢
    Since the is designed for the continued surveillance,the continuous supply of power to Arduino board is required.This needs to be satisfied for the proper functioning of the system.
➢
    The proposed system has to be placed in the public place.There is a danger of being damaged.So to avoid this,the entire system has to be enclosed in a proper insulated and a rigid case.

## VII.CONCLUSION:

This system can be used in all the river bridges.It ensures the security of the river bridges.It can detect the entry of heavy vehicles without error.This system if implemented in the river bridges can reduce the bridge collapses to the maximum extent.The proposed system satisfies the required performance and its outcomes are satisfactory.This system can help the traffic control personnel to keep themselves off the road.The continuous surveillance is made possible in this system.This can reduce the death toll in bridge collapse accidents as much as possible.This can be implemented practically in large scale to ensure the safety of the river bridges.

## VIII.REFERENCES

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[2].J.Eberspacher and J.Vogel "GSM Switching services and protocols" Second Edition