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## VISION BASED BOAT HEIGHT PREDICTION TO AVOID CRASH AND STREAM FLOW RATE ANALYSIS TO SAFEGUARD BOATS

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### ABSTRACT

It is very much necessary to have an automated system, that enables boat to cross the bridge safely. But due to incorrect estimation of water level by manual observation many boat-bridge crashes occur every year. To overcome this problem an image processing-based technique is used to estimate the height of the boat. The proposed project also monitors the dam gate conditions and also measures the water flow rate using the flow rate sensor to avoid the boat imbalances. These experimental results show that crashes and imbalances can be reduced.

### KEYWORDS

Image processing, Water flow rate, Flow rate sensor, Dam gate.

## 1. INTRODUCTION

As Inland Waterway is a mode of transportation, it is also known as cheapest transportation as no track is required. Bridges are constructed to provide people a means to cross the river. In recent decades, bridges are constructed mainly with steel, iron and concrete. Hence, if boat bridge crash occurs the failure of the bridges are very less or nil compared to that of boat collapsing. Though it is cheapest mode of transportation there are many problems in this mode of transportation. Main problem is increase or decrease in the water level. Due to this, the following variations may occur in the river

**Case 1.** Gap between water level and bridge.

**Case 2.** flow rate of the stream.

In case 1. Due to heavy rains or release of water from dams, the water level may increase and the available gap between bridge and water may decrease accordingly. If the height of the boat is more than the gap available between bridge and water level, then boat-bridge crash may occur. Or if water level decreases due to lack of rains, then the boat which possibly can pass may wrongly judge that it cannot pass. In case 2, the increase in the flow rate leads to sudden imbalance of the boat, which may kill lot of people. In our proposed project we tried

finding solutions to these specific problems.



**Fig 1: Boat – Bridge Crash.**

Image processing is a method of converting an image into digital form, perform specific operations in order to extract some useful information from it. The choice of image processing for this application involves extraction of boat height by capturing the image of the boat. Using water level indication circuit, water level can be continuously monitored through which the available gap between bridge and water surface can be obtained in prior. So that right decision can be taken whether boat can pass or not. Flowmeter is a device which will measure the velocity of the water flow. The choice of flow meter in the project is for sending precautionary messages to boat person which may reduce the boat imbalances

## 2. LITERATURE REVIEW

According to survey, no monitoring system is present for the safety of the boats and fishermen who are traveling in rivers where the bridges were built across the rivers. In fact, a significant amount of work has been done to avoid crashing of boats to bridge.

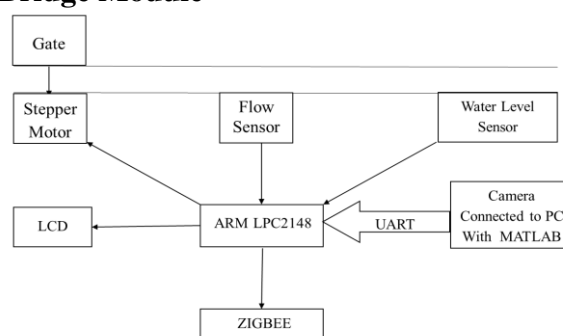
Dianyuan Han [1] proposed a solution for tree height measurement based on image processing by 3-point correction method. While developing this system, two marker points were used, one was set on the root of the tree and the other was set one meter high from the root. Ria [2] researched that flow meters have proven as excellent devices for measuring flow in the irrigation fields as it is required for measuring the water needed in irrigation fields in order to avoid damage of crops with excess water. Franco [3] used the image processing techniques of the image binarization, character recognition, and water line detection to detect water level. For the surface velocity recognition, they applied the PIV (Particle Image Velocimetry) method to obtain the recognition of the water surface velocity by the cross-correlation analysis. Jin [4] used ZigBee technology to send the information, this technology is characterized by low power consumption, high safety and support of a large number of network works. Sai Sreekar [5] proposed a novel idea of collecting and sharing real-time information about water levels at dams to an authorized central command center through far field communication, then the authorized central command center then takes a call whether to release the water by opening dam gates or keep them closed.

## 3. PROPOSED METHOD

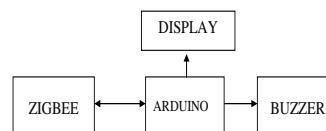
A dam is a barrier that stops flowing water. Dam serves for the purpose of storing water. But dam can store or retain only a particular amount of water, beyond which the dam gates are opened to discharge excess water into the river. This sudden discharge may increase the water level in the river. Here exists a problem, when the boatperson is not aware that the water is discharged and water level is raised, then he may wrongly assume that the

particular boat can cross the bridge as it has been able to cross in the past when water level is normal in the river. This wrong assumption of boatperson leads to the boat-bridge crash. In this project stepper motor is used to monitor the dam gate open and close and if dam gates are found to be open, then information is sent to the boatperson to warn about the raising water level as the water is discharged from the dam.

### Bridge Module



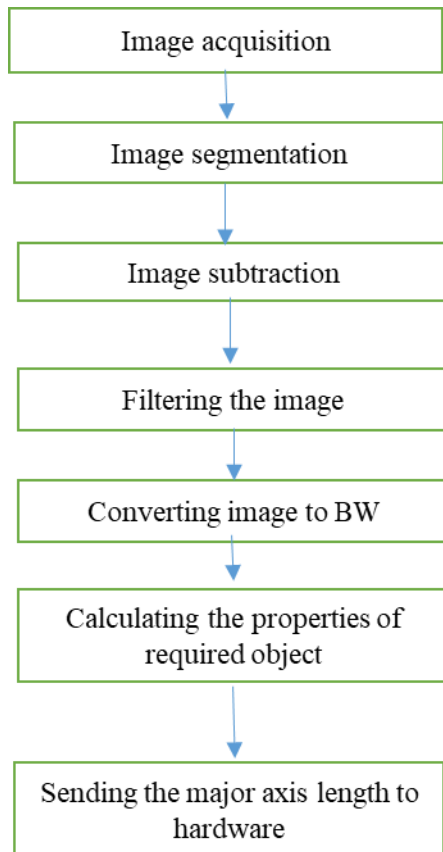
### Boat Module



**Fig 2: Block Diagram for proposed system**

Variation of water flow rate in the rivers can have serious impacts like floods or droughts. The flow can be varied by sudden release in water from the dams, excess melting of glaciers. So, the stream flow rate of rivers can never be constant. Not even floods and droughts, increased flow rate can also increase the chance of boat imbalances and lead to death of people travelling in that boat. A flow meter is used in this project to analyze the stream flow continuously. If flow rate is more than that the normal rate in the database, the warning messages are sent to the boat person to avoid imbalance to certain extent. The flow meter which is used in this project have inlet and outlet valves and a turbine. when water is passed into the inlet valve the turbine will rotate and water come out of the outlet valve. the turbine which is rotating by the continuous flow of water will give rpm through which the velocity of the

water is estimated. This velocity is compared to that of previous databases. If the velocity is more than that of normal one, then the decision has to be taken that flow rate is high and the same is informed to the boatperson.

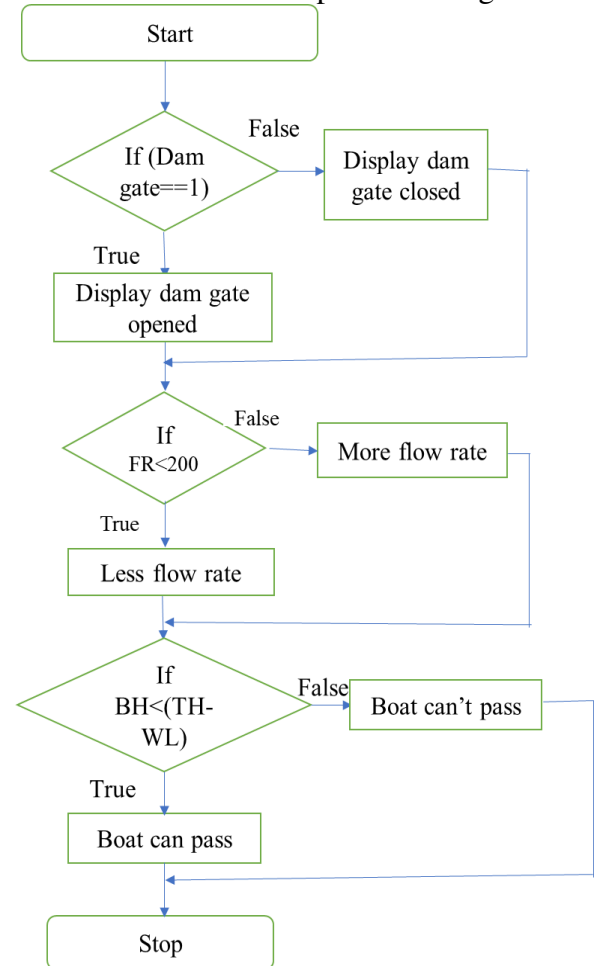


**Fig 3: Flow Diagram of Image processing**

To estimate the height of the boat image processing technique is used for which the video of the arriving boat is recorded and the snapshots of the video are taken simultaneously, Then the image is filtered using median filter and converted to the black and white image. And by extracting the properties of required object from the image the height of the boat is estimated which is nothing but major vertical axis length of the object. Then the value is set to the microcontroller. The received value from the MATLAB is then compared with the available gap when the water level is subtracted from the total height of the bridge. By which it is determined that the boat can cross the bridge or not and the message is sent to the bridge through a wireless

technology ZigBee.

In the boat the message is received that the boat can cross the bridge or not. Where buzzer sound is used in order to alert the boat person when the boat can't pass the bridge.

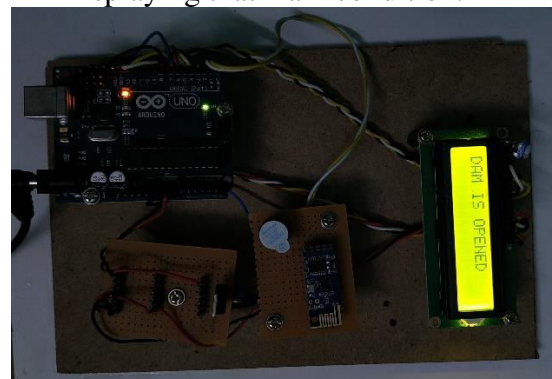


**Fig 4: Flow diagram of the proposed system**

## 4. RESULT

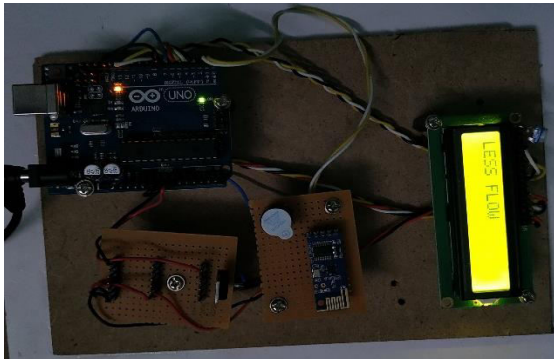
This project is successfully conducted and performed by:

- Displaying that Dam condition.



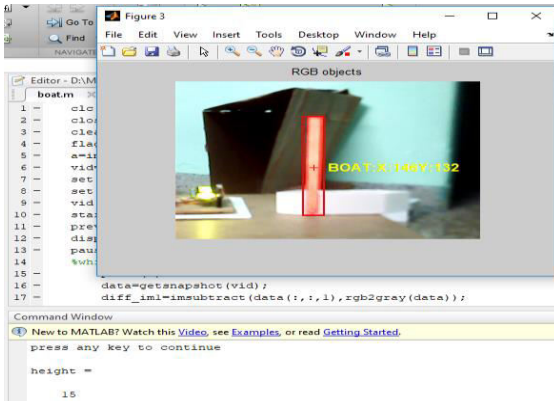
**Fig 5: Displaying message at boat when dam is open**

- Displaying the water flow rate.



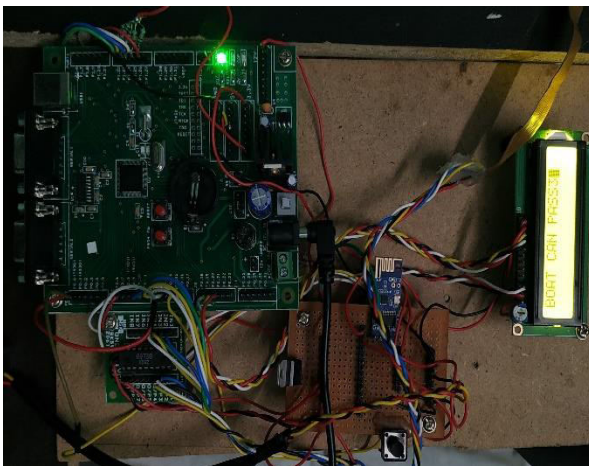
**Fig 6: Displaying the water flow rate status at the boat**

- Fig 7 and 9 indicates the boat height estimated from MATLAB.

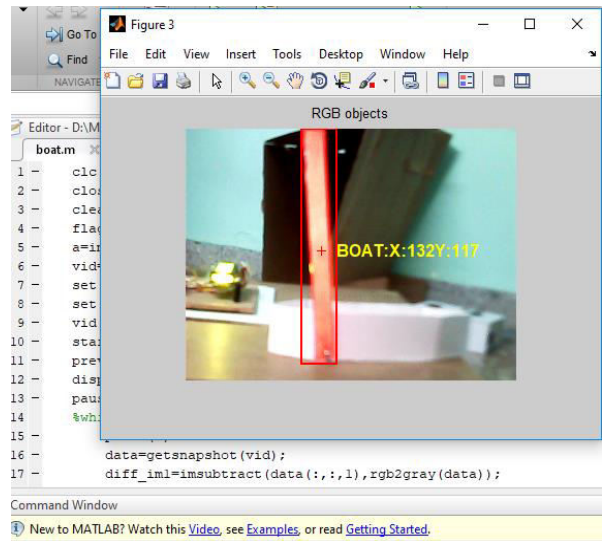


**Fig 7: Estimating the height of the boat Ex.1**

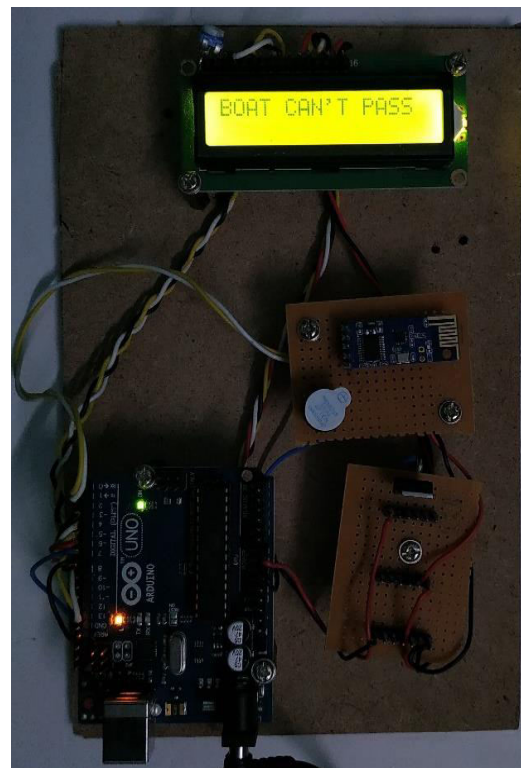
- Comparing the gap between water surface and bridge with boat height and displaying the result in fig 8 and 10.



**Fig 8: Displaying boat can pass for Ex.1**



**Fig 9: Estimating the height of the boat Ex.2**



**Fig 10: Displaying boat can't pass for Ex.2**

## 5. ACKNOWLEDGEMENT

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of this project.

## 6. CONCLUSION

This paper proposed a solution to overcome boat-bridge crashes and boat imbalances. An inbuilt circuitry which is designed to measure the height of the boat using image processing, measure the water level and calculate the available gap between the water surface and the bridge which help boatperson to have a safer sail. This paper also measures the stream flow rate and give the precautionary warnings to avoid boat imbalances.

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