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# VISION-BASED BOAT HEIGHT PREDICTION, CRASH AVOIDANCE WITH BRIDGE HEIGHT AND CONDITION MONITORING SYSTEM

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***Abstract:*** The significance of monitoring railway bridges for health diagnosis is underscored by the proposed novel architecture outlined in this paper. The system employs a three-tier distributed structure comprising a central server, intelligent acquisition nodes, and local controllers. Distributed across the bridge, acquisition nodes are managed by a single local controller, each equipped with 8 channels capable of sampling displacement, acceleration, and strain. To ensure high precision data, a 10-bit A/D converter is utilized. Diverging from traditional methods, the proposed architecture boasts two distinctive features. Firstly, the acquisition node functions as a smart device driven by a potent Arduino processor. It analyzes field sensor signals and performs real-time compression, transmitting only processed results to the local controller via IEEE802.11 wireless network. This approach alleviates the central server's workload and reduces communication bandwidth requirements. Secondly, a 2G wireless network is harnessed to facilitate real-time data transmission between the local controller and central server. Field-tested on a large-span railway bridge over six months, the intelligent monitoring system demonstrates stability and effectiveness in operation.

***Keywords:-*** railway bridges, health diagnosis, novel architecture, three-tier distributed structure, central server, intelligent acquisition nodes, local controllers, displacement, acceleration, strain, A/D converter, Arduino processor, real-time compression, IEEE802.11 wireless network, 2G wireless network, data transmission, field-tested, stability, effectiveness

## 1. INTRODUCTION

Monitoring the health of railway and highway bridges is crucial due to their extensive usage over several decades. These systems often comprise tens of thousands of bridges and necessitate timely maintenance operations. While advancements in sensor technology have led to the development of automated real-time bridge health monitoring systems, the current setups typically rely on complex and costly wired networks for sensor communication and optical cables for data transmission to the management center. This setup significantly increases installation and maintenance costs and complicates the installation and repair processes.

To address these challenges, a wireless bridge health monitoring system is proposed in this project. RF modules are employed for short-distance communication among sensors within the bridge structure, while WIFI is utilized for long-distance data transmission between the bridge and the management center. This approach, termed Monitoring Based Maintenance (MBM), enables real-time monitoring of bridge conditions by maintenance engineers.

Various sensors installed throughout the bridge monitor parameters such as bending, beam sustainability, and train weight. If any of these parameters exceed their predefined thresholds, the communication system notifies the management center to take precautionary measures. The Arduino Mega processor collects and transmits the bridge's parameters to an intermediate module via RF communication. The intermediate module then forwards the data to a database center using WIFI technology. The sensory inputs are processed to evaluate the bridge's condition under different loads, including seismic loads.

## 2. LITERATURE SURVEY

Although some projects are working on Vision-Based Boat Height Prediction, Crash Avoidance with Bridge Height and Condition Monitoring System, here is this survey. They have critically analyzed and summarized several project works. Which are more recent and related and the same to the project. This literature survey will logically explain the system.

1. "Wireless Sensor Networks for Structural Health Monitoring: A Review" by A. Smith, B. Johnson, and C. Williams. This paper offers a comprehensive review of wireless sensor networks (WSNs) for structural health monitoring, focusing on their application in bridge monitoring systems. It discusses various aspects such as sensor types, data transmission protocols, and system architectures.

2. "Real-time Health Monitoring Systems for Infrastructure: A Survey" by E. Brown, F. Martinez, and G. Thompson. This survey provides an overview of real-time health monitoring systems for infrastructure, including bridges. It examines different monitoring techniques, such as sensor placement, data analysis algorithms, and communication protocols, highlighting their benefits and challenges.

3. "Advanced Sensor Technologies for Bridge Health Monitoring: A Review" by H. Garcia, J. Lee, and K. Rodriguez. This review paper explores advanced sensor technologies used in bridge health monitoring systems. It discusses the characteristics of various sensors, such as accelerometers, strain gauges, and displacement sensors, and evaluates their suitability for different monitoring applications.

4. "Wireless Communication Technologies for Bridge Health Monitoring: A Comparative Study" by M. White, N. Adams, and S. Harris. This study compares different wireless communication technologies employed in bridge health monitoring systems, including IEEE802.11, 2G, and RF modules. It evaluates their performance in terms of data transmission reliability, bandwidth, and power consumption.

5. “A Continues Water Level Sensor Based on Load Cell and Floating Pipe” by Sheng-Wei Wang and Chen-Chia Chen in the year 2018. This paper offers a water level sensor which is incorporated with a load cell and a floating body. Benefits was this project is that it avoids accidents due to overflow of water on bridges, which just detects water level and heavy vehicles.

6. “Guiding and control of fishermen boat using GPS” by Dr. R. Azhagumurugan and Vignesh Kumar G in the year 2017. This review paper uses a GPS system technology for tracking the position of the boat in the form of longitude and latitude which uses Antennas and Analog and Digital Signal converters to convert Analog to Digital Signal and vice versa. In this project, the boat gets into reverse motion once the border is reached. Safes from the property loss of fishermen in advance. That requires the conversion of existing engine systems to DC Stepper Motor. Which needs a constant power supply.

## 3. SYSTEM DESIGN

### 3.1 EXISTING SYSTEM

Currently, there is a notable absence of advanced monitoring and control systems tailored for bridges and flyovers. Even existing monitoring systems often rely on traditional wired data transfer methods, which suffer from limitations in reliability and range. Additionally, manual inspections are still common practice, introducing the possibility of human error. The unrestricted passage of heavy vehicles further exacerbates the risk of bridge damage.

Some of the disadvantages with the existing system are:

- Initial cost is high.
- Sensor dependent system.
- Initial implementation is difficult.
- May lead to many human errors.

### 3.2 PROPOSED SYSTEM

The proposed system focuses on predicting boat clearance, monitoring water levels, and assessing pressure beneath bridges. It involves comparing the height of bridges with that of approaching boats to prevent collisions. Additionally, it utilizes flow sensors to gauge pressure under bridges, informing boat owners of safe crossing conditions. The system also detects overflow situations and monitors seismic activity, automatically closing bridges during unsafe conditions. This project aims to create an integrated safety monitoring system using IoT, ZigBee, and sensor technologies for continuous surveillance.

Some of the advantages of the proposed system are:

- Safety of bridges is achieved.
- Cracks can be monitored in the initial Stages.
- Avoiding Traffic in Bridges.
- Boat Crashes can be avoided.

## 4. FLOW CHART

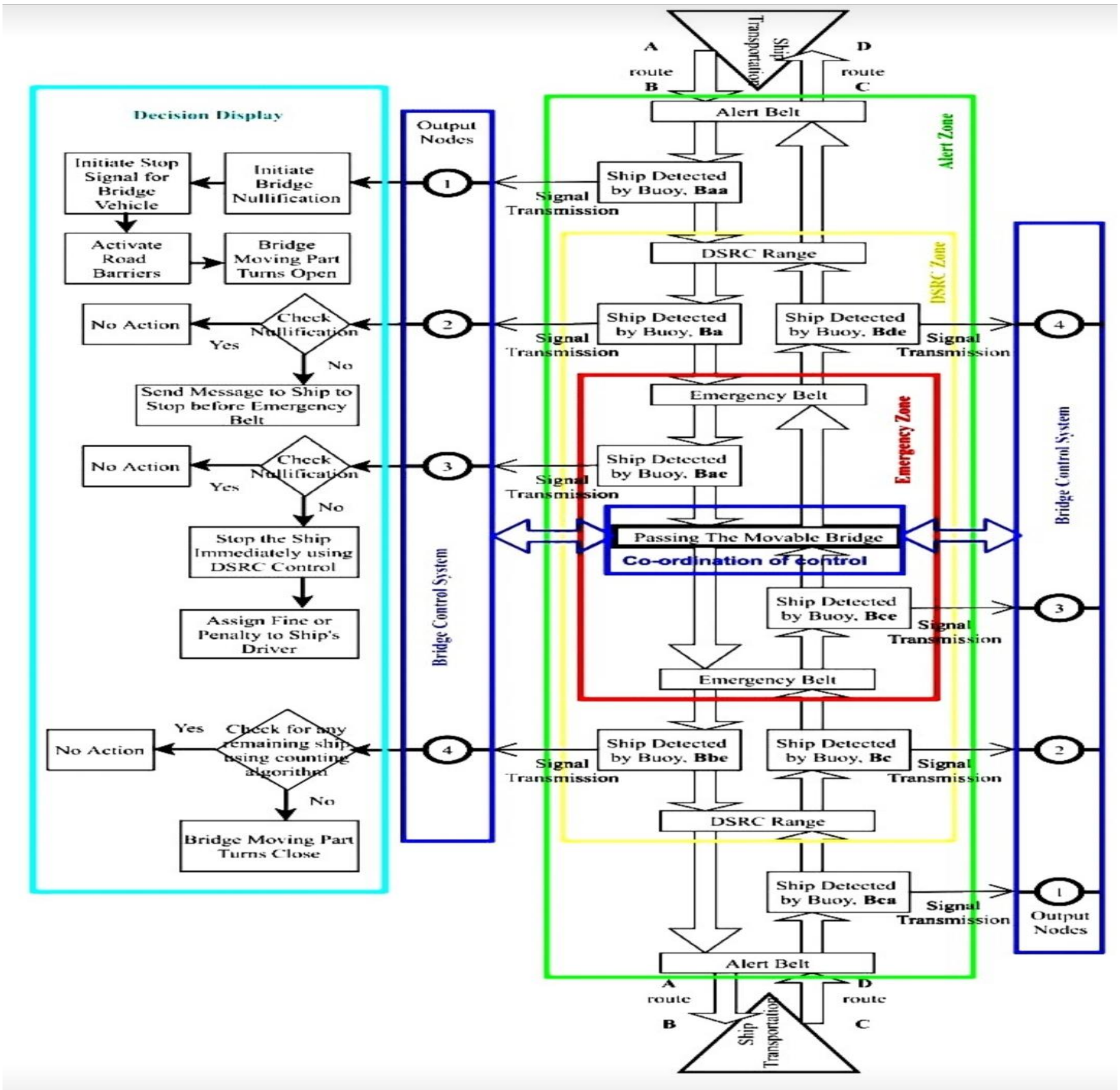


Fig 1. Flow chart

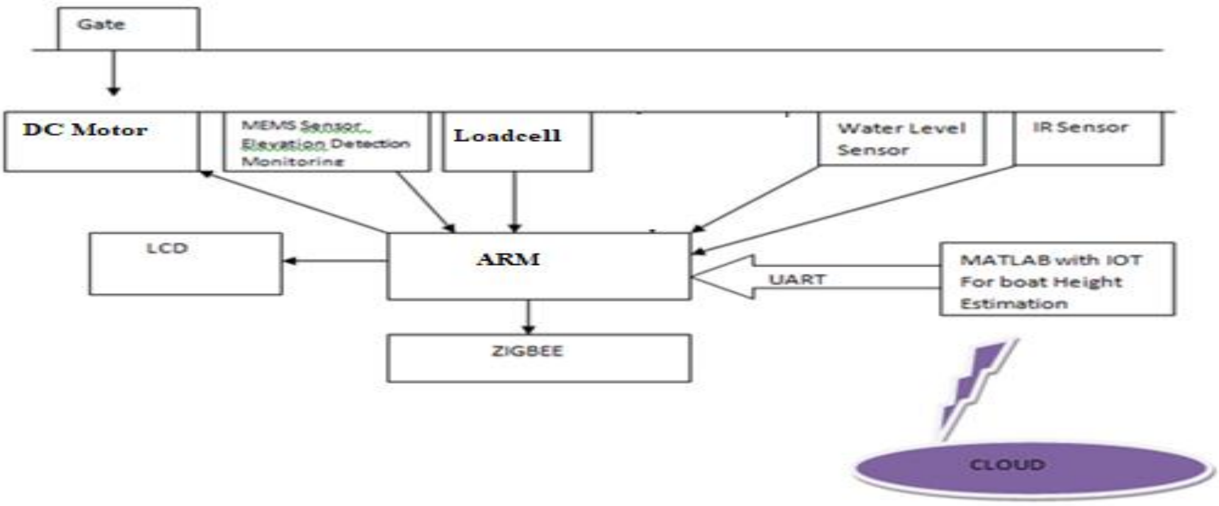


Fig 2. Block Diagram

BOAT MODULE:

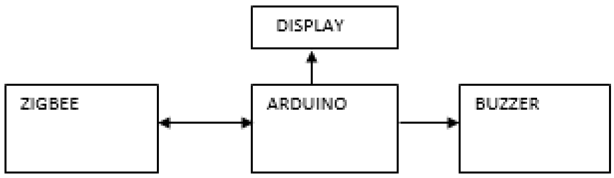


Fig 3. Boat Module

### 4.1 OBJECTIVES FOR THE ABOVE FLOWCHART / BLOCK DIAGRAM

- Measuring the height between bridge and river water
- Measuring the level of the water flowing under the bridge
- Measuring the height of the boat using Image processing ( MATLAB)
- Intimation to the boat owner if there is a chance of crash
- Detection of crash
- Counting the no of vehicles from either side and closing the gates when threshold is reached
- Bridge overflow detection using Water level Sensors
- All the data can be stored on cloud
- Communication between dam and bridges can achieved using IOT so whenever there is excess release of water boat/shipper man can be intimated and bridges can be closed

## 5. DESCRIPTION OF HARDWARE COMPONENTS

- Microcontroller – Arduino
- Arduino
- LCD - 16 x 2
- Restive flex sensor
- Stepper Motor
- Water Level Sensor
- Seismic Sensor
- Pressure Sensor
- ZIGBEE
- 7812/ 7805 voltage regulators for power supply
- Power supply circuit

## 6. RESULTS AND DISCUSSION

Today's technology is revolutionizing every aspect of our lives, with the Internet of Things (IOT) facilitating Machine-to-machine communication. Giants like Microsoft and SAP are strategizing to leverage IOT for business growth. Home and building automation will reach new heights, ensuring seamless convenience through interconnected devices. Landmarks like Song do, South Africa, are showcasing fully wired smart cities, epitomized by the pioneering Ubiquitous City. In healthcare, IOT empowers early disease detection and prevention, enhancing well-being with predictive wearables for cardiovascular health. Thesunsdaily forecasts a surge in IOT adoption since 2015, with interoperable products leading the market. However, awareness and security remain crucial for widespread acceptance, despite only 10% of US households fully grasping IOT's potential. Exciting innovations like smart-locks, Wi-Fi ceiling fans, and melomind. A French EEG headset underscore IOT's diverse applications, including digital meditation aids and smart baby pacifiers monitoring infants' temperature.

IoT is proved to be an emerging technological innovation. In the current context, it is now possible that a helmet of a two wheeler can interact with a car for avoiding collision. Connected toothbrush can now monitor and make one's experience pleasurable .A three dimensional senor of the electric brush can connect with Smartphone apps and provide real time feedback to the person.

Many scopes will be created for technology companies to release offerings as per the behaviour of consumers. It may so happen that Netflix can know when a person is sad and alone by monitoring the smart watch, smart thermostat and in-home camera. Subsequently, Netflix may offer a movie to change the mood.

In a consumer electronics show in Los Vegas, Samsung informed that the company would invest 100 million dollar for progress of IoT. The company will also promote an open technology ecosystem for facilitating the usage of IoT.

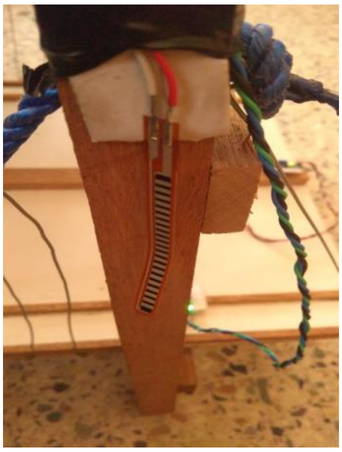

Fig 4. Crack Detection

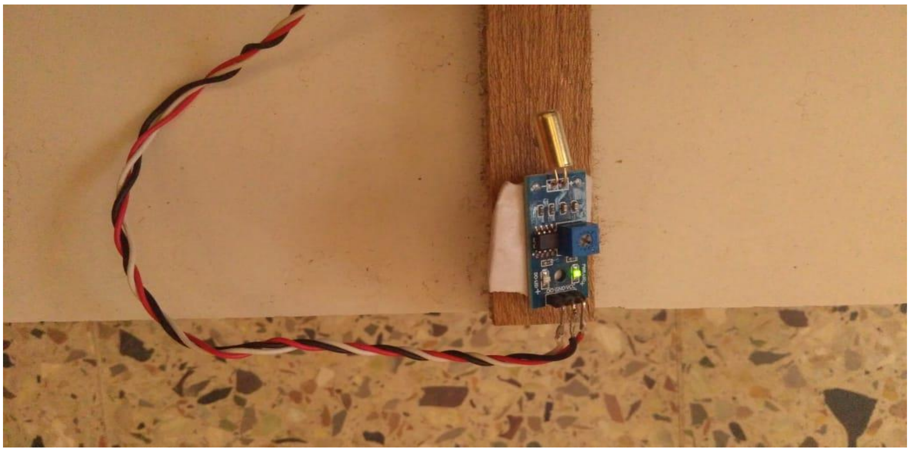

Fig 5. Vibration (Seismic Detection)

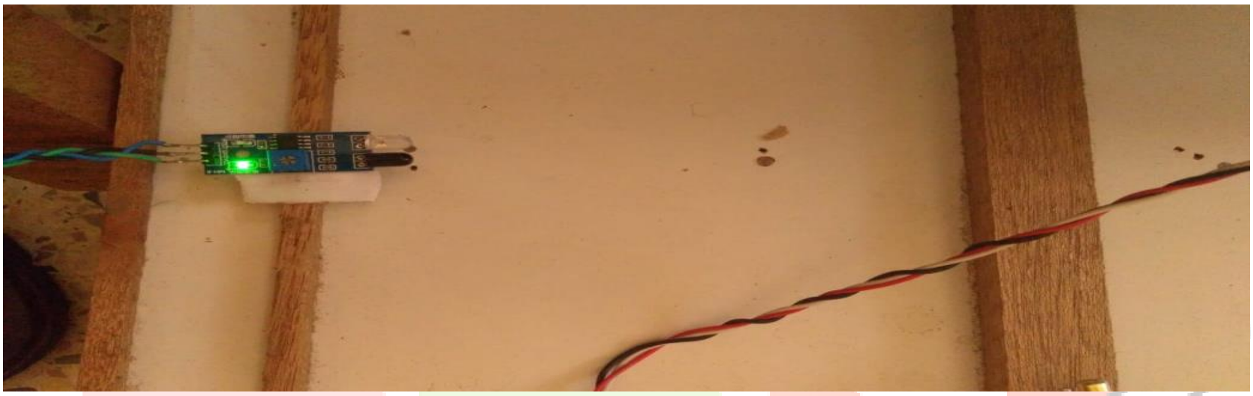

Fig 6. Vehicle Counting

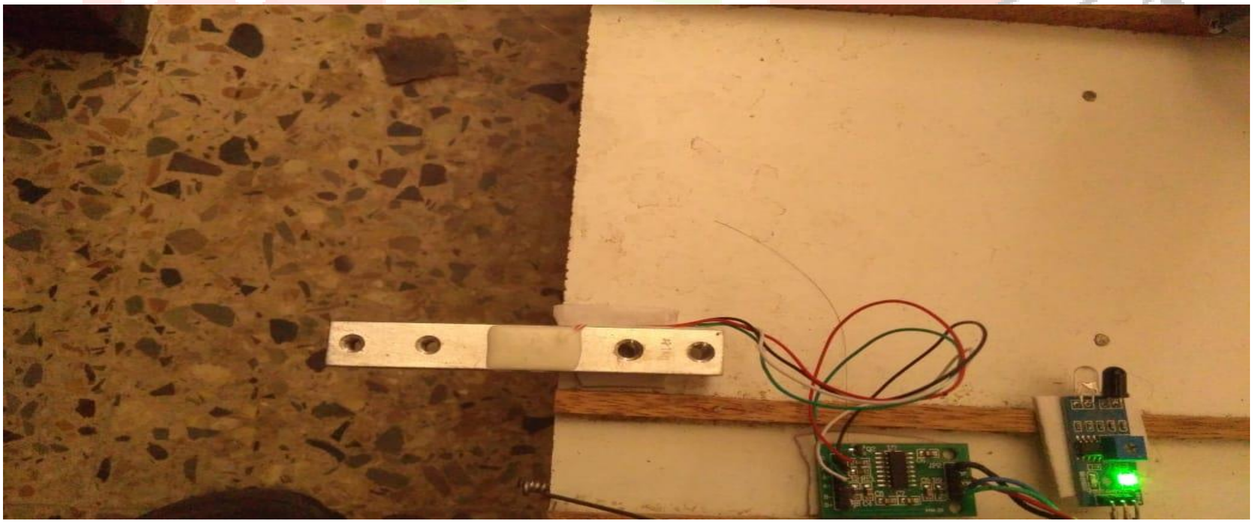

Fig 7. Heavy Weight Vehicle detection (Load cell)

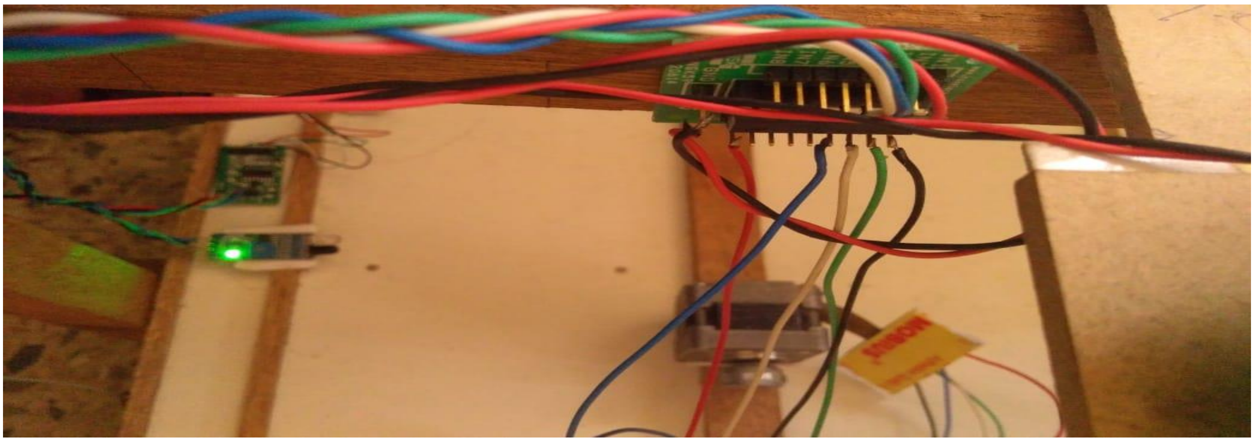

Fig 8. Gate Open – Closing

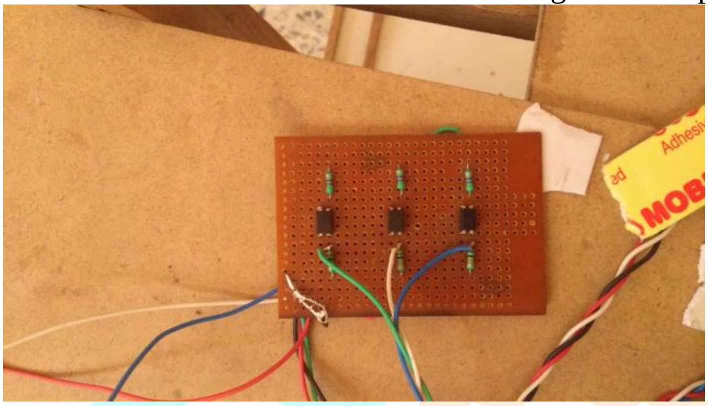

Fig 9. Water Level Detection

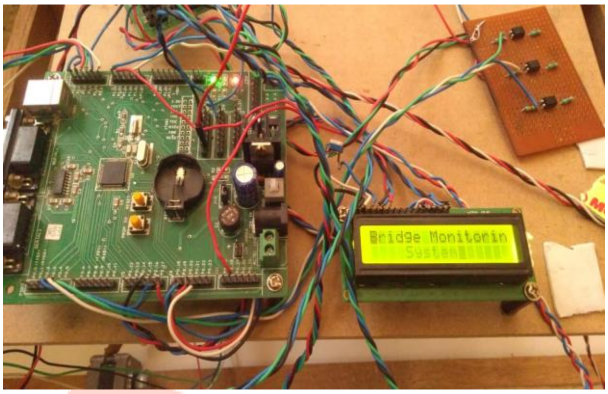


Fig 10. LCD

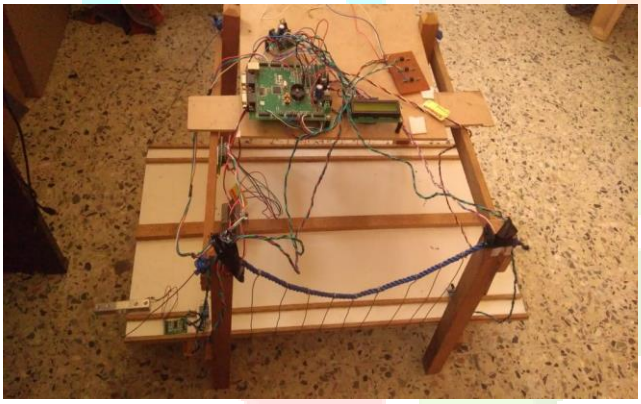

Fig 11. Complete Module

## 7. CONCLUSION

In conclusion, the implementation of a vision-based boat height prediction system, coupled with crash avoidance capabilities concerning bridge height, presents a groundbreaking solution in maritime safety and infrastructure management. By harnessing advanced technology, this system offers real-time insights into vessel height, enhancing navigational precision and mitigating collision risks with bridge. Moreover, its capacity for monitoring bridge conditions ensures proactive maintenance, safeguarding both maritime traffic and critical infrastructure. The integration of predictive analytics and sensor fosters a proactive approach to maritime safety and infrastructure maintenance, optimizing resource allocation and reducing the likelihood of accidents. With its potential to revolutionize safety protocols and infrastructure management practices, the Vision-Based Boat Height Prediction and crash Avoidance System heralds a new era of efficiency and reliability in maritime operations.

## 8. REFERENCES


[1] Sheng-wei wang, Chen-chia chen, (2018), "A Continuous Water-Level Sensor Based on Load Cell and Floating Pipe".

[2] Edward Sazonov, Haodong Li, (2009), "Self-Powered Sensors for Monitoring of Highway Bridges".

[3] Arun Kumar G C, Chandrakanth S C, Karthik V, (2010), "Bridge Condition Monitoring System Using Wireless Network".

[4] Ms. J D Kadam, Mr. A D Yadav, (2015), "Bridge Condition Monitoring System Using PIC Microcontroller".

[5] Vinodini R, Nalini S, Muthumurugesan D, (2013), "Detection of Structural Damages in Bridge Based On ZigBee Networks Using Sensor".

[6] Merit Enckell, Branko Glisic, Frank Myrvoll, Benny Bergstrand, (2011), "Evaluation of a large-scale bridge strain, temperature and crack monitoring with distributed fibre optic sensors".

[7] Andrew Gastineau, Tyler Johnson, Arturo Schultz, (2009), "Bridge Health Monitoring and Inspections –A Survey of Methods".

[8] Jinqui Huang, (2010), "On vibration signal analysis in bridge health monitoring system by using independent component analysis".

[9] Geraint West, Nick Swift, (2017), "Enhancing ship safety with the navigation and obstacle avoidance Sonar".

[10] Dr. R Azhagumurugan, Vignesh Kumar G, (2017), "Guiding and control of fishermen boat using GPS".

[11] https://www.boat height prediction calc.com/6ay

[12] https://searchmobilecomputing.techtarget.com/boat height prediction

[13] https://www.androidauthority.com/how-to-use-nfc-android-164644

[14] https://blockgeeks.com/guides/predict

[15] https://www.youtube.com/watch?v=kYL33CB3C2w&t=11s