



Underwater Wireless Network For Seafarer

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Abstract: This system consists of 8051 family microcontroller which is interfaced to the metal detector, spy camera and the system also uses battery. The data commands will make the robot to either go in forward, backward, left or right direction. The system makes use of night vision enabled spy camera with the help of which the user can view the area captured by this spy camera which will be mounted on this robot. Thus, with the help of this DTMF technology, the user of this system can operate the robot via data commands send through mobile phone, irrespective of the distance from the robot.

Index Terms - Traffic management, Embedded system, Radio Frequency, Emergency, Transmitter, Receiver.

I. INTRODUCTION

The vast oceans have always captivated human imagination, with their mysterious depths and uncharted territories. For seafarers, navigating these expansive waters is an integral part of their lives. However, communication in the underwater realm has long posed a significant challenge due to the limitations of traditional wired systems. Fortunately, advancements in technology have given rise to a fascinating solution: Underwater Wireless Networks. Underwater Wireless Networks offer a revolutionary means of communication and data transfer beneath the ocean's surface, enabling seafarers to connect, share information, and collaborate in real-time. These networks utilize a variety of cutting-edge technologies to overcome the unique obstacles presented by the aquatic environment, providing seafarers with unprecedented connectivity and enhancing their efficiency, safety, and overall experience at sea. One of the primary challenges in underwater communication is the limitations posed by traditional wired systems. In the vastness of the ocean, deploying and maintaining physical cables over long distances is impractical and expensive. Furthermore, the harsh underwater environment, with its corrosive saltwater, extreme pressures, and unpredictable currents, damage or sever these cables, rendering them ineffective. Underwater Wireless Networks eliminate the need for physical infrastructure, allowing for flexible and dynamic communication solutions.

II. RELATED WORKS

Over time, both the volume and value of the cargo carried have increased. For this reason, the damages caused by accidents in maritime transportation are also increasing. It is not possible to define the cost of loss of life in monetary terms during these accidents. The dynamic and ever-evolving field of maritime safety deals with the particular difficulties presented by the enormous and frequently inaccessible regions of the world's oceans and seas. Wireless communication networks are important components for ships, coastal stations, and maritime authorities to communicate effectively and securely. In this case, ensuring maritime safety entails harnessing technology improvements, putting in place efficient processes, and addressing particular wireless communication issues. Reliable and instantaneous information exchange between ships and land-based stations is made possible by Maritime Wireless Communication (MWC). It is worth consideration in emergency response, coordination, and navigation. To avoid mishaps and guarantee the general safety of maritime operations, communication systems, such as satellite communication and Very High Frequency /Ultra High Frequency (VHF/UHF) radio are required to be reliable. The Automatic Identification System (AIS) greatly enhances maritime safety by giving vessels real-time information on the positions, courses, and speeds of other adjacent ships. This helps with navigation and collision avoidance, enabling ships to modify their paths to avoid mishaps and guarantee safe travel. MWC has been used in emergencies for search and rescue operations. Distress signals guarantee a prompt reaction from maritime authorities and other vessels.



They are typically sent by Digital Selective Calling (DSC) on VHF radios. Navigators plan routes that avoid bad weather conditions since wireless connectivity makes it easier to receive weather reports on time. With the ability to provide precise and current meteorological information, this capability is required for minimizing weather-related mishaps and maximizing maritime safety. Maintaining communication system cybersecurity has significant importance because maritime communication is growing more digital and depends on wireless technologies. The integrity and safety of marine activities are preserved by preventing illegal access, manipulation, and disruptions to communication channels through the use of cybersecurity, preventions. Integrating Internet of Things (IoT) devices and sensor networks with MWC improves safety by facilitating the real-time data gathering and transfer of environmental factors, equipment status, and vessel conditions. Preventive and proactive risk management are also important factors to enhance maritime safety

In this existing system presents, An Edge Computing-Based Preventive Framework With Integration for Anomaly Detection and Risk Management in Maritime Wireless Communications was implemented. The safety of maritime environments in context with effective and secure wireless communication networks is required for ships, coastal stations, and maritime authorities. The dynamic nature of marine environments, where ships traverse vast and unpredictable expanses of oceans and seas, presents big challenges to safety and risk management. Wireless Communication Technology is widely employed in maritime activities for communication via ocean networks and Underwater Wireless Sensor Networks (UWSNs). Maintaining the safety of the maritime environment, effective anomaly detection, prompt risk mitigation, and real-time communication becomes more difficult due to its dynamic nature. International trade and transportation are facilitated by the maritime industry. The framework also places a strong emphasis on preventative safety measures, including cybersecurity safeguards to protect communication channels in the constantly changing digital marine operations environment. To demonstrate the effectiveness of the proposed framework, the experiments were performed based on a publicly available dataset and implemented in the context of marine communications.

III. PROPOSED SYSTEM

Underwater environments have always presented unique challenges for seafarers and marine researchers. The need for efficient communication and data monitoring in these environments has led to the development of underwater wireless networks. These networks enable real-time data transmission, environmental monitoring, and enhanced safety measures for individuals navigating the depths of the sea. One of the critical components of an underwater wireless network for seafarers is the power supply. To ensure compatibility with the selected components, a power supply operating at 5V is employed. This voltage is suitable for the efficient operation of the network, providing the necessary energy to power the various sensors and microcontrollers. Among the essential sensors utilized in the underwater wireless network is the MAX30100 sensor. MAX30100 sensor, a gas sensor is integrated into the network. Gas detection is crucial in underwater environments, as the presence of certain gases harmful or even life-threatening. This sensor continuously monitors the gas levels and alerts seafarers in case of any abnormalities, allowing for prompt action to ensure their safety. The Arduino Uno Microcontroller and NodeMCU play a vital role in the Underwater Wireless Network. These microcontrollers serve as the central processing units, managing the data processing and transmission within the network. They collect data from the sensors, process it, and transmit it wirelessly to other connected devices or a central monitoring station. The microcontrollers also enable the execution of predefined actions based on specific sensor readings, ensuring timely response to critical situations. Environmental monitoring is crucial in underwater environments to assess the conditions and identify any potential risks. To achieve this, sound, temperature, and humidity sensors are integrated into the network. The sound sensor detects underwater sound waves, providing valuable information about the presence of marine life or any potential disturbances in the environment. Temperature and humidity sensors, on the other hand, monitor the underwater climate, enabling seafarers to adapt to changing conditions and make informed decisions. To facilitate effective communication and alerts, a buzzer is incorporated into the network.

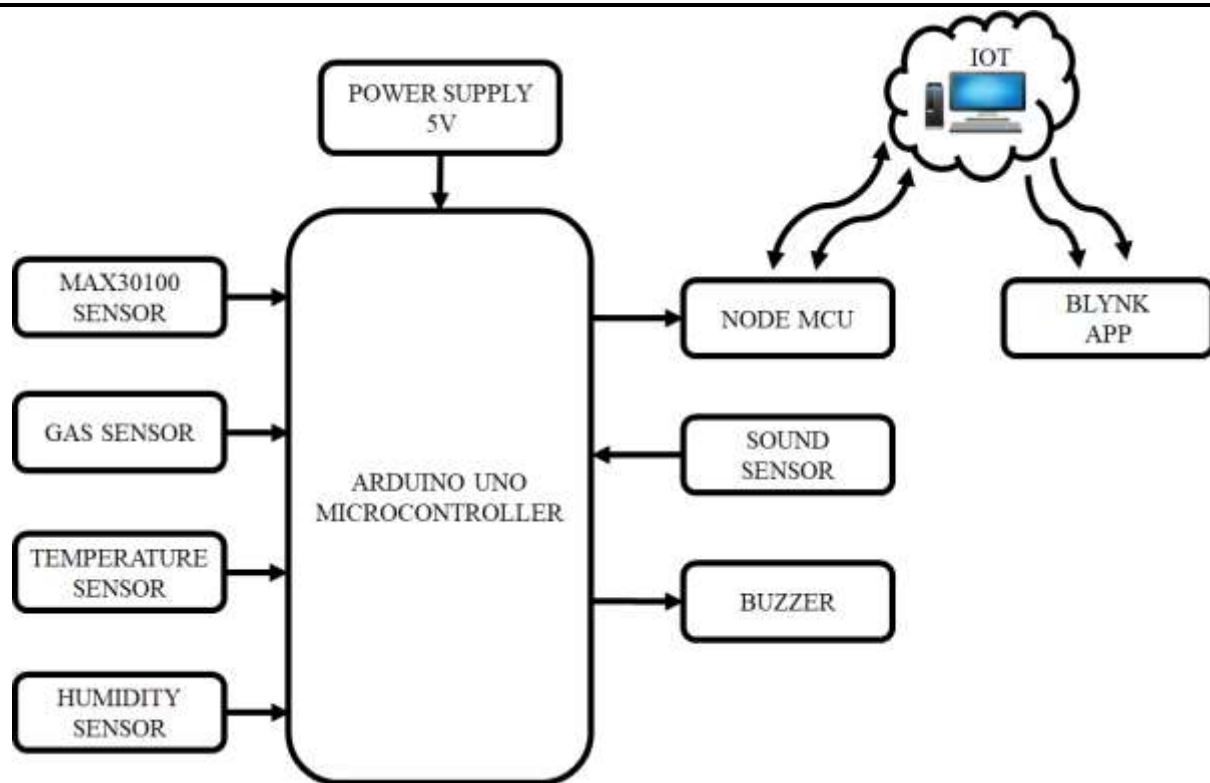


FIGURE 4.1 BLOCK DIAGRAM OF PROPOSED SYSTEM

IV. HARDWARE IMPLEMENTATION

Hardware view is the MAX30100 sensor is utilized to collect accurate and reliable data, providing valuable insights into the physical well-being of seafarers. A gas sensor continuously monitors gas levels underwater, ensuring the safety of individuals by alerting them to any abnormalities. Sound, temperature, and humidity sensors are integrated to provide comprehensive environmental monitoring in underwater conditions. A buzzer generates audible alerts and notifications based on specific sensor readings, enhancing situational awareness. The Blynk app serves as an intuitive interface, allowing users to visualize and control the network's data remotely, providing convenience and real-time monitoring capabilities. These components create a reliable underwater wireless network for seafarers.

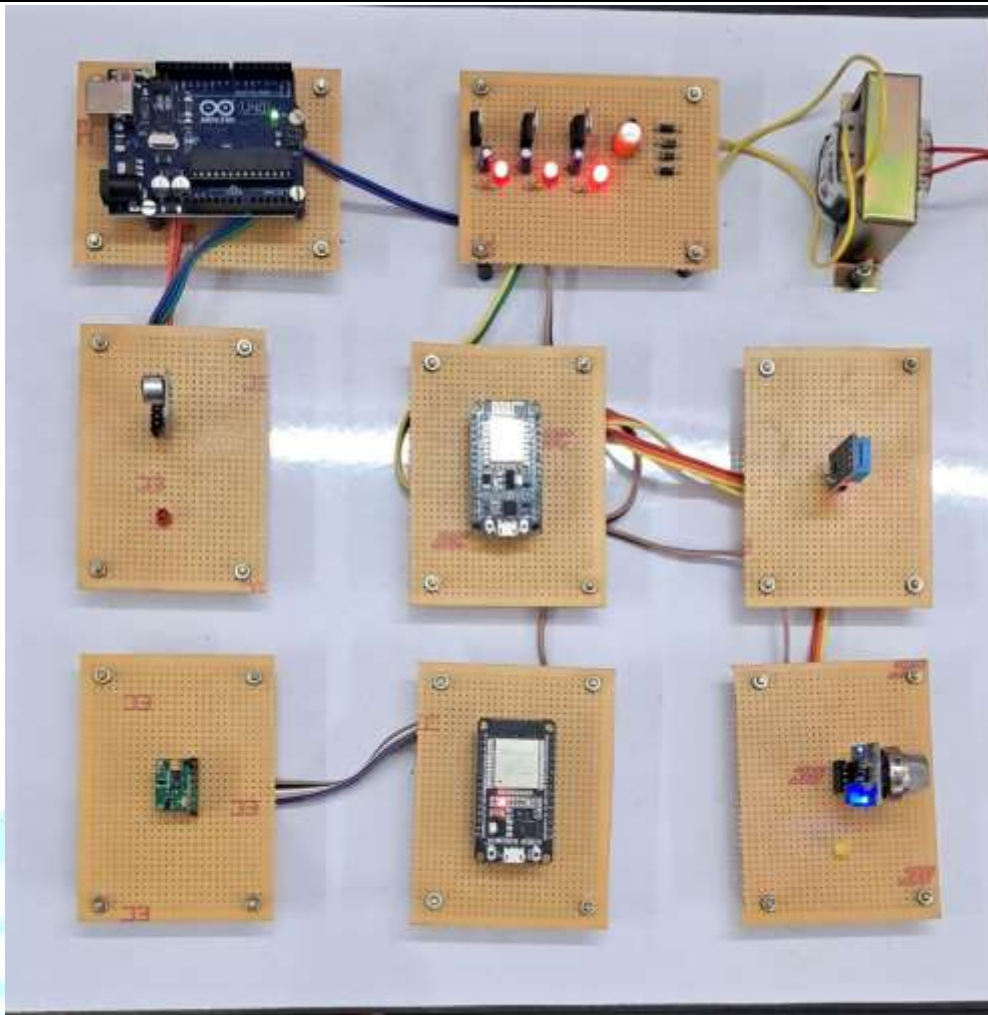


Figure 6.1 Hardware View

6.2 IOT DISPLAY

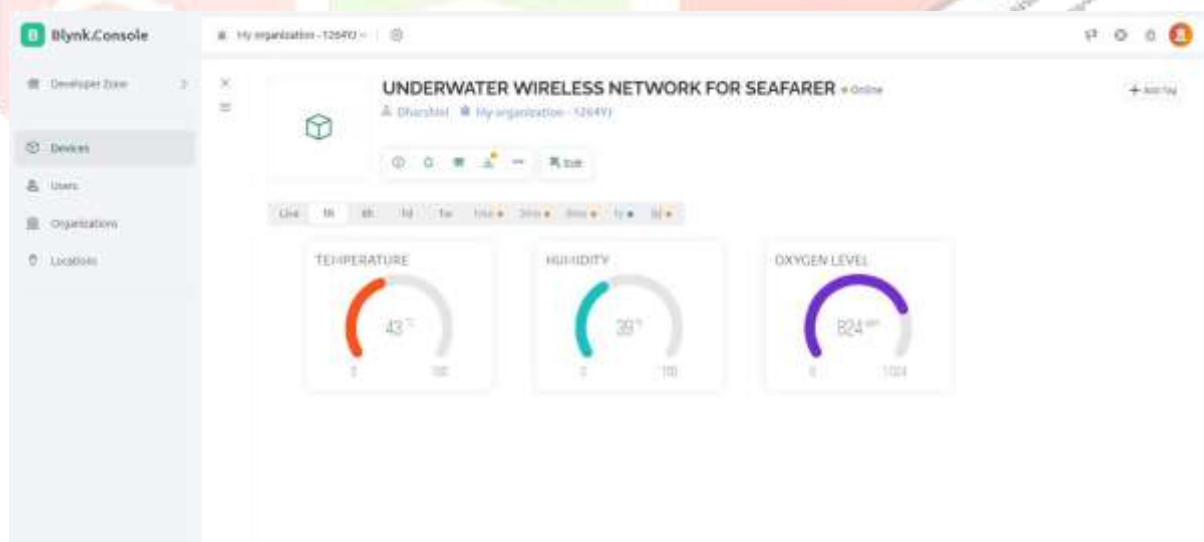




Figure 6.2 IOT Display

Abbreviations and Acronyms

IOT	-	Internet of Things
AI	-	Artificial Intelligence
NLP	-	Natural-Language Processing
WHO	-	World Health Organization
GPS	-	Global Positioning System
GPRS	-	General Packet Radio Service
GSM	-	Global System For Mobile Communication
SLS	-	Security Lock System
SES	-	Safety Engine System
FSR	-	Force Sensing Resistor
MQ3	-	Breath-Analyser
ADXL355	-	Accelerometer
API	-	Application Programming Interface
SVM	-	Support Vector Machine
GUI	-	Graphical User Interface
HMI	-	Human Machine Interface
UV	-	Ultrasonic Sensor

3.1 Maritime environment

The maritime environment presents intricate challenges in the field of maritime safety including poor connectivity, unpredictable weather, and the requirement for robust communication systems. Let S represents the maritime environment characterized by vastness and unpredictability oceans and seas then challenges in Maritime Safety (MS) attributed by expansive nature Communication Infrastructure (CI) required to cover maximum distance efficiently within S to ensure reliable and immediate information sharing and it is represented. The framework acknowledges that innovation is necessary to address enduring problems like cybersecurity, bandwidth optimization, and dependability. The proposed framework uses edge computing to recognize the need to process data closer to its source. It will achieve low-latency necessary for navigation, emergency response, and collision avoidance. The proposed framework with incorporation of edge computing to address the cybersecurity, bandwidth optimization and dependability.

3.2 Maritime wireless communication (MWC)

Oceans and seas are large and challenging environments in which MWC are utilized to enable safe, effective, and coordinated activities. These communication systems are essential to ships, coastal stations, and marine authorities because they enable sensitive operations like emergency response, navigation, coordination, and information exchange. A variety of technologies and protocols are available in the MWC space, with the goal of addressing the unique challenges posed by the constantly shifting maritime environment. Mathematically the challenging environment of maritime is employed.

Where, S represents the unpredictable and vast oceans and seas and MWC represents Maritime Wireless Communication. One of the fundamental components of Wireless Communication in the maritime environment is satellite communication. Satellites in orbit around the Earth give global coverage, allowing ships to communicate anywhere they are, even over very long distances. This technology is necessary for weather reporting, maritime safety, coordination, and reliable long-range communication. Because UHF and VHF radio communication technologies are so effective at communicating over short to medium distances, they are widely used in maritime settings. In particular, VHF radio is a widely used tool for ship-to-ship and ship-to-shore communication. Applications such as navigation, distress signals, and maritime coordination make extensive use of it.

3.3 Cyber-physical attacks

MWC are used for the functioning of various systems within the maritime industry, including navigation, control, monitoring, and communication. As per Maritime Cyber Attack Database (MCAD), the numbers and regions of known cyber-attacks in Maritime. Cyber-physical attacks on MWC have serious consequences, potentially leading to navigation errors, communication breakdowns, and compromised safety. Following are the major types of cyber-physical attacks that are used to target MWC.

3.4 Problem formulation

The dynamic and expansive features of maritime environments, characterized by large and frequently unreachable oceans and seas, present distinct problems for the maritime safety area. Wireless communication networks are the core components of coastal stations, and maritime authorities to communicate securely and effectively. MWC system is used for emergency response, coordination, and navigation; however, several

issues including bandwidth optimization, cybersecurity, and dependability still exist. Marine organizations rely on communication methods, such as satellite communication and VHF/UHF radio, there is an increased requirement for reliable and fast information sharing. By giving real-time information on vessel positions, courses, and speeds, technologies like the AIS improve safety by making navigation and collision avoidance easier. In order to prevent accidents and guarantee the general safety of maritime activities, the dynamic maritime environment necessitates constant innovation in communication systems.

3.5 Drawback

- Due to the potential for wireless communication anomalies and hazards to endanger public safety, it is imperative to develop a preventive framework.
- There is a regularization impact of dropout during training and the same is not present during the validation set evaluation.
- Efficacy in interpreting complex datasets and identifying patterns that indicate anomalies.

IV. RESULTS AND DISCUSSION

In this project proposes an Underwater Wireless Network for Seafarer was implemented. The development of an underwater wireless network for seafarers utilizing components such as the 5V power supply, MAX30100 sensor, gas sensor, Arduino Uno Microcontroller, NodeMCU, sound sensor, temperature sensor, humidity sensor, buzzer, and the Blynk app has proven to be a significant advancement in underwater communication, safety, and data monitoring. The Arduino Uno microcontroller and NodeMCU serve as central processing units, enabling efficient data processing and transmission within the network. This network offers real-time monitoring of environmental conditions, and vital signs, empowering seafarers with immediate access to critical information. The integration of gas sensors ensures the safety of individuals by detecting and alerting them to dangerous gas levels. The sound, temperature, and humidity sensors provide comprehensive environmental monitoring, while the buzzer generates alerts based on specific sensor readings. The Blynk app serves as an intuitive interface for remote access and control of the network's data. Together, these components create a robust and reliable underwater wireless network that enhances the safety, communication, and efficiency of seafarers in challenging underwater environments.

FUTURE SCOPE

Underwater Wireless Networks have a promising future scope for seafarers. These networks improve maritime safety by facilitating real-time data exchange between vessels, enabling them to share vital information and respond quickly to potential risks. They also hold great potential for underwater exploration and research, allowing seafarers and scientists to transmit large volumes of data in real-time, aiding in the study of marine ecosystems and underwater infrastructure. Furthermore, Underwater Wireless Networks support the use of underwater robotics and autonomous systems, enabling remote guidance and monitoring of underwater operations. Overall, these networks have the potential to revolutionize communication and enhance efficiency in the maritime industry.

V Acknowledgment

The preferred spelling of the word “acknowledgment” in American English is without an “e” after the “g”. Avoid the stilted expression, “One of us (R.B.G.) thanks...” Instead, try “R.B.G. thanks”. Put applicable sponsor acknowledgments here; DONOT place them on the first page of your paper or as a footnote.

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