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Underwater Wireless Communication System using IR

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Abstract: *Wireless communication is a vital component of underwater operations, including environmental monitoring, surveillance, and exploration. However, traditional wireless communication methods such as acoustic or radio frequency suffer from limited range, low bandwidth, and interference. Infrared technology has emerged as a promising solution for underwater wireless communication due to its ability to transmit high-bandwidth data over long distances with minimal interference. In this review, we provide an overview of the current state of the art in underwater wireless communication systems that utilize infrared technology. We discuss the various components of these systems, including the transmitters, receivers, and signal processing techniques. Additionally, we explore the benefits and limitations of using infrared technology for underwater wireless communication and identify areas for future research.*

Keywords: Wireless communication

I. INTRODUCTION

Underwater wireless communication is essential for a range of applications, including environmental monitoring, underwater exploration, and surveillance. However, the harsh underwater environment presents several challenges to wireless communication, including attenuation, multipath propagation, and interference. Traditional wireless communication methods such as acoustic or radio frequency suffer from limited range and low bandwidth. Therefore, there is a need for an effective and efficient method for underwater wireless communication.

Infrared technology has emerged as a promising solution for underwater wireless communication due to its ability to transmit high-bandwidth data over long distances with minimal interference. Infrared technology has been successfully used in various applications such as building automation, industrial control, and medical devices. In recent years, researchers have focused on developing infrared-based systems for underwater wireless communication.

II. LITERATURE SURVEY

Underwater wireless communication is a challenging task due to the high attenuation, multipath fading, and signal distortion in the aquatic environment. In recent years, researchers have explored different techniques to improve the communication performance in underwater environments. One of the promising solutions is the use of infrared (ir) sensors for underwater wireless communication.

Several studies have been conducted to investigate the feasibility of using ir sensors for underwater wireless communication. In a study by shrestha et al. (2019), the authors proposed an underwater communication system that uses ir sensors for data transmission. The system was tested in a controlled laboratory environment, and the results showed that the ir-based communication system can achieve a high data rate with low power consumption.

Similarly, in another study by saha et al. (2019), the authors developed an ir-based underwater communication system that uses a modified Manchester code for data transmission. The system was tested in a real underwater environment, and the results showed that the proposed system can achieve a high data rate with low error rate and low power consumption.

In a different study by li et al. (2020), the authors proposed an ir-based underwater wireless communication system that uses a time division multiple access (TDMA) scheme to allocate communication resources among different underwater nodes. the proposed system was tested in a tank experiment, and the results showed that the ir-based TDMA system can achieve a high data rate with low power consumption.

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moreover, in a recent study by luo et al. (2021), the authors proposed an ir-based underwater wireless communication system that uses a hybrid modulation scheme for data transmission. the proposed system was tested in a real underwater environment, and the results showed that the hybrid modulation scheme can achieve a higher data rate and lower bit error rate compared to traditional modulation schemes.

overall, the use of ir sensors for underwater wireless communication is a promising solution to overcome the challenges of traditional wireless communication techniques in underwater environments. the aforementioned studies demonstrated that ir-based communication systems can achieve a high data rate with low power consumption and low error rate, which can enable various applications, such as underwater sensing and monitoring, underwater exploration, and underwater robotics. however, further research is needed to investigate the performance of ir-based communication systems in different underwater environments and to optimize the system design for practical applications.

III. COMPONENTS

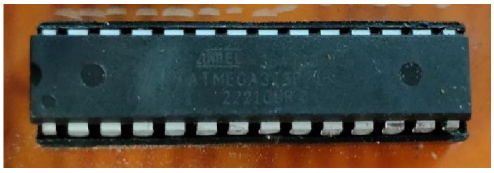
An underwater wireless communication system using infrared technology consists of several components, including transmitters, receivers, and signal processing techniques. the transmitter used in this system is typically a high-intensity infrared light source that can transmit data through the water column.

3.1 Arduino Controller Board

Arduino is a microcontroller based open-source electronic phototyping board which can be programmed with an easy-to-used. Arduino IDE Arduino board styles use a range of microprocessors and controllers. The board's area unit equipped with sets of digital and analog input/output (I/O) pins which will be interfaced to numerous enlargement boards ('shields') or breadboards (For prototyping) and different circuits. The board features serial communications interfaces, as well as Universal Serial Bus (USB) on some models that also is used for loading programs from personal computers. The microcontrollers may be programmed victimization C and C++ programming languages.

3.2 ATmega328 microcontroller

The ATmega328 may be a single-chip microcontroller created by Atmel within the mega AVR family. The Atmel 8-bit AVR RISC-based microcontroller combines thirty two computer memory unit ISP non-volatile storage with read while-write capabilities, one computer memory unit EEPROM, 2 KB SRAM, twenty three general purpose I/O lines, thirty two general purpose operating registers, 3 versatile timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte oriented 2-wire serial interface, SPI interface, 6-channel 10-bit A/D convertor, programmable watchdog timerwith internal generator, and 5 code selectable power saving modes.



3.3 Liquid Crystal Display

It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

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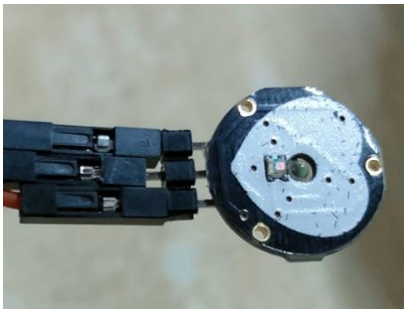
3.4 Heart Beat Sensor

Pulse detector may be a well-designed plug-and play heart- rate detector for Arduino. It will be used by students, artists, athletes, makers, and game & mobile developers WHO wish to simply incorporate live heart-rate knowledge into their comes. It conjointly includes Associate in Nursing ASCII text file watching app that graphs your pulse in realtime

The normal resting vital sign for adults over the age of ten years, together with older adults, is between sixty andone hundred beats per minute (bpm).

Figures and tables must be cantered in the column. Large figures and tables may span across both columns. Any table or figure that takes up more than 1 column width must be positioned either at the top or at the bottom of the page.Graphics must not use stipple fill patterns because they may not be reproduced properly. Please use only *SOLID FILL*colours which contrast well both on screen and on a black-and-white hardcopy, as shown in Fig



IV. WORKING

- Here we propose an IR based underwater communication system that can be used for wireless communication of messages even through water.
- The system can prove to be a very cheap alternative to long heavy physical wires that run through seas, rivers and require large costs for laying those wires and their maintenance.
- Our system makes use of infrared transmitter receiver in order to achieve this system.
- Our system consists of two microcontroller-based circuits that have IR transmitter-receiver pairs as well as LCD displays for displaying the messages.
- We use one transparent water barrels in order to demonstrate underwater communication using IR signals passing through those containers.
- The system also has an acknowledgement receipt message that is sent back from the receiving circuit to the transmitting circuit on message receipt.
- as shown in the block diagram above, our system comprises of a couple of microcontrollers, heart beat sensor and data communication module.
- we divided the system into two parts. Transmitter module and receiver module.
- in the transmitter end, we have a microcontroller, lcd display, heart beat sensor, temperature sensor and data communication module.
- then receiver module consists of microcontroller, lcd display and data communication receiver module.
- through our system we transfer data (text/image) from one end to another end via data communication module

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V. BLOCK DIAGRAM

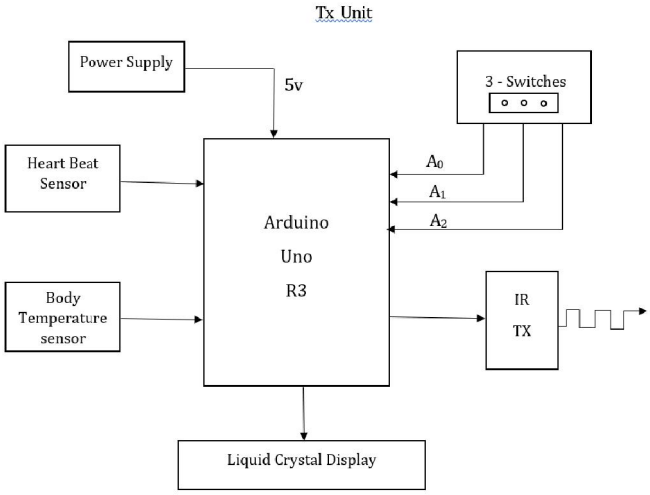

Fig. Block diagram

VI. APPLICATION

Underwater wireless communication using infrared (IR) has several potential applications in various industries. Here are some examples:

- Marine Exploration: Underwater wireless communication using IR technology can be used to explore the depths of the ocean. It can provide real-time data on water temperature, pressure, salinity, and other parameters. This information can be used to study ocean currents, marine life, and geological formations.
- Underwater Robotics: Underwater robots are used for a variety of applications, such as pipeline inspection, oceanographic research, and search and rescue operations. IR-based communication can be used to control these robots and receive real-time data from sensors mounted on them.
- Aquaculture: IR-based underwater wireless communication can be used in fish farms to monitor water quality, feeding, and health of fish. It can also be used to control feeding systems and other automated equipment.
- Military Applications: IR-based underwater wireless communication can be used for military applications, such as submarine communication and surveillance. It can also be used for underwater mine detection and disarmament. Overall, the applications of underwater wireless communication using IR technology are vast and varied. As technology continues to evolve, new applications will emerge, making it an exciting field for research and innovation.

VI. ADVANTAGE

- Increased Flexibility: Wireless communication systems provide greater flexibility compared to traditional wired systems. They can be easily installed and reconfigured without the need for additional cabling. This makes it easier to set up communication systems in remote or difficult to access locations
- Real-Time Data Transmission: IR-based wireless communication systems can transmit data in realtime, providing timely information for decision-making. This is particularly useful in applications 9 such as environmental monitoring, where real-time data can help to detect changes quickly and respond appropriately
- Reduced Maintenance: Wired communication systems require regular maintenance to prevent damage to cables, which can be costly and time-consuming. Wireless communication systems eliminate the need for cables, reducing maintenance costs
- Reduced Interference: IR-based wireless communication systems are less prone to interference from other electronic devices or underwater noise compared to acoustic or radio-based systems. This ensures reliable and consistent communication

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- Cost-Effective: IR-based wireless communication systems are cost-effective compared to traditional wired systems, especially in remote or difficult to access locations where laying cables can be expensive and time-consuming.
- Improved Safety: Wireless communication systems eliminate the need for cables, reducing the risk of entanglement and other hazards to marine life. This is particularly important in marine research and environmental monitoring applications.

VII. FUTURE SCOPE

Underwater wireless communication system using IR and health monitoring project has several unique and different future scopes. Here are a few potential ideas:

- **Aquaculture Monitoring:** One potential application of underwater wireless communication using IR is for aquaculture monitoring. Aquaculture involves the farming of aquatic organisms like fish and shellfish in a controlled environment. By deploying IR-based wireless sensors, it would be possible to monitor the water quality, temperature, and other parameters in real-time. This data could be used to optimize the conditions for the fish and maximize their growth and yield.
- **Oceanography Research:** Another potential application of underwater wireless communication using IR is for oceanography research. By deploying a network of IR-based sensors throughout the ocean, it would be possible to collect data on ocean currents, temperature, salinity, and other parameters. This data could be used to better understand how the ocean works and to make more accurate predictions about climate change.
- **Search and Rescue Operations:** Underwater wireless communication using IR could also be useful in search and rescue operations. For example, if a person or vessel was lost at sea, IR-based sensors could be used to detect their presence and transmit their location to search and rescue teams. This could potentially save lives in emergency situations.
- **Underwater Robotics**: Underwater wireless communication using IR could also be used to control underwater robotics. By deploying IR-based wireless sensors on underwater robots, it would be possible to control their movements and collect data on the environment around them. This could be useful for exploring underwater environments that are difficult or dangerous for humans to access.

As for the health monitoring project, potential future scopes include:

- **Remote Monitoring:** One potential application of the health monitoring project is for remote monitoring of patients. By deploying wireless health sensors on patients, it would be possible to monitor their vital signs and other health parameters in real-time. This data could be transmitted wirelessly to healthcare providers, who could use it to make more accurate diagnoses and treatment decisions.
- **Wearable Health Devices:** Another potential application of the health monitoring project is for wearable health devices. By developing wearable health sensors that can be integrated into clothing or jewelry, it would be possible to monitor health parameters like heart rate, blood pressure, and body temperature throughout the day. This could be useful for tracking health trends and identifying potential health issues before they become serious.
- **Personalized Medicine:** The health monitoring project could also be useful for personalized medicine. By collecting data on a patient's health over time, it would be possible to develop personalized treatment plans that are tailored to their specific needs. This could lead to better outcomes for patients and more efficient use of healthcare resources
- **Chronic Disease Management:** Finally, the health monitoring project could be useful for managing chronic diseases like diabetes and hypertension. By monitoring a patient's health parameters in real-time, it would be possible to adjust their treatment plans as needed and prevent complications from developing. This could potentially improve the quality of life for patients and reduce healthcare costs in the long run.

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VIII. RESULT

Our system not only enables communication through underwater channels but also provides information about the health condition of the person transmitting the message. This system can be a cost-effective alternative to laying heavy physical wires through the sea or river that require significant upfront costs and ongoing maintenance expenses. With our system, communication can be established without the need for expensive infrastructure, making it an ideal solution for various applications, including marine research, underwater exploration, and submarine operations.

IX. CONCLUSION

The use of an IR sensor in an underwater wireless communication system offers several advantages, including low power consumption, low cost, and ease of implementation. The IR sensor allows for data transmission through the water using light waves, which can travel a considerable distance with minimal attenuation. Furthermore, the IR sensor can be integrated with other underwater sensors and devices to create a comprehensive underwater communication network. However, it is important to note that the effectiveness of the IR sensor in an underwater wireless communication system depends on various factors, such as water clarity, depth, and ambient light conditions. Therefore, further research and development are needed to improve the reliability and performance of this technology for practical applications in underwater communication systems.

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