IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Design and Development of Underwater IoT Node and Floating Gateway

[1]Chinju Paul, [2] Ambily Francis,

[1]Mtech student, [2]Asst professor

[1]Mtech- Embedded Systems,

[1] Sahrdaya College of Engineering& Technology (SCET), Thrissur, India

***Abstract:*** Underwater wireless communication is a method of sending and receiving messages through water. The idea of wireless underwater communication technology is a progressing area in communication. Research has been active for over a decade on developing different methods for wireless underwater transmission. The purpose of this paper is to introduce a underwater wireless communication system with better data rates and in an easy manner by developing an IoT node and a floating gateway. The users can access the system by giving desired username and password in the webpage and give commands to the IoT node through the floating gateway. Floating unit, placed on the surface of water can act as a gateway between the user and the IoT node. The IoT node is placed on the bottom portion of water. The user can give commands to the RF transmitters in floating unit and then it transmits a signal to the receiver in IoT node and it will perform the application from the user. So here developing a underwater wireless communication system which can have a lot of underwater applications such as underwater valve controlling , underwater explosion etc. .

***Index Terms -*** underwater wireless communication, floating gateway, remote access, RF communication

## I. INTRODUCTION

This project proposes a system which is used for underwater wireless communication. Compared to terrestrial wireless communication, the underwater wireless communication is very difficult to achieve. So here introducing an iot node and a floating gateway to make the communication more effective with a better data rate and in a cost effective manner. Earth is a watery planet and two thirds of it is covered by water. So communication through water has great importance in the communication area. Underwater communication technology has become a fast growing area, with wide applications in commercial and military under water based systems . Underwater communications systems are very useful in remote control of off-shore oil industry, environmental pollution monitoring, scientific data collection from ocean bottom stations, disaster detection , early warning, , intrusion detection , underwater surveillance, national security and new resource discovery. The research area related with underwater wireless communication system techniques has a great importance in exploration of oceans and aquatic environments. Compared with terrestrial wireless communications, the underwater wireless communication channels in networks can be affected by the marine environment, by limited bandwidth, by noise , power resources, and by the underwater ambient conditions. So the underwater communication system undergoes , multi path effect , power resources, severe attenuation etc, which can make the underwater communication network into the most complex and hardest wireless channels in the nature. When facing this conditions in the underwater applications, a lot of challenges, which are not affected by the terrestrial communication systems, are coming up in the underwater wireless system , RF and optical communications for future underwater wireless communication systems. In such challenges, optical and acoustic are the most competing, and interrelated ones , due to the potential for long range and high bandwidth networked communications in size and power-constrained modems and unmanned systems. So here developing a wireless underwater communication system which can be used for the underwater valve opening and closing systems with better data rates , low cost and in an easy manner.

## 2. RELATED WORKS

The first paper gives an overview of the key developments in point to point communication techniques as well as underwater networking protocols since the beginning of this decade. It provide an insight into some of the open problems and challenges facing researchers in this field in the near future[1]. The paper that says about the possibilities of underwater communication and the new researches in underwater wireless communication techniques[2]. This work says about the high demand for underwater communication systems due to the increase in current human underwater activities[4]. The paper related with military underwater activities which require stealth operations, and hydro acoustic transmissions might temper the mission. For this reason, military underwater acoustic transmission aims for low probability of detection[5]

## 3. PROPOSED SYSYTEM

### 3.1. Block Diagram

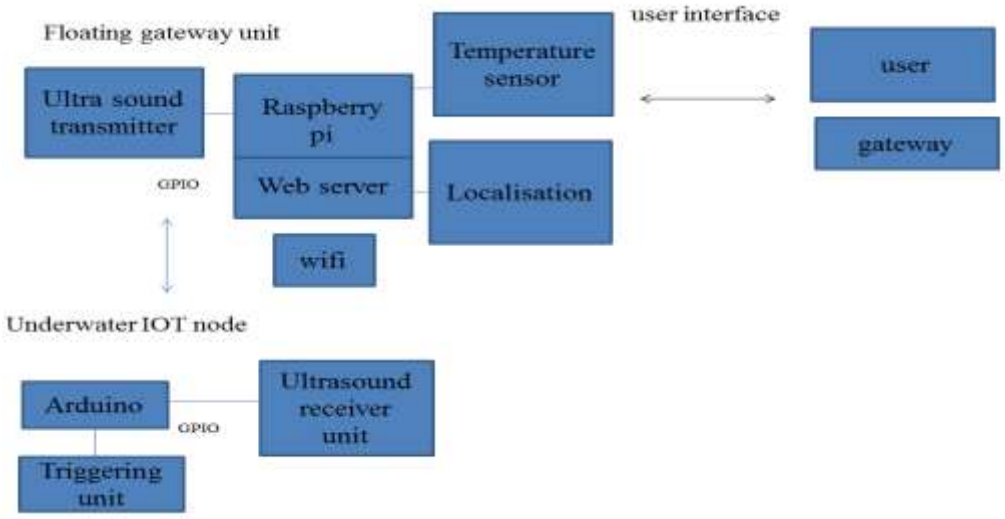


Fig 1: Block diagram of proposed system.

The system consist of mainly three sections . A floating gate way , an underwater IoT node and a user interface. This system mainly designed to make an underwater communication. Here the IoT node section actually act as a receiver and the floating gate way is the transmitter. The user can give commands and can control the IoT node through the floating gateway.

The floating system mainly contains a ultrasonic transmitter, raspberry pi, wifi module, temperature sensor, GPS. A webserver is created on the raspberry pi so the user can control the system. The user need to give a the username and password to access the system then user get the temperature reading and the location of the system. After that the user can have the buttons that created in the webpage so user can give commands through that . When user press the button, ultrasonic transmitter in floating unit sends a radio frequency signal of 50-200khz frequency signal to the IoT node. So by using this system we can provide a triggering in the IoT node by using the floating gate way. For different buttons we use different triggering unit. In the underwater pipeline systems we use this system to open and closing the valves of the pipelines. Here we are using four channel RF transmitter, that have four different signals having same frequency and by using all these channels parallel the data rate can be increased. By increasing the number of channel we can increase the speed of the system. Here the systems are connected to a wifi system so the distance that can be achieved between the user and floating gateway unit is 10m. But it can be extendable. If we are using satellite communication system then the user can access the system from anywhere in the world. The distance of RF transmitter used here is 14m. By using powerful transmitters like M64 modem we can increase the data rate and the distance of the system . All these modules have wireless connections . For communicating with the user interface we use a web server and client server programming. A GPS module is placed here to locate the position of floating unit. Temperature sensor monitors the general condition of the water.

### 3.1 System Design

Ultrasonic transmitter used to transmits sound waves to the receiver section. Here a four channel RF transmitter is used. A waterproof temperature sensor cable is used to obtain the temperature of the water in degree Celsius. The GPS is a location tracker for identifying the location of floating unit. Raspberry pi and arduino are the main component in each units and they are used to control all the other modules in the system. A webserver is created on the raspberry pi and is accessible to the user. A wifi module is there to provide internet connectivity to the system.

.

## 5. EXPERIMENTAL RESULT

As a result we obtained a low cost underwater wireless communication system with remote accessing features. They are commonly used for controlling the underwater pipeline valves with a data rate of 1kbps data rate. The user can access the system and can monitor the general water condition like temperature and position . Here user can access the remote control of the system and give commands to the raspberry pi and monitor the system.

### 4.1 Stage- 1 Results

In the first stage the IoT node is created . Fig 2 shows the program used in the arduino. The triggering unit consist of 4 leds which is given according to the signals from RF transmitter. So this is the program used to blink different leds (light emitting diodes) according to the signal and blinking led means transmitting a data from the RF transmitter, which is given by the user through webpage . Here a wireless communication is established

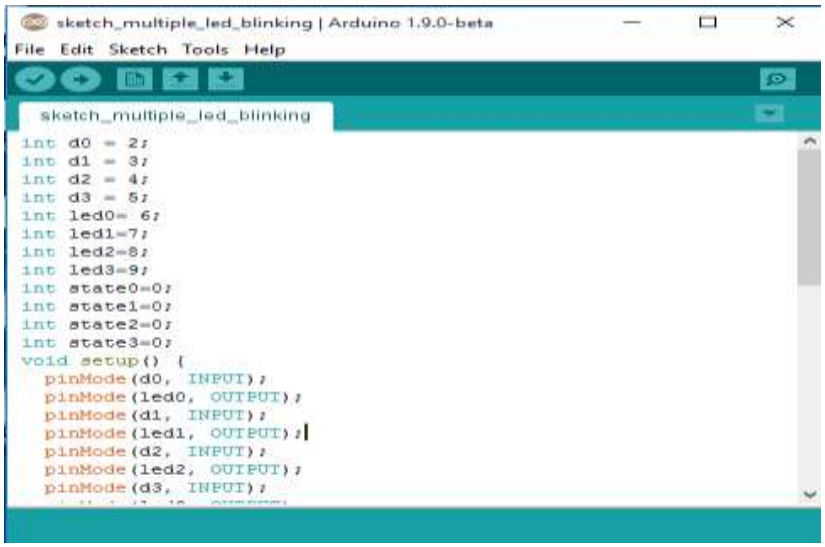


Fig 4: program used in arduino

In fig 3 the testing of IoT node is seen. In the first stage the IoT node is created and tested with the RF transmitter . In this step actually the transmitter pressed manually then the led blinks corresponding to the buttons present

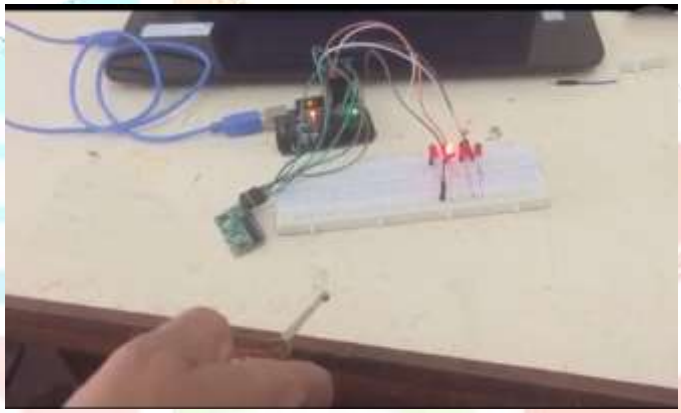

Fig. 3. Underwater IoT node

### 4.2 Stage- 2 Results

In the second stage webserver is created on the raspberry pi. For remote access , some webpages created by using a software webiopi. This software used to control and access the GPIO pins, sensors attached to the raspberry pi. The html code used here to create the webpages. Fig 4 shows the first webpage contain the name and password column. The user need to give desired user name and password and can access the system. Four webpages are created here. After accessing the system the user can know the temperature and position of the floating unit and get the control of the RF transmitter.

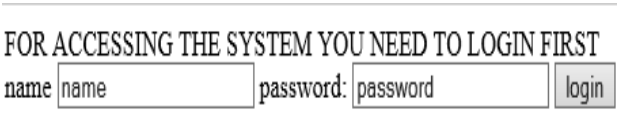


Fig. 4. First webpage for user

### 4.3 Stage- 3 Results

In this section the floating gate way is created and establishes a wireless connection with the user. Here a client server programming used. The IoT node crated is placed on the bottom of water and floating gateway placed on the water surface. User is about 10m distance from floating unit. And distance between IoT node and floating unit is 14m. The user access the webpage and give commands to the RF transmitter he transmitter send a signal to receiver section and corresponding led will blink. So here a wireless underwater communication is established with 1kbps data rate.

## 5. CONCLUSION

The purpose of this paper is to develop a underwater wireless communication system with better data rates and in an easy manner by developing an IoT node and a floating gateway. This system can be used for effective underwater applications ,the cases which needs wireless communication like underwater pipeline valve opening we can use this type systems. The data rates are better than other communication system and it is comparatively easy to operate. The user can control the system under the water so it's a simple way to provide communication with the modules inside the water. In many cases wired communication is not possible so we can use this type of systems to communicate under the water

.

**ACKNOWLEDGEMENT**

I wish to record my indebtedness and thankfulness to all those who helped me prepare this report titled Design and development of underwater IoT node and floating gateway and present it in a satisfactory way. First and foremost I thank God Almighty for His providence and for being the guiding light throughout the seminar. I want to start expressing my thanks to my internal guide Ms. Ambily francis, Asst. professor, Dept. of Electronics and Communication Engineering for the valuable advice and guidance towards this work and my project coordinator Dr. K R Joy Professor, Dept. of Electronics and Communication Engineering. I received motivation; encouragement and hold up from them during the course of work.

**REFERENCE**

[1] Mandar Chitre Shiraz Shahabudeen Acoustic ResearchLaboratory, National University of Singapore "Underwater Acoustic Communications and Networking: Recent Advances and Future Challenges" Marine Technology Society Journal 2008 Volume 42, Number 1

[2] Kenneth P. Hunt, James J. Niemeier, Anton Kruger, " RF Communications in Underwater Wireless Sensor Networks" IEEE conference 2010

[3] Jianguang Shi1, Shengye Zhang2, Can-Jun Yang , "High Frequency RF Based Non-contact Underwater Communication" IEEE conference 2011

[4] Xi Zhang, Jun-Hong Cui, Santanu Das ,Mario Gerla, Mandar Chitre "Underwater wireless communications and networks: theory and application: part 1" IEEE Communications Magazine November.2015

[5] Camila M. G. Gussen, Paulo S. R. Diniz, Marcello L. R. Campos, Wallace A. Martins, Felipe M. Costa, and Jonathan N. Gois "A Survey of Underwater Wireless Communication Technologies" Journal Of Communication And Information Systems, VOL. 31, NO. 1, 2016.

[6] Harsh Vardhan Sharma, Neeraj Manglani "Underwater Communication Systems: A Review" International Journal of Science, Engineering and Technology , 2017, Volume 5 Issue 3

[7] Roee Diamant, Lutz Lampe, and Emmett Gamroth "Bounds for low probability of detection for underwater acoustic communication" IEEE Journal Of Oceanic Engineering, Vol. 42, No. 1, January 2017

[8] Salma M. Maher, Ziad M. Ali, Haitham H. Mahmoud, Sameh O. Abdellatif, Mohammad M. Abdellatif , " Performance of RF underwater communications operating at 433 MHz and 2.4 GHz" International Conference on Innovative Trends in Computer Engineering (ITCE'2019) 4 February 2019

**BIOGRAPHY**

**Chinju Paul** received Bachelor of Technology in Electronics and Communication Engineering from University of Calicut, Kerala, India in 2018. She is currently doing her Master of Technology in Embedded Systems at Sahrdaya College of Engineering and Technology, Kerala Technological University, Kerala, India. Her research interest includes wireless communication, Deep learning and artificial intelligence.
Email: chinjupaul96@gmail.com

**Ambily Francis** received Bachelor of technology in Electronics and Communication Engineering from MG University, Kerala in 2008, M..Tech from MG university in 2012 and she is currently doing her PhD in Electronics and Communication Engineering, Karunya University, India . She is working as Assistant professor in the department of Electronics and Communication Engineering at Sahrdaya College of Engineering and Technology, Kerala. She has 8 years of teaching experience. Her area of research is Medical Image Processing.
Email: **ambilyfrancis@sahrdaya.ac.in**

.