LI-FI BASED DATA TRANSFER IN UNDERWATER SYSTEM

[1]Nakkramayana Vamshi, [2]Mudavath Sampath, [3]Vavilala Hitesh, [4]Swetha Tarigoppula

[1]Bachelor Of Technology, [2]Bachelor Of Technology, [3]Bachelor Of Technology, [4]Assistant Professor

[1]Department Of Electronics and Communication,
[1]Nalla Narasimha Reddy Education Society's Group Of Institutions Hyderabad,India
[1]vamshinakkaramayana@gmail.com, [2]sampathmudavath05@gmail.com,
[3]hiteshnani399@gmail.com [4]swethatarigoppula@gmail.com

***Abstract*—This Nowadays there is research related to underwater data transfer using li-fi. Li-Fi means light fidelity it is a visible light communication. It consists of LED'S and photo sensors. Here LED is used as transmitter and photo sensor is used as receiver. Here we are using light to *encode* data in binary form i.e., 1's and 0's. It is used to transfer data like text images underwater by using visible light communication.**

Keywords—LED, Photodetector, Underwater, MATLAB Software, LI-FI, Visible light Communication.

I INTRODUCTION

Li-Fi means light fidelity is fallout in the twenty-first century. The idea beyond this technique is to transfer data through LED whose quality varies even faster than the human eye. Here the transmission of data takes place by light emitting diode (LED). It is the latest version of Wi-Fi. The advantage of this wireless communication is its cost. Here led turned ON & OFF quickly because the reaction time of the LED is less than 1microsecond it cannot appear to the human eye because of a continuous beam of light. Sohe changing from ON state to OFF state transfers data. Here the ON state is represented by binary form 1, and the OFF state is represented by 0. A photodetector is used to receive the data from the led and it gives the original data. Li-Fi is a technology related to Wi-Fi, but here we are using light to transfer data. The advantages of Li-Fi over Wi-Fi are high speed, low cost, and efficiency. Li-FI uses visible light communication which takes more information and it is a solution for RF signals. Li-Fi provides better performance and security than Wi-Fi, underwater light penetrates and isn't observed by water and there are no interfaces. Here we are using MATLAB software to transfer data underwater by using Li-Fi. In LI-FI the data does not pass through walls so the data is sent very safely. In wifi the data we sent in underwater will somewhat observed by water and sometimes interference will occurs because of radio frequency signals and data will be accessed very easily by hackers so in that place of wifi we replaced by li-fi. By using li-fi there is no interface and absorption in water because light is not more absorbed by water.Like sound signals and RF signals are absorbed by water so we are using lifi which is more efficient. The figure 1 talks about underwater communication, how data is transferred and received by using light. In this paper we will discuss about LI-FI,and li-fi communication in underwater by using a led and photo detector where transmitter i.e light is placed inside the water and receiver i.e photo detector is placed inside the water. In this the noise is added to modulating signal i.e Bit error ratio and Noise ratio which is removed in this by using filters

F

Fig. 1. Underwater Communication

II LITERATURE REVIEW

In this project data is transmitted by using led and received by photo sensor..from[1]. H. Kaushal and G. Kaddoum, ''Underwater optical wireless communication,'' *IEEE Access*, vol. 4, pp. 1518–1547, 2016 we learnt that the electrical signal is converted to light signal at the transmitting end, and the light signal into an electrical signal underwater the audio is transmitted through the LED and received by the underwater sensor. Here we are using OOK modulation, li-fi can transfer text images, and data perfectly with a transmission distance the quality of the text sent underwater is calculated by character error rate (CER), and the quality of image transmission is calculated by bit error rate(BER).[2] fromN. Saeed, A. Celik, T. Y. Al-Naffouri, and M.-S. Alouini The system has transmitted that emits light in the direction of the receiver so here is the conversion of data from electrical to light signal. The receiver takes the light signal and converts it into an electrical signal in this technology we have increased speed, and more bandwidth.from [3] Z. Guo, Z. Li, and F. Hong learnt thatthe audio signal is transmitted through LED which is converted into digital values and these values are converted to red and green blue (RGB).from[4] J. M. Kahn and J. R. Barry,learnt that the RGB values are transmitted as light waves at the receiver submarines. In this underwater communication medium here we can use a laser as an alternative to led. The important things we should consider while designing li-fi are light and line of sight.Line of sight is nothing but it is a type of propogation in which the transmitter and receiver is placed in view with each other without any obstacles in between them because if there is any obstacle the data does not transfers.

III METHODOLOGY

Lifi technology transfers data in underwater communication.It is done by step by step.In this the existing one has noise, bit error rate is more and bandwidth is less. So in this proposed one we increased bandwidth and reduced noise and bit errorrate.

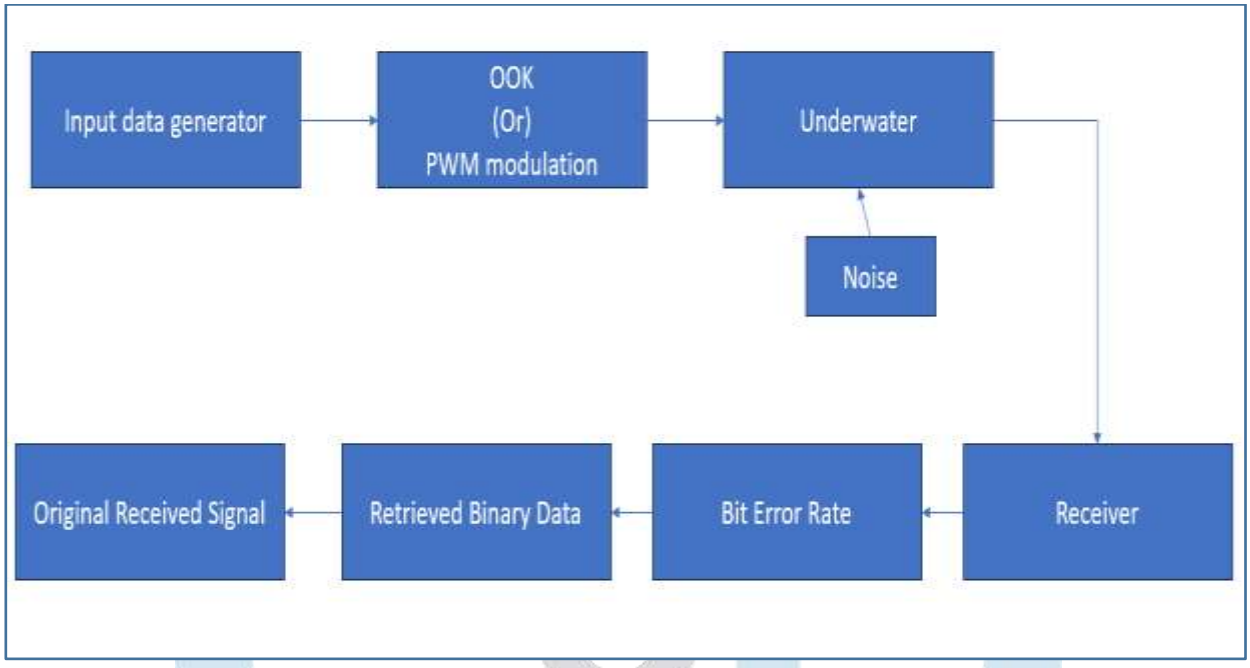

Fig. 2 Block diagram

TRANSMITTER

Firstly,the data i.e text or image or audio converts in to electrical signal and the signal is modulated andit is converted in to binary data.The binary data is formed is formed by light pulses through a modulation technique called ON-OFF keying (or) pulse width modulation(PWM).The light flickering conveys the binary data.The coverted light signal is goes in to underwater from underwater the light signal is falls on receiver section I.e on photo detector.In transmission we have:

3.1.1 INPUT DATA GENERATOR:

The data what we are sending (transmitting) I.e text,image or sensor data.After this the data we sent is encoded in to light signal

3.1.2 OOK(OR)PWM MODULATION:

OOK means that it represents binary data of the presence of [1] and absence of [0].The PWM means pulse width modulation it is used to modify the intensity of each led.For example,if we are transmitting a audio signal for that a sawtooth signal we got.the gotted sawtooth signal is compared with audio signal to generate the pwm signal.th.e signal is modulated and it is transferred by led as light

3.1.3 UNDERWATER:

In underwater the modulated signal of pwm I.e light is transmitted in to underwater.The light is combined with noise in underwater.

RECEIVER

In receiver the underwater modulated signal falls on photo detector it catch the modulation light signal acting as underwater ear attuned to the light language. And some noise combines in underwater will be calculated by Bit Error Rate.and got modulated signal without noise.The catched light signal is demodulated by transforming them back to electrical signal and recovering the original encoded data.By this process the encoded information gets in to its original form completely travels through water.LI-FI is more secure,efficient and high data transmission in underwater research and exploration. The light signal combined with noise is received by photo detector.The photo detector converts one form of energy in to another form that is from light signal in to elecric signal.

3.2.1 BIT ERROR RATE(BER);

It is the ratio of number of bits received in the error to the all number ofbits transferred/transmitted over a period of time.It is used to calculate the error.

3.2.2 RETRIVED BINARY DATA:

It is the data we got after the calculations of bit error rate.It is the data we got without noise in underwater. And this binary data is converted in to electrical form.

3.2.3 ORIGINAL RECEIVED SIGNAL:

It is the output we got at receiver section.It is the modulated signal we got in underwater without noise.

Iv. EXISTING OUTPUT

In existing output the bit error rate is more. In x-axis is signal to noise ratio isalso more.In y-axis we have bit error rate which is more the range of signal to noise ratio.In this the estimation of QPSK performance is done with and without coding is done.The efficiency of the signal is not much more .So we are doing this project to increase depth of communication. Another thing is to reduce underwater noise we are doing this.

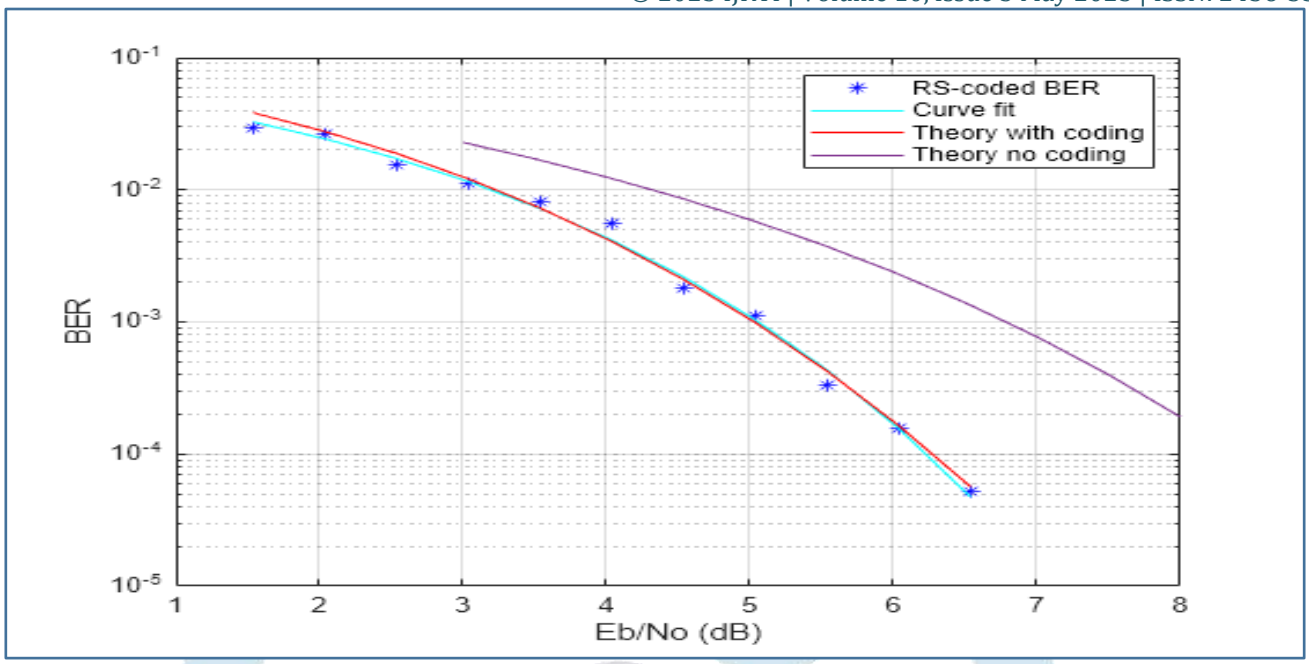

Fig. 3 Output of Eb to Bit error rate

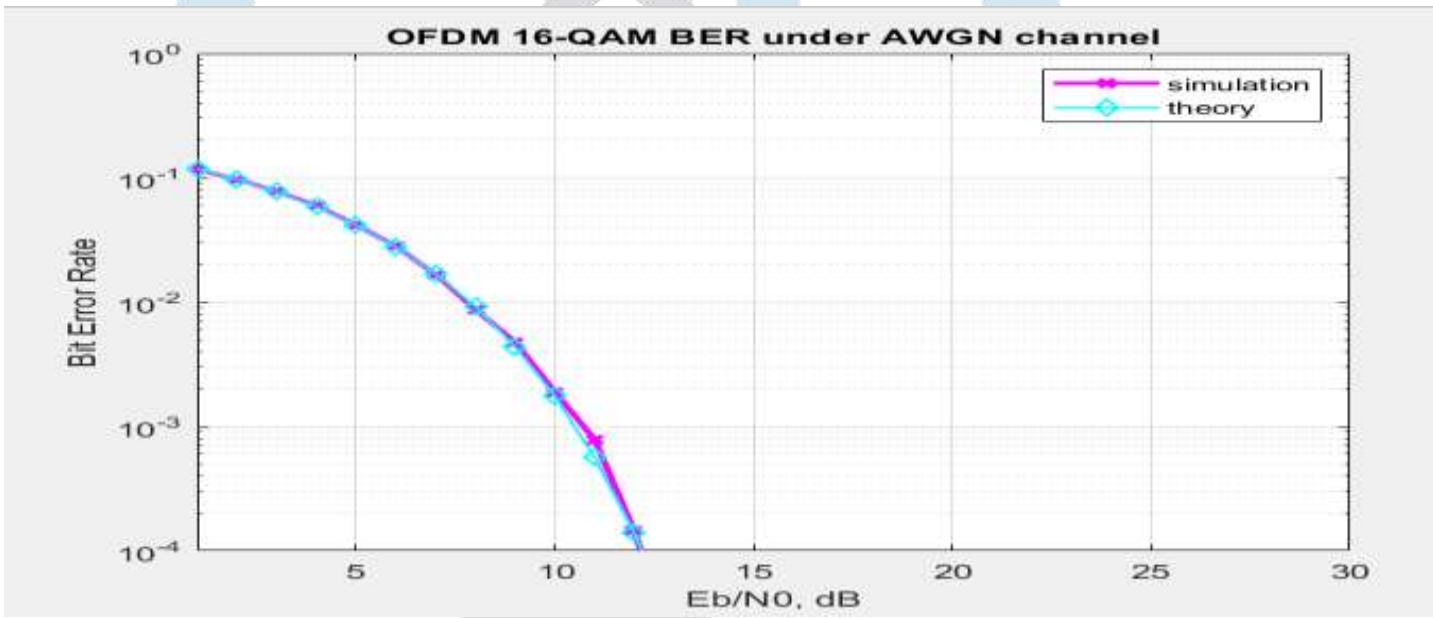

Fig.4 Output of Eb to Bit error rate

V. PROPOSED OUTPUT

This is the output of proposed system. In this we are using matlab software codeto do data transfer in underwater.The output of proposedsystem is shoun in fig(5)in this the x-axis is taken as signal to noise ratio and y-axis is taken as bit error rate this the bit error is reduced Here the signal to noise per bit (eb/no)is used to compare bit error rate performance.The formulae for finding bit error rate is :BER=NUM_ERRORS/LENGTH(DATA_BITS.The bit error rate is nothing but it is used to measurethe quantities the numbers of bit errors in the communication system.the ber is also expressed in percentage.

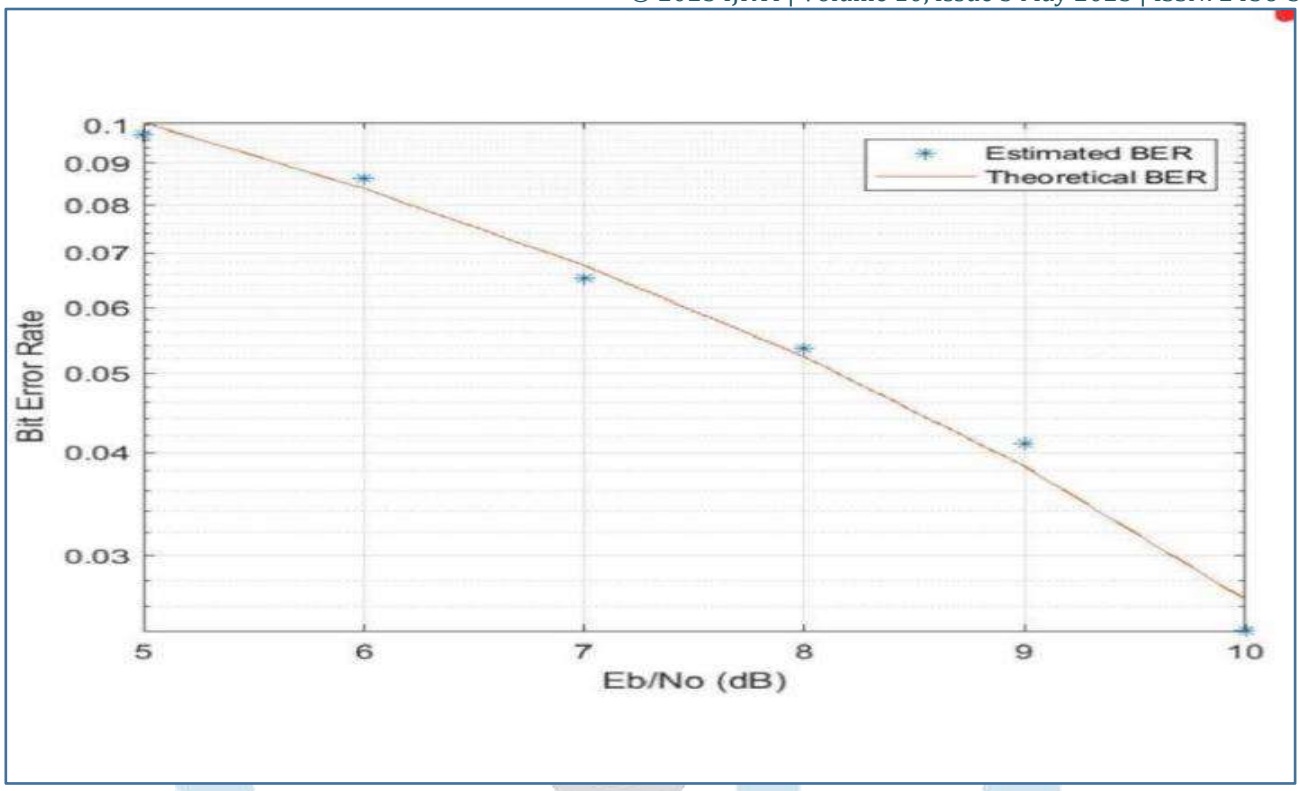

Fig.5 Output of Eb to Bit error rate

In fig(6) this the bit error rate is reduced to 5 compared to before output so the noise is reduced..When compared to fig(4) the signal to noise ratio is reduced so by reducing the signal to noise ratio the bit error rate is also reduced.The signal I.e the data we are sending by using matlab in underwater is sent clearly.

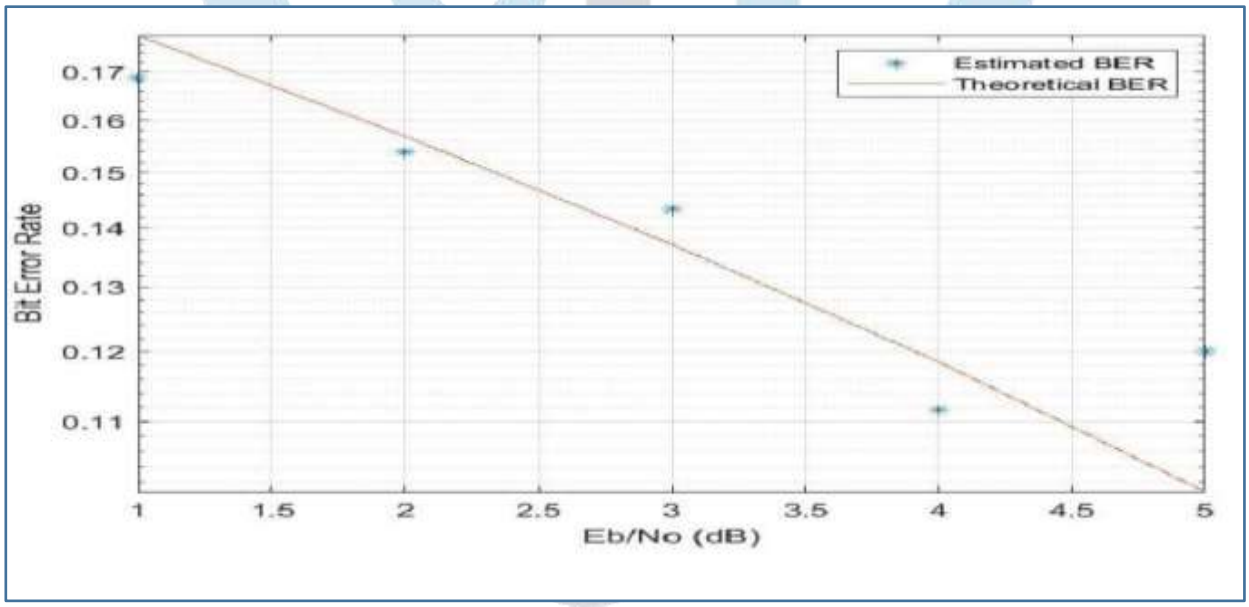

Fig.6 Output of Eb to Bit error rate

In fig(7) this we have transmitted modulated signal by using on-off keying.We get the filtered underwater signal in underwater and received signal with noise and we demodulated it and got received data without noise.Here on-off keying means light on and light off light on means indicated by 1 and light off is indicated by binary digit 0.in underwater the signal we transmitted after modulation goes to underwater in underwater it combines with noise.The signal combined with noise is calculated by bit error rate formulae.After ber calculation we get original recovered signal I.e the data what we transferred in the transmitter process of underwater we get that orignal signal at the receiver section.

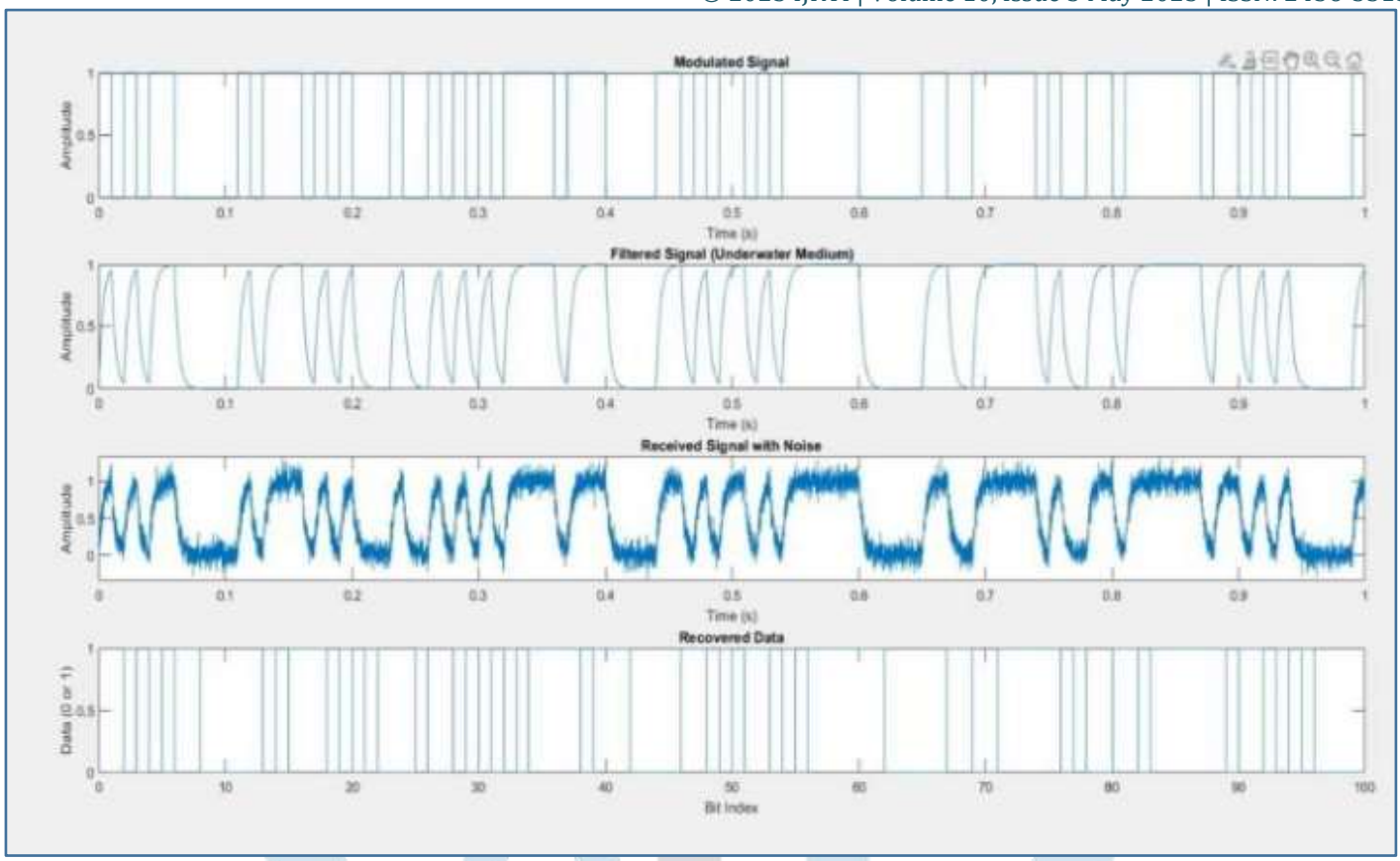

Fig.7 output of Received signal without Noise

VI. Challenges and Limitations

Some of the issues identified in this project is line of sight that is LIFI requires a line of sight and its maybe difficult to maintain underwater and another thing is that it doesnot work under direct sunlight. Absorption of light and scattering done in underwater sometimes. The main challenge of underwater system is line of sight and the clients movement and some times also modulation.The bandwidth also limited in underwater compared to land.In underwater the scattering occurs that is the light spreads in the system.Some times minimal interfere will be there in underwater for salinity of water.Light can't penetrate so if a person stands in front of receiver the light not passess and it can't be received by receiver section.So li-fi has both positive and negative sides.

VII. Advantages of LIFI over WIFI

●**Speed**: The speed of LIFI is more than wifi which is 250 times faster than wifi

●**Bandwidth:** The spectrum of visible light is more compared to wifi which is approxiametly 1000 times more bandwidth compared to radiable spectrum.

●**Security**: It is more in LIFI than Wifi because ligtht cant penetrate through walls.

●**Interference reduced:**LI-FI operates by light signal so in underwater the light experiences minimal interface like temperature.

●**Not harmfull to underwaterlifes**:It doesnot do any harms for underwater creatures which is done by radio waves

●**Efficiency:**lifi requires less power than compared to radio waves which is very important for battery powered underwaterdevices.

In lifi the attenuation is also lesscompared to radio waves.It has higher data ratetransfers as comparedto wifi .by telling about lifi we hasso many advantages that's why todays generation also requirs high data transferwithout interfaces so we prefer lifi in replaceof wifi.Lifi is also very safewhile compared to wifi because it cant accessed by any one in underwater.To access it has some code in underwater toaccess it .in land also it is used in offices,malls ,railways,etc so lifi has so many advantages compared to wifi.

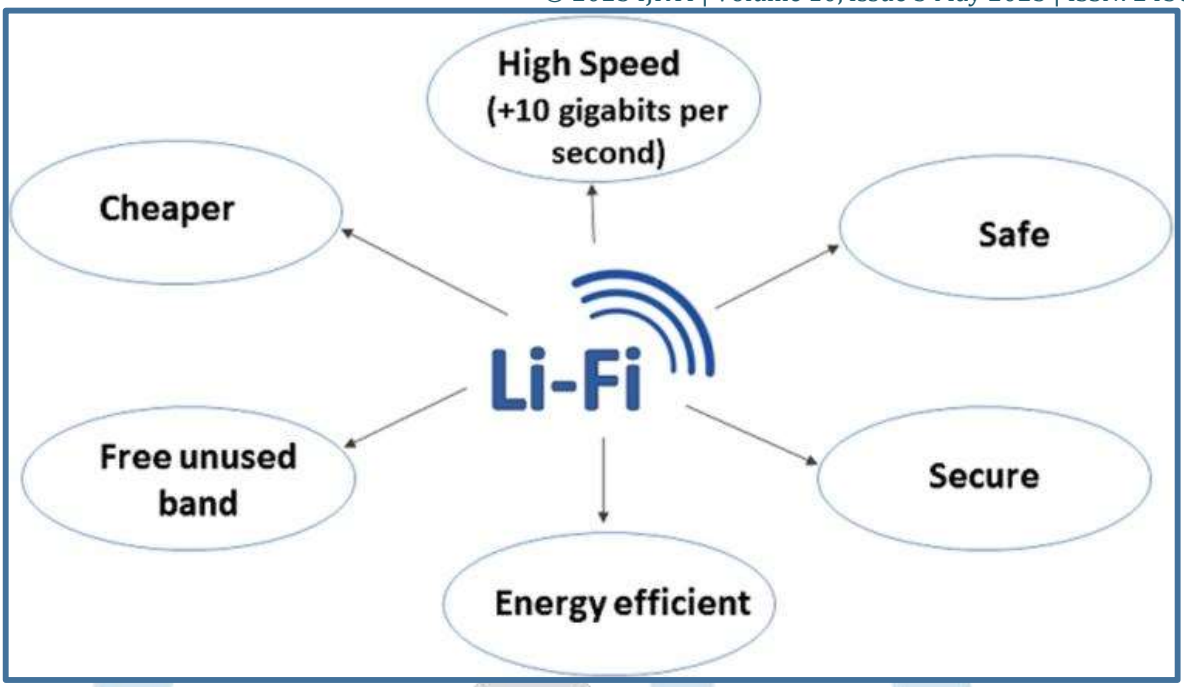

Fig.8 Features of LI-FI

VIII. Applications of underwater LIFI

● **Submarines:** If two submarines the data is transmitted between the submarines and if there is any obstacles in the path it can be identified.

●**For defence:** If there is any unknown ship is found then automatically that information will besent to higher authority.

●**fisherman security**:If shiper man finds any problem in sea then he can send information to othership or else to the higher authority.

●**Rescue operation :**If any rescue operation is done in sea.The information is sent from one ship to another ship.

●**Voice transmission**:It is possible to send voice in underwater.

IX. Conclusion

Overall this project tells us about LIFI that is light fieldity underwater data transfer.Lifi uses light intensity to transmit the data. Here every bulb can be used as wifi hotspot to transfer the data wireless as well as with greener and safer environment.Lifi is attracting people because population is increasing and people requires wireless internet so by using LIFI we get wirelessdata communication and LIFI works in line of sight which is direct.LI-FI is fast data transmission in underwater also.This technology will act like hotspot to the wireless underwater system.By using lifi thereis no radiation and greener environment and all the human beings can able to access the data they required in underwater.

X. Future scope

As the light is every where and we can use it free and li-fi is growing/becoming popular it will leads to safer,greener and ecomicallycleaner enviroment communication.In this project each and every led is used as LI-FI hotspot every one in world.The lifi can also combine with wifi can make many magics in wireless communication.In future it can grow to high security data transfer technology.In underwater for marine life lifi is very useful.After some years LI-FI plays a vital role in world it can become like internet of every thing.

REFERENCES

[1]. S. Dang, O. Amin, B. Shihada, and M.-S. Alouini, ‘‘What should 6G be?’’ *Nature Electron.*, vol. 3, no. 1, pp. 20–29, Jan. 2020.

2. S. Ariyanti and M. Suryanegara, ‘‘Visible light communication (VLC) for 6G technology: The potency and research challenges,’’ in *Proc. 4th World Conf. Smart Trends Syst., Secur. Sustainability (WorldS)*, Jul. 2020, pp. 490–493. [3] S. Idris, A. M. Aibinu, G. Koyunlu, and J. Sanusi, ‘‘A survey of modulation schemes in visible light communications,’’ in *Proc. 3rd Int. Conf. Trends Electron.Informat.(ICOEI)*,Apr.2019,pp.17.

3. ‘‘Recent advances and future directions on underwater wireless communications,’’ *Arch. Comput. Methods Eng.*, vol. 27, no. 5, pp. 1–34,2019.

4. H. Kaushal and G. Kaddoum, ‘‘Underwater optical wireless communication,’’ *IEEE Access*, vol. 4, pp. 1518–1547, 2016.

5. S. Zhu, X. Chen, X. Liu, G. Zhang, and P. Tian, ‘‘Recent progress inand perspectives of underwater wireless optical communication,’’ *Prog. Quantum Electron.*, vol. 73, Sep. 2020, Art. no. 100274.

6. M. Jouhari, K. Ibrahimi, H. Tembine, and J. Ben-Othman, ‘‘Underwater wireless sensor networks: A survey on enabling technologies, localization protocols, and internet of underwater things,’’ *IEEE Access*, vol. 7, pp. 96879–96899, 2019.

7. X. Sun, C. H. Kang, M. Kong, O. Alkhazragi, Y. Guo, M. Ouhssain, Y. Weng, B. H. Jones, T. K. Ng, and B. S. Ooi, ‘‘A review on practical considerations and solutions in underwater wireless optical communication,’’ *J. Lightw. Technol.*, vol. 38, no. 2, pp. 421–431, Jan. 15, 2020.

8. C. M. G. Gussen, P. S. R. Diniz, M. L. R. Campos, W. A. Martins, and J. N. Gois, ‘‘A survey of underwater wireless communication technologies,’’ *J. Commun. Inf. Sys.*, vol. 31, no. 1, pp. 242–255, 2016.

9. M. Lanzagorta, ‘‘Underwater communications,’’ *Synth. Lectures Commun.*, vol. 5, no. 2, pp. 1–129, 2012.

10. M. Rhodes, ‘‘Electromagnetic propagation in sea water and its value,’’ in *Proc. Mil. Syst. SEAS DTC Tech. Conf.*, 2007, pp. 1–6.

11. Z. Zeng, S. Fu, H. Zhang, Y. Dong, and J. Cheng, ‘‘A survey of underwater optical wireless communications,’’ *IEEE Commun. Surveys Tuts.*, vol. 19, no. 1, pp. 204–238, 1st Quart., 2016.

12. N. Saeed, A. Celik, T. Y. Al-Naffouri, and M.-S. Alouini, ‘‘Underwater optical wireless communications, networking, and localization: A survey,’’ *Ad Hoc Netw.*, vol. 94, Nov. 2019, Art. no. 101935.