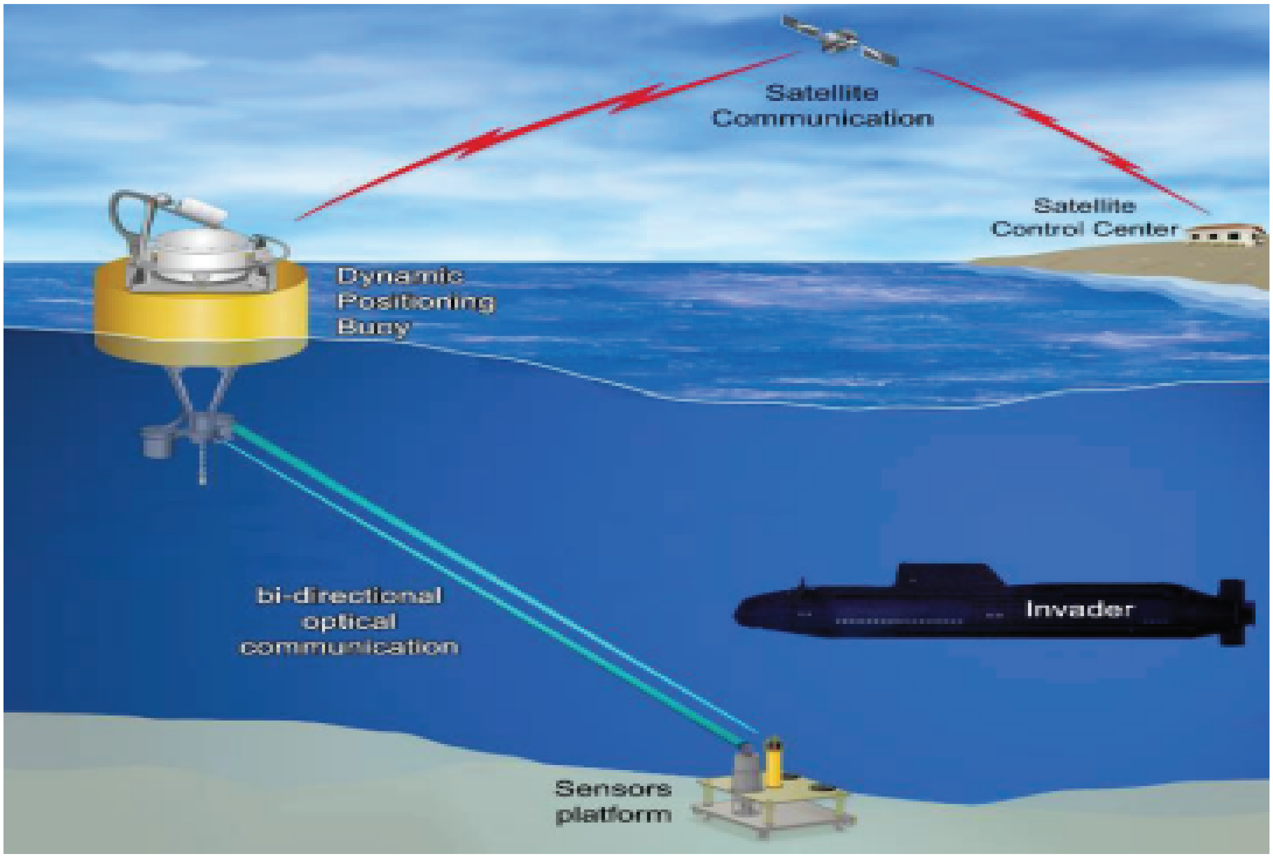
FCOM PROJECT REPORT

UnderWater wireless communication



SUBMITTED TO : Divyabramham **Kandimalla sir**

SUBMITTED BY :

ALKESH SHUKLA (S20210020252)

INTRODUCTION

Underwater wireless communication is a field of communication technology that focuses on transmitting data wirelessly underwater. In this context, IR sensors and TSOP1738 are commonly used components in the design of underwater wireless communication systems.

An IR sensor is a device that detects infrared radiation and converts it into an electrical signal. It can be used in underwater communication systems to transmit data wirelessly by modulating the infrared signal with the data to be transmitted. TSOP1738 is an IR receiver module that can detect and demodulate the modulated IR signal.

The 555 timer is an integrated circuit that can be used as a stable timer or oscillator in electronic circuits. It can be used in underwater communication systems to generate a modulating signal for the IR transmitter. The modulating signal can be used to encode data into the IR signal.

underwater wireless communication using an IR sensor and TSOP1738 with a 555 timer involves transmitting data wirelessly underwater by modulating an infrared signal using a 555 timer-generated modulating signal. The modulated IR signal is then received and demodulated by a TSOP1738 IR receiver module.

Abstract ;

Underwater wireless communication systems make use of two communication modules that transmit and receive data using infrared radiation. Each module consists of both a transmitter and a receiver, which transmit and receive data.

In an IR-based underwater communication system, data is typically encoded as light pulses and transmitted from an IR source to an IR receiver. The IR receiver then decodes the light pulses to recover the original data. The IR signal can be transmitted over a distance of several meters to tens of meters, depending on the transmission power, water clarity, and other factors.

One advantage of IR-based underwater communication is that it is immune to electromagnetic interference, which is a common problem with RF-based communication systems. Another

advantage of IR-based systems is that they can operate in real time, providing fast and reliable communication.

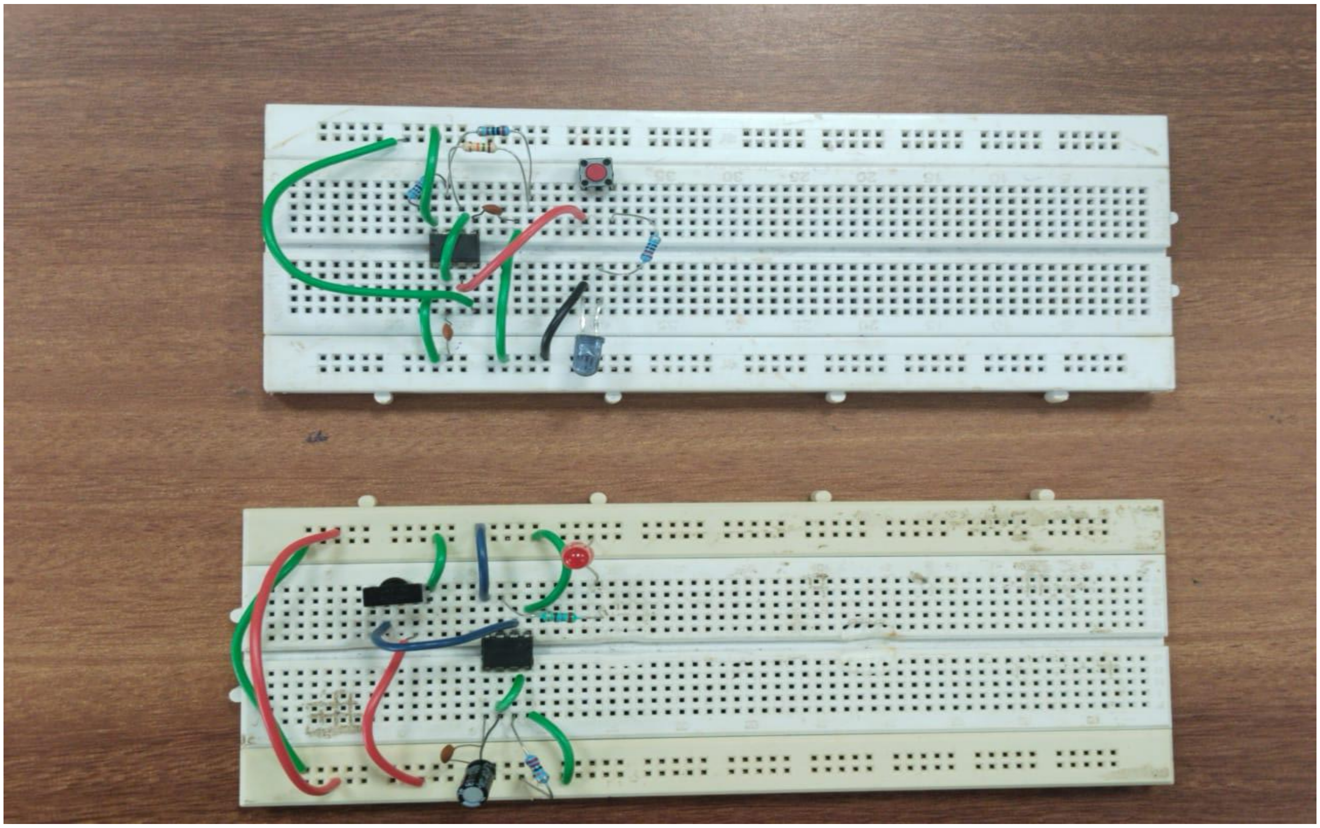
In the Matlab simulation of underwater IR communication, the IR signal can be modeled using mathematical equations that describe the propagation of light in water.

MATERIALS

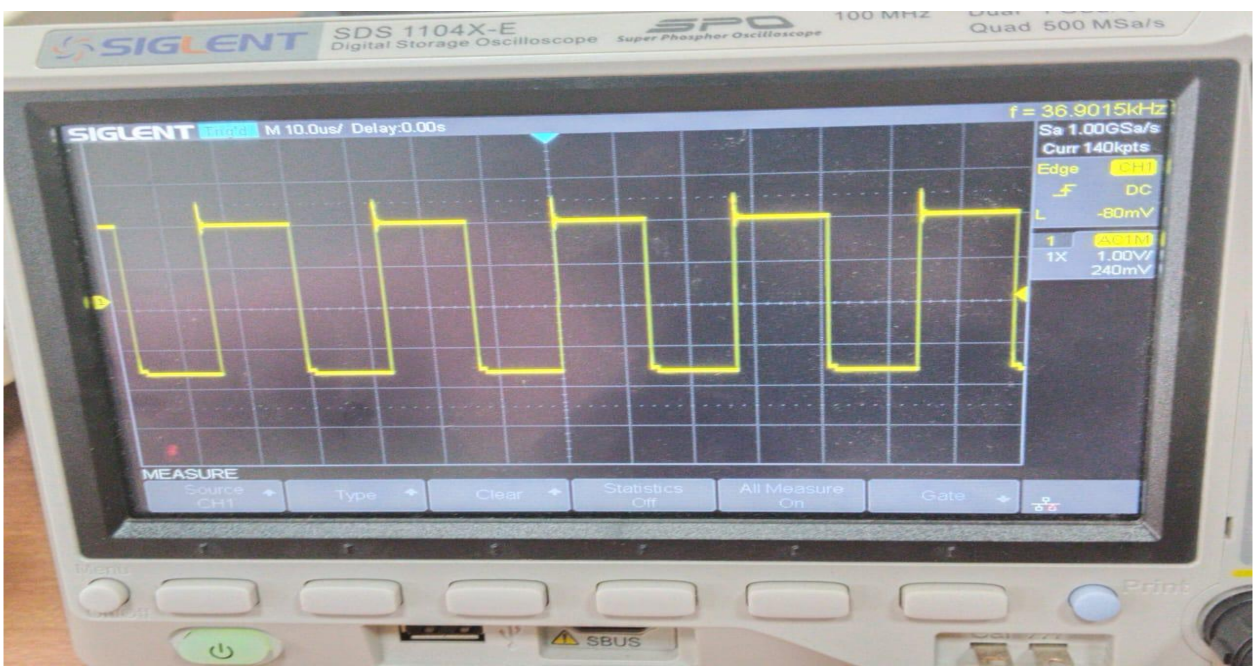
1. IR sensor (transmitter)
2. Tsop 1738 (receiver)
3. 555 Timer
4. Voltage source (8v to transmitter circuit and 5v to receiver circuit)
5. Resistor
6. Capacitor
7. Push button
8. Led (Red)

PROJECT IMAGES:

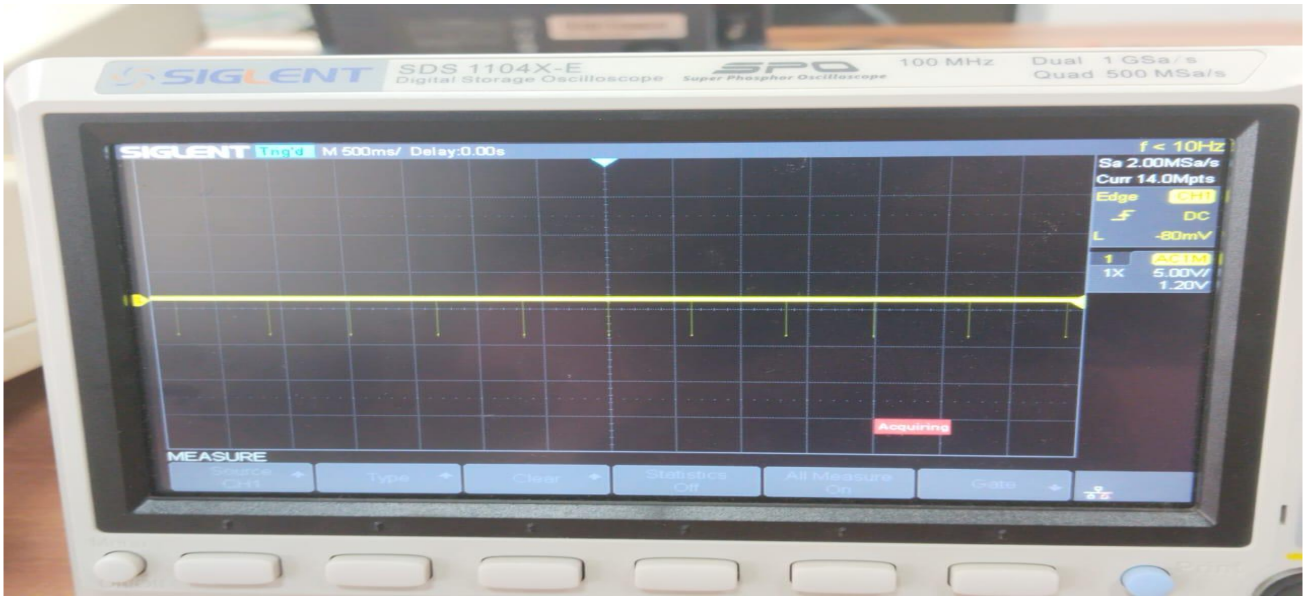
1. Transmitter circuit and receiver circuited



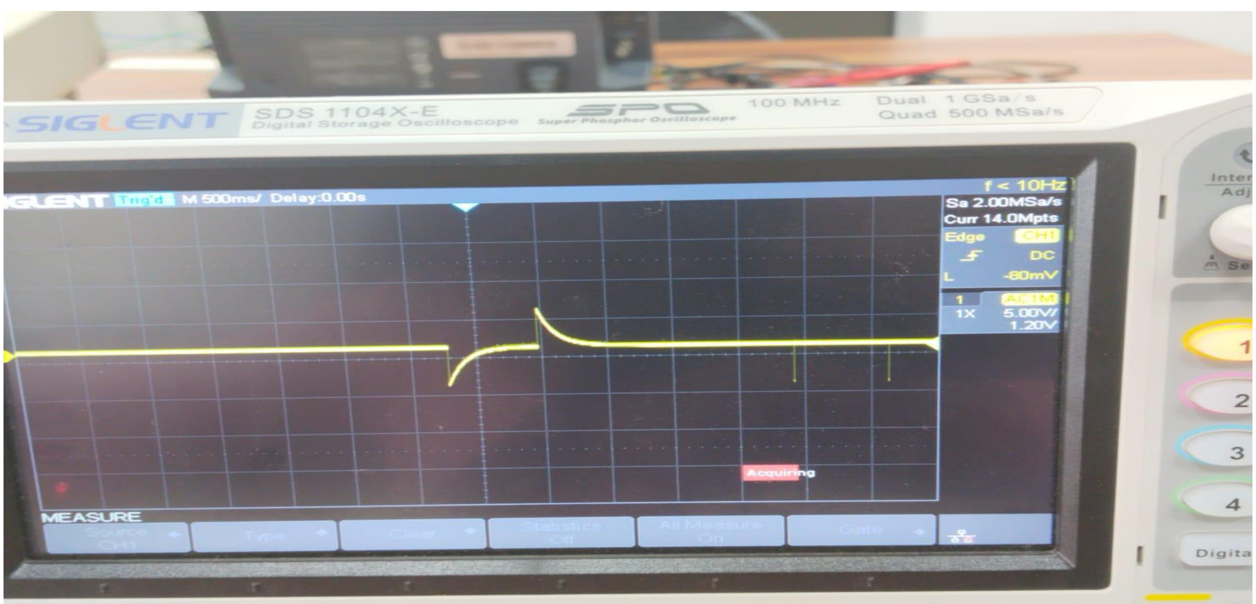
2 . At transmitter circuit when a input modulated signal is applied :



3. When the signal is not transmitted by the ir sensor the at the receiving end the voltage level is set to tsop1738 and look like :



4. When the tsop1738 receiver receiving the signal after when signal is transmitted by ir sensor:



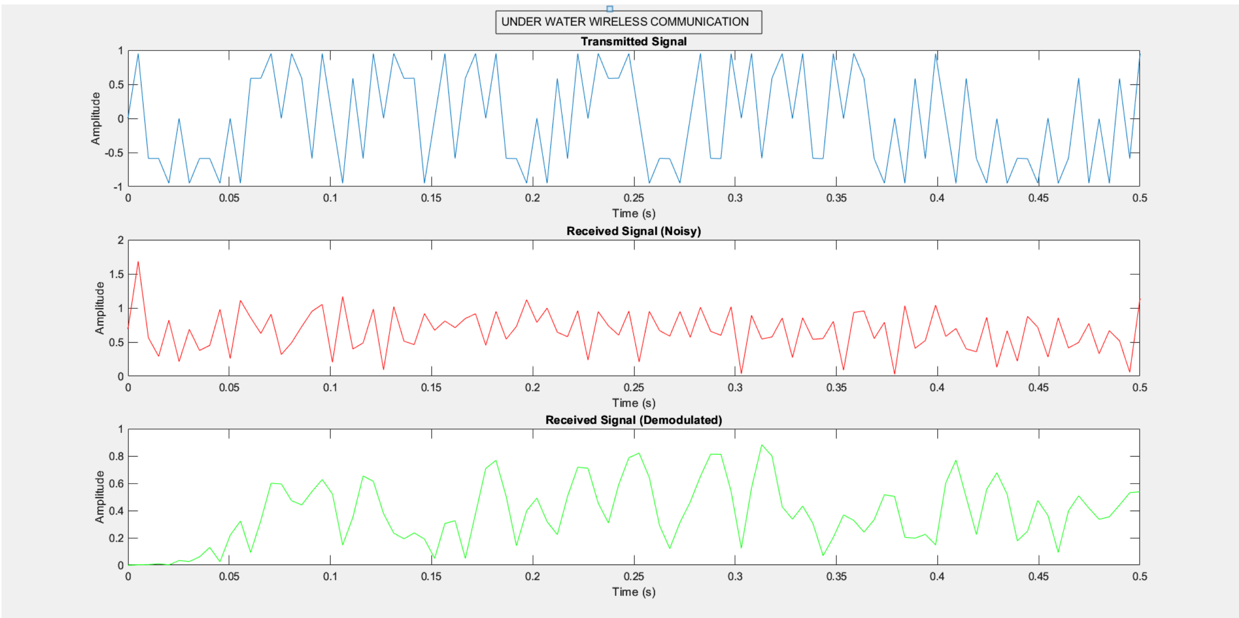
MATLAB CODE :

```
fs = 50000;             % Sampling rate (Hz)

T = 0.5;                % Duration of simulation (s)

fc = 10000;             % Carrier frequency (Hz)

T_bit = 0.05;           % Duration of each bit (s)

R = 2000;               % Distance between transmitter and receiver (m)

c = 1600;               % Speed of sound in water (m/s)

SNR = 10;               % Signal-to-noise ratio (dB)

% Generate message signal

msg = randi([0 1], 1, 100);

% Modulate message signal using BPSK

mod_msg = 2*msg - 1;

% Generate carrier signal

t = linspace(0, T, fs*T);

carrier = sin(2*pi*fc*t);

% Generate IR signal

t_bit = linspace(0, T_bit, fs*T_bit);

ir = square(2*pi*(fc/2)*t_bit);

% Upsample IR signal to match carrier signal sampling rate

ir_upsampled = interp1(t_bit, ir, t);

% Truncate mod_msg and ir_upsampled to be the same length

len = min(length(mod_msg), length(ir_upsampled));
```

```
mod_msg_truncated = mod_msg(1:len);

ir_upsampled_truncated = ir_upsampled(1:len);

% Multiply IR signal by modulated message signal and carrier signal

carrier_truncated = carrier(1:len);

tx_signal = mod_msg_truncated .* ir_upsampled_truncated .*
carrier_truncated;

% Simulate transmission through water

td = R/c;

t = linspace(0, T, length(tx_signal)); % Adjusted to match length of
tx_signal

rx_signal = tx_signal .* exp(-1i*2*pi*fc*(t-td));

% Add noise and interference

sigma = 10^(-SNR/20);  % Noise standard deviation

noise = sigma * randn(size(rx_signal));

rx_signal_noisy = rx_signal + noise;

% Demodulate received signal

rx_demod = rx_signal_noisy .* exp(1i*2*pi*fc*(t-td));

rx_demod_filtered = filter(fir1(20, 2*fc/fs), 1, rx_demod);

% Detect message signal

rx_msg = zeros(size(msg));

for i = 1:length(msg)

   idx_start = (i-1)*fs*T_bit+1;

   idx_end = min(i*fs*T_bit, length(rx_demod_filtered));

   if any(rx_demod_filtered(idx_start:idx_end) > 0)
```

```
        rx_msg(i) = 1;
    else
        rx_msg(i) = 0;
    end
end
% Calculate bit error rate (BER)
BER = sum(abs(msg - rx_msg))/length(msg);
% Plot transmitted and received signals
subplot(3,1,1);
plot(t, tx_signal);
title('Transmitted Signal');
xlabel('Time (s)');
ylabel('Amplitude');
subplot(3,1,2);
plot(t, abs(rx_signal_noisy),'r');
title('Received Signal (Noisy)');
xlabel('Time (s)');
ylabel('Amplitude');
subplot(3,1,3);
plot(t, abs(rx_demod_filtered),'g');
title('Received Signal (Demodulated)');
xlabel('Time (s)');
ylabel('Amplitude');
```

MATLAB_CHART:



RESULTS

1. Using the IR sensor TSOP1738 and 555 timer in underwater wireless communication can be an effective way to transmit data wirelessly underwater. The IR sensor can be used to detect and transmit modulated infrared signals that are then received by the TSOP1738 module. The 555 timer can be used to generate a modulating signal to encode data into the infrared signal.
2. The success of such a project would depend on various factors, including the underwater environment, the distance between the transmitter and receiver, and the sensitivity of the components used. Proper testing, calibration, and optimisation are crucial to ensuring reliable communication.

CONCLUSION

In conclusion, the use of an IR sensor, a TSOP1738, and a 555 timer in underwater wireless communication has the potential to be a viable solution for transmitting data wirelessly underwater. This project provides a basic understanding of how these components can be integrated to achieve reliable communication.

However, further research and experimentation are necessary to optimise the system's performance in different underwater environments, depths, and distances. The success of the project will also depend on the quality of the components used, as well as the design and implementation of the system.

Overall, this project can serve as a foundation for future developments in underwater wireless communication and inspire further innovation in this field.