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MCTE 4344
REMOTE SENSING AND TELEMETRY
SEM II || SESSION 21/22

MINI PROJECT

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Remote sensing

The sensor used in this project is CruzPro DSP Active Depth, Temperature Transducers. It is used underwater to capture depth and temperature data of the water. As the name suggests, it is an active sensor that emits an acoustic signal or pulse into the water. If an object is in the path of the sound pulse, the sound bounces off the object and returns an “echo” to the sonar transducer. The time between the emission of the sound pulse and its reception helps the transducer to determine the range and orientation of the object. This sensor is mainly used on fishing boats to find the best spot to catch fish with baud rate of 4800. It is reliable for up to 300m depth and temperature in between 0-32℃. To comply with the term remote sensing, having just a sensor is not enough. The data from the sensor needs to be sent far away from the monitoring site to the base site. The sensor is paired with XTend PKG 900 MHz modems to transmit the data to the base station.

Telemetry

For XTend PKG 900 MHz, the outdoor line-of-sight can be up to 65km if it is used with a high gain antenna. The 65km radius from IIUM could cover Bentong and Seremban. The least it can go for indoor or urban range with 2.1 DB dipole antenna is up to 300m. If we were at CUTe lab, the data could be transmitted to Block E4 of KOE. However, the actual range could be smaller due to many factors such as transmitting power, orientation of transmitter and receiver, height of antenna, weather condition, interference sources in the area and obstacles like trees and buildings. To figure out the best distance for any telemetry intended, we can install the software of this modem from the provider that is, X-CTU Software. Using this software, we can first determine the signal strength for a telemetry using the range test. From this range test, the best signal strength produced will determine the optimal range between the transmitter and receiver modem.

There will be two modems interacting. We assigned one modem as Radio1 and another as Radio2. Radio1(receiver) will be connected to the computer using RS-232 through the USB port. Radio2(transmitter) will be located at the monitoring site and connected with the sensor - in our case, the single beam water depth and temperature sonar.

Radio1 and Radio2 are powered by the 12V power adapter. Nevertheless, since Radio1 is connected to the PC, it can be powered up using Bus power mode - the USB connection. Nonetheless, the power output is limited to 100mW. These modems utilize RPSMA antennas. These antennas block unauthorized connection in order to increase the range. Increasing transmitter power output or lowering the receiver sensitivity can also increase fade margin. Fade margin is the additional path loss over the median which lowers the systems' performance to unacceptable levels. Thus, power output should be lower while the receiver sensitivity should be increased. This modem has an adjustable power output from 100mW to 1W and it has outstanding receiver sensitivity of -110 dBm @9600 bps.

Results & Analysis

The connection of the two modems shall be easy and straightforward. But we have encountered several problems in connecting both modems that we cannot manage to secure a connection and communication between them. The first reason is due to the type or 'family' that the two modems came from - they are not the same. In reality, we can connect and communicate with both of them but for our case, the firmware of the XBEE Digimesh 2.4 XT09 is not found and cannot be installed, making the module not found in XCTU. It is different from the 9XTend DigiMesh XTP9B-DM where the XCTU directly detects the radio module. Due to this, we only manage to configure the setting and setup of XTP9B-DM as shown in the figure below, but absolutely cannot access the setting of the other one at all. Shall we connect them, we can hold the range test and send out strings and examine the communication range between them, which is the actual telemetry part in this system. Adding these modems with the sensor will allow the data to be send from a far distance.