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Navigational Display

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Abstract: An appropriate integrated display system to display the current information of the ship is essential to help the ship officers in the decision making process. Navigational display is proposed to improve the efficiency for a safe navigation. By using Qt application software, current information of the own ship and target such as range, bearing, longitude, and latitude, are displayed at the top left corner of the radar screen display.

Keywords: Qt application software, range, bearing

I. INTRODUCTION

Unlike road traffic, there are generally no boundaries constraining what path a ship may take while moving between any two points. As a result there are situations where navigation schedules of two or more ships overlap – giving potential for collision or the ship might sink due to obstacles such as ice berg etc. It is very important to understand the current information of the ship required for the ship operator during navigation for a safe navigation.

The radar is one of the most used equipment systems onboard ships. It is designed for detecting and tracking targets at a considerable distance. it's of great practical value to the navigators. Proper use of radar and radar plotting aids in both restricted visibility and clear weather can help prevent collisions and ensure the safety of the ship. With the help of the radar system, the target information is collected and the information is processed by the processor and it is displayed on the screen by the satellite signals received by the Gps device.

The user inputs the target's coordinates(r,Θ) to the simulator. The simulator is an application built on Qt,it uses UDP network connection to send the (r,Θ) value to the display and stimulates the target inside the plan position indicator(PPI). It also continuously updates the positions of the target and specifies the range and bearing of the ownship. The output screen also contains the zoom in and zooms out options where the radius of the PPI can be increased and decreased.

II. OVERVIEW

This simulation consists of a sender application and Plan Position Indicator(PPI).These are connected using a UDP Socket. The range and bearing are simulated in the sender application and the sent to the PPI where the user can view the target that is approaching the ship.

A. Sender application

In this application, we simulate different position of the ship using the initial range and bearing values. It is used to read the range and bearing of the target ship. The accepted value is in the form of polar co-ordinates. To place the image in the PPI display system, the range must be converted to system's range in pixel. This will place the target in PPI in its accurate position from the ship. The conversion of polar to pixel can be performed using the following formula.

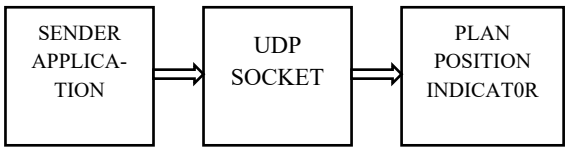

Fig 1. Block Diagram

$$R_p = R_t * \left(\frac{Radius}{R_s}\right)$$

$$B_t = (B_t + 270) * \frac{\pi}{180} \quad (1)$$

where R_p is the range in pixels, $R_t$is range of the target, R_s is range of the system and Radius is the radius of the plan position indicator. B_t is the target bearing.

To place the image in the PPI in Qt, the function QPixMap is used which takes the parameters in x-y coordinates. The converted pixel value of range is in polar form, to convert this we use the following formula.

$$x = R_p * \cos(B_t)$$

$$y = R_p * \sin(B_t) \quad (2)$$

Where x and y are the coordinates used to place the target image in the PPI.

B. UDP Socket

UDP (User Datagram Protocol) is a lightweight, unreliable, datagram-oriented, connectionless protocol. Creates a link between the sender application and the PPI. The QUdpSocket class provides a UDP socket. The most common way to use this class is to bind to an address and port using bind(), then call writeDatagram() and readDatagram() to transfer data.

C. Plan Position Indicator

The Plan Position Indicator (PPI) is a form of radar display which gives a map-like presentation of the echoes from objects in the vicinity of the radar set. The plan position indicator is designed using the software Qt. To design a PPI in Qt, many built in library functions can be used. The PPI is a circle in which the centre of the circle is

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the own ship location and the circumference of the circle system range.

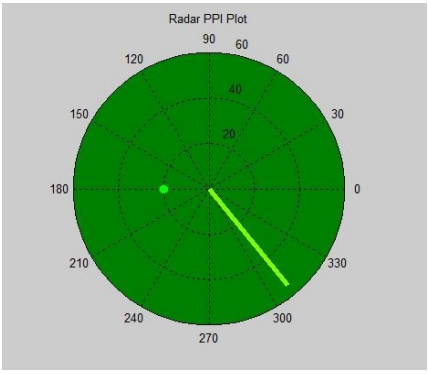

Fig 2. Plan position Indicator.

III. CONCLUSION

The preliminary usability of this application is to provide a secure journey in the sea. Using the application built on Qt software, a graphic interactive navigational information such as own ship details, target details and number of targets is displayed with the help of the radar system of the ship. This simulator will provide the accurate location of the approaching target, which can be used to estimate the time the ship is nearing and prevent any type of disaster. This helps the captain of the ship to view all the necessary information at a glance that is required for the passage planning. It also very important to avoid the upcoming dangers. All in all, it enhances the safety of navigation.

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