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NAVDEC DECISION SUPPORT SYSTEM TO AVOID COLLISION AND DISTRESS IN SEA NAVIGATION

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ABSTRACT- This paper proposes an advanced navigation decision support system (NAVDEC) mainly to avoid the collision among two or more vessels in sea. More commonly the faults can be occurred by the mistakes of human where it can be avoided by the decision support system. Decision can be taken by the navigator in critical situations with the help of the gathered information from different identification and tracking system. The planning of routes is more important to maintain the proper navigation in sea. The proposed system also uses the Ant Colony Optimization algorithm for planning the routes in collision time. In addition to this GDMSS of very high frequency management system can be used for the safe navigation and the data collection can also be sent to the coastal through the high frequency. Pollution in navigation can also be reduced automatically with the detection and avoidance of collision among the vessels in sea.

Keywords: Decision Support System, GDMSS, Path Detection, ARPA, GNSS.

I. INTRODUCTION

Monitoring of vessels is more essential to avoid the distress situations in sea. Various parameter values of vessels can be taken with the identification systems and thereby the human faults can be reduced. Path planning is the main factor to avoid the collision among the vessels in sea, Ant Colony Optimization algorithm can be used to detect the own ship path in the ocean. NAVDEC support system is the decision system to avoid collision and traffic between the vessels. Automatic aided RADAR is placed in the own ship to detect the nearer objects in the sea. Decision system involves with the various identification systems like AIS, ARPA, GNSS, ENC, GPS, and DGPS to handle the real time solution for collision in sea. GMDSS is the system to rescue ships in the dangerous situations in sea. To maintain the co-ordination between the multiple vessels Self Organization Time Division Multiple Access can be used, where separate timing can be given to each vessel to share their information for a safe navigation using the satellite communication.

II. METHODS AND MATERIALS

A. Expanded NAVDEC Decision System

The proposed decision system is used to acquire the information from the different controlling system and it can be displayed to the navigator to avoid the collision among the vessels in sea. In order to maintain the efficiency of the proposed system the expanded form of decision support system can be maintained. Parameter values of position, speed, path, arrival time, departure time of the own and surrounding vessels should be recorded using the expanded systems such as Path Planning Scheduling (PPS), Localizations of vessel states and its environment (LVSE), Determining Safe Trajectory Subsystem (DSTS).By avoiding the collision among vessels life of the navigator can be saved , damage in ships can be reduced ,and the goods can also be safely carried by the vessels. The block diagram representation of the decision system is shown in the below fig and each block function can be explained in the below section.

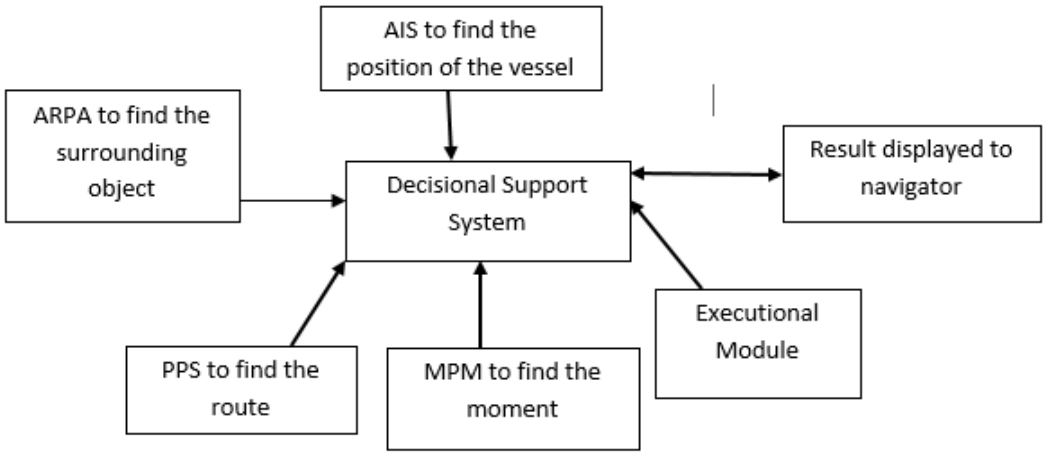

Fig 1.Block Diagram of NAVDEC

B. SOTDMA for identification system

Each vessels have their own time management to transmit their information to avoid the collision among them. Not only the monitoring of vessels is important but also the acquiring of data from the identification and controlling system is more essential and it can be done by the Self Organizing Time Division Multiple Access (SOTDMA).For the transmission of information among them separate time can be allocated with the desired frequency range. Ships equipment like rudder, engine, propeller, fuel level can be monitored continuously and if any of the fault occurred in the equipment means immediately the alarm can be generated and thereby the life of the navigator can be saved.

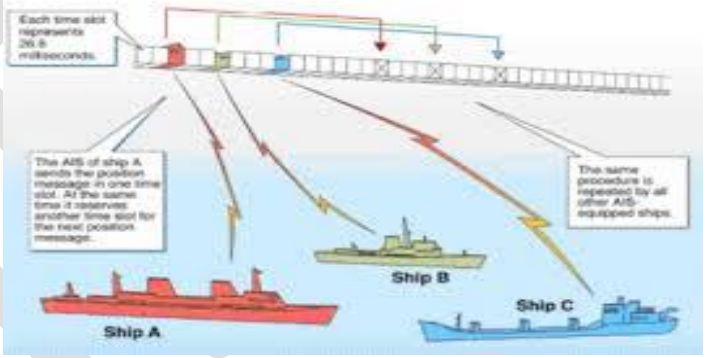

Fig 2.SOTDMA

Collision avoidance between the vessels using the SOTDMA of the simple diagrammatical representation is shown in the below figure. Automatic plotted radar can be used to find the surrounding vessels from its own ship and there by the course speed of the vessel can be maintained.

Fig 3. AIS alert system

C. GDMSS for marine safety

To save the life of the navigator GDMSS can be used in the sea navigation. Ship to ship and ship to shore communication can be done with the different transmitting wireless agents. If the ship faces difficult situations means then the message can be sent to the surrounding ships from the own ship. Immediate rescue alert and searching can be done with the SART (Search and Rescue Transponder) from the own ship distress to the nearby ship. Global detection of vessels position in sea can be found using the Emergency Position Indicating Radio beacon (EPIRB)

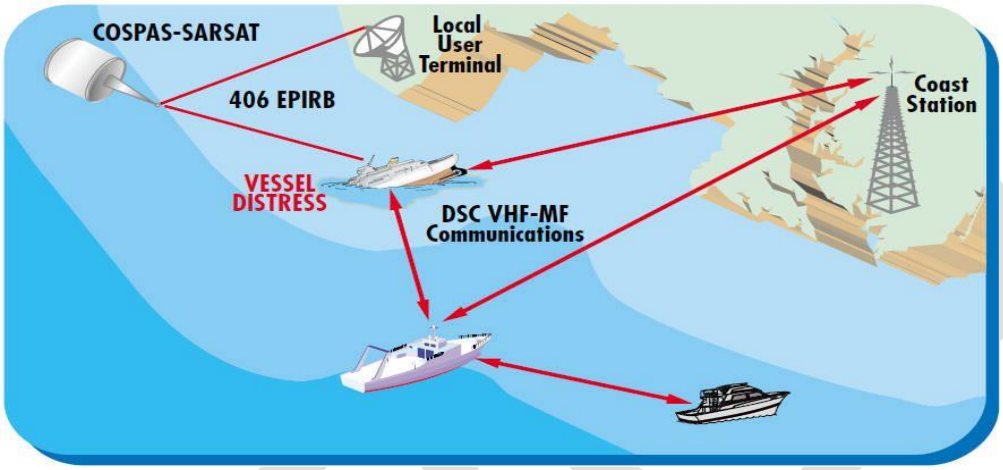

Fig 3.GDMSS

III. RESULT AND DISCUSSION

Collision avoidance among the vessels can be simulated using the MATLAB. By the avoidance of the collision among the vessels the life of the fisherman can be saved in the distress situation. Decision support system plays a major role in this proposed system. Algorithm can also be used for path scheduling. Simulation result can be shown in the below figure.

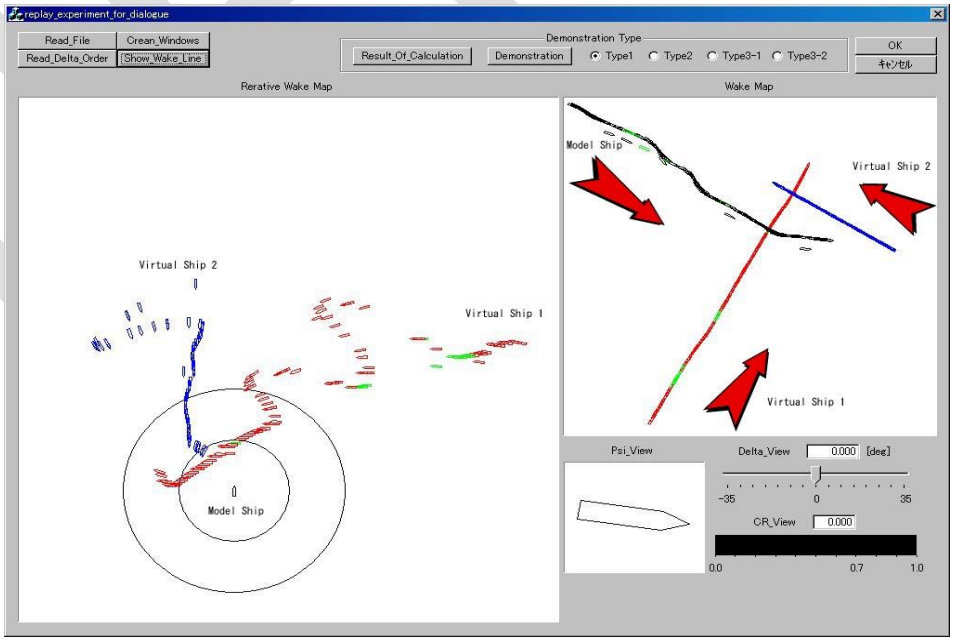

Fig 4: Simulated Result

IV. CONCLUSION

In this proposed system decision support system can be used to communicate between own vessel to other vessel to avoid the collision in the sea. Future enhancement can be done with the visualization based support system to improve the accuracy of the performances.

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