MSc Thesis

Improve safety at sea by increasing the situational awareness of the crew

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TU Delft DAMEN

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Notes

Preface

Abstract

Glossary

Abbreviations

AIS Automatic Identification System

AMS Alarm Management System

CAM-HMI Central Alert Management Human Machine Interface for presentaiton and handling of alerts

DOF Degrees of freedom

DP Dynamic Positioning

ECDIS Electronic Chart Display Information System

ENC Electronic Navigational Chart

IEC International Electrotechnical Commission

IHO International Hydrographic Organization

IMO International Maritime Organization

MARPOL International Convention for the Prevention of Pollution from Ships

SOLAS International Convention for the Safety of Life at Sea

STCW International Convention on Standards of Training, Certification and Watch-keeping for Seafarers

TEU Twenty foot Equivalent Unit

UID User Input Device

VHF Very High Frequency radio

Contents

1 Introduction

1.1 Research background

1.2 Problem statement

1.3 Research questions

1.4 Scope

including boundaries

1.5 Thesis structure

2 | Current knowledge

2.1 Accidents

2.2 Current projects

2.2.1 Shipping industry

2.2.2 Bridge

2.3 Shipping crew

Part I

Maritime Technology

3 | Manoeuvring capability

What are possible movements of the ship, based on it's capability

3.1 Input

For own vessel trial run, other vessels based on received information via AIS or others. DWT, L, B, speed, etc.

3.2 Limits

What are maximum values for manoeuvring capability. Based on trial run are values found for Nomoto (other theories?)

3.3 Desired capability

What are normal movements for a ship of a specific size

3.4 Expected route

Ship will most likely keep sailing straight and on same speed

4 | Filter situation

Input from static objects shown on the map

4.1 Traffic separation schemes

input from local authorities

4.2 Navigational aids

map/radar/etc.

4.3 Accepted probabilities

Which probabilities can be ignored to speed-up calculation

5 | Safe motion parameters

5.1 Regulations

Existing COLREGs, local regulations,

5.2 Well-clear

can also be rephrased to acceptable distance, safe behavior, etc. Depends on captain, company, etc. Also based on assumptions of Marin or other literature.

5.3 Visualization

Research of szlapczynski Describe the desired input and output

6 | Probability index

6.1 Input

What is needed from safe motion parameters and manoeuvring capability

6.2 Map for other vessels

6.3 Predicted capability envelope

7 | Visualization

7.1 Determine closes point of approach

Method to define if something is a hazard. Incorporate well-clear from previous chapter.

7.2 Hazards

Pin-point hazards, to show why a route is most likely.

7.3 Routeplanner

What is most likely the route. Based on high probability, combined with low probability other vessels.

Part II

Computer Science

8 | Information at the bridge

8.1 Instruments

What do regulations say about systems which should be on board

8.2 Parameters

Which information really comes from instruments at the bridge

8.3 Usage

Which parameters are relevant for the crew

9 | Communication

9.1 Systems for communication

Which systems or instruments are available, for which communication.

9.2 Protocols

What do protocols prescribe and what are thoughts behind this. Based on regulations and education.

9.2.1 Regulation

What is stated in regulations.

9.2.2 Education

What is thought on schools.

9.3 In practice

How does communication take place in practice? Find out by discussing with seafarers.

10 Mental model

10.1 Situational awareness

What is situational awareness and how is it achieved.

10.2 Shared between ships

Based on the communication, what is known on all ships. Difference between ships (flagstate, origin of crew, etc.)

10.3 Master and crew

Considerations of the crew at own vessel

10.3.1 Thought process

What steps does the crew take in their head

10.3.2 Desired input

What do they need to take good decisions

10.3.3 Information overload

What if you give them too much

11 | Possible decisions

11.1 Considerations

How to presents list of possible decisions

11.2 Test with seafarers

Test to validate if addition help

11.2.1 Set-up

11.2.2 Results

Part III

Wrap-up

12 | Results

Describe results when both researches are combined. Do they support each other.

13 | Conclusion

13.1 Answers to research questions

13.2 Recommendations for future research

Bibliography