Prototype development of ENC and Marine information services in the SMART Navigation project

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KRISO (Korea Research Institute of Ships & Ocean Engineering)
Sewoong OH
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The SMART-Navigation

- implements the concept of IMO's e-Navigation, providing additional services for Non-SOLAS ships such as Fishing boats, coastal vessels and ferries
01 SMART Navigation Project

- Major components of Project

Ship side | Com. Network | Shore side
---|---|---
ECDIS | LTE-Maritime | SMART Navigation Operating System
ECS | S-100 Dataset | NAMAS (WP1)
Mobile Device | S-100 Dataset | SBSMS (WP2)
Asia Pacific Web | ENC Tile map | SORPS (WP3)
| ENC Tile map | REDSS (WP4)
| ENC Tile map | PITAS (WP5)
| ENC Tile map | MESIS (WP6)

Database
- ENC DB
- Weather
- MSI
- Nautical Publications
- Hydro
- ETC

Source data Provider
- KMA
- KHOA
- KCG
- ETC

MSP | MCP | S-100 | LTE-M
---|---|---|---
Digital Communication (VHF/MF/HF)
## SMART-Navigation Service

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<th>Target Vessels</th>
<th>Communication Method</th>
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01 SMART Navigation Project

- Process of Project Implementation

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General public international promotion, technique / market trend analysis & policy advice

Adjust plan Establish long-term strategy

Assessment and agreement

Assessment and agreement

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Assessment and agreement

Assessment and agreement
02 REDSS (ENC Service for Non-SOLAS Vessel)

- **Today** (Problem with using chart in Non-SOLAS Vessels)
  - Small vessels equipped with GPS Plotter (ECS)
  - Chart data display and performance is different due to lack of ECS Standard

- [Images of GPS displays and nautical charts highlighting issues with non-compliant vessels.]
02 REDSS (ENC Service for Non-SOLAS Vessel)

- **Future** (Developing ENC Service in SMART Navigation Project)

  Develop ENC download and update service for ECS
  Develop ECS standard for SMART Navigation Project
  Develop ECS Prototype considering S-101 according to the ECS Standard
  Develop ENC Streaming Service (Web Map Tile Service)
Today

- Marine information service to support Safe Navigation
### Future

- Developing Marine information service considering the MCP, S-100 for MSP 5, MSP 12, MSP 14 and MSP 15

#### Research Topics

- Develop MSI Service (NAVTEX, S-124 NW)
- Develop Nautical Publication Service (S-122, S-123, S-125, S-126, S-127)
- Develop Marine Weather Service (S-412)
- Develop Marine environment and Hydrographic Service (S-104, S-111)
Prototype development of e-Nav Service

Prototype of ENC Service for Non-SOLAS Vessel

- Prototype development of ENC service for Non-SOLAS Vessel

1) Message Relaying
2) Message Queueing
3) Message Casting
4) Seamless Roaming

1) Unicasting
2) Broadcasting
3) Geo-casting
4) Multicasting
Prototype development of e-Nav Service

- ENC Distribution Service to ECS

**Diagram:**
- **View**
- **ECS**
- **EDUC**
  - ENC Distribution Client Module
- **File Server**
- **SMART Navigation Operation System**
- **EDUS**
  - ENC Distribution Server
- **MCP**
  - (Maritime Connectivity Platform)
- **eIM-ENC**
- **KHRA**

**Key Steps:**
1. Request Files (FTP)
2. Download Files
3. Request (MRN)
4. Response (Address)
5. Approve ENC License Authentication
6. Request ENC License Authentication
7. ENC Update License Check
04 Prototype development of e-Nav Service

- ENC Streaming Service
Prototype development of e-Nav Service

- REDSS (ENC Service for Non-SOLAS Vessel)
  - Zone for ENC Distribution Service: Group the ENC Coverage into 12 Zones for efficient Distribution service via LTE-M

### File Size of Zone

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Prototype development of e-Nav Service

- REDSS (ENC Service for Non-SOLAS Vessel)

  ECS Standard for SMART Navigation

  This Standard specifies the minimum operational, performance and technical requirements and methods of testing for SMART Navigation compliant ECS.

  - IEC 60945 (General requirements)
  - IEC 61174 (ECDIS requirements and testing methods)
  - Class B level of ECS and Additional Requirements
  - IEC 62288 (Presentation of navigation related info)
  - IEC 61162-1, 61162-2 (Digital interfaces)

SMART Navigation Service Based on S-100

- S-101 ENC
- S-104 Water level for Navigation
- S-111 Surface Current
- S-124 Navigational Warnings
- S-12X Nautical Publications

Message service for collision and grounding accident
- Remote monitoring service
- Optimal route planning service

Interoperability Requirement

- Interoperability catalogue
- Files describing how an ECS must combine data products conforming to different product specifications for display purposes

LTE-M Router Interface

- Define the digital interfaces to link to the LTE-M Router
04 Prototype development of e-Nav Service

- REDSS (ENC Service for Non-SOLAS Vessel)
  - The Research team improved the user S/W to process S-101 ENC according to the S-100 Portrayal Process

S-101 ENC (8211)
S-102 Bathymetric Grid (BAG)
S-111 Surface Current (HDF-5)
S-124 Nav. Warning (GML)
Prototype development of e-Nav Service

- REDSS (ENC Service for Non-SOLAS Vessel)
  - Process and Display of S-101 ENC

3 ECS Teams and 2 ENC Streaming Service Teams
04 Prototype development of e-Nav Service

- MEDSIS (Prototype of Marine and safety information service)

Prototype development of Marine and safety information Service

File Server

MCP (Maritime Connectivity Platform)

| MMS (Maritime Messaging Service) |

MCP Connector

MSI Service S/W

NPUB Service S/W

Weather/Hydro Service S/W

DB Adapter

S-124 MSI DB

S-12X NPUB DB

S-412/S-111 S-104 DB

S-412 GML/HDF-5 Converter

KHOA
- Nav. Warning
- Nautical Pub.
- Hydro Data

KMA
- Marine Weather

Mobile Device

ECS

1) Message Relaying
2) Message Queueing
3) Message Casting
4) Seamless Roaming

MC Portal

Maritime Cloud

MIR

MSR

MMS

1) Unicasting
2) Broadcasting
3) Geo-casting
4) Multicasting

Prototype development of e-Nav Service

- Geo-spatial Database for managing Feature based dataset
Prototype development of e-Nav Service

- **S-100 Data model**

**MSI – S-124 NW data model**

**NPUB – S-122 MPA, S-128 Catalogue of Nautical Products, S-201 AtoN**

- Thomas Christensen
- Eivind Mong (CCG)
- STM Validation
- DMA NIORD
- SMART Nav. Project
Prototype development of e-Nav Service

- S-100 Data model

Marine Weather – S-412

Marine environment and Hydro – S-102 Bathy, S-104 Tidal Height, S-111 Surface current
Prototype development of e-Nav Service

- Test results
04 Prototype development of e-Nav Service

- User satisfaction survey for the service prototype

- Title: User Satisfaction Survey for the SMART Service Prototype
- Date: 18 Dec, 2017
- Venue: Daejeon Railway Station Meeting Room
- Participants: Mariners, Fishermen (25 Persons)
- Survey Results: 56.4 (WP4), 57.53 (WP6)
### Summary of Prototype development

- Prototype development of REDSS and MESIS which is ENC service for Non-SOLAS Vessel and Marine information Service based on S-100
- Concentration of system integration with other research teams considering MSP, MCP and S-100
- MMS among MCP components (MMS, MIR, MSR) was used in the basic level
- REDSS consists of two ENC Services for Non-SOLAS Vessels (S-57 ENC and S-101 ENC Download and Update service for ENC, ENC Web Map Tile Service for Mobile App)
- MESIS consists of four marine information services (MSI, Nautical publication, Marine weather, Marine environ and hydro service) according to international standard based on S-100
- User satisfaction survey was conducted by the Questionnaire method
Future Plan

- Testing SMART Navigation Services in the Simulation Environ.
  - SMART Navigation Integrated Test Center was established in KRISO
  - Consists of Integration Operation System and 4 Simulators
  - REDSS and MESIS will be tested completely before installing in real service system
05 Future Plan

**MCP - MMS, MSR, MIR**

- **MMS**: Relating, Queueing, Roaming and Casting will be tested (Uni, Multi, Geo, Multi-Casting)
- **MSR**: Revision of Service spec, technical design and service instance and search SMART Navigation Service List and apply those
- **MIR**: User authentication test

- **HTTPS**: Client-Server Structure
- **DDS**: Publisher-Subscriber Structure
05 Future Plan

- Cooperation with KHOA, KCG and KMA
  - S-101 ENC will be produced and tested by REDSS (S-57/S-101 Download and Update Service for ECS, ENC Streaming Service for Mobile Device Application)
  - S-124 Navigation warning, NAVTEX Message by KCG
  - Nautical Publication (S-122, S-123, S-127, S-128) by KHOA
  - Marine environment and Hydrographic data (S-102 Bathymetric grid, S-104 Tidal height for surface navigation, S-111 Surface Current) by KHOA
  - S-201 Aids to navigation by MOF