Field test of a pilot small sea area ship information system using Maritime Cloud and smart phones

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Contents

• Introduction/Background
• Ondo Strait (Ondo-no-seto)
• Maritime Cloud
• Small Sea Area Ship Information System
• Field Test/Analysis
  – Position Accuracy, Time Delay, Throughput…
• Summary/Conclusion
• Acknowledgements
Introduction/Background

• Demands to reduce marine accidents
  • Information supports for sharing ships’ position information including non-AIS ships are demanded.

• Demands to get non-AIS ships’ position information

• Development of Small Sea Area Ship Information System;
  – Provides location sharing information by using smartphones and Maritime Cloud.
Ondo Strait (Ondo-no-Seto)

- Characteristics
  - West of Japan
  - 50km from Hiroshima
  - Narrow and bend
  - Minimum width: 60m
  - Crossing a very small ferry
  - Change of tidal currents

This map is based on the Digital Map 25000 (Map Image) published by Geospatial Information Authority of Japan
Ondo Strait (Ondo-no-seto)

Min. width 60m

High speed ship

Crossing a very small ferry
Maritime Cloud

Definition:

A communication framework enabling efficient, secure, reliable and seamless electronic information exchange between all authorized maritime stakeholders across available communication systems.

Core services:

- **Maritime Identity Registry.**
  - A centralized authority for identities of persons, organizations or ships that are using the Maritime Cloud.

- **Maritime Service Registry.**
  - A centralized repository of service standards and provisioned services world wide.

- **Maritime Messaging Service (MMS) server.**
  - A communication protocol on top of TCP/IP. Supporting reliable delivery of messages and geocasting.
Small Sea Area Ship Information System

- **Client App**: GPS Info. & Request LS Info. (4G)
- **Maritime Cloud MMS Server**: Every 10s
- **AIS Receiver + 4G router**: Every 60s -> 5s
- **Service Provider server**: AIS Information

Flow:
- 4G
- Internet
- AIS
- **Web Browser**
Small Sea Area Ship Information System

- **Client App**
- **4G Internet AIS**
- **Maritime Cloud**
- **MMS Server**
- **AIS Receiver + 4G router**
- **Every 10s**
  - Location Sharing Information (4G)
  - Location Sharing Information
- **Service Provider server**
- **Web Browser**
- **Internet**
- **AIS**
AIS Receiver at JCGA (Japan Coast Guard Academy)

- 10km from Ondo Strait

4G Router
AIS receiver
FURUNO FA-30
RS-422->USB->PC
Smartphones/Tablets (1)

- iPhone 6 (4G)
- iPad mini 4 (4G)
- Asus Zenfone2 (4G)
- Lenovo Tablet (No sim)
  - Wi-Fi : off (all devices)
Smartphones/Tablets (2)

- Snapshots
Focus Points for Analysis

• Position Accuracy of Smartphones/Tablets
• Time Delay of the System
• Throughput on Board
• If the GPS signal is weak in Environment
Field Test

• Test Ship: Subaru (Oshima College, formerly Oshima National College of Maritime Technology)
  – 14.5m, 14ton
  – AIS (JRC JHS-180)
  – GPS Compass (FURUNO SC-50)
Field Test

Trajectory (Jan 7th 2016)
Position Accuracy

Position Gaps between GPS Compass

![Graph showing position accuracy gaps between devices over time.](image-url)
Position Accuracy
2drms (2 distance root mean squared): 95%

<table>
<thead>
<tr>
<th>Device</th>
<th>2drms</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone</td>
<td>16.1m</td>
</tr>
<tr>
<td>iPad</td>
<td>17.2m</td>
</tr>
<tr>
<td>Zenfone</td>
<td>23.7m</td>
</tr>
<tr>
<td>Lenovo</td>
<td>16.3m</td>
</tr>
</tbody>
</table>
Time Delay
(Time interval: over 60 seconds)

Just started the turn

Already turned

Real Position

System Position
Time Delay
(Time interval: 5 - 10 seconds)
Throughput on Board

• OOKLA Speedtest
  – Fujitsu Arrows F-10D (4G)  Mbps
    | DOWN | UP |
    |------|----|
    | A    | 18.0| 10.2|
    | B    | 62.4| 23.3|
    | C    | 32.5| 12.2|
  – iPhone 4S (3G)
    | DOWN | UP |
    |------|----|
    | A    | 5.97| 1.28|
    | B    | 5.49| 3.56|
    | C    | 1.74| 1.58|
If the GPS signal is weak in environment
If the GPS signal is weak in environment

At Bridge

GPS
NMEA Signal
RS-422

RS-422 -> RS-232C Converter

RS-232C -> Bluetooth

Smartphones/Tablets

GPS NMEA Signal by Bluetooth
Summary/Conclusion

- Developed Small Sea Area Ship information System
  - Using Maritime Cloud
  - Using smartphones/tablets for non-AIS ships’ position
- Carried out field test
  - Position accuracy of smartphones/tablets
    2drms(95%) 15-25m
  - Data interval time 5-10 seconds -> Good results
  - Measured enough throughput on board
- This system would be helpful for safe navigation.
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