IoT 기반의 선박용 스마트보고 및 계류 시스템

카몰로브 아호마드혼* · 박수현**

*동서대학원 유비쿼터스 IT

**동서대학교

IoT based smart reporting and mooring system for vessels

Kamolov Ahmadhon* · Su-Hyun Park**

*Dept. of Ubiquitous IT Graduate School of Dongseo University

**Dept. of Computer Engineering, Dongseo University

E-mail : ahmadxonk@gmail.com, subak@dongseo.ac.kr

요 약

　Smart Ship은 현재 많은 논의가 진행중인 주제 중 하나입니다. 그 이유는 유사한 연구의 양이 증가하고 가속화되고 있기 때문입니다. 그 증거로 빅 데이터, 클라우드 및 IoT 등의 첨단 기술을 활용하여 선박간의 이동, 안전, 데이터 교환, 감시 시스템 문제를 해결하고 있습니다. 해양 기술에서 위와 같은 기술을 활용하는 것은 바다 위 선박간의 발생 할 수 있는 다양한 문제뿐만 아니라 항만과 통신하는 것에도 중점을 둡니다. 본 논문에서는 선박 및 항구를 위한 IoT 기반의 지능형 보고 및 정박 시스템을 제안합니다. 본 시스템은 선박이 정박할 경우 IoT 기술을 활용하여 자동으로 관리 시스템에 통보하며, 이후 정박을 원하는 다른 선박들에 대하여 빠르고 안전하게 남은 위치를 유도합니다. 시스템은 선박 계류 중에 시간, 노력 및 비용을 최소화 할 수있는 편의를 제공합니다. 이와 같은 시스템은 선박의 표류 시간, 비용을 최소화 할 수 있는 편의를 제공하게 됩니다.

ABSTRACT

　The Smart Ship is considered one of the most discussed and novel topics in developing technological period. In this reason, the amount of running researches on it is evolving so fast. As a proof, the faced drawbacks such as the departure of ships, their safety, exchanging data, traffic and data monitoring system are being solved by presenting advanced technologies and innovations like Cloud, BigData, IoT and etc. Expanding the utilization of these technologies in the Marine world emphasizes not only the departure of the ships in the water but also they focus on solving the problems of the ships connected with the communication to the ports. In this paper, we present an IoT based smart reporting and mooring system for vessels and ports. In the proposed system, the ships automatically send all the data about themselves to the port and after getting the data, ports automatically send the information about possible spaces to moor for the ships using the sensors at the port. The intended system gives an amenity to minimize the time, effort and the cost while mooring the vessels.

키워드

Internet of Things, Smart Ships, Smart Ports, A Mooring, Communication, Auto Reporting.

Ⅰ. Introduction

　After appearing the phrase of Internet of Things, it is getting common to give the name of "smart" to the items which we utilize in our daily life like Smart watch, Smart ship and etc. The premium reason of getting such name is they are capable of exchanging data and

command with each other independently. The items which communicate with each other by means of sensors and devices that are able to exchange data are the things of the internet. These devices will compose a stable factor of forthcoming Smart City[1]. Advanced researches that are doing on such smart devices and their internet claim that in a near future it is possible to create not only diverse sorts of smart cities but also we are able to make our planet "Smart". Making The Earth smart focuses on utilizing technologies like IoT, Cloud Computing, Machine learning, Computer Vision and struggling with the problems and drawbacks in the field by applying such leading and up to date technologies.

Shipping(Marine) is also considered one of these branches. That is the reason the most succeeded countries in technological world, Korea and Japan have already drawn their attention towards IoT and Cloud technologies in building Smart Ships and Smart Ports.[1],[2] In a deep explanation, the researches highlight to make the ship completely automate, to control the condition and obtain 100% monitoring of the ship in a real-time, to save all the data about the ship in Cloud and by means of these to make online connection with other ships and to provide vessels with safety and effectiveness in the marine. It is really worthy to note down that in shipbuilding it is essential not only the connection between ships but ship to port connection is also crucial. Especially, this communication plays an immense role in order to get efficiency and quickness while mooring the vessels. As entering the port territory and mooring takes pretty much time and during this process the ships exchanges lots of data with the port. With regret, still a main part of exchanging data is being managed with the help of radio connection. After transferring all the essential data about the ship to the port, the process of parking the ship is also handled in the same procedure and this requires additional toil and time from humans. Making automate of these procedures and solving the problems by means of IoT is an interest and demand of the day.

The proposed system which we present in this paper claims that the ships arrived to the port report all the data about themselves to the port automatically and after getting the data the port inform about available spaces to park for the ships using the sensors at the port spontaneously. The paper includes following sections: Section II is about vessels and ports communication, Section III describes proposed system architecture, Section IV is devoted to experiment and implementation and then conclusion for the paper.

II. Vessels and Ports Communication during a mooring(berthing) of the vessel

The conditions of the vessels at the port has the same importance with being at the sea. It gets a much time and energy to get the ports and to take a place to moor. One of the main reasons of this is the movement of the vessels all day along and another reason is during the procedure of placing at the port ships and posts have to keep the connection to exchange essential data. The data composes not only the name of the ship, model, the captain and the crew but also it informs about the general condition of the ship, the types of the cargo and etc. Additionally, a port dispatcher reports about available spaces to moor. Naturally, as mentioned these procedures requires additional time and attention. Aiming to faster the procedure and to create convenience before getting informed with our proposing system you may read a report between the ship and the port given below.

Here is and example of the VHK exchange between the Master of the container ship "Moonlight" and the New port Control from [4].

Message(s)
MASTER - Newport Port Control. This is «Moonlight» - AGW5, on channel1-2. I am spelling my name for you: «MOONLIGHT», Mike - Oscar -Oscar -November - Lima - India - Golf- Hotel - Tango. Call sign: Alfa -Golf- Whiskey - Five. Over.

NEWPORT PORT CONTROL - «Moonlight». Understood. What is your last port of call and your next port of call, please? Over.

MASTER – My last port of call is Bombay, India. My next port of call is Hamburg. Over.

NEWPORT PORT CONTROL - What is your cargo and Have you got any dangerous cargo on board? Over.

MASTER - I am a fully cellular container vessel. I have general cargo in containers on hoard. Total number of containers is 1,432. My deadweight tonnage is 27,865 tons. I have 785 tons of dangerous cargo, IMO Class 4.2, in containers on deck,

Taking a Pilot Aboard
MASTER - Newport Port Control. This is «Moonlight».

How do you read me? Over.

NEWPORT PORT CONTROL - «Moonlight». This is Newport Port Control. Reading you loud and clear. What is your position? Over.

MOONLIGHT - I am now in position: bearing 286 degrees, three miles from the Fairway Buoy. Are there any berthing instructions for me? Over,

NEWPORT PORT CONTROL - «Moonlight». This is Newport Port Control. Sorry, no berthing prospects for the moment. You should reduce your speed and proceed to the anchorage east of the Fairway Buoy. Rig the pilot ladder on the port side. Stand by on channel 1 - 2 lor further instructions. Over.

MOONLIGHT - Understood. Standing by on channel 1–2.

III. Proposed System Architecture

In this section we present the IoT based smart reporting and mooring system architecture and design for vessels. As we mentioned above, this system gives an amenity for sending the information of the ship automatically and informing the ships with available places to moor at the port. The system before sending the data about vacant places to a certain ship vie sensors checks the information of the ships which have reserved the place beforehand and then those places are sorted out from the list. And automatically the system skips out those places in the vacant list. Here, you may see the design and architecture of the system.
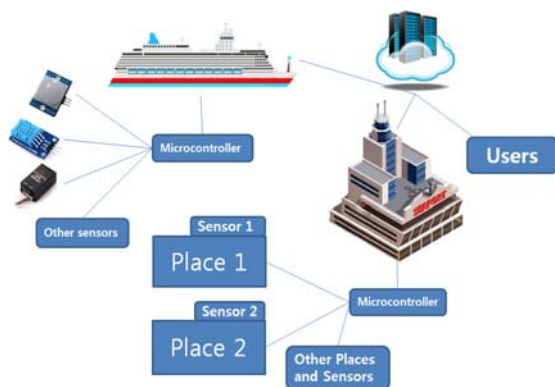

Figure 1. Architecture of the IoT based smart reporting and berthing system for ports and vessels.

As illustrated above Figure 1 and 2, this proposed system is aimed that the working procedure makes a similarity as following.

Figure 2. Design of the IoT based smart reporting and berthing system for ports and vessels.

A. The system at the ship

1) All stagnate information about the ship is transferred to the system in advance and it is kept constantly. (the model, color, length, name, owner of the ship and etc.) Moreover, the system keeps all the data about the ports and aimed places to moor(coordinate, map etc.).

2) The system receives continuous information with the help of the sensors fixed at the ship (the direction, speed, location, temperature and etc. of the ship).

3) The system presents opportunity for the responsible person (he may be a captain) insert and save the data.

B. The system at the port.

1) All the stagnate data about possible mooring spaces and sensors is inserted to the system beforehand and it is kept constantly(the measure of the space, location, number, sensor ID and etc.).

2) The system gets continuous data via the sensors that are fixed different places.(is the place vacant or occupied and if it is occupied it clarifies which ship has been moored there).

3) Getting the data taken from the sensors the system determines vacant and convenient space and it sends the information about the space to a certain ship.(the number of the space, location and etc.).

4) The system before sending the data about vacant places to a certain ship vie sensors checks the information of the ships which have reserved the place beforehand and then those places are sorted out from the list.

C. Cloud and Database

The Data about Ships and Ports is kept in certain Database. (the names and conditions of Ports and ships).

D. User

User (owner of the ship or responsible worker of the company) may know about the condition of the ships at the port.

IV. Implementation and Experiment results

As the example given in the second section the intended function of data exchanging between the port and the ship in our proposing system is illustrated below. Table 1. shows some of the information that is sent to the ports in an electron version.

Table 1. Vessels Information which can be seen on the port system.

Ship_ID	Ship_Name	Ship_Owner	Captain_Name	Ship_Long	Ship_Width
V-11111	BUSAN SHIP	Busan Ships	Hun-jae Lee	250m	32m
V-22222	SEOUL SHIP	Seoul Ocean	Hyo-Taek Lim	300m	40m
V-33333	KOREA SHIP	KorShips	Su-hyun Park	366m	49m
V-44444	SEA DIAMOND	USA Shipping	Neal Caffrey	215m	20m
V-55555	SEA ANGEL	Chine Ships	Wang Hai Di	340m	43m

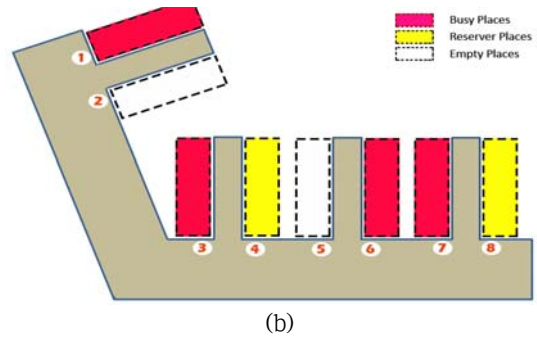Figure 3. a and b describe the data which are sent to the ship by the port.

(a)

(b)

Figure 3. (a) describes example message which can be sent from the port system to the ships. (b) example of an electronic port map which can be sent to the ships from ports.

V. Conclusion

In this paper we deeply illustrated the design and the architecture of the system which represents an immense amenity to automate the connection between novel Smart Ship and Smart Port. Our IoT based system helps to place the ships arrived to the port automatically. With the help of the system the ships may send essential data to the port and automatically they get informed about vacant places.

Acknowledgement

References

[1] Yasir Mehmood, Farhan Ahmad, Ibrar Yaqoob, Asma Adnane, Muhammad Imran, and Sghaier Guizani, "Internet-of-Things-Based Smart Cities:Recent Advances and Challenges", IEEE Communications Magazine, 0163-6804, September 2017
[2] https://www.marinelink.com/news/industries-solution427522
[3] http://www.marinemec.com/news/view,japan-develops-smart-ship-platform_44850.htm
[4] http://www.pfri.uniri.hr/~bopri/documents/21-MEArrivalataport_000.pdf