

Tracking system of fishing gear on small sized ship

Gul-Won Bang, Yong-Ho Kim

Abstract Background/Objectives: Recently, an annual amount of 44,000 ton in abandoned fishing gear has been occurred near Korean littoral sea. It is estimated that 33,000ton of them were left untreated in the sea. Damage as a ghost fishing that fish was caught in the abandoned fishing gear to end up dead would be 370 billion Won that will be approximately 10% of whole amount of fish in Korea. The purpose of this study is not only an expanding infrastructure of domestic marine information industry as well as the new demand creation for ocean observatory instruments industry but a loss prevention of fishing net and fishing gear to increase income of fishermen as well as the prevention of marine pollution

Methods/Statistical analysis: Tracking system based on smart phone for fishing gear on small sizes ship is to identify the location of fishing net and fishing gear through smart phone application using Bluetooth for data sending and receiving location of fishing gear. Transmission unit in tracking system is installed LED for recognize ability at night or in case of rain and fog as well. Collecting information in real time using the on-board GPS module for an exact location of buoy is transmitted receiver unit through built in modem

Findings: Received location information of buoy using standard data sorting is transmitted smart phone through Bluetooth. Smart phone APP is searching for the coordinate value of buoy in the map and it is provided in display to find the buoy easily.

Improvements/Applications: A number of domestic fishing vessels in 2014 remained 46,248. Tracking system of fishing net and fishing gear is available to install at an affordable price owing to linking smart phone with small sized ship.

Keywords : Small Ship, Fishing gear, Tracking, GPS, Bluetooth, Ocean

I. INTRODUCTION

An annual amount of 44,000 ton in abandoned fishing gear has been recently occurred near Korean littoral sea. It is estimated that 33,000 ton of them were left untreated in the sea. Damage as a ghost fishing that fish was caught in the abandoned fishing gear to end up dead would be 370 billion Korean Won that will be approximately 10% of whole amount of fish in Korea. A broken fishing gears has been caused damage not only in marine resources and ocean ecosystem but fishery activity, including quality degradation of marine resources and threat to safe operation of vessels. Costs for the disposal of broken fishing gears returned to the

ocean is two to three times as expensive as costs for waste disposal in the ground. It is necessary to need system which is able to recall broken fishing gears automatically based on their navigator in order for damage prevention of marine resources and ocean ecosystem, smoothness of fishery activity, and safe operation of vessels as well as marine waste disposal. The system is designed in this study to be able to identify the location of fishing gear capable of recoverability and loss prevention through smart phone.

A current ocean observation system is using artificial satellite to get an information from mooring or drifting at buoy. It is impossible to observe vast ocean using a great quantity of buoy owing to a high price. Low priced buoy to collect marine information less than two to three million Korean won was developed for sale in Korea. There is no specialized system tailored to the ocean information observation that is installed each sensors and controller as well as radio communication equipment for identifying location of fishing net and its gears for fishermen.

Some fishermen has install unlicensed AIS on fishing net to save cost recently. Fishing net can be easily found through its unique AIS signal if AIS is installed on fishing net. The fishermen have looked for their fishing net in the ocean using buoy that has their own unique mark before. However, it is not easy to find his own buoy in the middle of an ocean with bad weather or sea fog as well as jostling by waves even though coordinates of buoy are remembered. AIS is working without permission of establishment of radio station because AIS is universal device. The Korean maritime police forces to consider an unlicensed AIS signal as a foreign vessel owing to universal signal if the signal is detected in Korea sea area. The problem is occurred in overlapping signals between AIS signal in existing vessel and an unlicensed AIS signal when the fishermen are working on net task. The police has considered that two vessels were crashed based on overlapping signals[1][2].

II. MATERIALS AND METHODS

2.1. Principle of GPS

GPS gets the coordinate value to calculate the distance between GPS satellite and GPS receiver. It is possible to identify the exact location using only three satellite if we know the exact location and distance of GPS satellite because we live in the circular form of three dimensions in surface of the earth. It will be easily determined location in

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case of knowing two reference points and its each distance value if there is a one-dimensional world like a straight line. In two-dimensional world, three reference points and each distance value is needed to know. The reason why is that the meeting point of three circles will be a corresponding location when it is used a distance value as a radius based on holding the center of a circle for each reference point. It is the same that the location will be found in a part of overlapping four circle in three-dimensional space. However, it is possible to determine the location theoretically if there are only three satellite because the earth surface itself plays a role as a circle. This doesn't actually seem to enough to calculate precisely distance owing to a time error between a clock on board satellite and that of receiver in ground because the distance between GPS satellite and GPS receiver is to be calculated base on the time of radio wave arrival from satellite. Therefore, An exact location is to be identified only if radio wave must be received from four or more GPS satellites. The latest generation GPS receivers calculate an exact location because of receiving signals from twenty satellites. If so, how can a location value get from a tunnel that is difficult to temporarily receive GPS signal? Dead reckoning is used in this case. This is the method that the location of a present receiver is estimated based on the relations between the position values and receiver direction as well as speed prior to the signal lost [3].

Measurement data of GPS that is used for military purpose such as PPS(Precision Positioning Service) has an accuracy of less than 50 meters while SPS(Standard Positioning Service) is used for civilian with an accuracy of less than 200 meters. The service with lower accuracy in private sector is provided deliberately. In order for compensation method, DGPS(Differential GPS) is used to apply the correction data which used the difference between a particular location in a coordinate value and its measurement value. An accuracy with an error range of less than 10 meters was drastically improved in 2000 owing to elimination of selective availability from GPS signal. Ministry of Land, Transport and Maritime Affairs stated in 2009 that an exact positioning information corrected GPS error with from 30 meters to 1 meter was supposed to provide all coastal areas and inland area of Korea based on the completion of center for the cutting-edge GPS. GPS along with GIS is used navigation equipment in mainly airplane, vessel, and vehicle and it is also used to find the location of moving objects such as people and vehicles[4][5].

2.2. Principle of Bluetooth

Bluetooth in wire system is used 2400~2483.5MHz that is ISM(Industrial Scientific and Medical) frequency band. It uses a total eighty channels that is composed of 2402~2480MHz with the exception of 2400MHz after 2MHz and that of 2483.5MHz before 3.5MHz to prevent interference of other system which is used the upper or lower frequency. ISM is the assigned frequency band for industrial, scientific and medical purpose and wireless equipment with low power emission is used a lot individually because an authorized permission is not necessary to use radio

frequency. Amateur radio, wireless an, and Bluetooth are using this ISM band. There is concern for radio frequency interference problem between inter system owing to using the same frequency band with other system. Frequency hopping method that packet data is transmitted little by little and a large number of channel moves very fast according to a specific pattern is applied to prevent interference. Bluetooth makes assigned seventy nine channels hopping 1600 times per second[6].

The communication is working through synchronization of hopping pattern between Bluetooth devices. Bluetooth is composed of master part and slave part for their connection and the communication of two devices is not working if slave device is fail to synchronize frequency hopping which is generated by master device. This is able to provide stable connection without radio interference of other system. For one thing, one master device is able to connect up to seven slave devices. The communication between master device and slave device is possible while the communication between slave devices is impossible. However, their roles are able to switch according to the situation because the role between master and slave is not fixed[7].

Bluetooth is a secure protocol that is exchange information through 2.4GHz wireless link with low power for connecting mobile devices such as cellular phone, various input and output devices in computer, earphone, and headphone. The reason why Bluetooth is receiving the major spotlight is as follows; Firstly, it is possible to exchange data freely anytime or anywhere between all information devices because it observes standard and uses low power of 100mW with cheap price. Secondly, it is relatively secure on the security side because data transmission over the different frequencies as a frequency hopping is divided for transmission. Thirdly, Bluetooth signal is able to transmit any direction regardless of obstacles[7].

2.3 Connection method in Bluetooth

It isn't very complicated to connect method between Bluetooth devices. Connection attempt a couple of times makes anyone use the device easily. In case of connection between smart phone and headset supported by Bluetooth, smart phone will be master device and headset will be slave device. Turn on headset power then Bluetooth in smart phone is activated and it will be automatically searching every device around surroundings. Desired connection in model of mobile phone is selected for paring. There is a case of entering password especially in connection of notebook with Bluetooth mouse and keyboard. Once you have connectivity, automatic connection is possible whenever each device and Bluetooth is powered.

There are headset and keyboard supported by Bluetooth while notebook and mobile phone as a master device are not supported by Bluetooth. Bluetooth dongle as a repeater is used to solve this problem. The shape of dongle is generally the same of USB for easy connection in USB port. Sometimes dongle for an exclusive use is needed[8].

2.4 Tracking system of



fishing gear

Tracking system of fishing gear for buoy is consisted of as follows; transmitter, light emitting part, GPS receiver, rechargeable battery, solar cell, and recharge controller. The block diagram is shown in Figure 1. LED is emitting to able to identify a buoy in case of the night time, rainy weather and fog. GPS receiver installed buoy acquires the coordinates and wireless data transmitter sends them. Receiver includes data receiver module and Bluetooth communication modem. The transmitted coordinates value from transmitter is received to store buffer for sending smart phone through Bluetooth modem. Smart phone APP calls map information for not only search but display location that fits coordinate value of buoy to play role as a navigation for finding the location easily. Each buoy is given unique ID number to be identified for preventing collision. Solar cells installed inner buoy for corrosion proof by ocean water make possible use rechargeable battery[9].

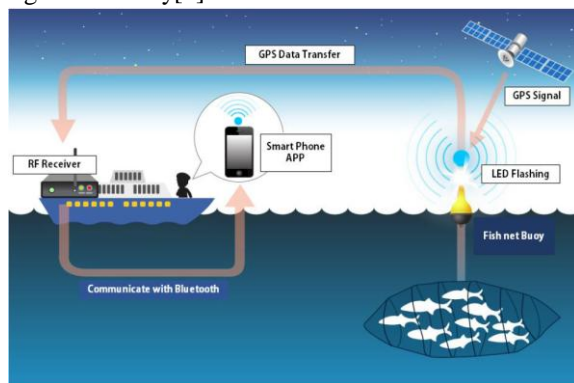


Figure 1. Design of Improved Decision

Block diagram of tracking system of fishing gear is shown in Figure 1. Structure of tracking transmitter module which is installed a buoy to send location signal is shown in Figure 2. Diagram of transmitter module is shown in Figure 3. Figure 4 is shown that the received GPS coordinates value in RF receiver that is receiving transmitted signal from transmitter is send to a mobile phone through Bluetooth. Implementation of location and tracking function in a mobile phone APP is shown in Figure 5[10].

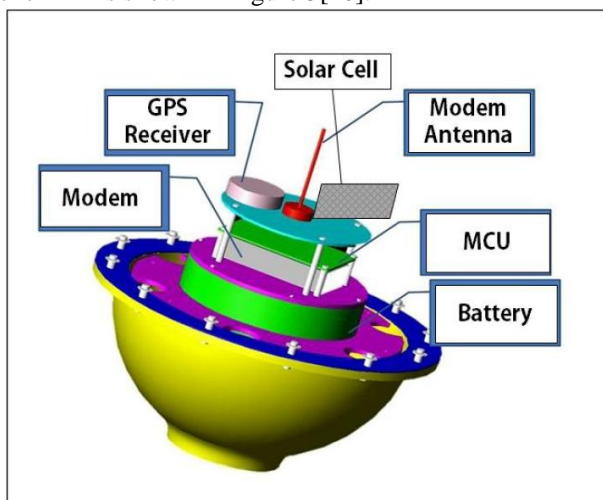


Figure 2. Structure of buoy in tracking transmission

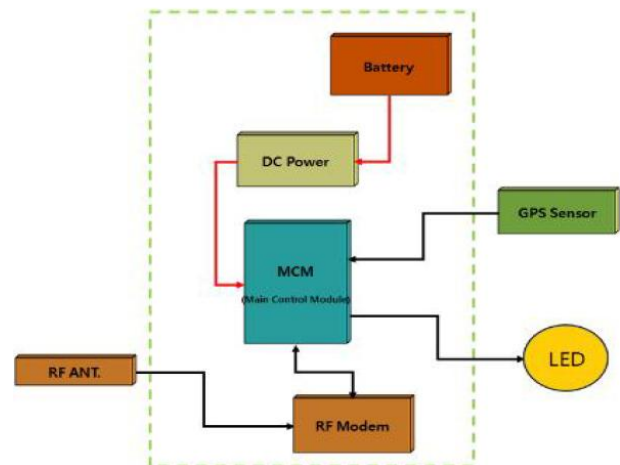


Figure 3. Diagram of acquisition device in buoy location information

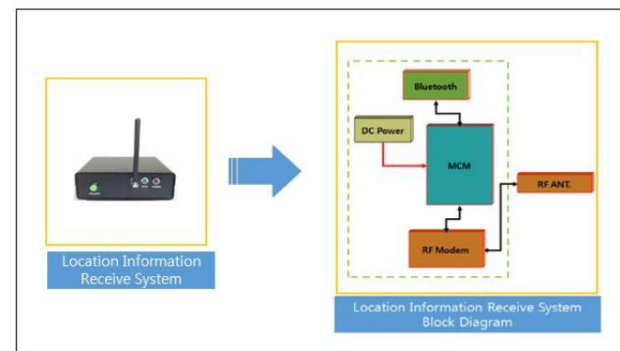


Figure 4. Receiver module of fishing gear



Figure 5. Tracking APP of fishing gear

III. RESULTS AND DISCUSSION

3.1 System specifications of fishing gear tracking in mobile phone

- Frequency band in communication : Use of UHF 400MHz band
- Out power : 2W
- Working voltage : 5V
- Power : Lithium-ion 7.2V, 5000mA
- Sollar cell without supplying power
- Rated water proof : IP68

3.2 Specifications of GPS receiver

- Model : NEO-6
- Built-in EEPROM
- Number of channel : 50ch
- Interface: RS232 TTL

- Power: 3.6V
- Baud rate default: 9600bps

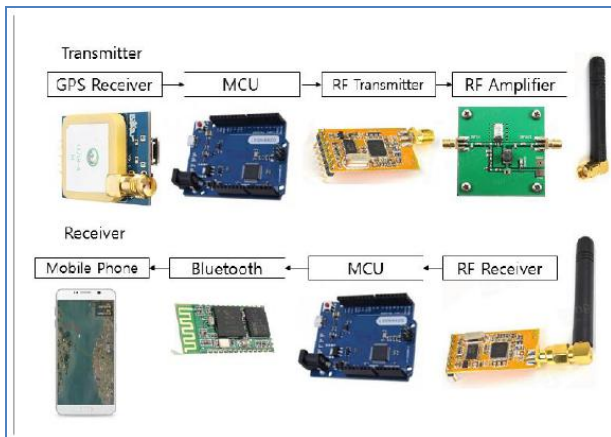


Figure6. Implementation of tracking system for fishing net

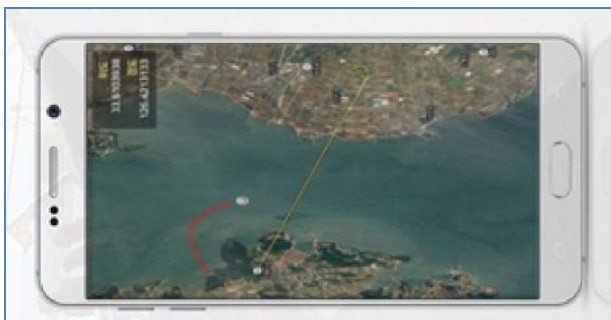


Figure 7. Mobile Phone App

Providing location of fishing net and GPS tracking Providing information of weather and precipitation Alarm function according to urgent announcements Block diagram of consisting transmitter for acquiring location information and receiver for receiving location information is shown in Figure 6 to implement fishing gear tracking system

An exact location was measured according to test result. It took 1~2 minutes to get GPS signal. LED built-in GPS module is flickering when GPS signal is catching first. The present data in latitude and longitude is the value of GPGLL. Conversion of 3730.67773, N, 12694.42632, E will be location coordinate value in 37.3067773, 126.9442632. An exact location is marked as this value is applied Google map. The location of Google map in a smart phone display is marked when the value of latitude and longitude is transmitted by transmitter and is stored by receiver in buffer and is sent to smart phone that is connected with Bluetooth. Figure 7 provides safe catch tracking by providing marine weather information with a service screen and supplementary service that can track the location of words with GPS coordinates actually entered on the mobile phone, and provides information to fishermen in conjunction with the national disaster alert service.

IV. CONCLUSION

A current ocean observation system is using artificial satellite to get an information from mooring or drifting at buoy. It is impossible to observe vast ocean using a great quantity of buoy owing to a high price. Low priced buoy to

collect marine information less than two to three million Korean won was developed for sale in Korea. There is no specialized system tailored to the ocean information observation that is installed each sensors and controller as well as radio communication equipment for identifying location of fishing net and its gears for fishermen. Location confirm system of fishing gear through smart phone based on Bluetooth, GPS receiver, and wireless data transmitter module to trace fishing gear location is researched in this study.

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