ID17- PERFORMANCE AND SECURITY IMPROVEMENTS IN AUV SURVEYS USING RF MODULES

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Abstract – Autonomous Platforms Department of Marine Technology Unit (UTM-CSIC) owns two portable AUV with water quality and imaging configurations that at the moment only have been used in littoral waters for safety reasons. To be able to operate this vehicles further off shore or out of line of sight and improve overall safety this department is developing a RF system to localize this vehicles were GPRS coverage is not available.

Keywords – AUV, RF communications, development, UTM, CSIC

INTRODUCTION

Autonomous Platforms Department of Marine Technology Unit (UTM-CSIC) currently has owns portable AUV with quality water sensors and side-scan sonar configurations respectively and is the newest established department in this service unit. This group is responsible of their maintenance and operation in scientific surveys where they are required but also are able to design software, hardware and structural improvements using these vehicles also as testing and developing platforms.

Until now, these vehicles have only been used in coastal surveys because of possible safety issues that can occur during operations where current security systems are not really reliable at open sea. Part of actual localization system is based on GPRS and tracking is limited only to areas with cell phone coverage, usually only tens of kilometers from coast. For this reason, and in order t operate such vehicles out of GPRS coverage it would be necessary to add a reliable short-medium range tracking system in open water.

For this purpose we are developing a tracking system based on RF able to receive vehicle position in real time, expandable to allow in the future bi-directional communication and real time monitoring during surveys.

ESPECIFICATIONS

Coastal AUV surveying area rarely is bigger than 1 km2. because of platform autonomy and survey normal path (usually a grid) as well. Then, in order to assure full coverage in offshore any communication system should have at least a minimum range of 5 km. Dimensions of the transmitter installed inside the AUV, its weight and power supply are also limitations to take into account in the system and technology choice. Taking into account all this characteristics two different kinds of modules have been considered:

• Xbee-PRO 868MHz OEM RF Modules: their main advantages are their reduced dimensions, low power consumption and cost (about 300€ entire system). It's wide used in low-cost wireless applications based on Arduino boards [1].

• FreeWave Industrial Radio Modules (869MHz): much more expensive option (about 3.000€ entire system) but commercially tested and used in similar platforms. Its power consumption is also higher than Xbee modules and its mechanical integration is more complicated.

CURRENT DEVELOPMENT

These kinds of devices are not really developed for marine applications and usually datasheet theoretical coverage ranges differ from real performance because of usage scenario itself: communication is not between two fixed points, antennas couldn't be as far from surface that they should and sea water is heavy attenuator of RF communications. Then, testing this kind of devices in a more realistic environment is necessary to determine a real operational coverage range. Tests were performed in a flat area with identical proceed and consisted in a simple device confined in a box carried by a person (in movement) sending NMEA strings with its position every 8 seconds to a computer placed as a fixed station while its position can be monitored in real-time using a software in Python at the same time that al information received is stored. To make more accurate the comparison GPS source was the same in both tests and similar antennas were used (2dB omnidirectional).

In the test were observed the poor Xbee performance when the antennas haven't direct view between them and its weakness against ground bounce loss. Otherwise, Freewave communications easily reach 1 km. distance without any significant signal loss or errors in NMEA sentences. In Fig. 1 maps obtained during tests in the surroundings of the Olympic channel in Castelldefels are shown.

In the last tests in Barcelona seaside we could receive GPS sentences between points separated more than 4km. without viewing increased the number of packets lost or with errors (about 1%) with the increase of the distance. Observing the differences in performances between Xbee and FreeWave our department is now focused to install FreeWave RF system in one of our vehicles in further tests.

This new module can be connected to secondary CPU that our vehicles have for testing and developing purposes and a new antenna should be designed and placed in our vehicles in addition to communication antenna that already have. Main advantage of having this second CPU is that all testing functionalities can be controlled by this extra CPU without interference the usual performance of the vehicle. At the same time, some laboratory tests to use this king of communication to interact with secondary CPU have been taking place.

REFERENCES

[1] Digi International Inc. (2009) "XBEE-PRO® 868 Range Validation" (White Paper).

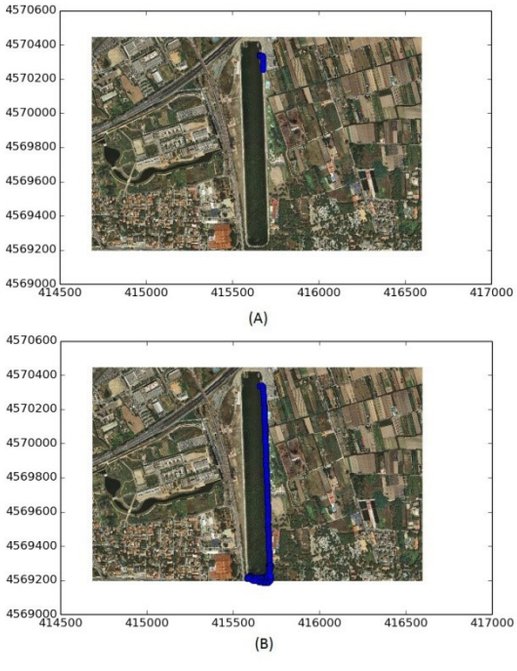

Fig. 1 Comparison between Xbee (A) and FreeWave (B) coverage range performance.