WAVE MONITORING USING BUOY BASED - WIRELESS SENSOR NODES
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Abstract
This article moves topic about wave monitoring, using wireless sensor node, built into a buoy. A wireless sensor node is equipped with 3D accelerometer. A specialized algorithm is developed to calculate wave height based on the approximated vertical acceleration caused by waves. The results from this algorithm are analyzed and visualized on the graphs and compass, using LabVIEW environment.

I. INTRODUCTION
This paper describes a technique for measuring the wave characteristics at a high spatial resolution using myRIO accelerometer. NI myRIO is a platform used by students that gives them the ability to "do engineering" and design real systems more quickly. The NI myRIO-1900 contains a three-axis accelerometer. The accelerometer samples each axis continuously and updates a readable register with the result [3]. Data from sensor are sent to the computer using a wireless network and then they are processed using LabVIEW with identification of physical characteristics, including height and speed [1,2]. The characteristics of the waves are measured in real-time and read from the myRIO accelerometer placed inside buoy floating on the water surface.

II. PROJECT DESCRIPTION
The main problem in the project is to make an application for buoy movement processing and obtain basic data on the physical properties of waves. Our solution is to use 3D accelerometer as a motion sensor, which is named NI myRIO and develop a program algorithm to estimate wave height and the direction of the X, Y, and Z axes. Data from the sensor located on a floating buoy are sent to the computer using the wireless network. The data are processed by an algorithm developed in LabVIEW.

A. Code description
In the figure below the processing of the data acquired from the accelerometer is described. The data from myRIO accelerometer are treated separately from X, Y and Z axis. The data acquired from X axis are filtered and values lower than a certain threshold are ignored. The values are then multiplied by 9.8 which give values in m/s². The processing of the Y axis is very similar to the previous case, therefore we shall focus on the Z component. In this case the values received from the sensor, after the filtering phase, are processed by a double integration and they are sent to PC. With this information it is possible to calculate the height of the waves. To send the data from myRIO to PC and in opposite direction, two variables are declared in the network and linked to the two codes present in myRIO and in PC. A computation of the azimuth is also developed in order to display the position of the wave on the compass, see Figure 3.

B. Results
The graphs below show the result of the work. First graph presents wave height, measured in decimeters and the second one contains a kind of compass, indicating precise direction of the wave.

III. CONCLUSION
Presented program allows for wave monitoring based on wireless sensor networks. Using this simple technology, various types of wave parameters can be measured, such as height, speed, direction and period. The solution captures specified motion parameters from integrated Micro Electro Mechanical Sensor-based inertial sensors, such as accelerometers and gyroscopes. Our method for real-time monitoring of the waves and the frequency of wave measuring apparatus, characterized by comprising: NI myRIO accelerometer inside the buoy.

Figure 1. NI myRIO accelerometer [3]

Figure 2. Block diagram of processing data developed in myRIO, in LabVIEW environment.
and a computer, situated on the ground, with a created program allows achieve
the desired target. For example, wave structure information from our project
can be used by students, marine scientists, environmental protection agencies,
the fishing industry and even swimming lovers such as surfers and swimmers.

REFERENCES


