

CHAPTER 1

INTRODUCTION

1.1 Background

The underwater object detection based on Sound Navigation and Ranging (SONAR) technique could give reliable information by navigating and detecting in various fields such as fisheries, maritime, oil and gas industry, and autonomous underwater vehicles deem information about the underwater object is important [1]. There are many methods that can be conducted to determine the underwater object surface. One of its methods is SONAR technique that began rapidly developed during and after the second world war as an eye for national defense to help the marine reach the object at underwater surface area and to know the characteristic of sea level [2], [3].

SONAR is a technique for detecting objects in the underwater surface by transmitting a sound signal that reflected in the object surface area to locate the object distance position and know their shape [4]. This technique uses echoes to measure the object characteristics in the water [5]. There are two types of SONAR which are active SONAR, and passive SONAR [6]. Active SONAR transmits and also receives the echo signals from the object to measure the signal strength by determining the range of the object position with different distances to provide the transducer flexibility in directing the echo signals [7]. Passive SONAR is only receiving echo signals from the object, which only one-way propagation that only detects the echo signal coming towards it.

This thesis is a development of the previous thesis of Miftahul Firdaus with title "2D Target Detection using Transducer Array for SONAR Application", it was conducted in the air medium with an array transducer SONAR on detecting the object and knowing the shape of the object [8]. The performance of the underwater object detection system is used Arduino Mega 2560 and AJ-SR04M waterproof ultrasonic module with a fish finder transducer sensor to obtain the underwater object information. AJ-SR04M module with fish finder sensor for receiving the reflection of the echo signals from the object to the data processor to obtain its position, and the dimension of the object. Arduino for processing the SONAR data is according to the Doppler effect on detecting the object. A simple Experiment on certain distances is expected to show the underwater object detection system is to be implemented efficiently for detecting the underwater object.

1.2 Problem Formulation

Based on the background, the object information is obtained from the experiment to process the data from transducer sensor output will be needed for extracting the information of the object appearance. The performance of the underwater object detector is to be analyzed and to find its accuracy depends on the sensor detector quality and transmitted signal distortion due to the water permittivity.

1.3 Objectives of Proposed Research

For detecting the underwater object by extracting the object information is obtained from the ultrasonic transducer sensor output and the uses advanced SONAR technique is needed. The uses of the SONAR technique is expected to improve underwater object detector for detecting the object on the underwater surface area.

1.4 Scope of The Thesis

This thesis is to provide the platform to detect the object in the underwater surface area by utilizing Arduino Mega 2560 and AJ-SR04M waterproof ultrasonic module combine with the fish finder transducer sensor. The platform is to visualize the presence of a stationary object by reading the object distance position around 20 centimeters until 8 meters and also shown the object shape by using the 1-Dimensional technique.

1.5 Research Methodology

The research methods that conducted are experimental, as follows:

1. Study of Literature

This step decides references from journals, papers, and books related to the SONAR technique, Arduino Mega 2560, and AJ-SR04M waterproof ultrasonic module combine with the fish finder transducer sensor.

2. Designing The Underwater Object Detector

This step is designing an algorithm to processed Arduino and AJ-SR04M module combine with the fish finder transducer sensor to obtain the object information.

3. Experiment

This step is conducted using the experimental scenario in an underwater surface area with Arduino and AJ-SR04M module combine with the fish finder transducer sensor to obtain the object data by measuring its position and dimension at certain distances.

4. Performance Evaluation

This step is conducted to analyze the accuracy level on experimental data by expecting the proposed system could provide a better accuracy on detecting the object at underwater surface area and shown the shape of the object in 1-Dimension.

1.6 Structure of This Thesis

The rest of this thesis described as follows:

- Chapter 2 BASIC CONCEPT
This chapter describes the theories, tools, and equipments related to this research.
- Chapter 3 SYSTEM DESIGN AND EXPERIMENTAL SETUP
This chapter describe system design and experimental scenarios conducted in this research.
- Chapter 4 RESULT AND ANALYSIS
This chapter describe the result and analyze experimental scenarios of underwater object detection.
- Chapter 5 CONCLUSION AND SUGGESTION
This chapter conclude this thesis and suggestion regarding future works.