CHAPTER I
PRELIMINARY

1.1 Background

Detecting the presence of objects behind walls by paying attention to vital signs such as breathing is important information. This information is used when rescuing victims of natural disasters who are buried under rubble [1,2]. Mainly used for defense systems such as detecting enemies behind walls. So that technology is needed to meet these needs. Through the Wall Radar (TWR) is a radar system developed to detect the presence of objects behind walls operating at Ultra Wideband frequencies. The antenna is placed parallel to the wall, the transmitted electromagnetic pulse spreads through the wall structure, so that any unexpected multipath pulses can interfere with the process of detecting objects that are behind the wall [3].

The deconvolution method can eliminate the effects of the electromagnetic signal reflected off the walls, but the results obtained are inaccurate. One of the inaccuracies in detecting objects behind the wall is the location of the object that is too close to the wall. The Delay Estimation method is used as a basis for correcting the distance from the wall to the target. Walls are a major problem in the TWR system, wall characteristics such as thickness, position and permittivity give different responses [11-12]. The identification results will be important information that can be used to make improvements with propagation modeling [4-7]. Methods for correcting wall position in cases of unknown walls have been investigated [11]. Methods to compensate for the wall effect to overcome masking problems that may occur in the detection process have also been reported [12].

In this paper, we propose the deconvolution method and the Delay Estimation method to improve the distance. In this study, the TWR radar was modeled using a Vector Network Analyzer (VNA). This paper is structured as follows; Part I describes the problems motivating the proposed method, Part II discusses the proposed method and the experiments that this research undertakes. Part III discusses the results of the experiment and finally the conclusions of this study.

1.2 Identification of problems

The characteristics of the walls vary, this greatly affects the accuracy and detection of objects behind the walls. To be able to detect objects accurately, it takes a large frequency, high resolution and wide bandwidth, so it can be identified as follows:

1. The effect of the walls needs to be overcome so that the detection accuracy can be improved.
2. The effects of distorted walls and propagation power are very much determined by the electrical characteristics and type of wall, so that the application of TWR will find various types of barrier walls.
3. Methods for compensating for the effect of varying walls are required in TWR.
4. A method for correcting the distance in target detection caused by the wall masking effect is required in TWR.

1.3 Purpose

This thesis research aims to design a wall effect compensation method for different walls. The performance test of the wall compensation method and the delay estimation method were carried out to improve accuracy and determine the level of accuracy of the proposed method.

1.4 Scope of problem

In this thesis research, there are several problem limitations including the following:

1. The type of wall used is printed stone and wood walls.
2. TWR is modeled with VNA which works at a frequency of 300 KHz - 8 GHz.
3. Processing data from TWR using the Matlab application.
4. The signal data processing is compensated by the deconvolution method and the delay estimation method.
5. Using a Vivaldi antenna.

1.5   Expected Results

The expected result in this study is that the proposed method successfully compensates for the effect of the walls and improves detection results.

1.6   Research methods

In the preparation of this thesis, there are several methods used, namely designing the TWR radar by referring to existing research. Applying the concepts that have been compiled to carry out laboratory practical testing by modeling the TWR radar system to find out the results in a simulation, and theoretically. Then perform analysis using software to determine the results of object detection numerically, analysis, and simulation.

1.7   Writing system

This research is divided into several discussion topics which are arranged systematically below:

CHAPTER II LITERATURE REVIEW

This chapter contains basic concepts and theories related to research.

CHAPTER III THE PROPOSED METHOD AND RESEARCH METHOD

This chapter as a whole discusses the methods proposed for research and plans the structure of the methods to be used in the research.