CHAPTER I INTRODUCTION

I.1 Research Background

In era globalization almost all companies engaged in the industry faced with a problem that is the level of competition is increasingly competitive. This requires the company to plan or determine the amount of production quality, in order to satisfy with the market demands well pinpointed and the quality of being suitable it is expected that corporate profits will increase (Kurniawan, 2012). Ceramic is the kind of floor covering the most popular used in indonesia because there are various excess owned, having flexibility as well as the use of high and can be applied to almost all part of the house. Besides strong, the floor of a house from ceramic material also do not need polishing and easy in its treatment. From the Table I.1 can be seen from the export, the volume of exports in fluctuation.The volume of exports ceramic in 2013 to 2014 increased by 4.3%, and in 2014 to 2015 decreased by 0.01%. While with imports, the volume of imports ceramic always increased every year. The volume of imports ceramic in 2013 to 2014 increased by 8.6%, and in 2014 to 2015 increased by 1%. This shows that the volume of imports ceramic annually positive experience trend. Factors that cause import volumes to be higher than export volumes are that ASAKI coach is the government's easy to include imported products without an inspection of standards, and in terms of price the difference is also cheaper than the price of ceramics in Indonesia (Kanal Satu, 2016).

Table I.1 Volume of Export and Import Ceramics (BI, 2016)

Year	2013	2014	2015
Export Volume (Ton)	295,780	337,000	336,520
Import Volume (Ton)	733,510	966,000	991,910

To fulfill the demand for export and import on ceramic products required quality products can compete with other companies. Quality is the overall nature of a product or service influence on its ability to satisfy needs expressed or implied (Kotler, 2005). To obtain the best quality of a product need to consider the process of quality control. In SNI ISO 13006: 2010 there are six variable requirements

characteristic related to the quality of ceramic tiles, namely: length and width, thickness, starightness of side, rectangularity, surface flatness and surface quality (Atmaja, 2015).

Balai Besar Keramik is a technical implementation unit under the Industrial Research and Development Agency, Ministry of Industry. Balai Besar Keramik has a duty conduct research, development, cooperation, standardization, testing, certification, calibration and development competence ceramic industry in accordance technical in relation set by the Head of Industrial Research and Development Agency (Balai Besar Keramik, 2016). Ceramic industry in Indonesia keep trying to always improve the quality of ceramics and design to keep captured the attention of domestic and foreign markets (Suryadi, 2016).

Currently the process of ceramic quality inspection in Indonesia, particularly in the Balai Besar Keramik is still done manually by human vision. Process of ceramic quality inspection manually will cause fatigue and saturation because process performed repeatedly. According to Muizuddin (2013) there are five groups causes of fatigue, namely monotonous work, load and duration work both physically and mentally, work environment, psychological, and disease. Therefore, ceramics in Indonesia need to be improved in accordance with the standard quality that has been determined.

According to Sadewa (2016) for the development of automation identification rectangularity ceramic based image processing using Shi-Tomasi method got error value between result of test of Balai Besar Keramik with proposal test equal of 43% and time efficiency obtained of 62.68%. With the results of the proposed test is still not good, because the results of the error value obtained only 43%, so it needs to be improved. Research conducted Atmaja (2015) classification of ceramic tile type based on the type of defect by considering environmental conditions, such as lighting, camera distance. Consider the scope of influence of environmental conditions in the form of objects and lighting with the factors considered. Therefore, it is necessary to measure accuracy rate ceramic surface using fuzzy method.

Fuzzy logic is a methodology of problem-solving control systems, suitable for implementation on systems, from simple systems, small systems, embedded systems, PC networks, multichannel or workstations based data acquisition and control systems (Wibowo, 2015).

According to Suryakant and Kushwaha (2012) algorithm based on fuzzy rule is very efficient to detect the edge by using the concept of artificial intelligence and digital image processing. The output that has been generated using the fuzzy method has found a clearer image edge compared to other methods. Using a fuzzy rule-based system is better for detecting edges and helping to extract edges with very high efficiency.

According to Bala and Dhir (2014) image processing using fuzzy method is a tool that can create expert formulation of knowledge and the combination of appropriate information from various sources. Fuzzy Rule is designed to get interesting solutions to improve the edge quality as much as possible. Another reason to use image processing of fuzzy methods is the uncertainty in conventional image processing.

With the development of technology to date and rapidly evolving science and to undertake infrastructure development requires the development of a varied, economical and safe model structure. This becomes possible as it coincides with the advancement of computer technology that can meet the increasingly sophisticated needs analysis and design of the current structure. This progress makes the ceramic production process easier with various design alternatives. Not only in the design process, but in the process of quality inspection also becomes more accurate and faster in determining the quality of ceramics. Determination of the quality of ceramics based on the number of defects identified slightly (Wardani, 2014).

To detect defects, then using digital image processing technology, the use of technology in detecting ceramic defects has proven to be very efficient in research conducted by (Rahaman and Hossain, 2009). Image processing can be used to extract various features of the image. This process runs automatically without

human intervention. With the automatic checking process using digital image processing technology, it is expected to replace the inspection process which is still done manually by the operator. Based on the background of the problem, the researcher focuses on designing visual inspection system for ceramics automation based digital image processing using Fuzzy Logic method.

I.2 Problem Definition

Problem definition from this research are:

1. How to design of automation system for ceramic surface quality control using Fuzzy Logic method?
2. How to measure the accuracy rate in process quality control of ceramic surface?

I.3 Research Objectives

The objectives of this research are:

1. To design of automation system for ceramic surface quality control using Fuzzy Logic method.
2. To measure the accuracy rate in process quality control of ceramic surface.

I.4 Research Boundaries

Defined boundary problem in the implementation of this research are:

1. Focus used to detect ceramic defects
2. Ceramics used is a ceramic floor that has a size of 30 cm x 30 cm.
3. The method used in this research is fuzzy mamdani method,
4. Membership function used in this research is triangular representation,
5. Image processing using MATLAB software,
6. The calculation on MATLAB software using MATLAB toolbox.

I.5 Research Benefit

Benefit of this research are:

1. To measure the accuracy rate in process quality control of ceramic surface.
2. To provide new ideas about design automation system for quality control of ceramic surfaces.

3. As a basis for further research.

I.6 Writing Systematics

This research will be described based on writing systematics:

Chapter I Introduction

This chapter contains descriptions of issues at Balai Besar Keramik regarding the quality of processes and inspections manually. So the proposed automation system that can identify ceramic surfaces using Fuzzy Logic method.

Chapter II Literature Review

This chapter contains an explanation of the theories relevant to the problem under study and the results of previous research. The theory used to support the research is design of automation system for ceramic surfaces quality control using Fuzzy Logic method at Balai Besar Keramik.

Chapter III Research Method

This chapter describes the description of the research steps covering the framework to explain the problems occurring in this research and systematically as a problem-solving phase that will provide answers to the research objectives. The research is design of automation system for ceramic surfaces quality control using Fuzzy Logic method at Balai Besar Keramik.

Chapter IV Data Processing and System Design

This chapter contains the data needed for fuzzy logic, Human Machine Interface design, PLC program design, Image Processing design, and design design of miniplant.

Chapter V Result and System Analysis

This chapter contains system analysis that has been done from design automation system for quality control of ceramic surface. Explaining the analytical design such as Human Machine Interface,

Graphical User Interface, PLC program, Image Processing, and experimental results.

Chapter VI Conclusion

This chapter contained the conclusion of the automation system design for ceramic defect detection using fuzzy logic method and the suggestion that related to the result automation system.