CHAPTER I INTRODUCTION

I. 1   Research Background

Water is a basic need of people for their life (Kurniawan et al, 2004). Clean water is utilized by the people for their activities such as industrial needs, city sanitation, agriculture, washing, cooking, etc. Get along with economic growth and number of the citizen, the clean water needs are increasing. Based on the demand for water needs, it is predicted that there will be 55% increase in water demand, between 2000 and 2050 due to 400% growing demands from manufacturing, 140% increasing demand from thermal electricity generation, and 130% from domestic use (WWAP, 2016).

There are 3 water sources commonly used by people. Those are surface water, artesian water, and rain water. Artesian water is the most common used water source (Soemarno, 2012). But, artesian water usually has poor water quality. Its quality is not appropriate to the standard of consumable clean water. Artesian water usually contains minerals such as manganese, iron, magnesium, calcium, and metals. High mineral dose which is above the standard, may cause brown water, dark spotting in clothes, and health damage. It is toxic to people health through physiological disorder such as liver, kidney, and nerve damages (Anggraini, 2012).

Telkom University is an institution that uses water for many activities around it. However, based on the observation that has been done, it has poor water quality. It is characterized by the smell of iron in the water, yellow stain on the toilet's wall as well as on the floor, accumulated debris on the bucket, and yellow appearance of the water. A questioner survey is conducted to do further identification toward water quality in Telkom University.

The results of questioner shows that 81% of 344 respondents agree that the water in Telkom University contains accumulated debris in the bucket, 77.62% of respondents agree that the water has brown color, 75.87% of respondents agree that there is a smell of iron in the water, and 81.1% of respondents indicate that the water could cause yellow stain on the toilet's wall as well as on the floor. The result of the questioner can be seen on the Appendix A.

The result of water quality test is shown in the Table I.1 and Appendix B for the complete result. The test is conducted accordance to clean water Regulation of Indonesian Ministry of Health standard No.416/MENKES/Per/IX /1990. Based on the test result, artesian water in Telkom University contains a high composition of iron (Fe) which is 1.25 mg/L. It is 0.25% higher than the maximum standard of iron (Fe) compound for clean water, which is 1.0 mg/L. The high level of iron (Fe) compound indicate weak water quality and could cause dark spotting on white stuff, cause an iron smell, and colloid which cause nausea and abnormal pain (Kurniawan et al, 2004).

Table I. 1 The Result of Water Quality Test

No	Analysis Parameter	Unit	Standard	Method	Test Result
1	TDS	mg/L	1500	SMEWW-2540-C	285
2	Turbidity	NTU	25	SMEWW-2130-B	2.02
3	Iron (Fe)	mg/L	1.0	SMEWW-3500-Fe	1.25
4	Fluoride (F)	mg/L	1.5	SMEWW-4500-F	0.162
5	Chloride (Cl)	mg/L	600	SMEWW-4500-Cr	8.09
6	Manganese (Mn)	mg/L	0.5	SMEWW-3500-Mn	0.132
7	pH	-	6.5-9.0	SMEWW-4500-H+	7.58

Generally, there are 4 water treatment and distribution process in Telkom University as an existing system. These processes consist of pumping process which suck water from the water source, place the sucked water in the ground tank, filtration, and distribution. The controlling and monitoring process of water treatment and distribution is done manually and there is no special treatment to reduce iron (Fe) concentration of the water. Therefore, it could not be denied that the water contains high iron (Fe) compound. Moreover, it requires much time to discover a problem in water treatment and distribution process because all the controlling and monitoring process are done manually. One of the problems is a pipe leakage problems.

Based on a previous research that has been done by Aziz and his team (2013), chlorine could be added to water to increase its quality. The additional of chlorine

could increase clarity of the water, kill or inhibit bacteria, and reduce iron compound in the water (Aziz et al, 2013). But, according to Cita and Aryani (2013), the application of chlorine in high dosage could cause health problems such as eye irritation or skin irritation. Hence, the use of chlorine should be in an optimum dosage. In the other side, to increase the efficiency of controlling and monitoring process, Gowtham et al (2014) built an automation system using PLC and SCADA.

Therefore, a controller is required to maintain water compound appropriate to standard and problems related to distribution could be avoided, such as a discovering of pipe leakage problems in distribution process. A system that could increase an efficiency of monitoring toward water distribution is required as well. One of the solutions is by using automation system to do controlling and monitoring the process for water treatment and distribution which maintain water quality appropriate to the standard and help the operator to monitor the whole process easily. However, the pipe leakage problems can be discovered easily by using flowmeter application. Based on those problems, a research on design of automation system for water treatment and distribution at Telkom University will be conducted.

I. 2   Problem Statement

Based on the problems background of this final project, the problem statements are:

1. How to design an automatic controlling and monitoring system model using SCADA for water treatment and distribution process in Telkom University area III?
2. How to design water treatment plant system in Telkom University area III?

I. 3   Research Objective

The objective of this research are:

1. To design an automatic controlling and monitoring system model using SCADA for water treatment and distribution process in Telkom University area III.

2. To design water treatment plant system in Telkom University area III.

I. 4 Boundaries

The boundaries of this study in order to make this research more focus are mentioned as follow:

1. This research focuses on artesian water treatment in Telkom university area III.
2. This research is done until design stage.
3. Financial is not analyzed in this research.
4. PLC Siemens S7-1200 is used as a controller for water treatment and distribution system
5. TIA Portal is used to program PLC S7-1200 by using ladder diagram.
6. The design of water treatment plant does not consider the location and infrastructure in Telkom University area III specifically.
7. The research only covers Telkom University area III, which consist of A-F dormitory buildings and 1-12 dormitory buildings.

I. 5 Benefit of Research

The benefits of the research are mentioned as follows:

1. Implementation of automation system facilitates the process of controlling and monitoring of water treatment and distribution process.
2. The design of automation system facilitates to improve the efficiency of controlling and monitoring process for water treatment and distribution process.
3. To design water treatment process accordance to standard of water treatment process.
4. Implementation of automation system facilitates the process of controlling the quality and maintain the water quality.
5. Support Telkom University to become a healthy campus by providing clean water accordance to standards.

I. 6   Writing Systematic

This research is described in writing systematic as follows:

Chapter I   Introduction

This chapter contains a descriptions of research background, problem statements, research objectives, research boundaries, benefit of research, and writing systematic.

Chapter II   Literature Review

This chapter contains of relevant literatures for observed problem and understand previous research. It also discuses the relation between concept and research that will be done.

Chapter III   Research Method

This chapter describes detail research steps including problem formulation, hypotheses formulation, and develops research model, identifying and operational of research variables, the design of data collecting and processing, research testing, as well as analytical data processing. Designed system is an automation system of water treatment and distribution to improve efficiency in controlling and monitoring the process. It could maintain water quality accordance to standard as well.

Chapter IV   Data Collection and Processing

This chapter contains required data to design an automation system for water treatment and distribution to maintain the quality appropriate to standard and to facilitate the operator in controlling and monitoring the system. Furthermore, the data will be used to design the system of water treatment and distribution plant.

Chapter V   Analysis

This chapter contains an analysis of the research that has been done. It analyzed whether he designed automation system of water treatment and distribution could be used to do centralized and automated

controlling and monitoring process. It also explains each past of designed automation system, such as Human Machine Interface, PLC Program, database, and the result of the research.

Chapter VI Conclusion and suggestion

This chapter contains conclusion of the conducted research result along with the advice given for the improvement and future result.