CHAPTER 1
INTRODUCTION

1.1 Background

Irrigation in agriculture has an important function in the growth and maintenance of plants, both large-scale and home farming. Traditional irrigation which is mostly used by farmers not giving good results. Excess amount of water in plants can cause soil leaching, loss of fertilizers and increase in soil salinity [1]. This condition can be reduced by providing sufficient water for plants according to their needs. In order to increase efficiency in water use when irrigating plants, a Drip Irrigation System is applied where this irrigation method can save water by allowing water to drip slowly to the roots. This irrigation is usually used in areas with low water intensity (small rainfall) or used on plants that must have regular humidity [1]. Most of the drip irrigation systems implemented in Indonesia still use a manual system, namely the system for opening and closing irrigation canals which are still manually. The Drip Irrigation System is very efficient in irrigating certain crops. Conventional irrigation systems only provide water based on a dose but its distribution or flow to plants is not scheduled and does not see the condition of the crop land [2]. The Drip Irrigation System is also a form of method in Urban Farming where the strategy of using narrow land to produce fresh food ingredients is an effort to fulfill urban food availability and can increase physical access because it shortens the distribution process and can increase household economic access through household income [3].

Technological developments are now almost used in various fields, including agriculture, especially in the more modern Urban Farming, one of which is by utilizing computer technology and the internet. Internet of things (IoT) is a concept or program where an object has the ability to transmit or transmit data over a network without using the help of computer and human devices [4]. IoT has been widely applied in several fields to science and industry, such as in the fields of health sciences, informatics, geography and several other fields of science. Internet of Things based drip irrigation control

system is a tool (system) created to help make it easier to flow and control water for crop irrigation using a Smartphone. This tool aims to increase work effectiveness so does not take up time and energy in watering plants and precisely in determining the intensity of water in the soil. Moreover if we see the current Covid-19 pandemic situation requires people to stay at home so they need innovation in survival, especially for food ingredients. The Drip Irrigation System is an innovation that is suitable to be applied because the cost of manufacture is cheap and does not require large agricultural land so that it can be built in the house area. This tool is also inspired by the problems faced where it is difficult for us to save water use on plants whose houses are barren (lack of water) and want to save water use. Farmers also sometimes find it difficult to determine whether the intensity of water in the soil is less or more for the fertility of their crops [2].

This IoT-based drip irrigation research has advantages over previous drip irrigation where control can be done anywhere and anytime whenever connected to the internet network using a Smartphone. In addition to distributing water to plants, this tool can also mechanically help to treat plants by activating some treatment valve and deactivating water valve and then channeling it through the same path. The treatment used is an organic fertilizer liquid and has been filtered like ordinary water so that it does not clog the drip irrigation canal.

1.2 Problem Formulation

In conventional irrigation, several problems were found such as excessive water intensity so that it did not match what was needed and caused soil leaching, loss of fertilizer and increased soil salinity. Besides that, there are several areas where the intensity of water/rainfall is low, so it is necessary to save water usage. Morover, problem in conventional irrigation also can not be controlled remotely and data such as temperature, humidity or pH can not be shown. Therefore, in order to eliminate the above problems, this research focus to design an IoT-based drip irrigation system which is described in detail as follow:

1. An irrigation system has been created to reduce excessive water use and can be controlled remotely based on three parameters, namely temperature, humidity, and pH.
2. A system has been created that can monitor 3 parameters, namely temperature, humidity and pH.
3. How to measure the quality of the system that is made includes the value and accuracy of the measuring instrument.

1.3 Objective

With the implementation of this research, the aim is to obtain and prototype an IoT-based drip irrigation control and monitoring system using RTDB Firebase as a database that is accessed using a Smartphone.

1.4 Problem Limitation

Based on the description of the problem formulation, there are several limitations of the problem that focus on several things in this final project.

1. The system built only focuses on building an IoT system and connecting it to mechanical/hardware devices.
2. The Smartphone application used is limited only to Android users.
3. In temperature data collection there is no logger data, data collection is discrete and only approaches.
4. The QoS value on the network is observed only on Throughput and Delay.

1.5 Research Method

To get a good tool in terms of quality by considering the QoS value and Error Value, the design steps are described in Figure 1.1 and the explanation is as follows below.

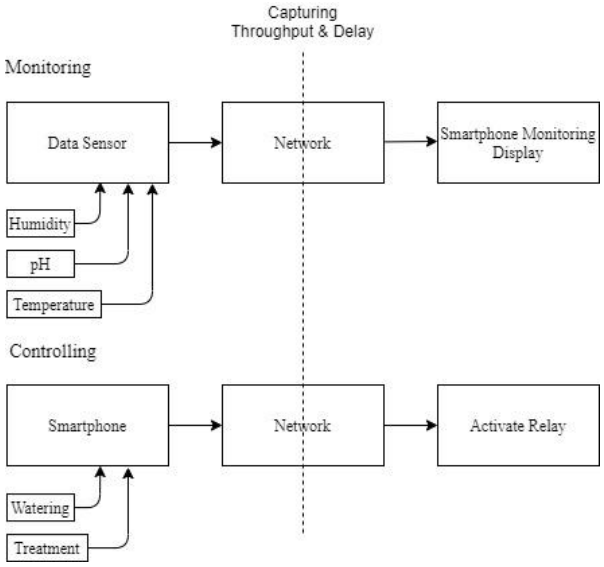

Figure 1.1. Schematic of research method.

1. To Determine

   The design includes system software, smartphone applications and hardware in the form of drip irrigation mechanics and the controller. Designing a system related to the final project based on the selected method which can then be realized in accordance with the design that has been done.

2. Data Collection

   At this stage, the information data collection process in the form of performance, throughput and delay has been analyzed.

   a. Performance data is taken from the overall performance of the Tool whether the Application can monitor sensor data, control Watering and Treatment either Automatically from the Cloud or from the Application according to the Watering point.
   b. Network QoS data in the form of Throughput and Delay are taken from the Data Delivery Capture on the Wireshark Application which is used to view Communications between IP Smartphones and IP Hardware.
   c. The room temperature sensor data is taken according to the value read on the application.

3. Performance and QoS Analysis

   At this stage, analysis and comparison are carried out based on the parameters of QoS Throughput, Delay and Performance control/monitoring from the results of data collection.

   a. Throughput or Data Consumption is processed from Number of Bytes divided by Time Span for several times of sensor monitoring and controlling. The results are then averaged and written in bps units.
   b. Delay is processed from the amount of difference each time data is sent divided by the number of data sent for several times of sensor monitoring and controlling. The results are then averaged and written in units of millisecond.
   c. Performance data obtained by several observations ranging from the entire working process of the tool in controlling from smartphones and the cloud, recording the monitoring results on the application, recording whether the control system can control the relay according to the watering and treatment points.
   d. The temperature value read in the application is compared with the temperature value read on the analog temperature gauge.

4. Data Output

   It is the result of analysis or data processing in the form of overall performance or network of tools, comparing tool performance data with data that should be achieved and evaluating system and hardware performance.

1.6 Structure of The Thesis

The rest of this thesis is organised as follows:

1. Chapter 2 BASIC THEORY of IoT based Drip Irrigation

   This chapter contains a discussion of the basics of theory related to this thesis, such as Drip Irrigation, Smart Urban Farming, IoT and the components and systems to be used.

2. Chapter 3 EXPERIMENT DESIGN of IoT based Drip Irrigation

This chapter contains a discussion of component controllers and IoT-based Drip Irrigation work systems.

3. Chapter 4 RESULTS AND ANALYSIS of IoT based Drip Irrigation

   This chapter summarize the results of testing and analysis of the design of tools and systems Final Project.

4. Chapter 5 CONCLUSSION AND SUGGESTIONS

   This chapter summarize the conclusions from the processed data and suggestions for further development.