

# CHAPTER I

## INTRODUCTION

### 1.1 Background

Agriculture became one of the key roles in the development of human civilization. With increasing food demand, many people make efforts to increase food production[1]. West Java Province is the largest food producer in Indonesia[2,3]. The tropical climate to be one of the main factors to be considered in determining the timing and pattern of planting season[2],[24]. West Java Province is the largest food producer in Indonesia[2],[3]. The tropical climate to be one of the main factors to be considered in determining the timing and pattern of planting season[2],[24]. Climate and weather can affect the growth of rice plants. According to the classification of rice plant growth includes the stage of nursery, vegetative stage, reproductive stage and Ripening stage[6]. As a result of changes in climate and weather conditions irregular[7] then the need for monitoring on a daily basis in the field [8] thereby reducing a significant burden for farmers[5]. To support the growing season pattern [2] and to detect early symptoms of the information changes in climate and weather conditions, the loss of which food production can be reduced with the use of agricultural technology[4]. Information and communication technology in agriculture is one of the efforts in maintaining food security [9]. To that can be done by spreading the sensor device in the field using a wireless sensor network technology [4],[5].

*wireless sensor network (WSN)* consist of many autonomous, able to cooperate, powerful battery and data storage[10]. Wireless sensor nodes are built with low cost, low power and small in size. These nodes are capable of forming a self-organized network, each node is equipped with a transceiver to communicate with other nodes[10] in a multihop through the wireless channel and is used in large scale [11]. With the support of this technology, the field information is obtained remotely in a

fast and continuous[5]. There are few studies of the deployment and monitoring changes in climatic conditions in rice plants in the technology of *wireless sensor network* in rice plants [7],[8],[15] with a star topology. In the study[4] describes how node sensors are used to monitor the height of rice plants and to use the method of clustering routing algorithms[9]. This research proposed the design and implementation of the *wireless sensor network* (WSN) based on Zigbee platform [12] in support of sensor nodes monitoring with cluster tree topology at the stage of rice growth.

## **1.2 Identification of Problem**

- a. In the development of rice crops there is often a failure that resulted in the influence of climatic conditions and weather and pests. So the farmers only get information about their development through agricultural stakeholders.
- b. To reduce the workload of farmers in reaching large areas then it takes agricultural technology to detect natural phenomena.

## **1.3 The Research Objectives**

Designing and implementing device on wireless sensor network system to monitor the value of changes in temperature, soil moisture and pH levels RealTime at each stage of rice plant growth including vegetative stage, reproductive stage, ripening stage.

## **1.4 Hypothesis**

There are few studies of the deployment and monitoring changes in climatic conditions in rice plants in the technology of *wireless sensor network* in rice plants [7],[8],[15] with a star topology. By designing and implementing tools based on the zigbee platform protocols using a cluster tree topology network, capable of monitoring temperature, humidity, pH levels in real time performed on different days

during the growing season, so as to help and provide information on plant growth rice.

### **1.5 Scope of Work**

The design of wireless sensor networks using the standard Zigbee IEEE 802.15.4 and Arduino uno R3 protocols. Xbee series 2 as its radio communication module. The designed nodes are 7 units, including: Zigbee Coordinator, Zigbee Router, Zigbee End Device.

1. The area of research is 2 hectares.
2. Topology used cluster tree
3. Application Monitoring changes in climatic conditions, sensor nodes used for air temperature is DHT11, for soil moisture with Soil Moisture YL69 and pH sensors.
4. Research device carried out for 15 days each stage of rice growth
5. Research area on rice plant growth include: vegetative stage, reproductive stage, ripening stage.

### **1.6 Methodology research**

Research Methodology is done in several stages, namely:

1. Conducting literature studies by identifying research needs and collecting information and studying problems that occur in agriculture, especially rice crops. as well as observing the area of the location about the growth of rice plants include: vegetative stage, reproductive stage, ripening stage.
2. Determine the initial coordinate point of the research area.
3. Design of wireless sensor networks such as Zigbee Coordinator, Zigbee Router, Zigbee End Device include: Zigbee platform, Arduino uno, shield board and sensor.
4. Perform testing within the topology pair.

5. Determine the distance of the node's reach by obtaining the RSSI (*dBm*) value against the distance (*meters*) with the XCTU software.
6. Testing data delivery time of each sensor node with cluster tree topology
7. Monitoring the indicators of each sensor node.
8. Analyzes RSSI, delay and monitoring changes in temperature, soil moisture and pH levels during the growing season with a *wireless sensor network* (WSN) system.