CHAPTER 3
RESEARCH METHODOLOGY

In this section, we will discuss the research methodology used in this study. It contains research design, data source and data analysis.

3.1 Research Design

A. Design Phase

Making and designing a trash can with an Internet-based separation system using several parts with the aim to analyze a problem that occurs in the design of the tool system. The design of this prototype includes hardware, software and users.

Hardware:

1. Arduino Uno Board

Is a microcontroller board that is fully controlled by ATmega328. Arduino UNO has 14 digital input / output pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz Crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. Arduino Uno is used to control electronic devices so they can interact with each other. Functioning as a controller and overall tool controller.

2. Inductive Proximity Sensor

Serves to detect metal objects. Proximity sensor will detect the presence of metal objects even if they are not visible. The working principle of this sensor is to generate a magnetic field with high frequency. If a metal object is brought close to the sensor surface, the magnetic field will change. Used to detect Metal objects and activate Metal servo

3. Ultrasonic Sensor HC-SR04

Sensors that function to convert physical quantities (sound) into electrical quantities or vice versa are converted to distance. In other words ultrasonic sensors are used to read objects. In this design an ultrasonic sensor is used to detect objects in front of the trash and to detect the volume of the trash. Used to detect human objects and detect trash volume and activate the trash door servo and send e-mail via Ethernet Shield.

4. Ethernet Shield

Ethernet Shield is a module used to connect Arduino to the internet using cable (Wired). Arduino Ethernet Shield is based on the Wiznet W5100 ethernet chip. Serves to connect the Arduino to the internet using cable (wired).

5. Servo Motor

Used as a propeller motor which is angled through an Arduino Uno microcontroller. In this case study, it is used as a door opening and closing the trash can. Used as a motor to open the door to the trash and metal and non-metal trash doors.

6. Jumper Cables

Used as a connecting cable between Arduino and other electronic devices so that it can be controlled via Arduino. Used to connect components with one another.

Software:

1. Arduino IDE Software

Programming application used specifically for microcontroller systems that are open source. Arduino IDE programming using the modified C programming language and embedded Load Loader program functions to translate between the Arduino IDE compailer software with a micro controller.

B. Testing Phase

The testing phase is run after the prototype design phase has been completed which aims to show the results of the design process, such as testing sensors which are used as an analysis of whether the tool can work well. This testing phase also aims to analyze the problem that is the main focus of this research. Such as the optimum distance analysis of inductive proximity sensors in reading objects and the accuracy of inductive proximity sensors in reading objects that are not fully metal.

3.2 Data Source

In this study, the data needed to be able to do an analysis of a problem that is the focus of this study. Existing data is data in the form of objects or more specifically, metal and non-metal junk objects.

Data is taken by direct observation around the author's residence. From the data obtained, the authors specify as follows:

Metal Trash:

1. Drink Cans
2. Perfume Cans
3. Scissors
4. Spike
5. Used Cable

Non-Metal Waste:

1. Paper
2. Used cloth
3. Plastic bags
4. Plastic snacks
5. Styrofoam

3.3 Data Analysis

After getting all the data needed, data analysis is done to get the final results of this study, the data obtained above will be used in the Inductive Proximity sensor testing scenario to find the optimum distance and the accuracy level of the Inductive Proximity sensor in reading objects that are not fully metal.

To find the optimum sensor distance in reading objects, the test scenario is carried out by bringing metal objects closer to the sensor and the optimum distance is calculated, the test scenario is performed at a distance of 0.1 cm, 0.3 cm, 0.5 cm, 1 cm, 1.5 cm and 2 cm. The results of the testing process above are recorded so that the optimum distance is obtained. To find the accuracy of the sensor in reading objects that are not fully metal, the test scenario is carried out by attaching metal objects that are not fully metal to the Inductive Proximity sensor and scanned to all four sides to ensure that all objects are read by sensors, the data is tested with metal objects that are not fully metal. For 20% metal objects, the test

is carried out with used cable waste, for 50% metal objects, the test is carried out with scissors trash, for 70% metal objects, the test is carried out with perfume cans and for 100% metal objects, the direct test is carried out with canned trash used drinks and spike. The results of the testing process above are recorded so that the accuracy of the sensor is obtained in reading objects that are not fully metal.