CHAPTER 4
ANALYSIS AND DESIGN

4.1 Analysis

This final project aims to analyze and create an Ultrasonic Sensor based on a Smart Stick Microcontroller. This tool is able to provide initial information about the presence of objects/obstacles to the user in the form of sound output from the buzzer. In this tool is installed 1 Ultrasonic Sensor which is used to measure the distance between the stick and solid objects in the launch.

4.2. Design Analysis Hardware Wemos D1 Mini

In this research, I use the Wemos D1 mini module as a microcontroller to send notifications. So that by using the wemos module there is no need to use Arduino Uno anymore. Wemos D1 mini is a mini wifi board based on ESP266 which is known to be economical and reliable. ESP8266 can connect microcontroller devices such as arduino to the internet via wifi. This can create mini projects without using Arduino as a microcontroller, because the Wemos D1 Mini module can work alone or stand alone to process any input code or coding.

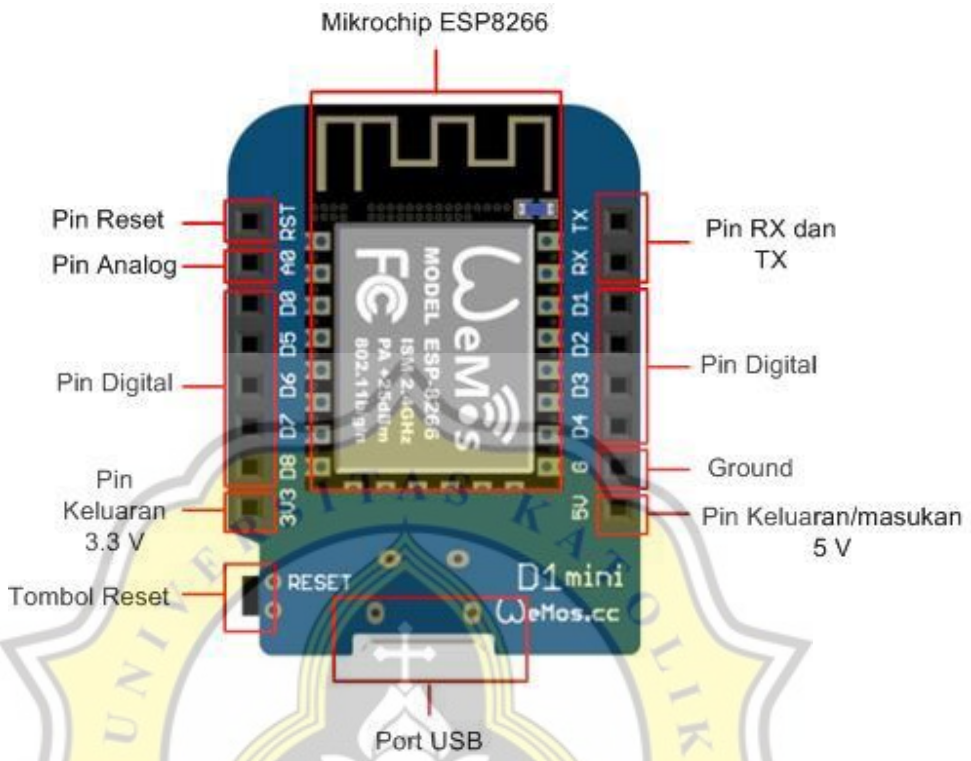

Figure 4.2 Wemos D1 Mini.

Explanation of these sections are :

- The USB port is used to connect the WeMos D1 Mini with a computer, via a pair of USB cables.
- Digital pins have a digital signal of 0 or 1.
- Analog pins have analog properties or continuous values.
- Microchip used is ESP8266 Microchip.
- There are two voltage pins. The available voltages are 3.3V and 5V.
- Reset pin and resetd button are used to reset the device.
- RX and TX pins, used for serial data communication with other devices.
- GPIO (General Purpose Input Output) pins, are input output pins specifically installed on the WeMos board for connection to external devices.

- Pin I2C (Inter-Integrated Circuit), Its function is for I2C communication. For example, a device without I2C if you want to connect to WeMos requires 7 pins.
- SPI (Serial Peripheral Interface) pin, is a pin for synchrounous serial communication.

4.3. Motion Sensor Ultrasonic HC-SR04

The sensor used in this study is an ultrasonic sensor which functions to determine the distance from an object. The way this sensor works is based on the principle of the reflection of a sound wave so that it can be used to interpret the existence (distance) of an object with a certain frequency.

Figure 4.3 Sensor Ultrasonic HC-SR04

Table 4.3 definition Ultrasonic pin HC-SR04

GND	Ground (Vss)
TRIG	Trigger/Input (PortA.2)
ECHO	Output (PortA.3)
VCC	VCC

Sound waves have a very high frequency of 20,000 Hz and the speed of sound is 340 m/s, so the formula for finding distance based on ultrasonic is :

$$s = 340.t/2$$

Information :

s = distance between ultrasonic sensor and object (reflecting plane),

t = the difference between the time of transmitting the wave by the transmitter and the time of the wave.

4.4. Buzzer

Buzzer is an electronic component that can convert electrical energy into sound. A type of speaker but smaller, the working principle of the buzzer is very simple. Generally, the type of buzzer on the market is a piezoelectric buzzer that works at a voltage of 3 to 12 volts DC.

Figure 4.4 Buzzer

Based on the picture, the buzzer component specifications are as follows :

1. Piezoelectric, which is a black tube that is the source of sound.
2. The negative pin is a short buzzer pin to be connected to negative current or GND.

3. The positive pin is the long buzzer pin and the tip is to be connected to a positive current or VCC/5V.

4.5. LED

LED or Light Emitting Diode is an electronic component that can emit monochromatic light when a voltage is applied with a forward bias. Has a shape like an incandescent light bulb but does not require burning the filament to produce light so it does not generate heat. The following is the shape and symbol of the LED (Light Emitting Diode) :

Figure 4.5 LED

4.6. Design Program

In this research program the problem to be solved is to detect obstacles, holes and locations, the first process is to detect obstacles and holes using an ultrasonic sensor connected to the Wemos D1 Mini microcontroller. The following is a schematic drawing and hardware design :

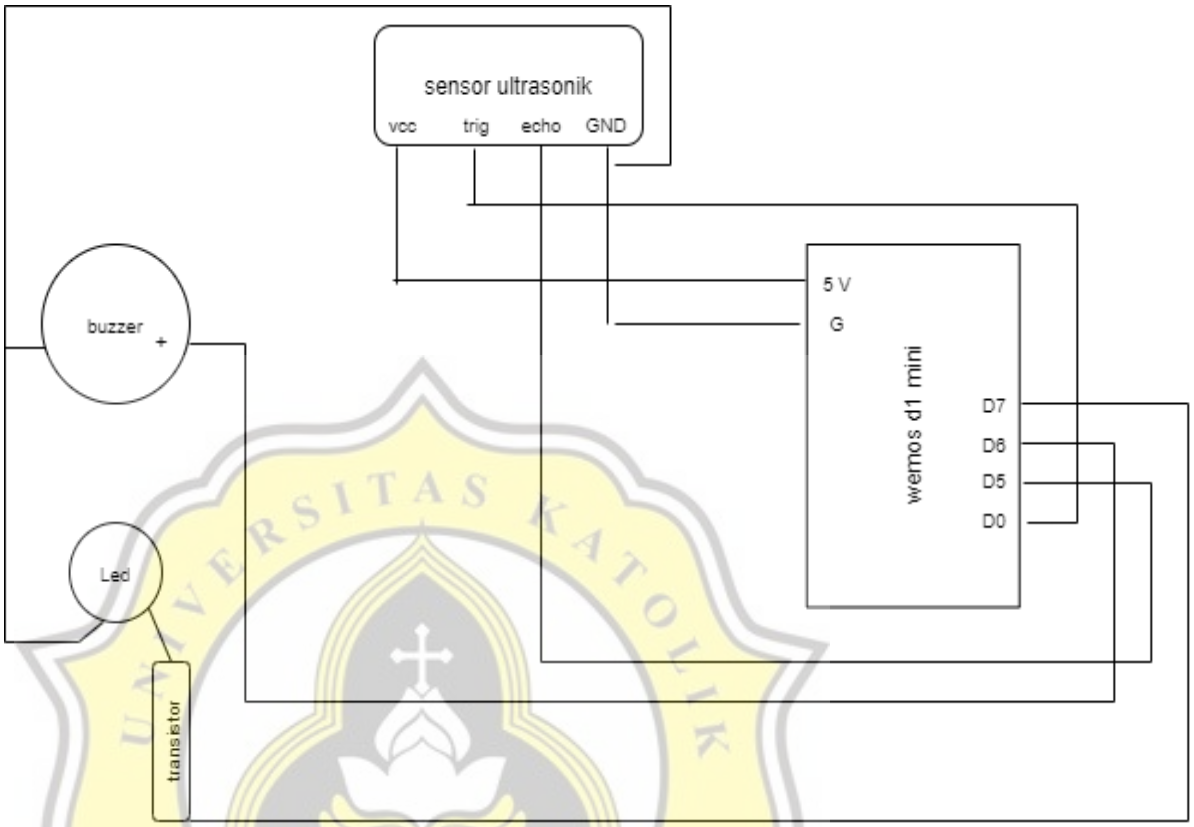

Figure 4.6.1 Schematic system

In figure 4.6.1 above the ultrasonic sensor is connected to the buzzer and Led then the trigonometry sensor is connected to pin D0, echo is connected to pin D5. VCC of Ultrasonic Sensor is connected to 5v whereas. For more details see figure 4.6.2.

Figure 4.6.2 Design Hardware

Figure 4.6.2 is a hardware drawing of the blind stick made. The electronic design in Figure 4.6.1, assembled using heated copper then connecting sensors and modules with the help of a PCB board, and still using a USB cable instead of a battery. Inside the device, when it detects an obstacle with a distance of 133cm, the buzzer and LED will sound and the LED will turn red.

4.7. Design Tool

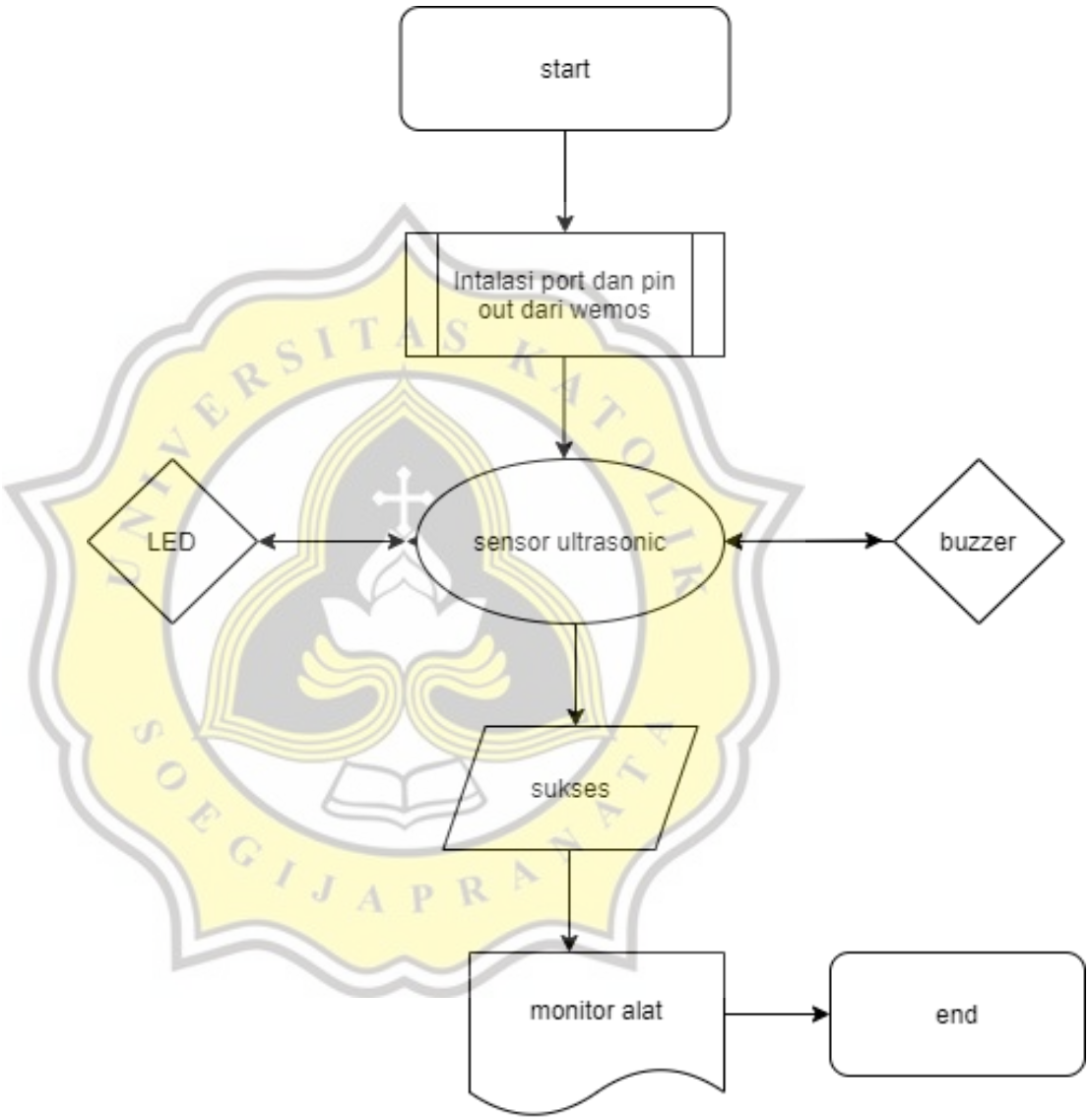

Figure 4.7 Design Flowchart

The flowchart above begins with the process of installing ports and pins from the Microcontroller then heading to the Ultrasonic sensor. If the sensor detects an

obstacle, the buzzer will sound and the LED will emit light and vice versa if the obstacle is not detected then the buzzer and LED will not work. If both tools are successful then the next thing to do is to monitor the tool.