CHAPTER 3
RESEARCH METHODOLOGY

3.1.   Literature Study

In this process, the authors collect and read journals related to monitoring water quality in aquariums or water quality for fish farming. The data taken in the form of parameters that can affect the quality of aquarium water, such as pH, temperature and turbidity.

The optimal temperature range for the life and development of aquatic organisms ranges from 25 to 35ºC while the acidity level in the aquarium model is at pH 6.8-7.5 [7]. The turbidity data taken is not a unit of turbidity (NTU) but data in the form of a voltage that is read by the sensor. If the low voltage is below 1 volt or less than 2 volts then the water is declared cloudy, but if the voltage is above 2 volts, then the water is declared clean.

Besides water parameters, there are also algorithms to process data from each sensor. The algorithm used in this project is Sugeno fuzzy logic. Why fuzzy Sugeno? because the output of this algorithm is not a fuzzy number, but a constant number or a linear equation. All journals that the author collects are as a reference for working on and building this project.

3.2.   Collecting Datasets

Data for turbidity sensor testing using coffee, aqua and tea water. The pH sensor test uses aqua water mixed with pH powder with known values, such as pH 4.01 and pH 6.87 powder. while the temperature sensor uses plain water, hot water, and ice water.

3.3. Program Implementation

In this process, the pH sensor, turbidity, temperature, I2C LCD, and buzzer are connected to Arduino, then Arduino software installs several libraries for temperature and 16x2 LCD. Sensors for pH, turbidity and temperature are inputs to detect the content of pH, turbidity and temperature in water. The program is then executed and uploaded using Arduino Uno. Then the data obtained from the sensor is processed using a fuzzy algorithm with 18 rules to generate fuzzy values. Fuzzy value will be reprocessed by the defuzzification method. The results of this defuzzification will turn off or turn on the buzzer. The 16x2 LCD is an output that will display the value read by the sensor and buzzer as a warning notification that the water is getting dirty and ready to be replaced.

3.4. Testing

Calibrate each sensor first before combining them into a system in order to get the right value. The pH sensor calibration uses a mixture of aqua water and pH powder (pH 4.01 and pH 6.87). The pH sensor calibration of 4.01 got an average value of 3.97 and a voltage of 2.61. As for the pH powder 6.86, the average value was 6.96, and the voltage was 3.08. The turbidity sensor uses aqua water, tea and coffee. The temperature sensor uses hot, normal and cold water.

The testing of the entire system is carried out by entering various categories of water according to the existing sensors in stages. Mix this category of water every 15 minutes to allow the sensor to read its maximum.