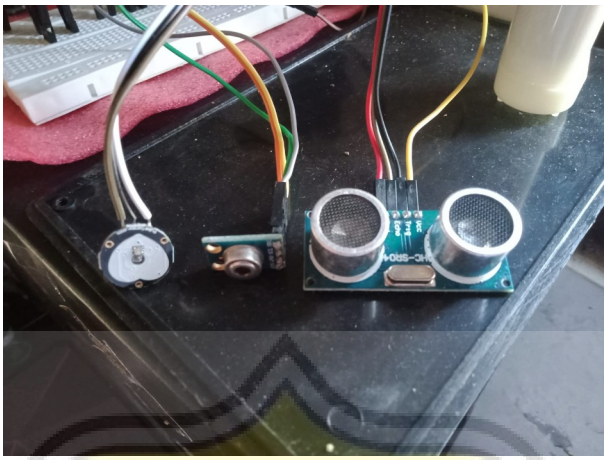
# CHAPTER 4
# ANALYSIS AND DESIGN

## 4.1. Hardware


**Picture 4.1: Arduino Uno**

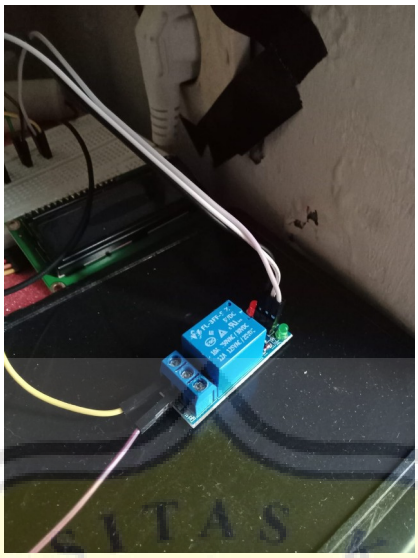
Arduino Uno is a microcontroller board based on Atmega328 (datasheet). It has 14 input pins from digital output where 6 input pins can be used as PWM outputs and 6 analog input pins, 16 Mhz crystal oscillator, USB connection, power jack, ICSP header, and reset button. To support the microcontroller so that it can be used a USB or power cable with AC to DC adapter or battery to run it. Uno is different from all previous boards in terms of USB-to-serial connection, namely using the Atmega8U2 feature which is programmed as a USB-to-serial converter, in contrast to the previous board which uses the ship's FTDI USB-to-serial driver. The name “Uno” means one in Italian, to mark the launch of Arduino 1.0. Uno and veri 1.0 will be the reference versions of Arduino. The Uno is the latest in a series of Arduino USB boards, and serves as a reference model for the Arduino platform, for comparison with previous versions.



**Picture 4.2: Sensor MLX90614, Pulse sensor, HC-SR04**

To detect the pulse rate, the writer uses a pulse sensor. The pulse sensor is used to facilitate the incorporation of pulse measurement with data applications into its development. The pulse sensor works well at 5V and 3.3V in the microcontroller. There are 3 male wire terminals (ground, power, and data) with standard connectors. The MLX90614 sensor is a sensor that is used to measure temperature by utilizing infrared radiation. Infrared MLX90614 serves to detect the intensity of infrared radiation emitted by the object / test object. Because this sensor is not in physical contact with the test object / object, this sensor has a wide measurement range from -70 degrees Celsius to +380 degrees Celsius. Infrared radiation is a part of the electromagnetic spectrum that has a wavelength from 0.7 to 1000 microns. However, only 0.7-14 microns can be used to measure temperature.

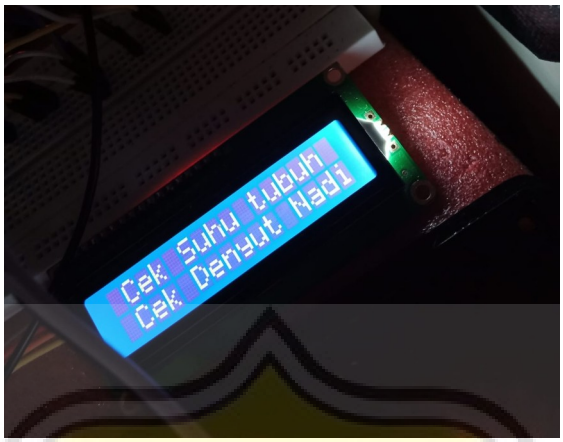
The HC-SR04 sensor is used as input for the pump for automatic hand sanitizer. The HC-SR04 sensor is an ultrasonic sensor module which is usually used for distance measuring devices. On the HC-Sr04 sensor there is a pair of ultrasonic transducers, one of which functions as a transmitter whose job is to convert the electrical signal into an ultrasonic sound wave pulse signal with a frequency of 40KHz, and the other transducer serves as a receiver whose job is to receive ultrasonicsound wave signals.



**Picture 4.3: Relay**

Relay is a switch (Switch) which is operated electrically and is an Electromechanical component (Electromechanical) which consists of 2 main parts, namely Electromagnets (Coil) and Mechanical (a set of Switch Contacts/Switches). Relays use the Electromagnetic Principle to drive the Switch Contacts so that with a small electric current (low power) they can conduct higher voltage electricity. For example, a Relay that uses 5V and 50 mA Electromagnets is able to move the Armature Relay (which functions as a switch) to conduct 220V 2A electricity.

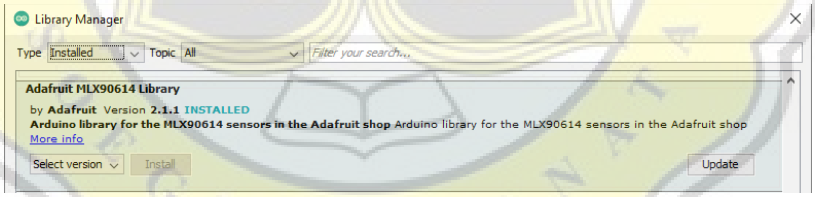
The relay is useful as a 5volt pump switch to automatically dispense hand sanitizer with object input at a distance of less than five centimeters.




**Picture4.4: LCD 16x2**

The 16x2 LCD functions to display digital value output from the mlx90614 sensor and pulse sensor, and displays health conditions, namely healthy, unhealthy, sick

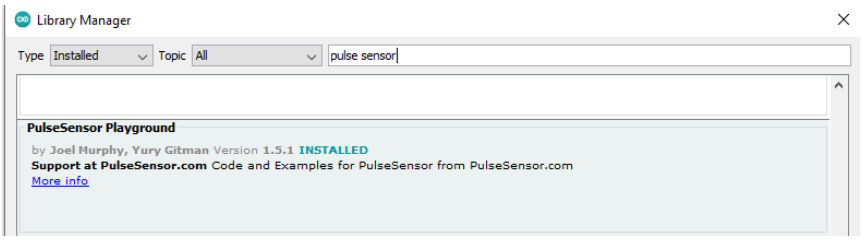
## 4.2. Library Sensor MLX90614




**Picture 4.5: Library MLX90614**

Library to support Melexis MLX90614 infrared thermometer Arduino library to support Melexis MLX90614 infrared thermometer using the I2C interface. For I2C support the SoftWire software bit-banging Arduino library is used. GNU LGPL v2.1. This library, created by Steve Marple.

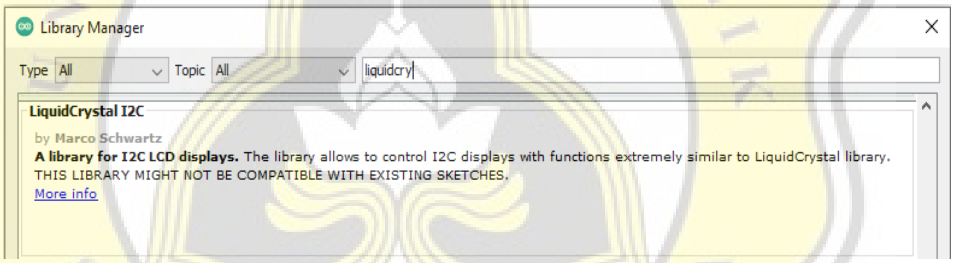
## 4.3. Library Pulse Sensor




**Picture 4.6: Library Pulse Sensor**

The Pulse Sensor library is used to calibrate the number of pulses in minutes or BPM (Beats Per Minutes). This library, created by Joel Murphy, Yury Gitman, Brad Needham.

## 4.4. Library LCD 16x2 I2C




**Picture 4.7: Library LCD 16x2**

The I2C module attemps to reduce the number to cords on the LCD and make it seem less complex. To make it easy to calibrate / adjust LCD, we'll need an I2C module that uses the I2C library.

## 4.5. Algorithm Fuzzy Logic Sugeno

Fuzzy logic is a logic that has a value of fuzziness between true or false. Rules (algorithms) are used to create predictive models. It provides a new way to explore and understand data. Although fuzzy logic was developed in America, it is more popular and widely applied by Japanese practitioners by adapting it to the control field. One of the reasons is because western people tend to view an issue as black and white, yes and no, guilty and innocent, or equivalent to the world of Aristotle's binary logic, while eastern culture is more accepting of the "gray" or fuzzy world. Fuzzy logic allows membership values between 0 and 1, gray levels as well as black and white, and in linguistic terms, uncertain concepts such as little, fair, and very.

Fuzzy logic can be used in the fields of control theory, decision theory, and some areas of management science. The advantage of fuzzy logic is that it is able to process linguistic reasoning, so that in its design there is no need for mathematical equations from the object being controlled. Fuzzy logic is generally applied to problems that contain elements of uncertainty, imprecision, noisy, and so on. Fuzzy logic bridges precise machine language with human language that emphasizes meaning or meaning and is developed based on natural human language.

To design a fuzzy system, it is necessary to do the following steps:

- Define the functional and operational characteristics of the model.

  In this section, it is necessary to consider what characteristics the existing system has, then the characteristics of the operations that will be used in the fuzzy model are formulated.

- Decompose model variables into fuzzy sets

  From the variables that have been formulated, a related fuzzy-fuzzy set is formed without compromising the domain.

- Create fuzzy logic rules

  The fuzzy rules show how a system operates. The general way of writing rules is in the form of IF – THEN with operators (OR or AND).

Fuzzy Sugeno method is a fuzzy inference for rules that are represented in the form of IF-THEN, where the output (consequent) of the system is not a fuzzy set, but a constant or linear equation. This Sugeno method is a fuzzy method that has proven to be effective when dealing with complex non-linear systems, which are very difficult for synthetic analysis.

Zero-order Sugeno fuzzy model

In general, the form of fuzzy Sugeno is as follows:

IF $(x_1$ is $A_1) \bullet (x_2$ is $A_2) \bullet \ldots\ldots \bullet (x_N$ is $A_N)$

THEN **z=k**

**Picture 4.8: Algorithm Fuzzy Sugeno**

Where Ai is the i-th fuzzy set as the antecedent and k is a constant (firm) as the consequent. The Sugeno model is an attempt to develop a systematic approach to constructing fuzzy or fuzzy rules from a set of input and output data.