CHAPTER 5
IMPLEMENTATION AND TESTING

5.1 Implementation

This project uses the Arduino IDE app. This app is used for compilation and upload the program. This program can be seen as follows:

1. Libraries used in this project:
   1. `#include <SPI.h>`
   2. `#include <Ethernet.h>`
   3. `#include <PubSubClient.h>`
   4. `#include <Servo.h>`

2. Setting network:
   5. byte mac[] = { 0xDE, 0xED, 0xBA, 0xFE, 0xFE, 0xED };
   6. IPAddress ip(192, 168, 1, 177);
   7. IPAddress server(192, 168, 1, 10);

3. Function callback is used to process data commands from Domoticz and Node-RED frameworks. This code controls the servo.

   8. void callback(char* topic, byte* payload, unsigned int length) {
      9.  Serial.print(topic);
     10.  Serial.print(" ");
     11.  for (int i=0;i<length;i++) {
     12.    Serial.print((char)payload[i]);
     13.  }
     14.  Serial.println();
     15.  if (payload[0] == '1' && payload[1] == '1') {
     16.    myservo.write(0);
     17.  }
     18.  if (payload[0] == '1' && payload[1] == '0') {
     19.    myservo.write(90);
     20.  }
     21.  }
4. The function below connects Arduino UNO to MQTT.

22. void reconnect() {
23.   // Loop until we're reconnected
24.   while (!client.connected()) {
25.     Serial.print("Attempting MQTT connection...");
26.     // Attempt to connect
27.     if (client.connect("arduinoClient")) {
28.       Serial.println("connected");
29.       // Once connected, publish an
30.       client.publish("domoticz/out","hello
31.       world");
32.     } else {
33.       Serial.print("failed, rc=");
34.       Serial.println(client.state());
35.       Serial.println(" try again in 5 seconds");
36.       // Wait 5 seconds before retrying
37.       delay(5000);
38.    }
39.  }
40. }

5. The following program is used to read the upper and lower limits of water in the water reservoir, if the upper limit of the sensor reads \(\geq 250\) then the water pump machine will die and if the lower limit of the sensor reads \(<250\) then the water pump machine will light to fill the water at tub shelter.

42.   dataAir1 = analogRead(pinAir1);
43.   dataAir2 = analogRead(pinAir2);
44.   if (dataAir1 \geq 250)
45.   {
46.     digitalWrite(pinPump, LOW);
47.   }
48.   if (dataAir2 < 250)
49.   {
50.     digitalWrite(pinPump, HIGH);
51.   }
6. The following program is used to send notifications to the Domoticz framework via MQTT by publishing it when the rain sensor reads the analog value. If the sensor reads $\leq 500$ then it will send a notification that the water pump machine is alive and if not the water pump machine is dead.

```plaintext
52. sensorValue = analogRead(sensorPin);
53. if (sensorValue<=500) {
54.   client.publish("domoticz/in","{"idx":4,
55.   "nvalue":0,"svalue":\"Mesin Pump Hidup\" }");
56. }
57. else {
58.   client.publish("domoticz/in","{"idx":4,
59.   "nvalue":0,"svalue":\"Mesin Pump Mati\" }");
60. }
```

7. This program is used to send notifications to the Domoticz framework via MQTT by publishing it when the obstacle sensor reads the value. If the reading sensor detects an obstacle it will send a notification that the door is open, otherwise it will send a notification that the door is being closed.

```plaintext
59. obstacle1 = digitalRead(obstaclePin1);
60. if (obstacle1 == LOW){
61.   client.publish("domoticz/in","{"idx":5,"n
62.   value":0,"svalue":\"Pintu Terbuka\" }");
63. }
64. else{
65.   client.publish("domoticz/in","{"idx":5,"n
66.   value":0,"svalue":\"Pintu Tertutup\" }");
67. }
68. delay(1000);
```
8. The following program is used to count water debit using waterflow sensor, in this program I use constant variable which serves to set the water speed. After that the value of the discharge of water in units of milliliter will be published to MQTT and will be displayed data on Domoticz framework.

```c
67. if((millis() - oldTime) > 1000)
68. {
69.   detachInterrupt(sensorInt);
70.   debit = (((1000.0 / (millis() - oldTime)) * 
71.     pulseCount) / konstanta);
72.   oldTime = millis();
73.   flowmlt = ((debit / 60) * 1000)*2;
74.   totalmlt += flowmlt;
75.   unsigned int frac;
76.   char data[200];
77.   float temp_coop = totalmlt;
78.   Serial.println(temp_coop);
79.   String payload="\"idx\":9,\"nvalue\":0,\"svalue\":\""+String
80.     {temp_coop}+"\"\} ";
81.   //String payload="\"Suhu\":"+String(temp_coop)+"\")
82.   payload.toCharArray(data, (payload.length() 
83.     + 1));
84.   client.publish("domoticz/in", data);
85.   pulseCount = 0;
86.   attachInterrupt(sensorInt, pulseCounter, 
87.     FALLING);
88. }
89. delay(1000);
```
5.2 Testing

The first microcontroller will run the program to connect to MQTT and Node-RED. Once connected, if the upper waterlevel sensor value has a value $<250$ then it will turn on the air pump machine and if the top waterlevel sensor has value $\geq 250$ then the water is full and will turn off the water pump machine. When the water pump engine turns on the rain sensor it will read if any water flow will send a message to Domoticz that the water machine is on, otherwise it will send a message to Domoticz that the water machine is dead.

![Illustration 5.1: The rain sensor reads the flow of water from the water pump machine](image1)

![Illustration 5.2: Status Pump ON](image2)

![Illustration 5.3: Status Pump OFF](image3)
The water flow function of this project is to calculate the water discharge in milliliter size. To accurate the flow of water, then experiment.

Table 5.1: Water Debit Counting Experiments

<table>
<thead>
<tr>
<th>Volume &amp; height water</th>
<th>Konstanta (flowmeter)</th>
<th>200ml</th>
<th>300ml</th>
<th>500ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500ml &amp; 9cm</td>
<td>4.5</td>
<td>205ml</td>
<td>322ml</td>
<td>496ml</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>222ml</td>
<td>334ml</td>
<td>562ml</td>
</tr>
<tr>
<td>1000ml &amp; 6cm</td>
<td>4.5</td>
<td>196ml</td>
<td>305ml</td>
<td>490ml</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>218ml</td>
<td>332ml</td>
<td>561ml</td>
</tr>
</tbody>
</table>

From the above experimental results, water pressure in the shelter affects the process of calculating the flow of water.

On home gate security system, if ordered by domoticz to lock, the servo will work to lock the gate. And users can monitor from Domoticz if the servo has worked properly. And if the door is open or closed the user can see the status in Domoticz.

Illustration 5.4: Status Open Door and Unlocked

Illustration 5.5: Status Close Door And Locked

Illustration 5.6: Switch Servo