ARDUINO BASED WATER LEVEL MONITORING AND CONTROL VIA CAN BUS

TUAN ABU BAKAR BIN TUAN ISMAIL

UNIVERSITI MALAYSIA PAHANG

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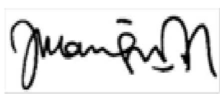

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Specially dedicated to my family, supervisor and friends. Thank you for the support and encouragement.

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ABSTRACT

This thesis presents the water level control system that uses Arduino microcontroller to monitor and control the water level via CAN Bus. The current level of water in the tank is monitored and displayed on the liquid crystal display (LCD) and the system able to control the water level to be at the desired level. The desired level of water is obtained by controlling by pumping the water in and out from the the tank. The level is controlled using Arduino Uno that is interfaced with the plant using CAN Bus that provides the communication between the Arduino and LCD display.

ABSTRAK

Tesis ini membentangkan sistem kawalan paras air yang menggunakan Arduino pengawal mikro untuk memantau dan mengawal paras air melalui CAN Bus. Tahap semasa air di dalam tangki dipantau dan dipaparkan pada paparan kristal cecair (LCD) dan sistem dapat mengawal paras air berada pada tahap yang dikehendaki. tahap yang dikehendaki air diperoleh dengan mengawal dengan mengepam air masuk dan keluar dari tangki itu. Tahap itu dikawal menggunakan Uno Arduino yang berantara muka dengan kilang menggunakan bas CAN yang menyediakan komunikasi antara Arduino dan paparan LCD.

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LIST OF SYMBOLS

℃	Degree Celcius
cm	Centimetre
mm	Mili metre
mA	Mili Ampere

LIST OF ABBREVIATIONS

CAN	Controller Area Network
ECU	Electronic Control Unit
GSM	Global System for Mobile Communication
SMS	Short Messaging System
DC	Direct Current
LCD	Liquid Crystal Display
IDE	Integrated Development Environment
USB	Universal Serial Bus
GPS	Global Positioning System
TTL	Transistor-Transistor Logic

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Water is one of the natural resources on earth that can be used in daily life and really important for human's daily life activities. Without water it effect most of the daily activities such as bathing, cleaning, watering plant, drinking, and industries needs which affect daily production.

With the advanced of technology, the water is managed more systematically and more efficient which can avoid the wastage of water usage. It will help human to manage the water easily and save the energy to perform other activities effieciently. With proper management and intelligent control system, will avoid the issues involving water such as water pollution, wastage of water, water shortage to the users, and shortage of water for industry needs which can affect their production of the product produced.

1.2 PROBLEM STATEMENT

Water is one of the natural resources on earth which is important for the living things especially for human in their activities in daily life. An intelligent monitoring and controlling water level system can help human to manage the usage water more efficient and systematically which can lead to the proper life.

1.3 OBJECTIVE

The objective of this project is to design and build a water level control system that will:

i) Display the current water level.

ii) To control water level at desired level.

1.4 SCOPE OF RESEARCH

The scope of research for this project are:

i) To design and fabricate water level control using Arduino microcontroller as a main controller.

ii) To use CAN bus protocol which languages can integrates with Arduino and the hardware system.

1.5 THESIS OUTLINE

This thesis consists of five chapters. The summary of every chapter is outlined below.

Chapter 1 consist of introduction and project overview including the objective, problem statement, and scope of research.

Chapter 2 consist of literature review about Controller Area Network (CAN), and the journal about the water level system using other method and system.

Chapter 3 consist of methodology including the project flow chart, system flowchart, block diagram, and hardware system.

Chapter 4 consist of analysis and discussion about the project that has been conducted.

Chapter 5 consist of conclusion and recommendation for the project.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter the past working researches based on CAN Bus system applications are reviewed. The reviews are focused on the design techniques for implementation of CAN Bus for data monitoring and taking an appropriate decision based on the data in the control system. Based on the reviewed then was used to achieve the objective of this project works.

2.2 CONTROLLER AREA NETWORK (CAN)

Controller Area Network (CAN) is a serial bus communication system develop for the automotive industry as a replacement for complex wiring with two wire bus[1]. These abilities has led to the popularity in other industries likes building automation, medical and manufacturing industries[1]. CAN bus was developed by BOSCH for message broadcaster that maximises the signalling rate up to 1 megabit per seconds (Mbps) [1].

2.2.1 Applications

The CAN is a protocol that allows the microcontrollers to communicate with the device on the CAN bus without using any computer host[2]. This application has been used in many fields area but the most popular applications are in automotive industries in cars[2].

This protocol also used in industrial automation and embedded control such as machinery production, medical equipment, building automation and wheelchairs[3]. The embedded control system in automotive industries has been upgraded from stand-alone system to highly integrated and networked control system[3].

The CAN communication in vehicles can be controlled by the Electronic Control Unit (ECU) [3]. ECU handles the controlling of the engine, fan, turbo, and sensors[3]. The combination of these two devices enable reducing the cable wire of connectors and increase the reliability of the systems[3]. The combination of network and mechatronic modules will help the user to carry out the diagnostic and coordinate the operation for the separate subsystems more effective and efficient[3].

2.3 MICROCONTROLLER BASED WATER LEVEL CONTROL SYSTEM

An automatic water level control system is developed to control the water level in a reservoir or water storage with the water level sensor mounted at the top of the reservoir of the water tank to detect the reading of water level at high or lower level[4].

An automatic control system can be defined as a system designed to function with minimal or less manpower used to control the system[4]. An automatic control system not only help to avoid water wasted but also can help in financial management and also energy saving[4].

The automatic water level monitoring system can be built by integrating the sensors, circuit diagram, microcontroller, display device, water pump, and the water level detected is done by the computer[4]. By implementing this system, it is possible to monitor water level in the tank which helped to reduce water wastage and shortage of water for human needs[4].

2.4 MICROCONTROLLER BASED WATER LEVEL INDICATOR USING GSM

With the advanced of the technology the monitoring system also can be upgraded by using Global System for Mobile Communication (GSM) [5]. By using GSM the monitoring system for monitoring the water level can be done from time to time and alerted by GSM via cellular network using Short Messaging System (SMS)[5].

The remote monitoring system is an effective method to transmit, analysed, manage and give the feedback to the goal of the information[5]. According to the transmission method monitoring for this system, if the system alert the situation the signal will be sent through SMS and the authorise person will be notified the stage of the water level[5].

2.5 DESIGN AND IMPLEMENTATION OF A WIRELESS NETWORK WATER LEVEL CONTROL SYSTEM

The advancement of the technology made the water level control system can be managed with the wireless network using Zigbee become more feasible with increasing of the reliability of the system can be considered in wireless process control system into large scale industrial applications[6].

The wireless implementation considered the reduction of the wire which reduced the cost, easy maintenance since the wire is reduced, and provision control redundancy[6]. The requirement for wireless system to work for this system are, the flow of water can be controlled, measured of water level can be monitored, and able to communicate data in real time[6]. Consistency operation of the equipment under the circumstances, the wired system produce the consistent result with input and wireless system produces the consistent result with the input are the performance requirement for this system[6].

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In this chapter the methodology of the project will be explained. The methodology of this project started when the title is chosen and the overview of this project is being sketched. The methodology chapter is divided into a few stages. The overall project flowchart is shown in Figure 3.1.

3.2 PROJECT FLOW CHART

The flow of the project implementation is described in flowchart depicted in Figure 3.1. The project started with meeting with the supervisor where the brief overview of the project is explained. The first stage is the literature review where the related works that have been done by other reserchers are reviewed. The second stage is design and development of the system. At this stage the design of the water level monitoring and system control is done based on the related works that have been reviewed. The next stage is to test the interfacing between hardware and software. The testing and troubleshooting is done in order to insure the objective of the project is achieved. The result obtained from th testing is then being analysed and finally the project is end up with thesis writing

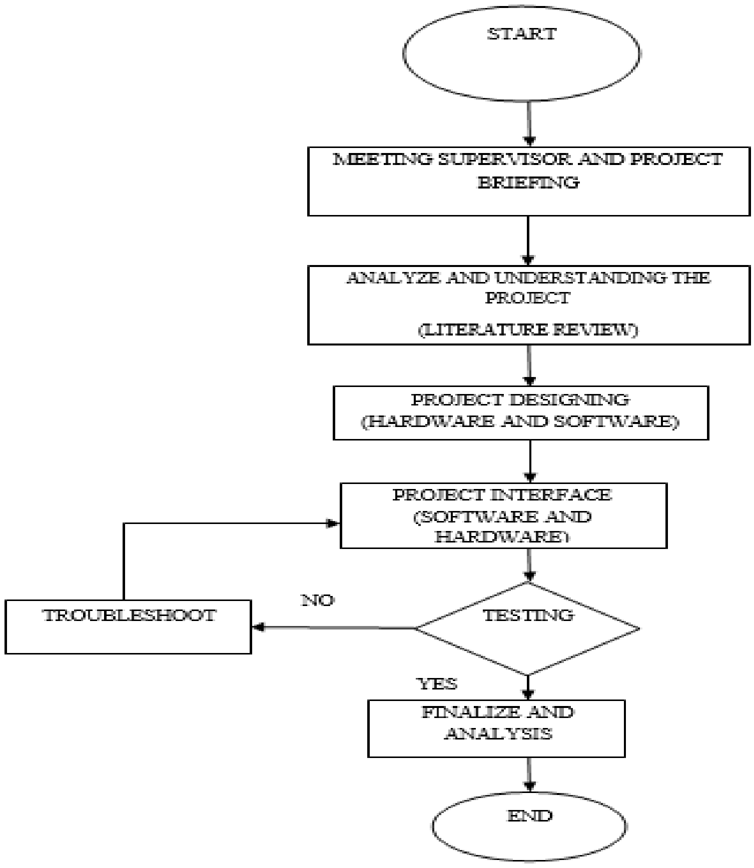

Figure 3.1 Project flow chart

3.3 SYSTEM FLOW CHART

The system for this project is based on the Figure 3.2 below. The system started with CAN is initialised and the LCD will display the current water level reading. For the desired water level, it can be set by varying the potentiometer to value desired. The maximum value for this system is 15 centimetre (*cm*). After the desired value been set, the DC motor will pump the water in or out based on the desired value and the sensor will take the reading and displayed it into LCD screen. If the sensor reach the desired value, the DC will stop pump the water and the system end.

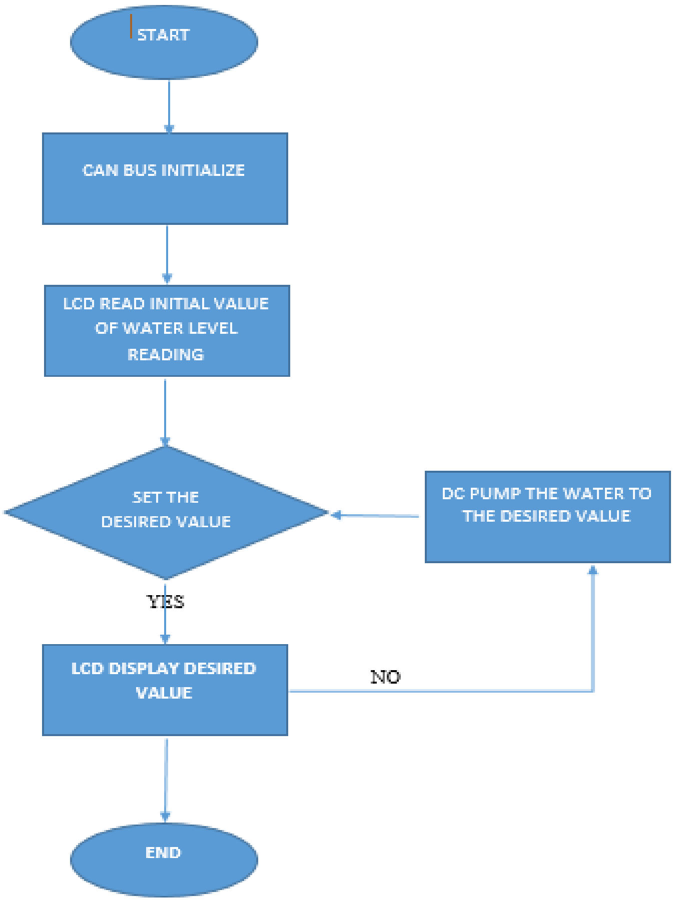

Figure 3.2 System flow chart

3.4 BLOCK DIAGRAM

The block diagram for this system is shown in Figure 3.3. The input for this sytem is the desired water level which can be set and controlled by Arduino and CAN bus shield as a controller for this system. The actuator for this system is DC water pump which flow water in and out based on the desired input and LCD will display the ouput of the system which is the sensor reading and measurement. The system will end when the error reach the steady state.

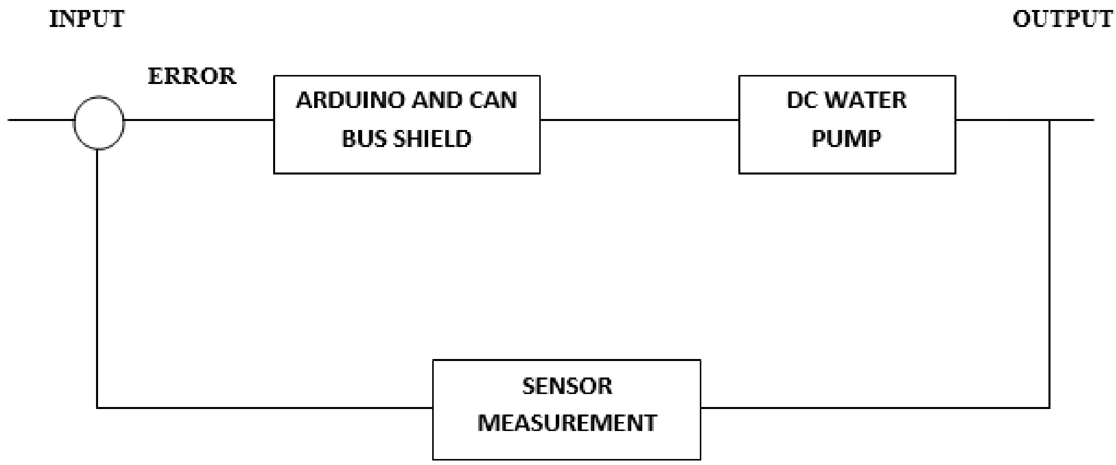

Figure 3.3 Block diagram

3.5 HARDWARE DESIGN

3.5.1 Arduino Uno

Arduino is an open source building electronics project. It consists of physical programmable board microcontroller and software which called as Integrated Development Environment (IDE) which can be connected to computer. Arduino does not need separate board hardware to load a new code to the board but can simply use USB cable. Arduino also used simplified C++ code which can make it easier to learn programming and provide more accessible package. Arduino can interact with various type devices such as buttons, GPS units, cameras, smart phone, motors, speakers, sensors and many more.

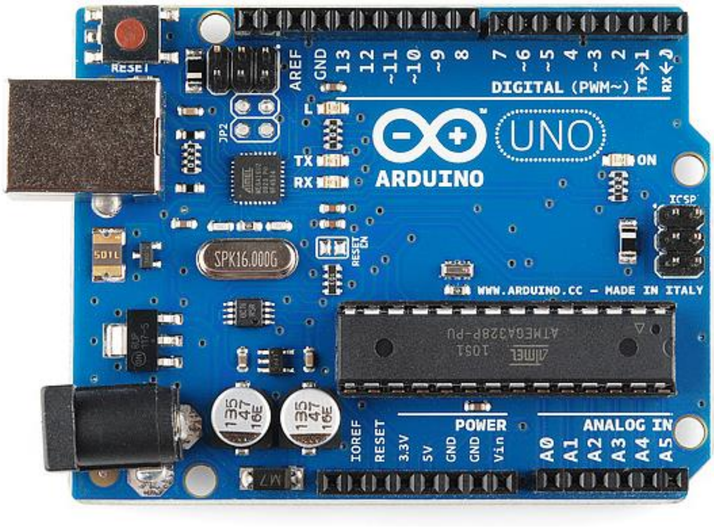

Figure 3.4 Arduno Uno

Arduino UNO is suitable for first time user and it complete with the library in order to learn how to use it. It has 14 digital input/output pins, 6 analog inputs, USB connection, power jack, reset button and more. It completely contains everything needed to support the microcontroller.

3.5.2 Ultrasonic sensor

The ultrasonic sensor used wave propagation to detect the liquid level that work with the frequency range of 20kHZ to 200kHZ. This sensor is a non-contact sensor which is placed at the top of the hardware.

Figure 3.5 Ultrasonic sensor

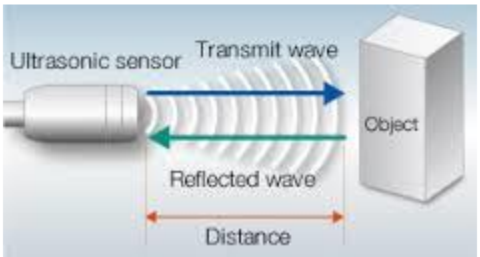

Figure 3.6 Ultrasonic application

In this application, the sensor sends out the wave and hit the object. As the wave hit the object, the echoes of the wave reflected and returned back to the sensor. The time taken to return back is directly proportional to the distance between the sensor and the material of the object. The time duration is measured by the sensor then further used can be calculated as the level liquid in the tank. The speed of waves can be affected by the change of temperature in the tank which also will affect the reading.

3.5.3 Liquid Crystal Display (LCD)

In this this project, to monitor the current water level Liquid Crystal Display (LCD) is used to display the reading of the water level. The type LCD used is I2C type which reduced the wiring to the microcontroller compared to the regular 16x2 LCD display. With I2C LCD it only needs four wire to connect to the microcontroller compare to the regular LCD which need more than four wire to connect to the microcontroller.

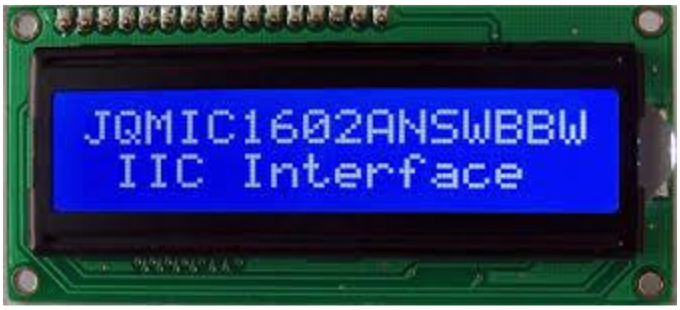

Figure 3.7 I2C LCD display

3.5.4 L298N Motor Driver Controller Board

The DC motor cannot be connected directly to the microcontroller like Arduino because it only can supply only up to 40 mili Ampere which is not enough to run the motor. Therefore, to control the motor with microcontroller the motor need to be connected with transistor, resistor, capacitor, and diode which avoid the damage to the microcontroller and ensure that the motor can run properly. By using L298N motor driver controller board it can save the time to set up the hardware and reduced the wiring to the microcontroller and make it simpler. L298N is a driver which has transistor, resistor, capacitor, diode, and H-bridge builds up in the board which can accept standard Transistor-Transistor Logic (TTL) and inductive loads such as relays, solenoids, DC and stepping motor. By using this driver the direction and speed of the motor can control easily without using relays and with H-bridge on the board it can act as heat sink.

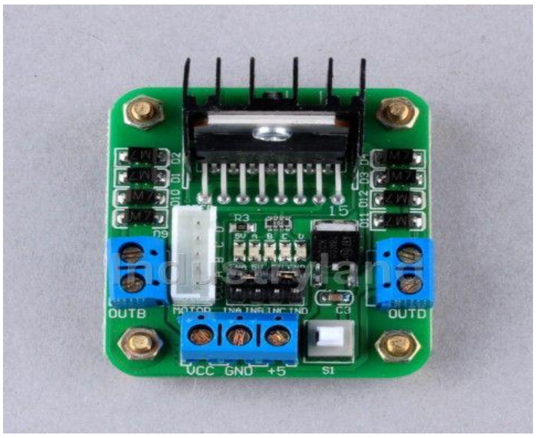

Figure 3.8 L298N motor driver controller board

3.5.5 Direct Current (DC) Motor

The DC motor is an electrical machine that converts the electrical power to the mechanical power. There are few types of DC motor that can be used to convert electrical power to the mechanical for this water level control system. In this project, the reversible DC motor is used in order to control the flow in and out water into the tank.

Figure 3.9 DC motor

3.5.6 Power supply

The voltage is supplied by the power supply which enable the DC motor to run. The power supply has improved the performance of the DC motor and provide longer time of operation with comparing to battery as a power supply. By using the power supply also enable the DC motor to run without any delay and at constant speed.

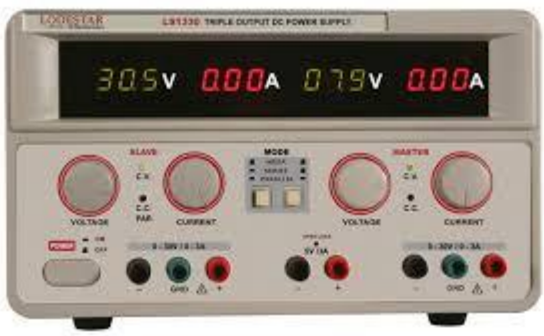

Figure 3.10 Power supply

3.5.7 CAN Bus shield

CAN bus shield is the combination of the MCP2515 controller and MCP2551 transceiver which can give microcontroller like Arduino the CAN bus capability. CAN bus shield has medium communication speed and reliable. Some of the pin on the shield already has its own function and for the other usage it can be connected at the free pin mode which can be referred at CAN bus shield pin map.

Figure 3.11 CAN bus shield

3.5.8 Prototype fabrication

The prototype for this project is shown in Figure 3.12 below. The fabrication of the hardware for this project consist of Arduino and CAN bus shield as a microcontroller, ultrasonic sensor, motor driver board connected to the power supply and DC motor, and LCD display. After completing the hardware fabrication, software development is designed.

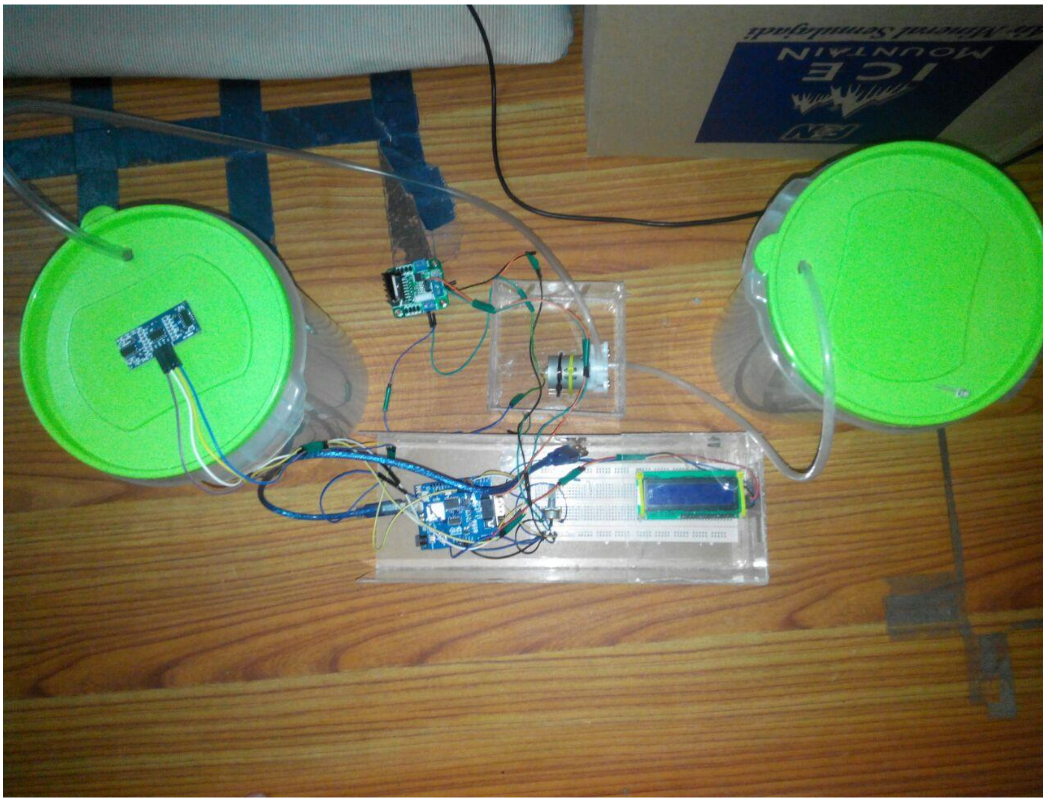

Figure 3.12 Prototype fabrication

3.6 SOFTWARE DEVELOPMENT

Software development is really important for this project especially to the microcontroller to control the system. There are three stages for the software development for this project.

First stage for the software development for this project is coding the microcontroller to monitor and display the water level in the tank. The coding for monitoring is shown below. For monitoring water level, I2C LCD and ultrasonic sensor need to be programmed.

```
#include <Wire.h>

#include <LCD.h>

#include <LiquidCrystal_I2C.h>

#define I2C_ADDR  0x27  // Define I2C Address where the PCF8574A is

#define BACKLIGHT_PIN   3

#define En_pin  2

#define Rw_pin  1

#define Rs_pin  0

#define D4_pin  4

#define D5_pin  5

#define D6_pin  6

#define D7_pin  7

int n = 1;

float DesiredLevel;

LiquidCrystal_I2C
lcd(I2C_ADDR,En_pin,Rw_pin,Rs_pin,D4_pin,D5_pin,D6_pin,D7_pin);

#define trigger 3

#define echo 4

pinMode(trigger,OUTPUT);

 pinMode(echo,INPUT);

digitalWrite(trigger,LOW);

 delayMicroseconds(2);

 digitalWrite(trigger,HIGH);

 delayMicroseconds(10);

 digitalWrite(trigger,LOW);

 delayMicroseconds(2);

 duration = pulseIn(echo, HIGH);
```

```
distance =(duration/2.00) / 29.10;
waterlevel= 22.00-distance;
lcd.clear();
lcd.print("Water level=");
lcd.print(waterlevel);
lcd.print("Cm");
delay(2000);
```

For the second stage, coding the microcontroller with DC pump motor is need in order to control the water flow in and out based on the desired level. The coding for controlling the DC motor is shown below.

```
#define MOTOR_1 5
#define MOTOR_2 6
#define relay 7
pinMode(MOTOR1, OUTPUT);
 pinMode(MOTOR2, OUTPUT);
 pinMode(relay, OUTPUT);
int sensorValue = analogRead(A3);
  // Convert the analog reading (which goes from 0 - 1023) to a voltage (0 - 5V):
  float voltage = sensorValue * (15.0 / 1023.0);
  float DesiredLevel = voltage;
  // print out the value you read:
  Serial.print("Desiredlevel = ");
  Serial.println(DesiredLevel);
```

Finally, the final stage for this software development for this project is initiliazing the communication between Arduino and CAN bus shield. The coding for initiliazing the communication between Arduino and CAN bus shield is shown below.

```
#include <Canbus.h>

Serial.begin(115200);

 Serial.println("CAN-Bus ");

if(Canbus.init(CANSPEED_500))  /* Initialise MCP2515 CAN controller at the specified speed */

  {

    Serial.println("CAN Init ok");

  } else

  {

    Serial.println("Can't init CAN");

  }
```

CHAPTER 4

RESULT AND ANALYSIS

4.1 INTRODUCTION

In this chapter, the analysis of the result that been collected from the system is analysed. The result is based on the experiment conducted and the data collected.

4.2 WATER LEVEL READING

In this experiment, the reading of water level by ultrasonic sensor gives a different measurement based on the condition set. As an example, for this experiment the measurement of the water level at the room temperature and the measurement of the water level at 65°C temperature shows a different result.

For the room temperature, the desired value for the water level shows almost the same value with the sensor measurement. Ultrasonic sensor can take the reading without any delay on time pulse and the reading is almost accurate with desired level.

Desired level (*cm*)	Sensor reading (*cm*)
0	0
1.25	1
2.33	2
3.03	3
4.27	4
5.54	5
6.12	6
7.61	7
8.55	8
9.07	9
10.02	10
11.34	11
12.11	12
13.43	13
14.77	14
15	15

Table 4.1 Water level reading at room temperature

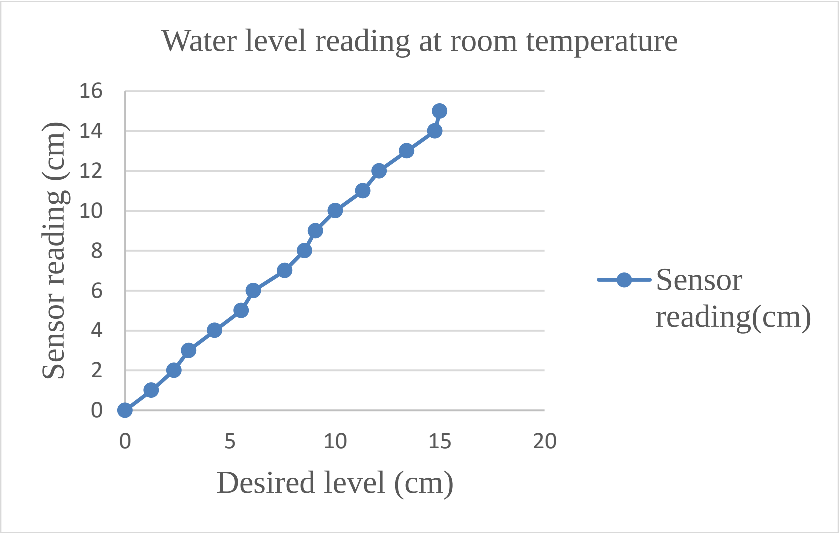

Figure 4.1 Water level reading at room temperature

For 65°C temperature, the desired value for water level is different with sensor measurement due to the vapour produced in the tank which affect the sensor reading. The vapour produced made ultrasonic sensor reading not accurate due to the velocity of the sound wave is distracted by the water vaporised into the air which makes wave travelled take longer time to reach echo of the sensor.

Desired level (*cm*)	Sensor reading (*cm*)
0	0
1.23	2
2.31	3
3.65	4
4.77	5
5.09	5
6.13	6
7.73	8
8.89	9
9.02	11
10.11	12
11.95	13
12.65	14
13.04	15
14.21	15
15	15

Table 4.2 Water level reading at 65°C

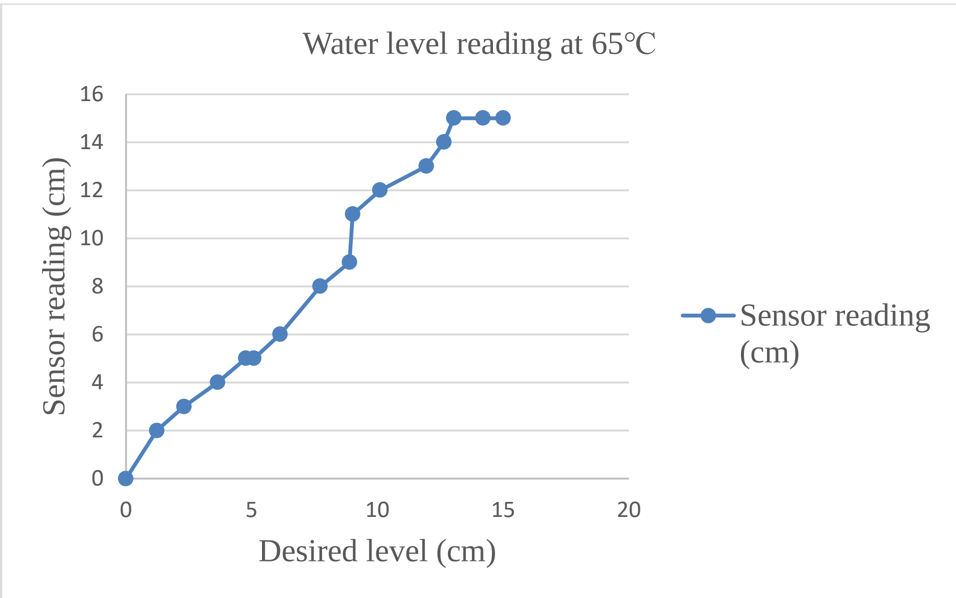

Figure 4.2 Water level reading at 65°C

4.3 WATER FLOW

The time taken for the water flow in and out into the water tank for this experiment is recorded and the graph is plotted.

For the water flow in, the time taken for the water to reach the maximum level is faster than the water flows out from the tank to reach zero value in the tank. The time difference is due to the size of the hose that is connected to DC motor pump is different. For the size of hose used to flow the water in is 4 *mm*.

Time(*minute*)	Water level(*centimeter*)
0	0
1	4
2	5
3	8
4	10
5	11
6	14
7	15

Table 4.3 Time taken for water flow in

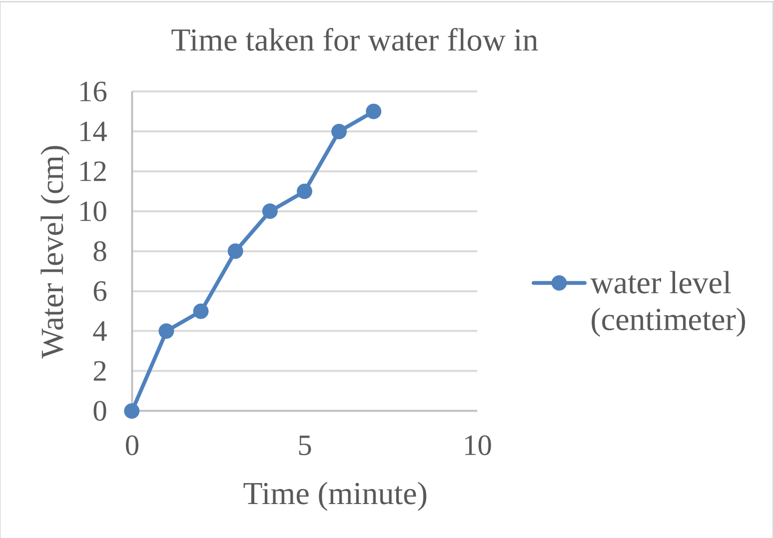

Figure 4.3 Time taken for water flow in

For water flow out time taken to reach zero value is higher at certain level due to the size of hose used is bigger than the size for the water flow in. The size of hose for t he water flow out that connected to the DC pump motor is 6 *mm* which 2 *mm* bigger than flow in which take time longer at certain level.

Time(*minute*)	Water level(*centimeter*)
0	15
1	13
2	12
3	10
4	7
5	5
6	3
7	0

Table 4.4 Time taken for water flow out

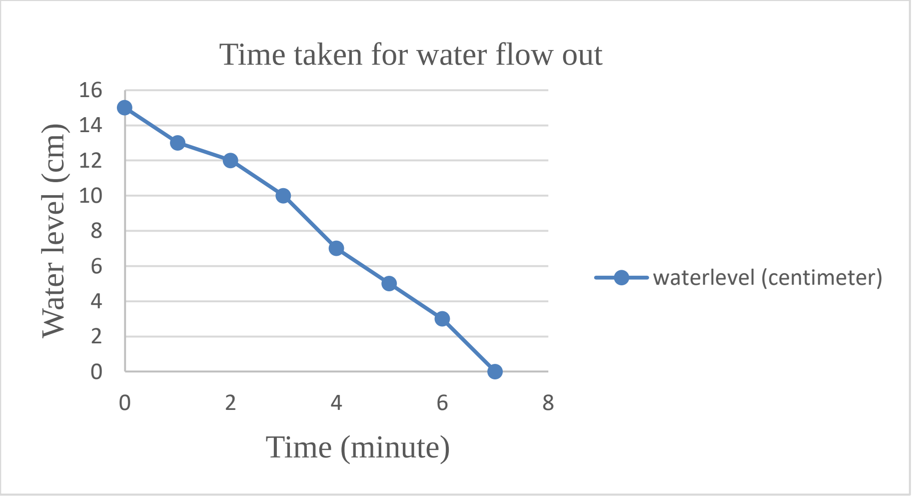

Figure 4.4 Time taken for the water flow out

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

In this chapter, the project conducted can be concluded and the recommendation can be made based on the analysis and the outcome that has been achieved for this project. The software and hardware successfully designed and well executed for this project.

5.2 RECOMMENDATION

Based on the experiment has been executed a few recommendation can be made for improvement in the future. The sensors work really well for this experiment but have the limitation which can affect the measurement of the water level under some circumstances.

The limitations of the ultrasonic sensor for this project, it has slightly offset from actual reading and become inconsistent when the computed time is low. This will affect the reading the water level measured. Besides that, the reading also can be inaccurate when the temperature is higher than the temperature room. A better specification on the current model will help to improve the accuracy and the precision for this project as an example, by using HY-SRF05 sensor model.

Furthermore, using Alternating Current pump motor also will improve in regulating the water flow in or out with a better time operation and reliability.

REFERENCES

[1] S. Corrigan, “Introduction to the controller area network (CAN),” *Appl. Report, Texas Instruments*, no. August 2002, pp. 1–15, 2002.

[2] Rensselaer Polytechnic Institute, “Controller Area Network Implementation: Technical Details & Case Study,” *Rensselaer Polytech. Inst.*

[3] K. H. Johansson and T. Martin, “Vehicle Applications of Controller Area Network.”

[4] E. V. Ebere and O. O. Francisca, “Microcontroller based Automatic Water level Control System,” *Int. J. Innov. Res. Comput. Commun. Eng.*, vol. 1, no. 6, pp. 1390–1396, 2013.

[5] M. Amirruddin, N. M. Mukhtar, H. A. Halim, and N. S. Noorpi, “Microcontroller Based Water Level Indicator Using GSM Modem : Design And Application,” 2012.

[6] L. Lu, R. Lewis, M. Hu, and R. Lin, “Design and Implementation of a Wireless Networked Water Level Control System,” no. May, pp. 159–163, 2015.

APPENDIX A

```
#include <Wire.h>

#include <LCD.h>

#include <LiquidCrystal_I2C.h>

#include <Canbus.h>

#define I2C_ADDR  0x27  // Define I2C Address where the PCF8574A is

#define BACKLIGHT_PIN   3

#define En_pin  2

#define Rw_pin  1

#define Rs_pin  0

#define D4_pin  4

#define D5_pin  5

#define D6_pin  6

#define D7_pin  7


int n = 1;

float DesiredLevel;

LiquidCrystal_I2C
lcd(I2C_ADDR,En_pin,Rw_pin,Rs_pin,D4_pin,D5_pin,D6_pin,D7_pin);


#define trigger 3

#define echo 4

#define MOTOR_1 5

#define MOTOR_2 6

#define relay 7
```

```
int duration, distance, waterlevel, MOTOR1, MOTOR2;
void setup()

{
 Serial.begin(115200);
 Serial.println("CAN-Bus ");
 lcd.begin(16,2);
 pinMode(trigger,OUTPUT);
 pinMode(echo,INPUT);
 pinMode(MOTOR1, OUTPUT);
 pinMode(MOTOR2, OUTPUT);
 pinMode(relay, OUTPUT);
 lcd.print("  Water Level ");
 lcd.setCursor(0,1);
 lcd.print("   Indicator  ");
 delay(2000);
 if(Canbus.init(CANSPEED_500))  /* Initialise MCP2515 CAN controller at the speci-
fied speed */
  {
    Serial.println("CAN Init ok");
  } else
  {
    Serial.println("Can't init CAN");
  }
  lcd.begin(16,2);
```

```
 lcd.setBacklightPin(BACKLIGHT_PIN,POSITIVE);
 lcd.setBacklight(HIGH);
 lcd.home ();                // go home
}

void loop()
{

 int sensorValue = analogRead(A3);
  // Convert the analog reading (which goes from 0 - 1023) to a voltage (0 - 5V):
  float voltage = sensorValue * (15.0 / 1023.0);
  float DesiredLevel = voltage;
  // print out the value you read:
  Serial.print("Desiredlevel = ");
  Serial.println(DesiredLevel);

 lcd.clear();
 digitalWrite(trigger,LOW);
 delayMicroseconds(2);
 digitalWrite(trigger,HIGH);
 delayMicroseconds(10);
 digitalWrite(trigger,LOW);
 delayMicroseconds(2);
 duration = pulseIn(echo, HIGH);
 distance =(duration/2.00) / 29.10;
 waterlevel= 22.00-distance;
```

```
lcd.clear();
lcd.print("Water level=");
lcd.print(waterlevel);
lcd.print("Cm");
delay(2000);
if(waterlevel<=DesiredLevel )
{
   digitalWrite(MOTOR_1, HIGH);
   digitalWrite(MOTOR_2, LOW);
   lcd.clear();
   lcd.print("MOTOR FOWARD");
   lcd.setCursor(0,1);
   digitalWrite(relay, LOW);


}


 else if (waterlevel>=DesiredLevel)
{
 digitalWrite(MOTOR_1, LOW);
 digitalWrite(MOTOR_2, HIGH);
 digitalWrite(relay, LOW);
 lcd.clear();
 lcd.print("MOTOR REVERSED");
 lcd.setCursor(0,1);
 }
}
```