UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SOLAR POWERED WATER SENSOR TO MONITOR WATER QUALITY FOR FISH FARM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Industrial Power) (Hons.)

By

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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TAJUK: **DEVELOPMENT OF SOLAR POWERED WATER SENSOR TO MONITOR WATER QUALITY FOR FISH FARM**

SESI PENGAJIAN: **2016/2017 Semester 1**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

………………………………

PUAN EMY ZAIRAH BINTI AHMAD

(Project Supervisor)

ABSTRAK

Seperti yang kita tahu projek ini dilakukan dengan melakukan simulasi dan reka bentuk dalam skala kecil untuk tangki ikan. Sistem teknologi hijau adalah tujuan utama untuk projek ini yang direka untuk menjadi bebas dari sistem grid kuasa utama. Komponen utama sistem terdiri daripada panel solar, pam air automatik dan juga sensor suhu. Panel solar digunakan untuk membekalkan tenaga elektrik untuk sistem untuk mikropengawal dan membaca data yang diberikan daripada sensor untuk mengawal pergerakan pam air. Untuk mengelakkan sebarang kerosakan kepada bateri solar pengawal caj dihubungkan dengan panel solar. Tenaga yang disimpan dalam bateri akan dibekalkan kepada sistem untuk mengawal dan memberi kuasa pada pam air. Jika suhu air di dalam sistem melebihi suhu optimum pam air akan diaktifkan. Hasil terakhir akan menunjukkan sistem ini akan dikendalikan dengan sempurna dan menjadikannya bebas daripada sistem grid kuasa utama yang dengan menggunakan panel solar.

ABSTRACT

As we know this project are done by doing the simulation and design in a small scale for fish tank. The green technology system is the main purpose for this project which is designed to be independent from main power grid. The main component for the system consist of solar panel, automatic water pump and also temperature sensor. Solar panel is use to provide electrical energy for the system which is microcontroller read the data given from the sensor to control the water pump movement. To prevent any damage to the batteries solar charge controller are connected to the solar panel. The energy that store in the batteries will supplied to the system to control and powered the water pump. If the temperature of the water in the system exceeds for the optimum temperature the water pump will activated. The last result will show this system will operated perfectly and making it independent from the main power grid system which by using the solar panel.

DEDICATION

To my beloved parents, supervisor and friends

ACKNOWLEDGEMENT

First of all I would like to express my thanks to Puan Emy Zairah Binti Ahmad, a lecturer at Engineering Technology Faculty UTeM to be my supervisor along this semester and also for the next semester.

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CHAPTER 1

INTRODUCTION

1.1 Introduction of the Project

Generally, in a world there are many types of fish which salt water fish and also fresh water fish. For some fish temperature is the most sensitive part for it growth this is because to growth it must get the optimum temperature. Tilapia fish is the best example toward the sensitive of the temperature. The best optimum temperature for this fish to growth are between 27°C to 30°C. This is because to ensure the survival of the fish the optimum temperature are required. (Temprasit et al. 2015) The process of the fish growth will follow the specification needed when the optimum temperature are achieved in the range given.

The main proposes for this project are by using the solar powered water sensor. Generally this system are connected to the automatic water pump which control by the microcontroller based on the temperature system. The design of the system is the green technology system which are independent from the main power grid. To prevent any damage for the batteries solar charge controller are connected to the solar panel. It will powered the water pump and also microcontroller by using energy that stored in the batteries.

1.2 Problem Statement

Aquaculture plays a very important role in Malaysia as it is one of the main sector contributed to the economic growth. However, problem that normally faced is the bad water quality of water.

Majority of fish farms are located in remote regions hence diesel generator is used to provide power demand. Therefore solar powered system is the most feasible.

Normally, now days most of the water pump does not display the temperature of the fish tank or pond. It will make the fish breeder difficult to know what is the current temperature for fish tank. If the temperature of the tank are not in the optimum temperature it will affect the growth the of the fish. Hence water temperature sensor are added to the water pump to regulate the water temperature for the fish tank.

For the most decades to be a dependable method and cost effective are proven for aquaculture system by using the photovoltaic.(USDA NCRS 2010) Generally the water must work efficiently by changing the water into it, through and out of the pond to maintain the optimum temperature of the pond

1.3 Project Scope

The usage of the photovoltaic technology system in aquaculture are the main scope for this project. Briefly, the aspect is highlighted into the proposed the method to solve the problem, analysis the problems, suggested the solution from the expected result and testing result by collecting all the data. Moreover to assembles of the component and design the construction of the prototype the hardware and software are implement for this project.

1.4 Objective of the project

Aquaculture plays a very important role in Malaysia as it is one of the main sector contributed to the economic growth. However, problem normally faced is the quality of water is inferior and insufficient to meet the demand.

Majority of fish farms are located in remote regions so most of power demand is provided by diesel generator. Therefore solar powered system is the most feasible. The objectives for this project are:

a) To develop a water sensor powered by solar.
b) To control the water temperature of the fish tank by using microcontroller.
c) To analyse the performance of the system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction of Literature Review

In this chapter it tell about previous study from other author or journals about the system. Besides that, it also included market surveys, the background of the project and method in doing this project. It also review the past work that similar that already done by others.

Nowadays, as we know to generate the electrical energy the main sources is the non-renewable sources such as coal and petroleum (Ioakeimidis et al. 2013).This electrical energy will produced and directly supplied by the power grid line to the consumer.

This project are the solution to improve for providing energy to the fish tank. As we know to regulate the system manually and proper control the usage of manpower needed and if the system suddenly breakdown it will take time to maintain it and will affect the condition of the fish.

In this project, main purpose is providing electrical energy to fish tank are by using solar power, the energy that produce can maintain and regulate the water temperature by using the microcontroller and water pump.

2.2 Project operation

The important part to control the water temperature is by using the PIC16F877A and it will read all the data from the temperature sensor. If the temperature of the water are suddenly drops or rises the water temperature sensor will read and transfer to the microcontroller to give the signal to the water pump, the water pump will automatically pump the water from the reservoir tank to replace the water in the tank. This prototype will develop in a small scale for demonstration purpose by using small box container that similar like fish tank.

2.3 Project Component that used

The main part to design this project are implement hardware and software form. To build the prototype for this project that have several step and sometimes it also requires trial an error method. This is because sometimes the hardware that build are not fit with the system.

2.3.1 Type of Photovoltaic (PV) Modules

2.3.1.1 Polycrystalline

Polycrystalline panel are made up from the silicon off cuts, mounded to form a blocks. From the process it creates a cell made up of several bits of pure crystal. The appearances also difference which is for this type has a random crystal arrangement and the panel look a little blue cause of reflect some of the light. The size, price and performances a very similar to mono-crystal type. For the performances, the both type is less efficient caused of the method that produce them and performs slightly better than mono-crystalline in low light conditions. Polycrystalline is easy susceptible to shading like a mono-crystalline type.

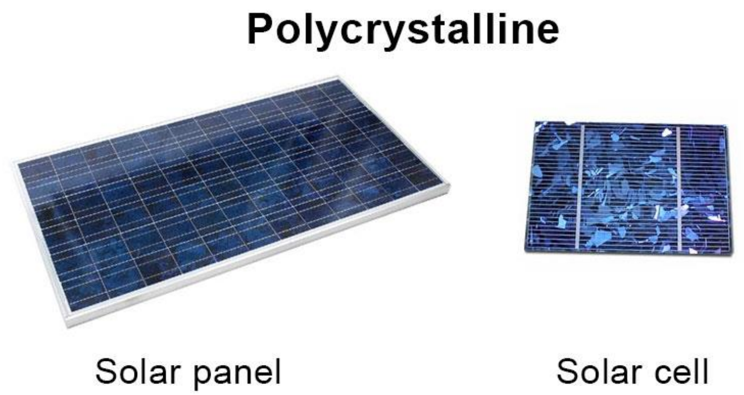

Figure 2.1: Polycrystalline panel and cell

2.3.1.2 Mono crystalline

The solar cells in mono-crystalline panels are slices cut from pure drawn crystalline silicon bars. As PV panel made of single crystal silicon cell manufacturing process they are one of the most complex and expensive. The entire cell is aligned in one direction, which means when the sun is shining brightly on them at the correct angle, they are extremely efficient. This PV are able to convert the highest amount of solar energy into electricity of any type of flat solar panel.

This type have a uniform blacker colour because they are absorbing most of the light. PV panel from Mono crystalline type endure a reduction in output once the temperature from the sunlight reaches around 50°C or 15°F and the losses of efficiency is lower than PV panel made from polycrystalline cells.

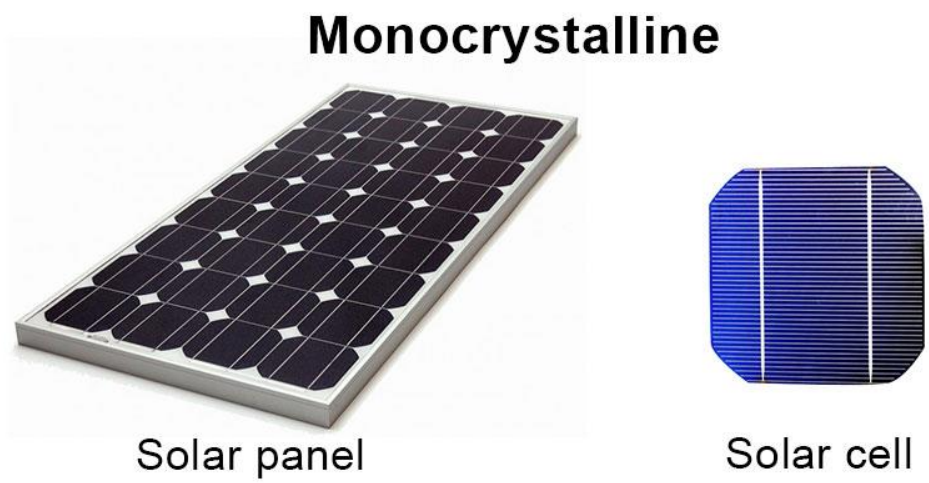

Figure 2.2: Monocrystalline panel and cell

2.3.1.3 Thin Film

Thin film are totally different technology to Mono and Poly crystalline panels. This type can be identified as having solid black appearances. These types are made by depositing photovoltaic substances. The example of the most common photovoltaic substances used are; Amorphous Silicon, Cadmium Telluride (CdTe), Copper Indium Gallium Selenide (CGIS) and Dye-Sensitized Solar Cell (DSC).

The thin film offers reliability, long life, and high efficiency. The efficiency of thin film is does affected by shadow like other type of solar panel or modules. It's also very suitable to dull and diffuse conditions. These types take up a lot of space than other type but the price is generally cheaper.

Figure 2.3: Thin-film panel and cell

2.3.2 Solar Charger Controller

The solar charge controller is regulate the voltage and current coming from the solar array going to the battery and in particular to protect the battery from overcharging, subsequent gassing, loss of electrolyte and possible plate damage. It ensures that the batteries are always in good condition.

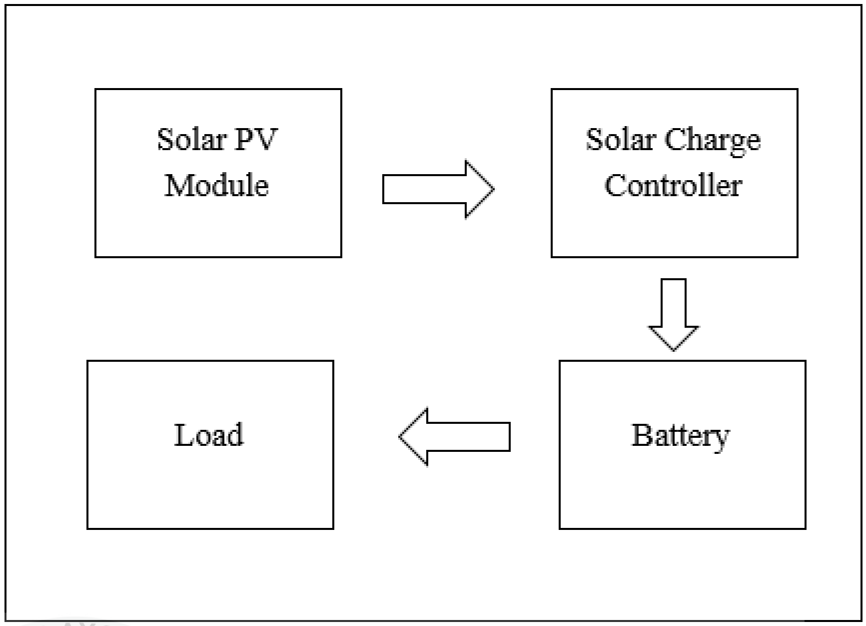

Figure 2.4: Solar charge control flow and Diagram

Solar charge controller has two types that commonly used; Pulse Width Modulation (PWM) and Maximum Power Point Tracking (MPPT). The charging rate for both type is depends on the level of battery charge level which to allow charging is nearly to the maximum capacity of battery and also to prevent overheating. PWM controller is basically a switch that connected to the solar module to a battery and the output voltage of this module will carried out to the battery. The MPPT controller is different from PWM type where this type more expensive and then it will adjust the input sources or voltage to maximum power and convert these sources to supply the varied voltage based on requirement.

Figure 2.5: Solar Charger Controller

2.3.3 Types of Batteries

Batteries in solar applications have to meet the demands of unstable grid energy, heavy cycling (charging and discharging) and irregular full recharging. There's a variety of battery types fitted for these unique requirements. Considerations for choosing a battery include cost, cycle life and installation and maintenance.

2.3.3.1 Traction Batteries

The term footing battery identifies with all batteries used to power electric vehicles. The capacities with regards to portability, for example, bike to a for-lift truck are range from 30 or 40 Ah. .Normally 6 or 12 Volt units are the littler footing batteries where 2 volt cells are the biggest. Sun powered power application are the perfect for the footing batteries as they are expected to be completely released and energized every day. The bigger footing batteries can withstand a large number of release cycles.

Figure 2.6: Traction batteries

2.3.3.2 Sealed Batteries

There have many sorts for this batteries from 1 or 2 Ah to single cell footing batteries. The benefits of fixed batteries it no need support and are spill-confirmation. Be that as it may, they do have hindrances in any case; the cost are more costly than other battery sorts, and they require more exact charging control and can have a shorter life, particularly at high temperatures. This batteries are appropriate for sunlight based application in light of the fact that can work for long stretch without support.

Figure 2.7: Sealed batteries

2.3.4 Waterproof Temperature Sensor

This is a pre-wired and waterproofed version of the DS18B20 sensor. Handy for when need to measure something far away, or in wet conditions. While the sensor is good up to 125°C the cable is jacketed in PVC so we suggest keeping it under 100°C. These 1-wire digital temperature sensors are fairly precise (±0.5°C over much of the range) and can give up to 12 bits of precision. With any microcontroller there are using a single digital pin, and you can even connect multiple ones to the same pin, each one has a unique 64-bit ID burned in at the factory to differentiate them. Usable with 3.0-5.0V systems.

Figure 2.8: Waterproof temperature sensor

2.3.5 Microcontroller PIC16F877A

Figure 2.9: PIC16F877A Chip

This type of PIC are mostly used in the microcontroller world. As we know to create some coding are not that easy that we think but this PIC can be used for many type of application for embedded system. This PIC16F877A have total number of 40 pins and there are 33 pins for input and output.

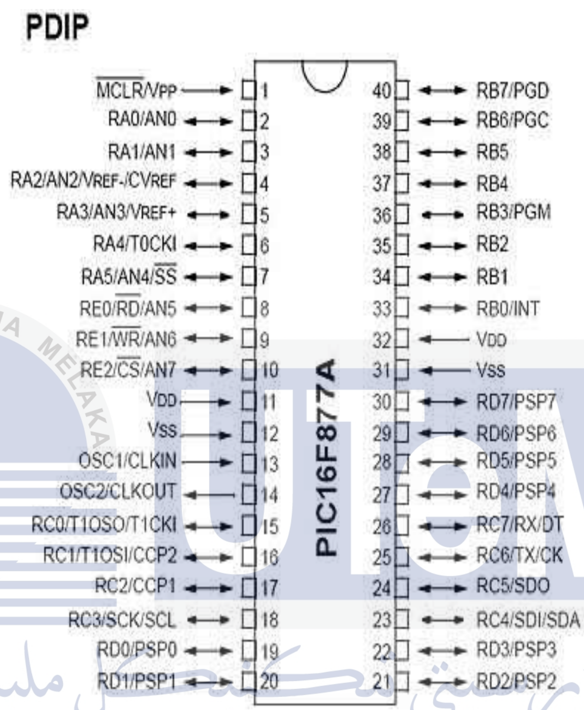

Figure 2.10: Schematic diagram

2.3.6 Water Pump 12V

This water pump is function to pump in and pump out the water from the reservoir tank to the main tank when the temperature sensor receive the signal.

Figure 2.11: 12 V Water pump

2.3.7 MPLAB & PICKIT

MPLAB is a software that runs on your development environment for your embedded microcontroller design. By using this software the coding can be write and run for the system. PICKIT as we know is use to program and debug microcontroller work as EEPROM. It use to burn the coding program in the PIC16F877A which are connected to SK40C to the computer.

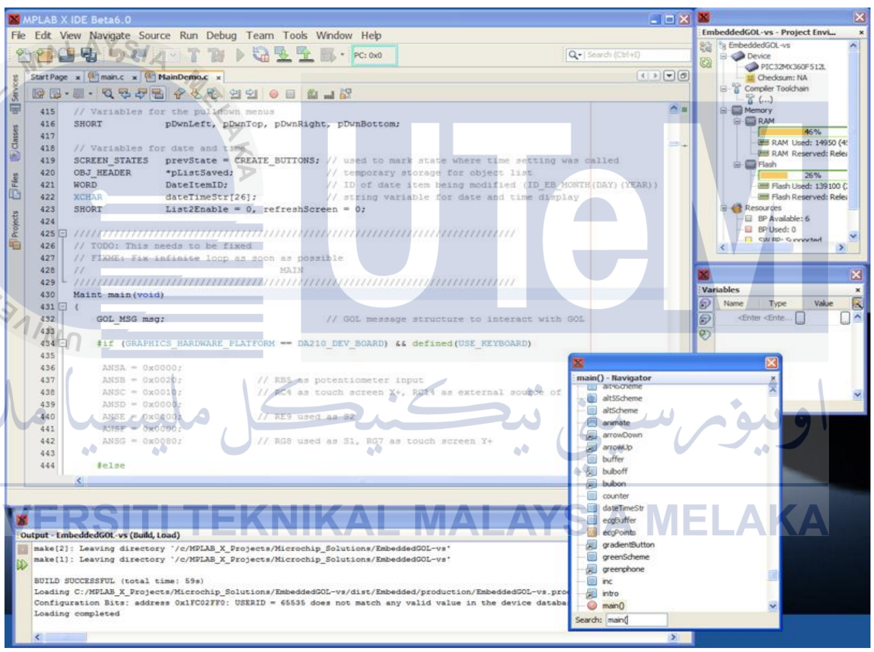

Figure 2.13: MPLAB

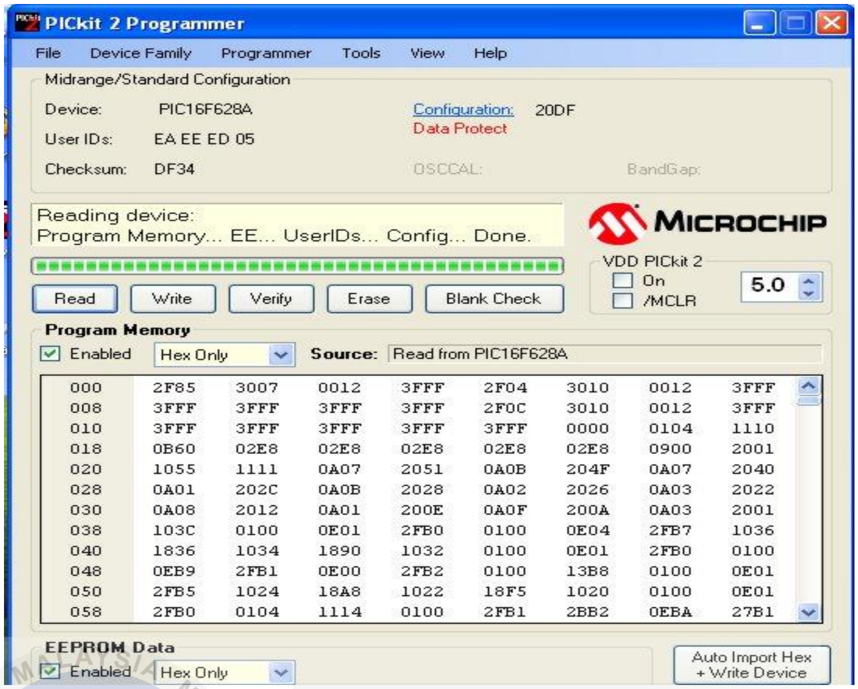

Figure 2.14: PICKIT

2.4 Stand Alone Photovoltaic System

Stand alone photovoltaic power system known as an Off Grid system, which means the system doesn't need supply from TNB. Stand alone photovoltaic power system (SAPVPS) is an independent system without connected the supplies to the electric grid.

There have some step to design the stand alone photovoltaic power system; identify the solar radiation and the sizing of all components. Solar radiation can be observed in tropical climates with a reaching 800Wm2 and occurring within a short time interval, from few seconds to few minutes, according to the geographical location.(Saleh et al. 2015)

For this system, it has the simplest type which is a direct-couple system, where the direct current output of a PV module is directly connected to a DC load. For this condition, it suitable for normally applications such as water pumps, ventilation fans and small circulation pumps for solar thermal water heating system whereby the system does not have electrical energy storage. For stand-alone solar PV system, the batteries are used for energy storage.

2.5 Summary Of Project

As we know about the previous research lot of man power needed to maintain the system working in order state. This is because by using the main power grid it will take high cost to maintain it because of the renewable energy that used. It will make this system are not so efficiency and green technology.

Nowdays, for the accurate reading of temperature, temperature sensor are widely being used to replace the normal thermometer. For the previous research system we found that if the temperature of the water suddenly rises or drops it need a man to operate and measure it manually by open it the water pump from the reservoir tank. We can say that the system are not efficiency because the temperature of the water are not measured constantly and the water pump will on until the switch is off.

If the system still same like previous the cost for the bill will high. For example for the fish farm that we visit located in Manjung, Perak that said the temperature water farm are optimum. But when few week we found that the water temperature for the ponds are not well regulated because the different in size of the fish.

Based on the result, we can conclude that the previous system are not so efficiency to maintain the optimum temperature for the fish tank to grow. Besides that, the cost to maintaining the system are so expensive and high compare to the project that we develop.

CHAPTER 3

METHODOLOGY

3.1 Introduction for methodology

There are lot of method are been used to completing this project. For example to make the prototype work in order there are several steps and process detail that will show in this chapter. For this project that are three main parts.

Which is started from the PV array which work as the input or main source for this project. Besides that, is the water pump which will move water into the tank and reservoir of the system .And the third is the temperature sensor which is used to detect the suitable temperature for the fish.

3.2 General Flowchart

Figure 3.1 below shows the steps and proper order to ensure this project can be done in the estimating time and cost. This project can be succeed if the planning with work and systematic skill are combined into this project.

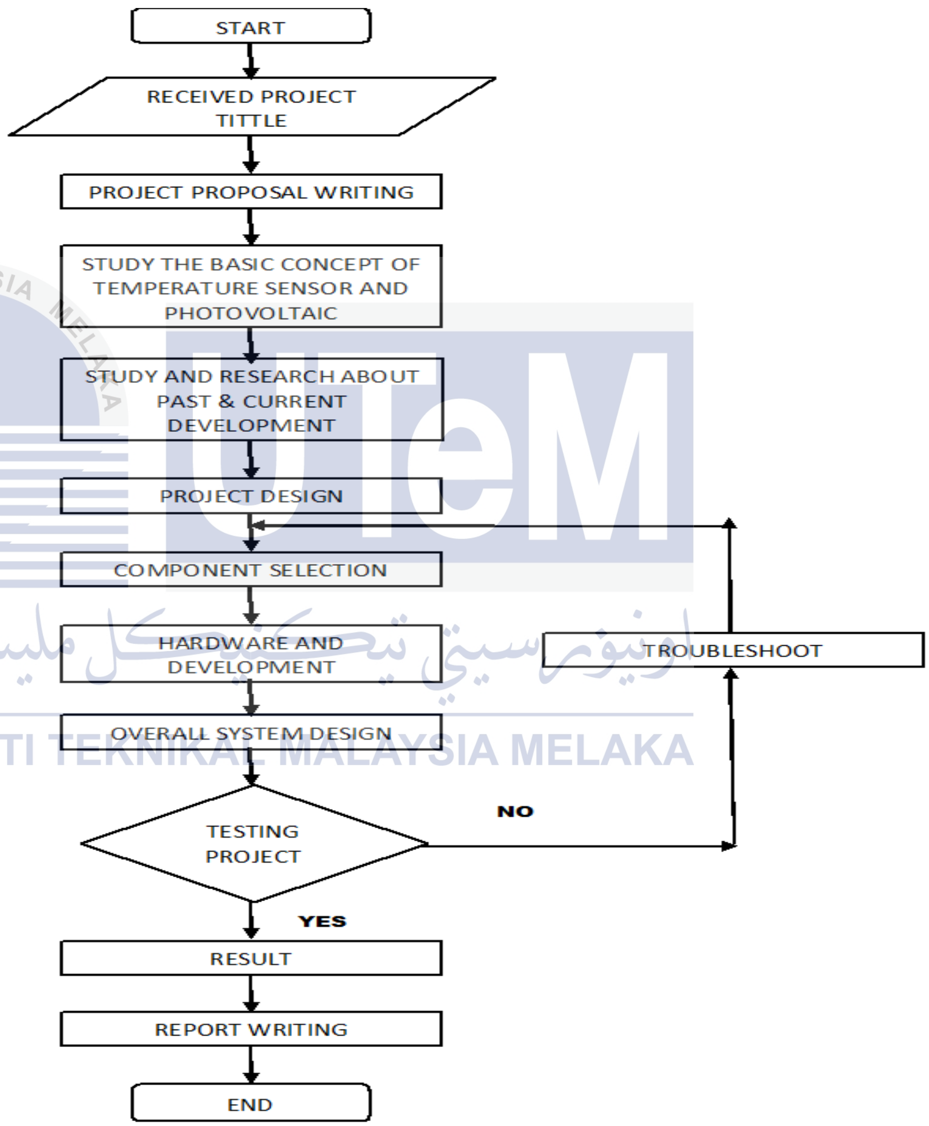

Figure 3.1: General Flowchart of the project

3.3 Photovoltaic Flowchart

Figure below shows the flowchart of the photovoltaic system in this project. The function of the photovoltaic is to collect the energy from the sunlight and store it into array. Then the energy will be collected and will transferred to the system which is water pump. This flowchart shows when the motor received energy from the photovoltaic it will rotate and produced the oxygen for the fish.

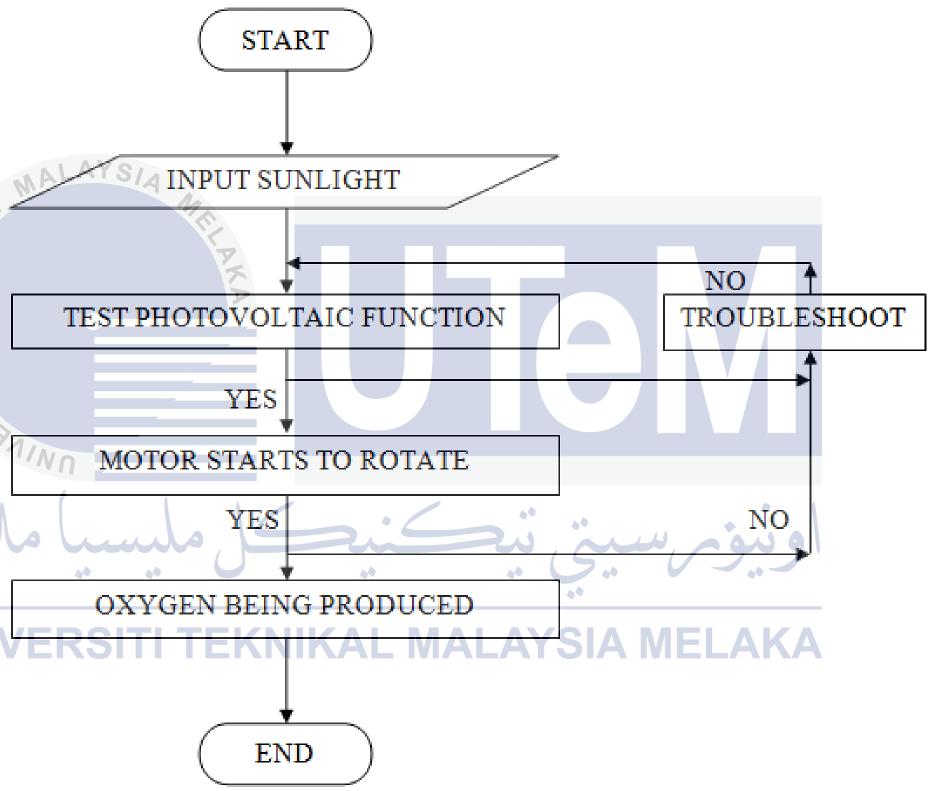

Figure 3.2: Flowchart of Photovoltai

3.4 Temperature Sensor Flowchart

In figure below it shows the flow of the temperature sensor which function to detect the suitable temperature for the fish breed. Temperature sensor model DS18b20 which is waterproof are been used for this project.

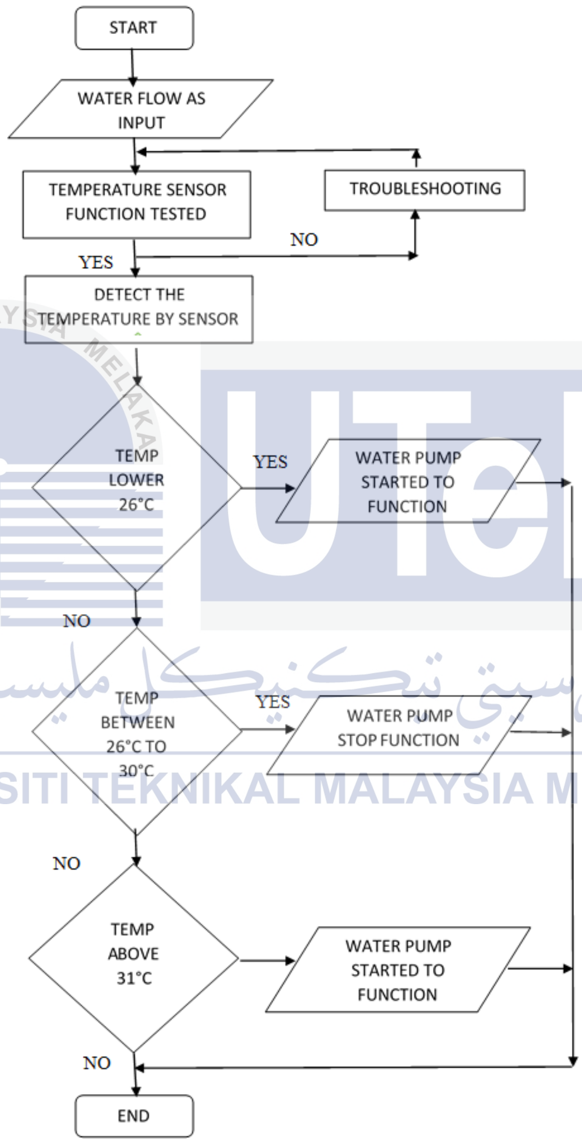

Figure 3.3: Flowchart of Temperature Sensor.

There are three different conditions for this sensor to detect the temperature which are been set up in the coding earlier. For the low temperature it will indicates that the water in the cold condition that are below 26°C. For the best temperature it will display as appropriate temperature which are between 27°C to 30°C. And for the high temperature the range are above 31°C.

3.5 Block Diagram of the Project

This figure below shows the block diagram of this project. From the block diagram below we can see photovoltaic is function as the main sources to supply for the system. When the energy is stored in the array it will transfer to the charge controller. As we know charge controller function to control the output of the photovoltaic and also to cut off the load for the batteries if fully charged.

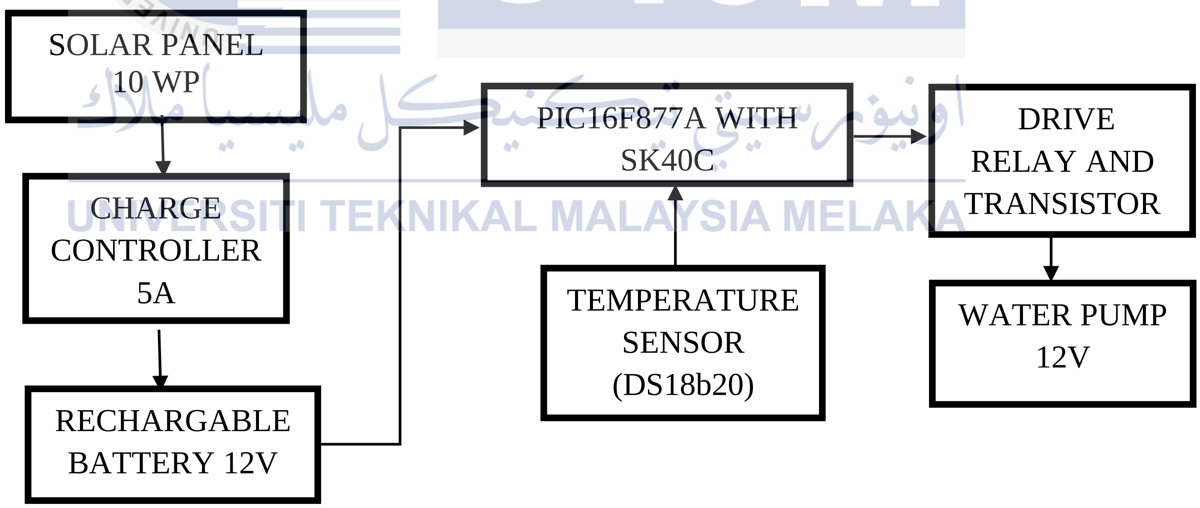

Figure 3.4: Project Block Diagram

When batteries fully charged it will transferred to the microcontroller which is SK40C. The suitable range of voltage for SK40C to operate are 7V to 15V. Temperature sensor are connected to the microcontroller when the temperature sensor read and analyzing the temperature for example if the reading is low temperature, temperature sensor will give the signal to the microcontroller and microcontroller will activate the water pump to regulate the temperature for the fish tank until get the optimum temperature reading.

In this project to control the activation of water pump the water pump and drive relay are connected. The function of relay in this project is to supplied voltage for SK40C because it does not enough voltage to activate the water pump.

3.6 Circuit Project

Figure below show the full circuit of the project, which is includes the connection for crystal and oscillator. For the input and output one port are been used and for the VDD and the ground port are shared.

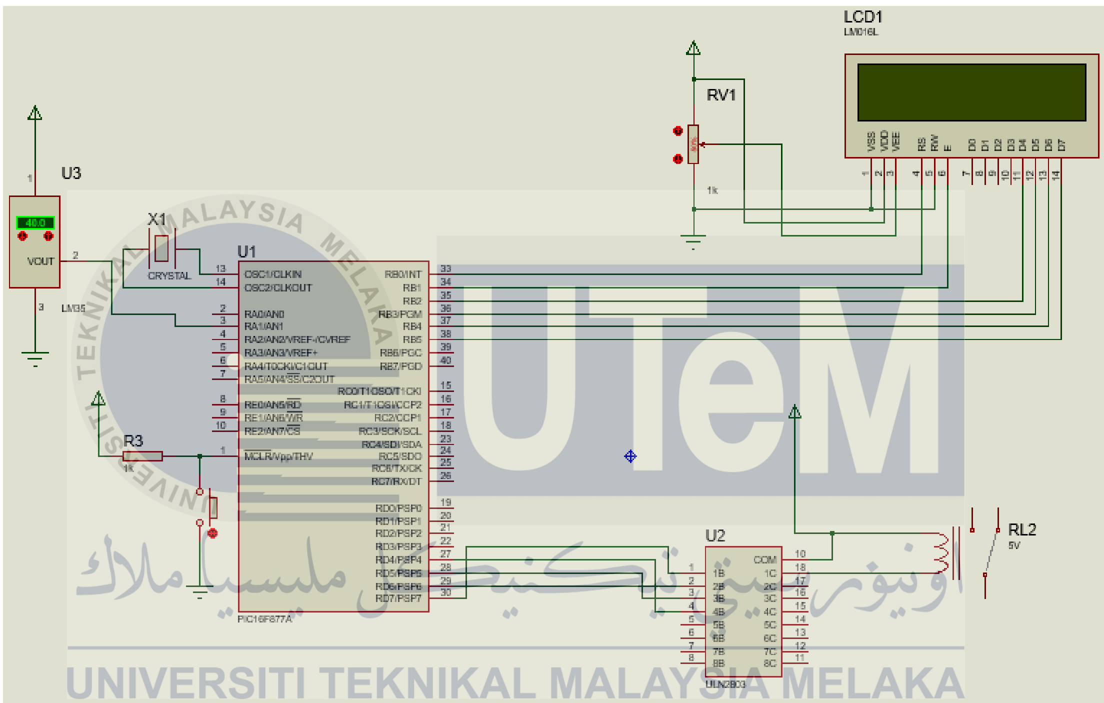

Figure 3.5: Full Circuit Diagram

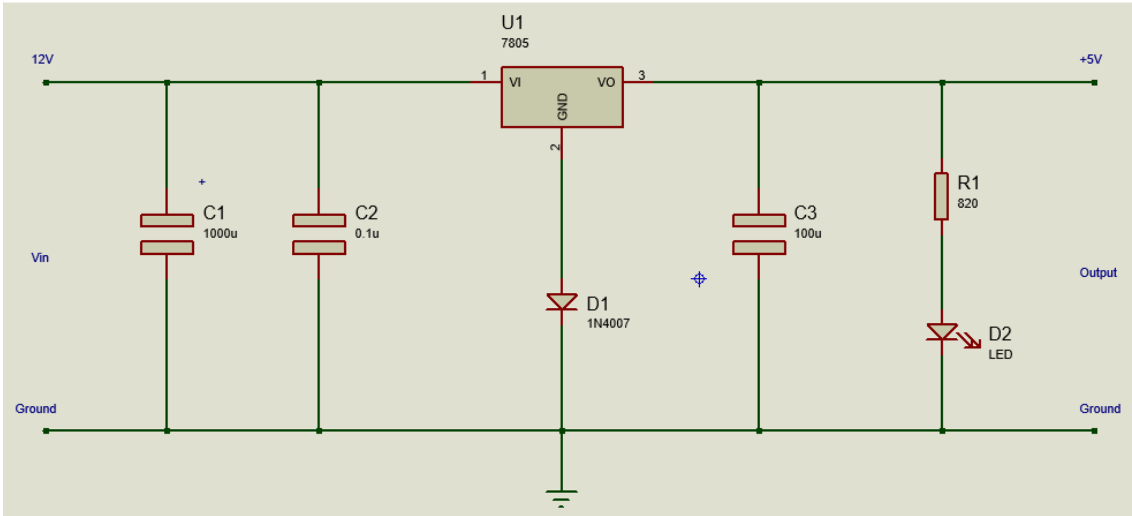

Figure 3.6: Voltage Regulator circuit LM7805

For each port only +5V can be supplied which suitable for simple equipment such as LED. This rated of voltage are not enough to activate the water pump. In this circuit to activate the 12V water pump relay must be connected to the microcontroller.

Besides that, to prevent any backflow of 12V voltage to the PIC diode are been used, which are for protection PIC from damage. To maintain and provide more stable voltage transistor are also used and the voltage range between 3.3V to 5.5V. The stable voltage for relay coil activate is 5V.

3.7 Project Testing

Before completed this project all the component must be tested if it can work in proper condition or not. For example photovoltaic, charger controller, temperature sensor and water pump should be tested to see whether it function well. Why this testing process must be highlighted this is because to ensure no problem will occur for the next semester and we can find the way to overcome the problems if occur.

3.8 Summary

In this chapter, all the process to develop the project have been discuss for example the general flowchart of the project, temperature sensor flowchart, photovoltaic flowchart, block diagram and also full circuit have been explained in detail. To get the desired result both hardware and software must be merge together. For the flowchart it shown about overall project function from beginning until the end by using the hardware given.

This chapter also discuss about the whole of the project. Which is starting from chapter 1 follow by chapter 2 and chapter 3. For chapter 2 which is literature review are mention about the hardware and component are used. Chapter 3, methodology which is discussed about the flowchart of the whole system, block diagram and also full circuit design. To develop this project software and hardware are been used to get the result that we want to achieved.

CHAPTER 4

RESULT AND ANALYSIS DATA

4.1 Introduction

In this chapter, the outcomes is to cover the method develop of hardware by relating the all the factor such as input and output response through this project and will be elaborated and discussed.

4.2 Project Development

This prototype, show the scale of the project harware for fish farm been powered by solar panel.

Figure 4.1: Project hardware

4.3 Solar Panel 10WP

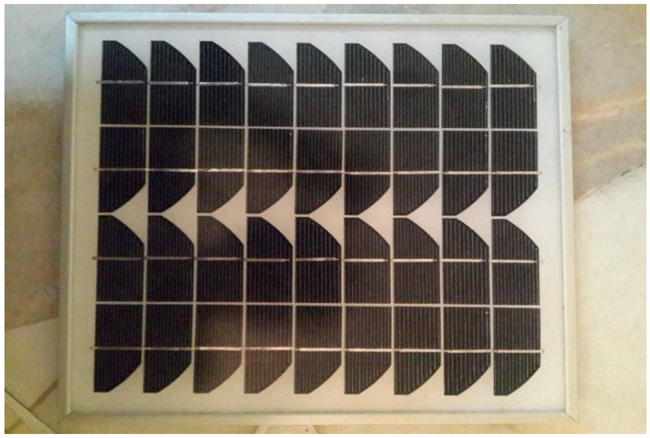

Figure 4.2: Solar Panel 10WP

By referring table below it shown the characteristics for this solar panel which is open circuit voltage is 20.5 while for the short circuit current 0.66A. The maximum and minimum for this solar panel operating temperature is -40°C to +80°C and the peak power are 10W.

Table 4.1: Solar panel characteristics for 10WP

Peak Power (Pmax)	10W
Production Tolerance (%)	±3
Maximum Power Current (Imp)	0.57A
Maximum Power Voltage (Vmp)	17.4V
Short Circuit Current (Isc)	0.66A
Open Circuit Voltage (Voc)	20.5V
Application (V)	DC 12V
Operating Temperature (°C)	-40°C to +80°C

Table 4.2: Parameter Solar Panel 10WP

Solar cell	10WP
Type of cell	Mono crystalline
Net weight	500g
Dimension	330 x 300 x 20mm
Frame	Anodized aluminium alloy
Front glass	2.8 mm tempered glass
Junction box	IP65 rated
Year life	25 years limited output

The parameter for the solar panel are shown on the table above, It shown the type of the cell which is mono crystalline. This solar panel are made from the anodized aluminium alloy which is prevent from rusting, the front of the glass are made from tempered glass. The year life are about 25 years limited output.

4.4 Solar Charger Controller

Figure 4.3: Solar Charger Controller

For this project the type of solar charger controller been used are 5A and also have (LED) to show the indicator of PV, load and also the status of battery. The protection system for this solar charger controller are protection from short circuit, reverse current and also have cut off mode to prevent damage for load. Table 4.3 and 4.4 show the technical specification for this solar charger controller.

Table 4.3: Electrical Parameter

Description	Parameter
Nominal System Voltage	12V
Max. batt Volt controller	16V
Rated Battery Current	5A
Charger Circuit Voltage Drop	≤0.26V
Discharge Circuit Voltage Drop	≤0.15V
Self-Consumption	≤6mA

Table 4.4: Mechanical Parameter

Mechanical Parameter	Parameter
Overall dimension	97(3.82)x66(2.6)x25(0.98) mm/inches
Mounting dimension	86(3.39)x44(1.73) mm/inches
Mounting hole size	Φ5
Terminal	2.5mm²
Net weight	0.05kg

4.5 Rechargeable Battery

Figure 4.4: Sealed Lead Acid Battery

Table 4.5: Battery Characteristics

Voltage	**12V**
Current	1.2Ah
Cycle use	14.5V – 14.9V
Standby use	13.6V – 13.8V
Initial current	Less than 2.36A

4.6 PIC16F877A Circuit

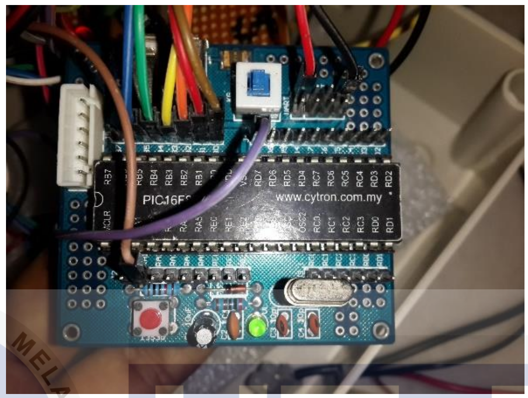

Figure 4.5: PIC16F877A

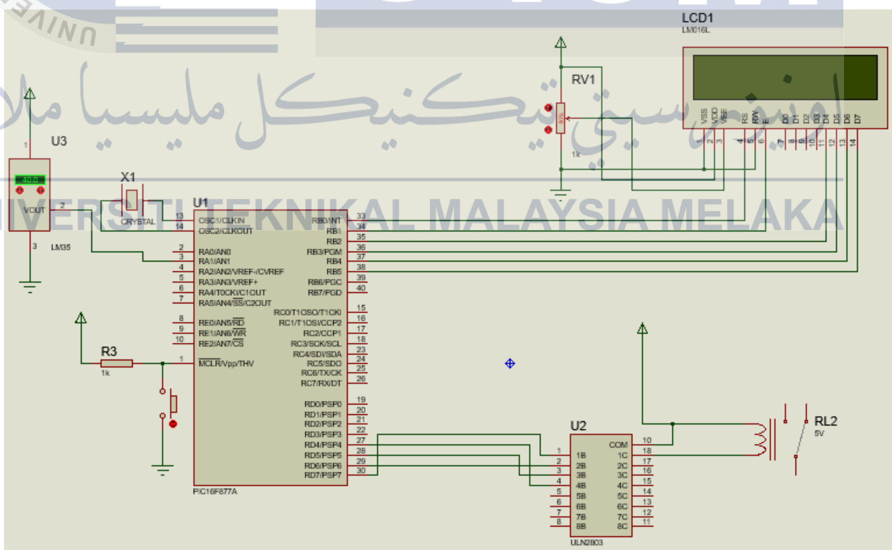

Figure 4.6: Full circuit schematic diagram

Based on figure 4.5 and 4.6 above shown the full circuit for this project. For each port only +5V can be supplied which suitable for simple equipment such as LED. This rated of voltage are not enough to activate the water pump. In this circuit to activate the 12V water pump relay must be connected to the microcontroller.

4.7 LM7805 Voltage Regulator

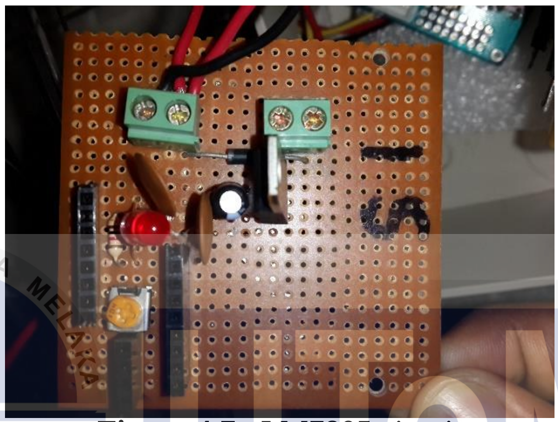

Figure 4.7: LM7805 circuit

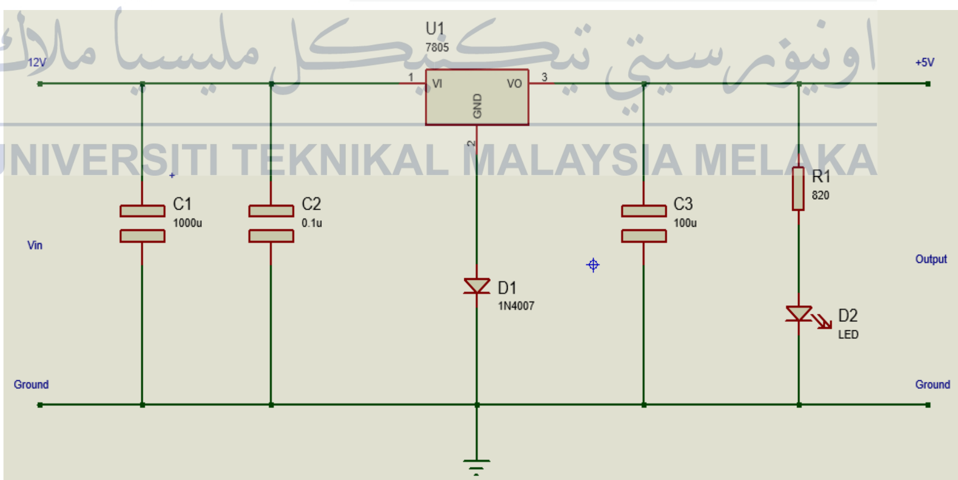

Figure 4.8: LM7805 circuit diagram

Based on figure 4.7 and 4.8 above this is type of voltage regulator been used. These type of regulator are very common and also been used such as many project that used 5V supply. The operation for this voltage regulator there are connected to the 12V supply.

But for the LM7805 which is a linear regulator there are such of things should be concern. Which the power dissipation will be high and it will fry your regulator unless install the heat skin on it.

4.8 Factor of the System Input

Sun oriented exhibits and the temperature sensors are the information components of this project. Photovoltaic is the primary parts of this project. Once the sun powered beams achieves the sun oriented boards, the photovoltaic cells in the sunlight based board will change over sun based vitality into electrical vitality. The electrical vitality created is in DC. This electrical will be put away in sun based charger before being conveyed to water pumps and PIC Microcontroller. The temperature sensor will recognize the change of water temperature in the fish tank. The temperature sensor utilized is DS18B20. Once the temperature sensor sense the change of temperature in the fish tank, the sensor will send flag to the PIC16F877A pack and this PIC16F877A unit will initiate the water pump.

4.9 Response of the System Output

Temperature sensor will identify change in temperature in the fish tank. This sensor henceforth will send signal to PIC Controller. PIC Controller will then initiate the pump and work at the same time to pump in water into the tank furthermore release water out of the tank. Signal and LED lights have been utilized as marker to caution or to alert the framework.

The sort of fish we use in Fish farm Project is the Tilapia Breeds. The scope of temperature for the survival of this fish is 27°C - 30°C.

Table 4.6: System for Response output

Temperature (°C)	Movement of the water pump	LCD shown
Lower than 27 °C	Water pump release the water into the tank	Temperature are Low/Normal condition
27°C to 30°C	Water pump stop function and the water are no discharged out from the tank.	Temperature are Optimum condition
Above 30°C	Water pump release the water into the tank	Temperature are High condition

Figure 4.9, 4.10 and 4.11 shown the display for the temperature sensor been detected. It has three types of condition display which is low/normal temperature, optimum temperature and also high temperature.

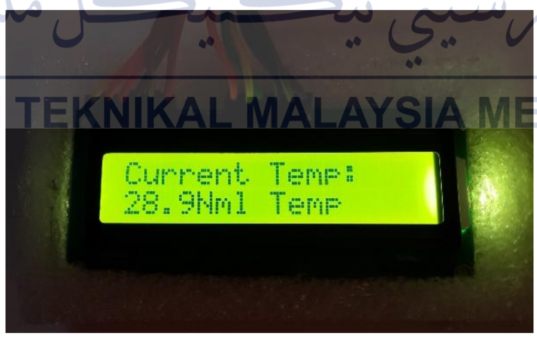

Figure 4.9: Display for Low/Normal Temperature

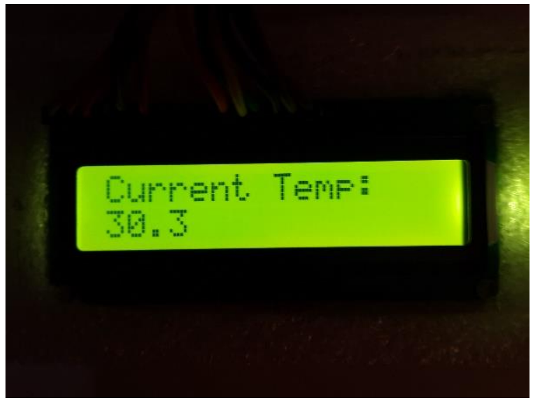

Figure 4.10: Display for Optimum Temperature

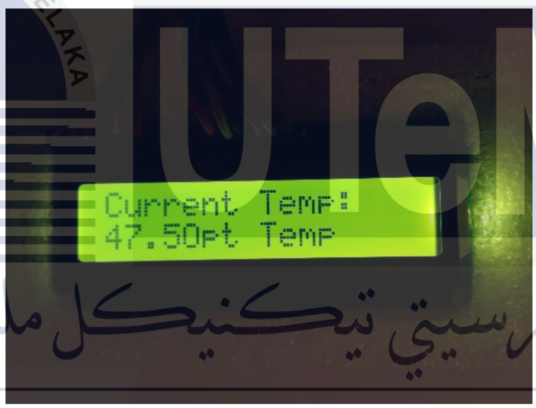

Figure 4.11: Display for High Temperature

4.10 Data analysis for Solar Panel by different angle

Table 4.7: Power can produce for one week with angle 15°

	Day													
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
Date	V	A	V	A	V	A	V	A	V	A	V	A	V	A
7.00 AM	13.2	0.1	12	0.11	13.2	0.11	10	0.1	12.2	0.13	11.4	0.11	12.1	0.14
8.00 AM	14.3	0.13	15.2	0.17	14.2	0.13	13.3	0.15	14.2	0.2	13.1	0.23	14.3	0.2
9.00 AM	16.2	0.21	18.4	0.22	16.2	0.18	15.2	0.23	16.8	0.23	17.1	0.28	17.5	0.3
10.00 AM	17.1	0.26	18.6	0.27	18.1	0.2	18.3	0.32	18.1	0.31	18.5	0.29	18.6	0.35
11.00 AM			19.4	0.61	19.1	0.31	18.5	0.3	19	0.35			19.7	0.43
12.00 PM			19.4	0.58	18.1	0.25	18.9	0.39	18.7	0.31	19.8	0.39	19.3	0.42
1.00 PM			13.5	0.1	18.5	0.35	19.1	0.4	19	0.41	19.4	0.31	19.2	0.39
2.00 PM	18.2	0.41	19	0.2	19.7	0.4	18.5	0.48	19.7	0.58	19.3	0.33	20.1	0.58
3.00 PM	18.1	0.3	19.1	0.23	20.1	0.44			19.2	0.48	19	0.4	20.2	0.6
4.00 PM	17.8	0.35	18.4	0.24	17.9	0.3			17	0.3	18.4	0.35	18.4	0.33
5.00 PM	16.3	0.35	17.5	0.19	18.3	0.22	16.2	0.31	15	0.34	17.5	0.32	17.5	0.29
6.00 PM	14.8	0.2	16.5	0.13	15.3	0.1	14	0.26	14.5	0.22	15.3	0.15	15.8	0.22
TOTAL (W)	**337.3**		**384.95**		**624.01**		**476.3**		**573.87**		**596.6**		**903.96**	

Based on table state, the values of the power that can produce for each day is slightly different. According to on the table above, Sunday make the highest output of power with 903.96 watts and the lowest on Monday with 337.3 watts. During the analysis data, Monday, Thursday and Saturday has a wet day and it gives a lot impact due to produce an output power. Table 4.7 shows the value of current and voltage with the solar panel with 15° of inclination angle. According to on the result above influenced by the weather condition like as raining at the place that located the solar panel.

Table 4.8: Power can produce for one week with angle 30°

	Day													
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
Date	V	A	V	A	V	A	V	A	V	A	V	A	V	A
7.00 AM	13.5	0.12	12.1	0.11	13.6	0.13	10.5	0.11	12.5	0.16	11.5	0.11	12.3	0.13
8.00 AM	14.5	0.12	15.2	0.17	14.8	0.16	13.6	0.17	14.3	0.21	13.4	0.25	14.7	0.19
9.00 AM	16.3	0.23	18.6	0.22	16.4	0.2	15.4	0.24	17	0.26	17.4	0.3	17.5	0.31
10.00 AM	17.13	0.28	18.7	0.27	18.2	0.21	18.4	0.33	18.3	0.33	18.7	0.33	18.5	0.34
11.00 AM			19.5	0.61	19.3	0.33	18.7	0.32	19.2	0.37			19.7	0.43
12.00 PM			19.5	0.59	18.3	0.26	19.2	0.42	18.9	0.33	20	0.42	19.5	0.45
1.00 PM			13.4	0.12	18.8	0.37	19.5	0.44	19.3	0.57	19.6	0.33	19.6	0.43
2.00 PM	18.7	0.42	19.2	0.26	19.9	0.41	18.7	0.5	19.9	0.64	19.6	0.36	20.2	0.5
3.00 PM	18.6	0.31	19	0.25	20.2	0.45			19.9	0.5	19.3	0.42	19.8	0.46
4.00 PM	17.9	0.37	18.6	0.22	18.2	0.23			17.3	0.3	18.6	0.39	18.5	0.33
5.00 PM	16.5	0.37	17.5	0.19	18.5	0.24	16.7	0.36	16.9	0.24	17.8	0.34	17.9	0.29
6.00 PM	15.1	0.22	15.9	0.17	15.7	0.13	14.1	0.19	15.3	0.16	15.7	0.18	16.5	0.21
TOTAL (W)	**355.8**		**403.52**		**688.68**		**507.6**		**648.12**		**657.2**		**873.83**	

Table 4.9: Power can produce for one week with angle 45°

	Day													
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
Date	V	A	V	A	V	A	V	A	V	A	V	A	V	A
7.00 AM	13.5	0.12	12.2	0.12	13.7	0.11	10.5	0.12	12.5	0.16	11.5	0.11	12.3	0.11
8.00 AM	14.5	0.12	15.8	0.18	14.8	0.16	13.5	0.17	14.4	0.21	13.4	0.25	15.2	0.19
9.00 AM	16.4	0.23	18.5	0.24	16.3	0.22	15.5	0.24	17	0.26	17.5	0.3	17.2	0.27
10.00 AM	17.13	0.27	18.7	0.29	18.5	0.2	18.3	0.33	18.4	0.32	18.7	0.32	18.5	0.34
11.00 AM			19.9	0.61	19.3	0.22	18.7	0.32	19.2	0.37			19.7	0.41
12.00 PM			19.7	0.59	18.3	0.32	19.3	0.41	18.9	0.34	20	0.42	19.5	0.39
1.00 PM			13.3	0.11	18.7	0.27	19.5	0.44	19.3	0.42	19.6	0.33	18.7	0.29
2.00 PM	18.4	0.46	19.3	0.27	19.9	0.38	18.7	0.5	19.9	0.6	19.7	0.36	19.5	0.43
3.00 PM	18.7	0.31	19.2	0.23	20.2	0.44			19.5	0.5	17.4	0.42	20.1	0.51
4.00 PM	18.3	0.4	18.4	0.21	18.4	0.32			17.2	0.37	18.6	0.38	19.4	0.42
5.00 PM	16.8	0.42	17.6	0.24	18.9	0.24	16.8	0.36	16.9	0.34	17.8	0.35	17.8	0.35
6.00 PM	15.2	0.21	15.8	0.19	15.7	0.12	14.1	0.2	15.6	0.31	15.6	0.18	16.5	0.2
TOTAL (W)	**378.3**		**413.42**		**638.1**		**509.5**		**625.86**		**649.1**		**838.3**	

From the table 4.8, the solar panel has been analysis with inclination angle at angle 30°. The highest power that can produce is power produce is 873.83 watt on Sunday and the lowest is 355.8 watt on Monday. While at table 4.9 shows the result if the solar panel is inclination angle at 45°. Based on all the analysis, the value of output is not having much different. But, it is important to identify the best angle that will be used solar panel based on the result and the characteristic of place been used.

Based on figure 4.12 illustrated the voltage produced against time start from on the morning until evening at 7.00 is to 6.00 pm. The result of voltage is shown for four different angles; 0°, 15°, 30° and 45°. For example, the graph show for one day; Monday. The voltage that has been produced for each hour has a small changes value of open circuit voltage.

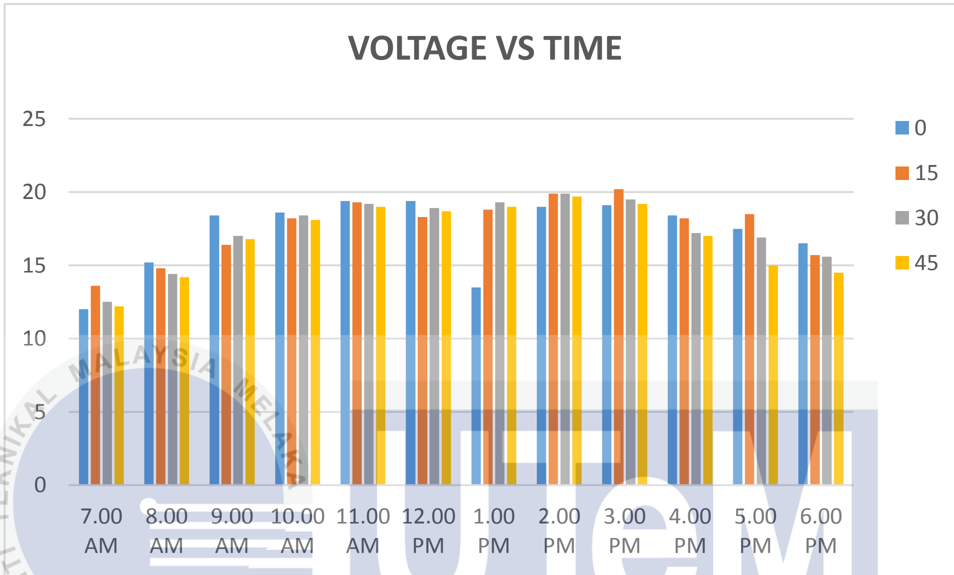

Figure 4.12: Voltage against Time

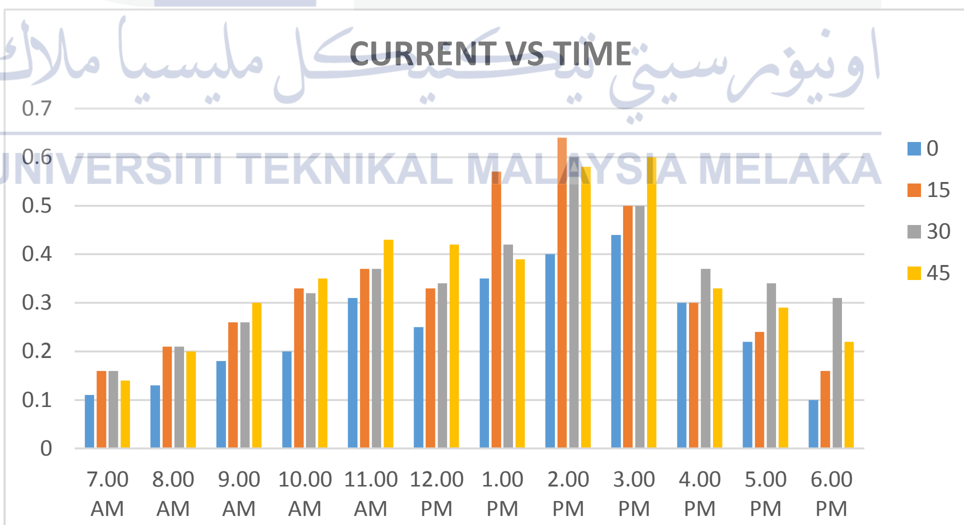

Figure 4.13: Current against Time

Based on the figure 4.13 show the current short-circuit output with four different angles for one day; Monday. After compare the voltage output from figure 4.12 and this graph of solar panel can make a good performance charging of the battery from the 11 am until 3.00 pm. It causes of the highest output produced during this duration but depends on the weather condition. According to on the figure above shows the most constant inclination angle due to produce current for good performance in charging the battery.

4.11 Discussion and Conclusion

The framework working in view of the photovoltaic framework. Essentially sunlight based vitality or light vitality is expected to produce power. Sun powered vitality is a renewable sort of vitality its accessibility guarantees the era of power. The formation of sun oriented vitality additionally requires little systems of support. At the point when the framework introduced in the fish tank, the framework will without anyone else's input naturally produces power and thus store the created electric in the battery. The battery that controlled by switch will supply electric to the water pump to guarantee the oxygen in the fish tank. This framework will figure out how to work itself with least operation by human. It can work in view of the necessities that was set by the fish farm.

CHAPTER 5

CONCLUSION

5.1 Summary of the Project

Innovation in aquaculture sector the design of this project are achieve the target in developing in this sector. By using microcontroller stimulation the water can function automatically if the temperature are increase or decrease. Solar panel has been tested about one week under direct sunlight meanwhile, the construction and installation of the prototype have completely done. Besides that, the process of the water conversion will take place when the temperature of the fish farm are high and low temperature. Hope this project will contributed in aquaculture sector.

5.2 Project Recommendation Future

In future hopefully this project will take place to improve and also achieve more the objective desire. To fulfil all the desire needed, this project be improvise by modified it for example the battery used by using high capacity of battery it can store more energy. Besides that, can add one more water pump easy the process of the water conversion, Moreover, to ease the fish farmer set the temperature needed because some types of fish are not same, so keypad at the microcontroller can be installed

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APPENDIX C

DATA SHEET AND CODING

CODING SYSTEM

```
#include <htc.h>                    //include hitech C header file

#include "lcd.h"            //include lcd header file
#define _XTAL_FREQ                  20000000

__CONFIG(FOSC_HS &                       // High Speed Crystal.
                WDTE_OFF &               // Disable Watchdog Timer.
                PWRTE_ON &               // Enable Power Up Timer.
                BOREN_OFF &              // Disable Brown Out Reset.
                LVP_OFF);                // Disable Low Voltage Programming.

#define LCD_E                       RB5          // E clock pin is connected to RA3
#define LCD_RS                      RB4          // RS pin is used for LCD to differentiate data is
command or character, RA2
#define LCD_BACKLIGHT               RA1          // Back light of LCD, active high, connected to
RA1

#define LCD_DATA                    PORTD  // Data port of LCD is connected to PORTD, 8 bit mode
                                                           // DB7(LCD) = RD7(PIC)
                                                           // DB6(LCD) = RD6(PIC)
                                                           // DB5(LCD) = RD5(PIC)
                                                           // DB4(LCD) = RD4(PIC)
```

```
                                        // DB3(LCD) = RD3(PIC)
                                        // DB2(LCD) = RD2(PIC)
                                        // DB1(LCD) = RD1(PIC)
                                        // DB0(LCD) = RD0(PIC)
#define Skip_ROM            0xCC
#define Convert_T           0x44
#define Read_scratchpad 0xBE

#define Port_18B20      RB0
#define Tx_18B20        TRISB0 = 0
#define Rx_18B20        TRISB0 = 1

void delay_ms(unsigned int ui_value);

unsigned char reset();
void write(char WRT);
unsigned char read();

int main(void)
{
    unsigned temp;
    unsigned short tempL, tempH, fraction;
    unsigned int i = 0;         // declare a variable to store
    // ensure all the hardware port in zero initially
    PORTA = 0;
```

```
PORTB = 0;

PORTC = 0;

PORTD = 0;

PORTE = 0;


// Initialize the I/O port direction, this must be configured according to circuit

// TRISX control pin direction, output pin must be configure as '0'

// while input must be configure as '1'

TRISA = 0;

TRISB = 0;

TRISC = 0;

TRISD = 0;

TRISE = 0;


//Initialize LCD to be use

lcd_initialize();


lcd_putstr("initializing");  //LCD display for the starting part

lcd_goto(0xc0);

lcd_putstr("Temp.Sensor");

delay_ms(1000);

lcd_clear();

lcd_putstr("Water Temp");  //LCD display for the starting part

lcd_goto(0xc6);

lcd_putstr(":Degree C");
```

```
while(1)          // create an infinite loop

{


        if(!reset())

        {

        write(Skip_ROM);

        write(Convert_T);

        delay_ms(750);


        reset();

        write(Skip_ROM);

        write(Read_scratchpad);


        tempL = read();                 //read low temp value

        tempH = read();                 //read high temp value

        i=((unsigned int)tempH << 8 ) + (unsigned int)tempL;        //put
both value in one variable

        i = (float)i * 6.25 ;           //calcuation from the table provided

        lcd_goto(0xc0);

        lcd_bcd(5,i);                           //display the temperation in
LCD

        __delay_ms(750);

        }

}
```

```
}


void delay_ms(unsigned int ui_value)

{

	while (ui_value-- > 0) {

		__delay_ms(1);		// macro from HI-TECH compiler which will generate 
1ms delay base on value of _XTAL_FREQ in system.h

	}

}


unsigned char reset()

{

	Tx_18B20; // Tris = 0 (output)

	Port_18B20 = 0; // set pin# to low (0)

	__delay_us(480); // 1 wire require time delay

	Rx_18B20; // Tris = 1 (input)

	__delay_us(60); // 1 wire require time delay


		if (Port_18B20 == 0) // if there is a presence pluse

		{

		__delay_us(600);

		return 0; // return 0 ( 1-wire is presence)

		}

		else
```

```
            {
            __delay_us(600);
            return 1; // return 1 ( 1-wire is NOT presence)
            }
}

void write(char WRT)
{
        char i,Cmd;
        Cmd=WRT;
        Rx_18B20; // set pin# to input (1)

            for(i = 0; i < 8; i++)
            {
                if((Cmd & (1<<i))!= 0)
                {
                // write 1
                Tx_18B20; // set pin# to output (0)
                Port_18B20 = 0; // set pin# to low (0)
                __delay_us(1); // 1 wire require time delay
                Rx_18B20; // set pin# to input (release the bus)
                __delay_us(60); // 1 wire require time delay
                }
                else
                {
```

```
                    //write 0
                    Tx_18B20; // set pin# to output (0)
                    Port_18B20 = 0; // set pin# to low (0)
                    __delay_us(60); // 1 wire require time delay
                    Rx_18B20; // set pin# to input (release the bus)
                    }
            }
}
unsigned char read()
{
        char i,result = 0;
        Rx_18B20; // TRIS is input(1)
                for(i = 0; i < 8; i++)
                {
                Tx_18B20; // TRIS is output(0)
                Port_18B20 = 0; // genarate low pluse for 2us
                __delay_us(2);
                Rx_18B20; // TRIS is input(1) release the bus
                if(Port_18B20 != 0)
                result |= 1<<i;
                __delay_us(60); // wait for recovery time
                }
        return result;
}
```