CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Aquarium pump is one of the electrical equipments that needed to be inside of an aquarium. It works as an air ventilation system inside of an aquarium and it is built with its own water filter system. The usage of aquarium pump consistently is needed in order to ensure the life of the living creatures in the aquarium or in other words, the oxygen content inside the aquarium is always adequate. Electrical energy is used to run the aquarium pump. Therefore, high cost of expenditure is needed to pay the electrical energy used by the aquarium pump.

Photovoltaic (PV) systems are becoming very attractive solutions to supply electrical energy to the aquarium pump. There are various ways as medium for generating electricity but some of them give bad impact to the environment such as air pollution, greenhouse effect and thinning of ozone layer. Therefore, due to energy crisis and environmental issues such as pollution and global warming effect, PV system is good choice for generating electricity. PV system has more advantages such as operating and maintenance costs for PV panel is lower, if compared to costs of other renewable energy system. It is easy to install on the ground without any interference to residential lifestyle. Unfortunately the actual energy conversion efficiency of PV module is rather low. So to overcome this problem and to get the maximum possible efficiency, the design of all the elements of the PV system has to be optimised.

In order to increase this efficiency, the maximum power point tracking (MPPT) controllers are used. Such controllers are becoming an essential element in PV systems.
A significant number of MPPT control schemes have been elaborated since the seventies, starting with simple techniques such as voltage and current feedback based MPPT to more improved power feedback based MPPT such as the perturbation and observation (P&O) technique or the incremental conductance technique. Recently intelligent based control schemes MPPT have been introduced. In this research an intelligent control technique using fuzzy logic control is associated to an MPPT controller in order to improve energy conversion efficiency. The fuzzy logic controller is one of the MPPT methods which are very suitable for photovoltaic array because fuzzy control is a range to point or range to range control unlike the classical control strategy. It helps to track maximum power from any environmental conditions and has good stability as well as the response rate is high.

However, the problem is still exists if the PV Module is installed to one fit position. To overcome this problem, sun tracking system has installed to the PV module. If the sun located at the direction that is not perpendicular to the solar panel, the power that can be generate is low compare to the when the sun located exactly perpendicular to the solar panel. Sun tracking system can move the solar panel according to sun rotation from east to west. So that, maximum electric energy convert from solar panel is gained and more efficiency will produce compare with the fixed solar system.

1.2 PROBLEM STATEMENT

Usually, aquarium pump used continuously to ensure sufficient oxygen supply in aquarium. Indirectly, this will result in high expenditure costs that needed to be paid for the used electricity by aquarium pump. Therefore, Solar energy is a good choice for supply the power to the aquarium pump, since it could be built almost anywhere with sunlight and electricity cost is cheap for own need.

Unfortunately, the efficiency level of the photovoltaic module is relatively low. So, Photovoltaic system is a need to improve the energy generation efficiency that received from the solar cell using Maximum power point tracking controller. The power that can be generated by solar panel still low if the solar panel stayed at fix position. So that, to fix this problem, sun tracking system was added to this project. The solar panel
that can be generating here is high power compare to the solar panel only stay at fix position. Sun tracking system will control the position of the solar panel so that it is always perpendicular to the sun. Solar panel will generate the highest power when it perpendicular to the sun.

DC-DC converter is added as an interface between the output from the solar cell and the load. It extracts the maximum power from the solar cell and transfers it to the load by stepping up or boost as per the requirement at the load side.

1.3 OBJECTIVE

The objectives of the “Aquarium pump driven by solar cell using MPPT” project are as below.

i. To track and optimise the maximum output power of the solar panel by implementing the sun tracking system.

ii. To implement fuzzy logic controller for maximum power point tracking (MPPT).

iii. To regulate the output voltage of the solar panel using dc-dc boost converter

1.4 SCOPE PROJECT

This project is focused to design and build the prototype of photovoltaic system that can generate electricity and drive the aquarium pump. Therefore, this project will cover the scope as followed.

i. The solar panel chosen for this project is the monocrystalline solar panel.

ii. The DC motor is chosen to move solar panel according to the movement sun.

iii. The Arduino Uno Rev 3 was chosen as controller for the DC motor.

iv. Using Light Dependant Resistor (LDR) or Photoresistor as a sensor.

v. The dc-dc boost converter is generated by using diode, MOSFET and other suitable components.