CHAPTER 1

INTRODUCTION

1.0 OVERVIEW

This chapter is about the introduction to the project background of design and development of solar powered aeration system. Problem statements are identified based on the project background and the objectives are discussed. The scope and the limitations is described in term of k-chart. The chapter outline is also illustrated.

1.1 INTRODUCTION

Aquaculture farming has started in Malaysia in year 1950 majoring in the production of fish and crustaceans. Since then, there has been a tremendous increment in aquaculture demand from year to year as recorded in FAO Fishery Statistic, reported by the Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nation as shown in Figure 1.1 [1]
In aquaculture farming, aeration system is used to ensure the water and air circulation of the ponds. There are many types of aeration system such as vertical pump, pump sprayer, propeller-aspirator pumps, paddle wheels, and diffused air that have different level of efficiency[2] that is measured in term of Standard Oxygen Transfer Rate (SOTR) which is the amount of oxygen added oxygen added in 1 hour under standard condition [3]. Table below shows the types of aerator with their average efficiency.

<table>
<thead>
<tr>
<th>Aerator Type</th>
<th>Average SAE (lbs O₂/hp-hr)</th>
<th>SAE Range (lbs O₂/hp-hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical pump</td>
<td>2.3</td>
<td>1.1 – 3.0</td>
</tr>
<tr>
<td>Pump sprayer</td>
<td>2.1</td>
<td>1.5 – 3.1</td>
</tr>
<tr>
<td>Propeller-aspirator pumps</td>
<td>2.6</td>
<td>2.1 – 3.0</td>
</tr>
<tr>
<td>Paddle wheels</td>
<td>3.6</td>
<td>1.8 – 4.9</td>
</tr>
<tr>
<td>Diffused air</td>
<td>1.5</td>
<td>1.1 – 2.0</td>
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</tbody>
</table>

Despite of the types of aerator available, the production of high quality aquaculture products still at a low level and this has been a concern for most of the aquaculture farmers. This is because the current aeration system technology is inadequate due to no monitoring feature is equipped to ensure ideal condition for aquaculture growth. The monitoring system is very important to maintain the ideal factors that affect the growth of aquaculture products.
The three main factors are pH level, temperature of water and concentration level of dissolved oxygen. Therefore, a good aeration system that can monitor these conditions will be able to produce high quality products which bring higher Return of Investment (ROI) [4].

This thesis is based on the basic of theoretical study of the aquaculture water quality and hardware design and development of aeration system to investigate the monitoring system designed and the ability of the system to sustain ideal pond condition for the aquaculture farming. The results from the developed hardware are collected and analysed to ensure system ability to monitor and control ideal temperature level, pH level and concentration level of dissolved oxygen.

1.2 PROBLEM STATEMENT

Based on the conducted ground survey in a tiger prawn aquaculture farm known as Agrobest Sdn Bhd situated in Tanjung Batu, Pekan, the three factors mentioned are confirmed to be the key factors in producing high quality aquaculture products. As in current practice of the farm, manual processes such as taking water temperature samples and measuring dissolved oxygen level are still being applied in aquaculture farming. These reduce the work efficiency and accuracy that affect the end result. With the monitoring process on the aeration system, all the data can be monitored to ensure and maintain the ideal state of the pond. Therefore, this project has incorporate the use of intelligent controller, Arduino YUN and UNO and three sensors which are the temperature sensor, pH sensor, and dissolve oxygen sensor to be designed as the monitoring unit for the aeration system equipped with solar powered oxygenator pump as underwater aeration system for control purposes.

1.3 OBJECTIVE

The three (3) main objectives of the project are:

i. To investigate the fundamental issues related to aquaculture farming.

ii. To design and incorporate several sensors to ensure high concentration of dissolved oxygen level in aquaculture farming.

iii. To develop a complete prototype of aeration system powered by solar energy.