THE SIMULATION OF TRIPLE EXPOSURE SOLAR COOKERS

MOHD FADHLI BIN MAT ZAIN (2006690240)

SUPERVISOR: MDM FAUZIAH BINTI JERAI @ JUNAIDI

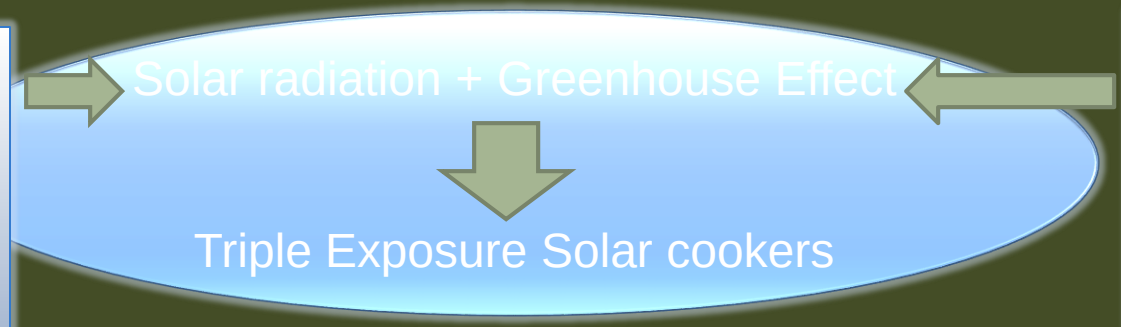
CO. SUPERVISOR: MR. ZAINOOR HAILMEE BIN SOLIHIN

INTRODUCTION

- Solar energy is the technology obtaining usable energy from the light of sun.
- Solar energy can be converted into other forms of energy, such as heat and electricity.
- NASA Solar Energy Panel identified three broad applications to be used from solar energy
  - the heating and cooling
  - the chemical and biological conversion of organic materials to liquid, solid and gaseous fuels
  - the generation of electricity

OVERVIEW OF PROJECT

Radiation emitted from the sun. most places in Malaysia receive 17 to 21 MJm^{-2} of daily solar radiation per day



Trapping heat energy is to increase and maintain the temperature at a higher level

- Modelling of one rectangular shape as a solar oven
- 3 surface will exposed to the solar radiation directly
- CFD simulation of solar cookers based on climate of Shah Alam, Selangor.

PROBLEM STATEMENT

- the main problem on solar oven is to reach the temperature of solar oven that suitable for cooking.
- Solar oven experiments by using triple exposure is still no validation of the performance.
- Location of solar oven is one of the important factors to be considered

OBJECTIVE

- To determine the temperature distribution for triple exposure on solar oven
- To determine suitability of Malaysia climate for solar thermal
- To obtain the simulation result on triple exposure solar oven by CFD software.

SCOPE

- To determine the highest temperature can be gain by solar oven
- To determine the duration of time for highest temperature gain
- The thermal performance testing was conducted at Shah Alam, Selangor, Malaysia which is located at Universiti Teknologi Mara Malaysia.
- The temperature is determined by dependants on time.

SIGNIFICANT OF PROJECT

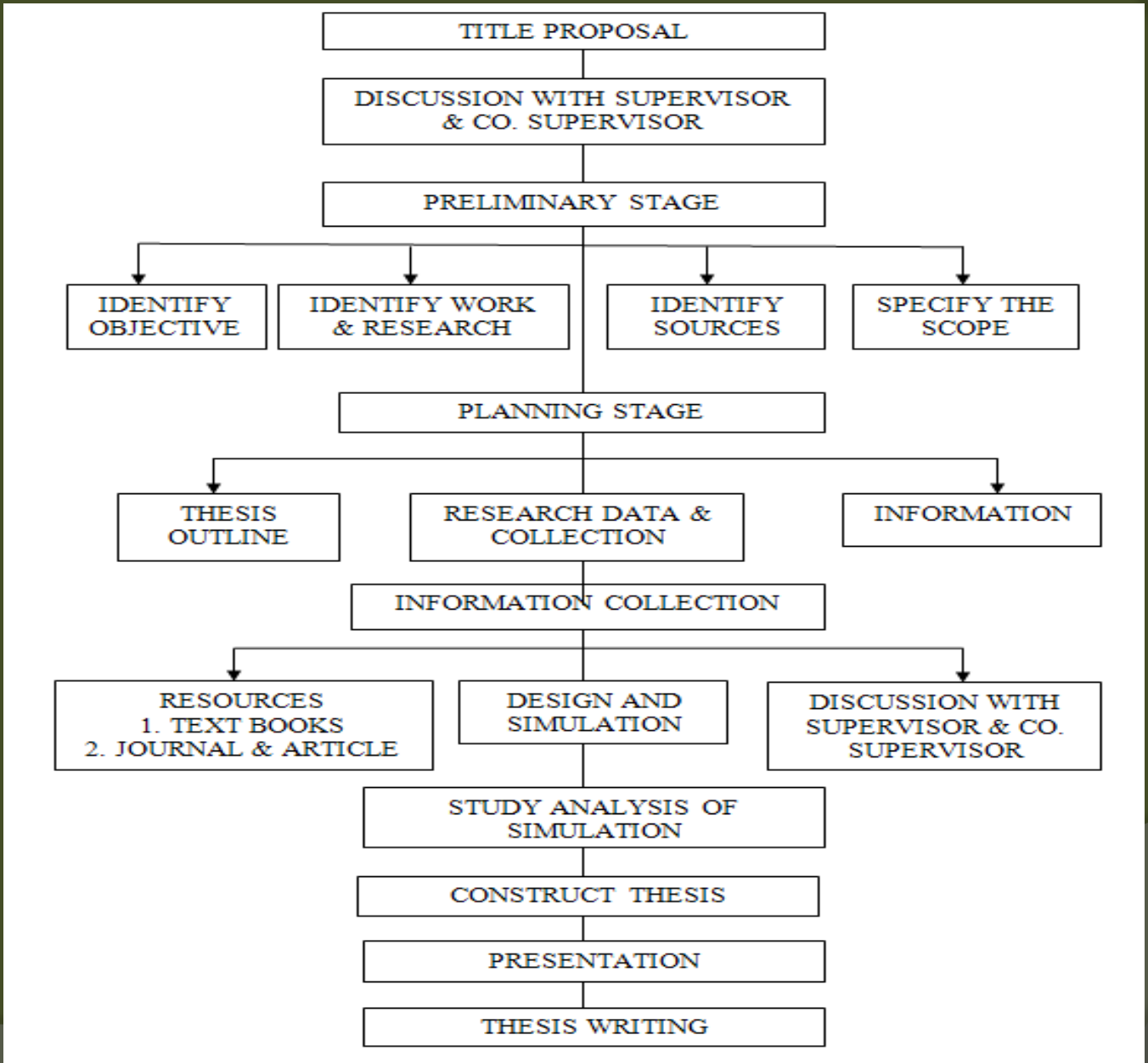
- it can reduce dependants on wood and charcoal for cooking fuel
- one of the opportunities to developed one of the cookers that safe, lower cost and convenience for all people.
- the performance of solar oven of triple exposure in Malaysia climate will be known as well

RECENT STUDIES

AUTHOR	DESCRIPTIONS
M. B. Habeebullah, A. M. Khalifa, and I. Olwi	• The analysis of the present work is based on an insulated pot with a glazed insulation window in an oven. • To minimizing heat losses, better heat transfer would be ensured by heating the pot from the bottom and sides similar conventional cookers • Wind is a major factor in determining the cooker performance
Emad H. Amer	• Introduce a double exposure of solar oven • The absorber is exposed to solar radiation from the top and bottom sides • The double exposure cooker reduces the cooking time generally about 30-60 min • The temperature of the absorber plate and oven air can reach as high as 165^0C and 155^0C

Herliyani Suharta, K. Abdullah and A. Sayigh	• The development of solar oven has been divided to fourth generation • Introduce to the people to some places in Indonesia as a respondent • The highest temperature for fourth generation ovens reached without load was 175^{o}C
Jose´ M. Arenas	• The solar kitchen that was developed has reaches an average power scale of 175 W, with an energy efficiency of 26.6% • the design have reduced the weight of the solar kitchen to less than 5 kg and the assembly and disassembly times to 2 and 1 min, respectively

METHODOLOGY



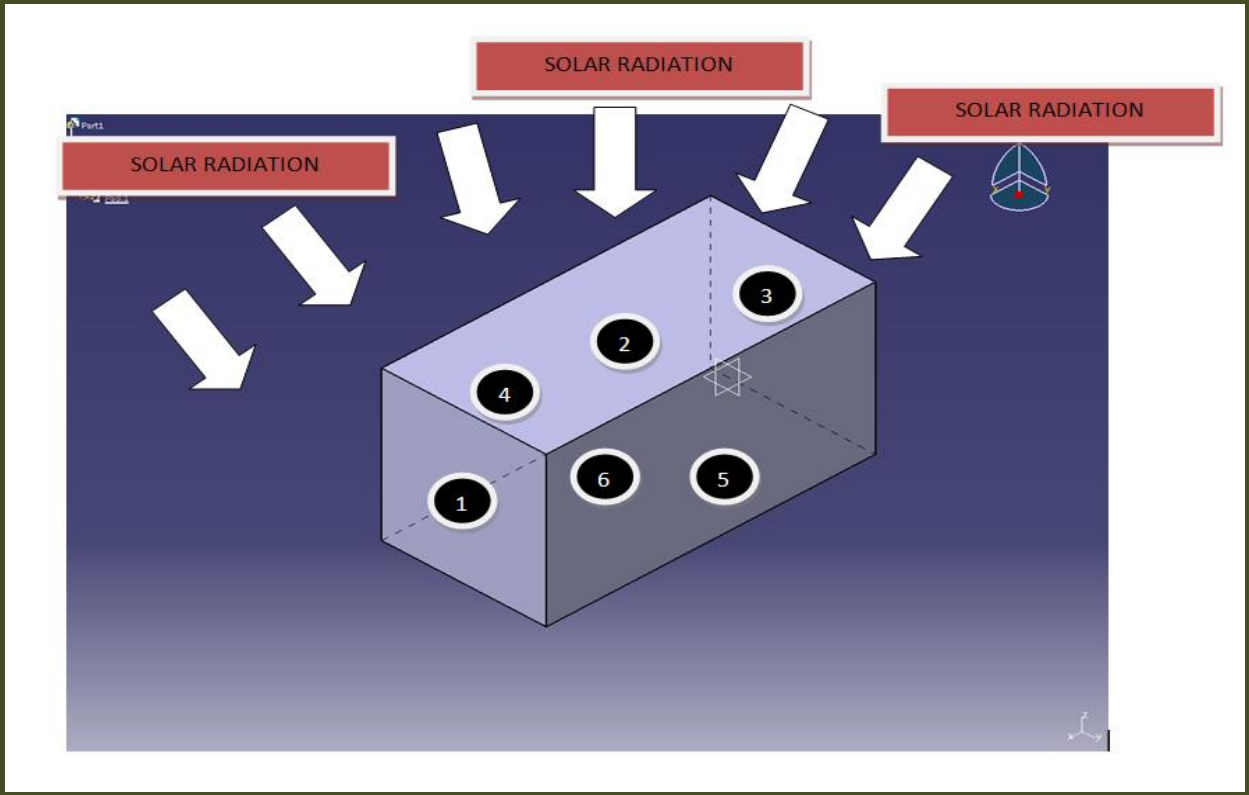
GANTT CHART

Activity/Month	7/09	8/09	9/09	10/09	11/09	12/09	1/10	2/10	3/10	4/10	5/10	6/10
Find Project and Title												
Study and Literature Review												
Proposal												
Methodology												
Learning CFD software (CD-adapco)												
Presentation FYP 1												
3-D Modeling												
CFD Simulation												
Result Analysis												
Thesis Writing												

PRELIMINARY SIMULATION

- Model solar oven will be design by CD-adapco software.
- Model will meshing based on the size of model
- Simulation will run by using CD-adapco software.
- Some input need to be define such as
  - Temperature outside based on the location
  - Total heat energy outside as a heat source
  - Variable of time (1 hour for each time taken)
  - All general parameter and constant relate to solar radiation and heat transfer

Source data: http://www.pvmc.uitm.edu.my/pvmc2009/aboutems.asp



- Surface 1,2,and 3 are expose to the solar radiation
- Surface 4,5 and 6 are close and assume as an insulator
- Define the surface 1,2 and 3 as an inlet of the model to absorb the heat energy from outside

THANK YOU……