Drying Design Model for Dried-Anchovy Using Solar Collector and Solar Cell Panel Position Control

Selamat Meliala, Saifuddin, Rosdiana

Abstract:Drying of anchovy is an important activity carried out on one of the dried fish products. In this research, the process is done to improve the quality of drying of anchovy by removing some water content to the extent that microbes can not grow and maximize the absorption of solar light with solar collector and solar cell position control. This simulation results in Maximum Power Point Tracking (MPPT) using ATMEGA32 mocrocontroler in order to reduce heat loss and also energy from sunlight. With MPPT and flat plate solar collectors can follow the direction of the sun movement with an angle of 90^0 so that the angle between the solar collector and solar panel perpendicular to the sun. The design of MPPT simulation and drying tool is aimed to dry the anchovy from the initial moisture content ± 90% to> 10%. This research is done by experimental method that is by observing and measuring the things done on the dryer and then processing and evaluation of research data. The conclusion of the simulation result analysis is the MPPT simulation circuit using Proteus program has been running as it should by paying attention to not the appearance of error listing in the simulation.* Light Dependent Resistor*(LDR) as light detection from simulation able to drive servo motor according to direction of sunlight with range of angle 0^0-180^0, and back to move servo motor position of origin 0^0. LDR is designed by detecting angle shift of light that move horizontal servo motor is optimal with range of angle 0^0- 180^0so that light detected the error rate is very small against solar panels and solar collectors.

Index terms: Models;Solar Energy;Solar Collectors;Fish Dryers; Heat Transfer

I.INTRODUCTION

The development of technology and science today has an impact on the needs of electric energy consumption is increasing. On the issue it is necessary source of renewable alternative energy to meet current electricity needs one of which uses solar energy (Solar Energy). Solar cell that serves to convert solar energy into electrical energy is very urgent applied in Indonesia due to the increasingly expensive energy sourced from oil and natural gas that can not be updated source and limited capacity[1]-[7]. The solar cell technology is a semiconductor stretch that can absorb photons from sunlight and convert them into electricity. Solar cells are widely used for a variety of applications one of them as a marine dryer product.Indonesia as a country with a tropical climate has quite abundant sunshine, located on the equator which has a tropical climate and solar radiation for most of the year. The utilization of solar energy can be used in the dryer to reduce the use of fossil-based energy that will cause global warming. Post-harvest processing of seafood has an important role in the life of Indonesian society, which is also a source of significant foreign exchange income of the country's marine sector. With the application of solar energy system in this research, this product is expected to accelerate the drying process and maintain the quality and quality of post harvest products of marine products.

A.Problems

Problems to be studied in this research are:

1. How to model the static solar collector to automatically follow the direction of the movement of the sun with the intention of obtaining optimization of the absorption of solar energy by using solar cell driven by AC motor from ATMEGA 16 microcontroller command.
2. Conducting testing on the tool as a result of model design to determine the feasibility value of efficiency, effectiveness and saving of electrical energy sourced on solar energy.
3. Analyze what percentage uptake or efficiency of solar cell devices combined with solar collectors.

B.Specific Purpose of Research

The purpose of this research in the first year is modeling and making appropriate technology for drying anchovy using solar collector and solar cell position control. In the second year of this study aims specifically to know the performance of the prototype of solar cell utilization and solar collector as a source of energy in the system Prototype drying of anchovy.

II.LITERATURE REVIEW

A.Drying

Drying is a simultaneous process of heat transfer and water vapor, requiring heat energy to evaporate the water content removed from the surface of the material, which is dried by a typically hot drying medium. The purpose of drying itself is to reduce the water content of the material to the extent that the development of microorganisms And the activity of enzymes that can cause decay is stunted or stalled. Thus the

Revised Manuscript Received on December 22, 2018.

Selamat Melial,Faculty of Engineering, Universitas Malikussaleh, 24351 Lhokseumawe, Indonesia
Email:selamat.meliala@unimal.ac.id
Saifuddin, Faculty of Engineering, Universitas Malikussaleh, 24351 Lhokseumawe, Indonesia
Rosdiana, Faculty of Engineering, Universitas Malikussaleh, 24351 Lhokseumawe, Indonesia

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

dried material can have a longer shelf time. Dryer with solar collector is a drying system that utilizes solar energy. The solar drying system consists of two main parts namely the solar collector and the drying chamber [8].
The solar collector is a device that can collect or absorb solar radiation and convert it to heat. Solar collectors can be defined as heat transfer systems that generate heat energy by utilizing solar radiation as the primary energy source. Solar collectors operate without sound (unlike large wind turbines) so as not to cause noise pollution. Solar collectors usually have a very long lifespan, And maintenance costs are very low because there is no moving parts. Solar collectors are also quite easy to install. Solar energy is one of the best energy options for remote areas, when the power distribution network is impractical or impossible to install. Given the electrification ratio in Indonesia only 55-60% and almost all areas that have not been powered by electricity is a distant rural area From the power plant.[8]

B.Heat Transfer Process

The heat transfer can be defined as a process of moving an energy (calor) from one region to another due to the temperature difference in the area.
The heat transfer by conduction is a heat transfer process in which heat flows from a high temperature region to a low temperature region in a medium (solid, liquid or gas) or between different mediums directly intersecting. In general the heat flow rate by conduction can be calculated by the following formula:

$$qx = -kA\frac{dT}{dx} \quad \text{.....(1)}$$

information :
Q = heat flow rate (W)
K = thermal conductivity of the material (W / m^2. ° C)
A = cross-sectional area (m^2)
DT / dx = the temperature gradient of the cross section, ie the rateChange of temperature T to distance in direction of hot flow x.

C.Stepper Motor As A Solar Panels and Collector Panels

Solar panels and solar collectables for maximum light are required by solar tracking devices. Active traces are trackers that work on the basis of coordination or combination of microprocessors with electro-optical or time-based based sensors. Using a solar tracker system can increase the effectiveness of solar panels and solar collectors , Because the largest energy received by solar panels and solar collectors is the direction of solar radiation perpendicular to the field of solar panels and solar collectors. Sun tracking system with 2 rotary axis is designed to improve the effectiveness in energy reception. Sun enforcement basically has a working principle that Sama.Kedua sun penjejak this one-axis tracking system. This system can only follow the movement of the sun from east to west which is caused by the motion of the rotation bumi.Sensor that is used is a photo resistor.To be able to improve the efficiency on the sun tracker, A two-axis system can be applied to the sun's tracker. A two-axis system allows the sun's tracker to control the azimuth position and latitude from the sun's position. This allows the sun's tracker to follow the sun more precisely throughout the year.The stepper motor in the tracking system is used as a panel drive. In the electric driving motor is known two kinds of motor drive that is the motor DC / AC and steper motor. Motor DC / AC consists of 2 pieces of coil as a ststor and magnetic core that can rotate on its axis as a rotor.Karenanya DC / AC motor rotation is continuous . Explanation of stepper motor in stepper motor there are 4 stator coils arranged in certain position so that can not produce continuous rotation. Magnetic core will stop rotating if stator give magnet opposite to nucleus of magnet, because both pull pull. If the electric current is passed to the coil 1 then the magnetic core will be faced with coil 1, then if the electric current is shifted to the coil 2 then the magnetic core will be faced with the coil 2, and so on. The magnetic core can also stop rotating at the position between the two stator coils by Provides an electric current on two coils simultaneously. This can be utilized to produce smaller turn angles, and motor rotation becomes smoother[9].

D.Working Principle of Microcontroller

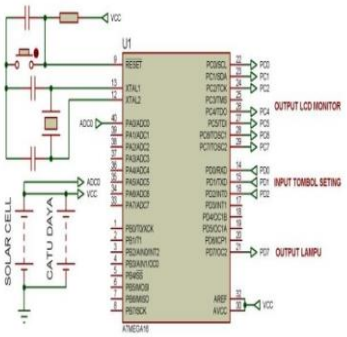
The easy way to operate the internal equipment of a microcontroller such as (timer / couter, ext, usert, etc.) is to learn the equipment control registers. The microcontroller is also an integrated chip that is often part of an embedded system. In microcontroller application there are advantages of system performance by using microcontroller is as follows:
1. The drive on the microcontroller uses assembly programming language based on basic digital rules so that the operation of the system becomes very easy to work in accordance with (assembly language is easy to understand because it uses the assembly language application where the input and output parameters can be directly accessed without using many commands) .Design This assembly language does not use so many requirements for writing programming languages such as uppercase and lowercase for assembly languages still to be taught.
2. Microcontroller arranged in one chip where processor, memory, and I / O integrated into one unit of control system so that microcontroller can be said as a mini computer that can work innovatively according to system requirement.
3. The running system is independent of the computer while the computer parameters are only used to download instruction commands or programs. The steps to download computer with microcontroller is very easy to use because it does not use many commands.
4. On microcontroller available additional facilities for memory development and I / O tailored to the needs of the system.
5. The price to get this tool is cheaper and easier to obtain[10].

E.Working Principle of LDR

When it is dark or the light is dim, the material from the disk produces free electrons with a relatively small amount. So there are few electrons to transport the electrical charge. That is, when the light is dim, the LDR becomes a poor conductor, or it can be called LDR Big in

Retrieval Number:F12520476S519/19 ©BEIESP
Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

the dark or dim light. At the bright light, there are more electrons out of the atoms of the semiconductor material. So the more electrons will be to carry the electrical charge. That is, when the bright light, the LDR becomes a good conductor, or LDR can have a small resistance in the light Another application of this LDR sensor is a burglar alarm. For example, for a series of light alarm system (using LDR) which is active when there is light. When we adjust the sensitivity of LDR (Light Dependent Resistor) in a circuit then we need to use potentiometer. When it gets light then the buzzer or bell will sound and when it gets no light then buzzer or bell will not soun



d[11].

Figure 1. LDR sensor

F.Hardware Design

The design of hardware consists of:

G.Power Supply

The Power Supply is a circuit that provides a power supply for each component in the circuit. The DC motor actuator automatically consists of electronic motor components that require a stable power supply. The circuit should be modified to fit the needs. The magnitude of the required output voltage is 24 Volt DC voltage.

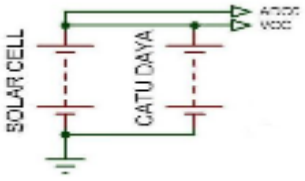


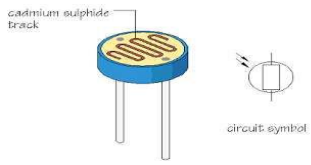
Figure 2. Power Supply Circuits

The circuit is made with one source ie the source battery as the main power supply on the whole tool. Solar cells serve as chargers in the battery and act as parameters for the operation of the actuator automatically through ADC 0.

H.Control Devices

The use of control device is ATMEGA32 microcontroller. Schematic of microcontroller circuit, as in figure 3.

Figure 3. ATMEGA32 AVR Microcontroller System Series Scheme.



Microcontroller circuit is composed of a minimum system circuit that is ATMEGA32, external oscillator and reset. An external oscillator serves to determine the speed of program execution. The external oscillator circuit consists of capasitor and crystal components with a value of 11,0592 MHz. Crystal with value 11.0592 MHz is used to get the right value when using the timer function with period 100 ms. The reset button works to reset the microcontroller. PORT C functioned as LCD monitor output port. PORTD functioned as light output port, input button, and enter the light sensor[19].

I.LCD Monitor

The use of LCD monitors serves to display the solar cell voltage and time settings(hours, minutes and seconds). The LCD circuit scheme is as shown in Figure 4.

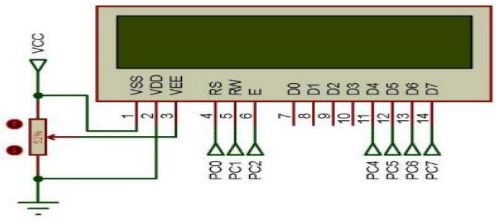


Figure 4. LCD Monitor Series Scheme 16x2 characters.

Variable resistor is used to adjust the character's display contrast on the LCD.
Setting Button

The use of the Settings button functions to enter data settings in the form of hours, minutes and seconds of lights that will turn on and off. As in figure 5.

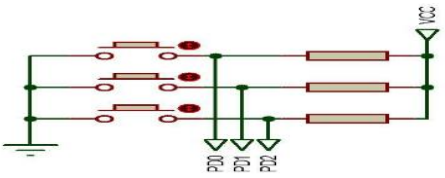


Figure 5. Setting Button Setting

Pin D bits 0, 1, and 2 are enabled as input settings button. Resistor of 1 Ω serves to limit the incoming currents to the microcontroller. The 5 volt voltage passed on the resistor of 1 kΩ gives the data input on the D Pin of the 0th bit, 1 and 2 logic 1. When all the buttons are pressed then the current will flow directly to ground, so that the data input on Pin D is 0th bit, 1 and 2 become logic 0.

J.Designing Software

The data processing and control device in the form of ATMEGA32 microcontroller will be filled (downloaded) program. The program is written in C language. The program contains the operation of street lighting, solar cell

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

voltage readings and time setting for operating the lights on or off automatically, which will then be displayed via the LCD based on the program that has been created.

K.Light Sensor

Light sensor used is solar cell. Solar cells in addition to functioning as an energy source but also can be used as a light sensor. Solar cell when exposed to sunlight will produce voltage and vice versa if not exposed to light, then the solar cell does not produce voltage. The solar cell voltage functioned as a light sensor in lamp automation will be further processed by ATMEGA32 microcontroller with ADC (analog to digital converter).

L.ATMEGA32 microcontroller

Users do not need to re-set the program when the system does not get the power supply and will be reused, because files with extension *.hex are already downloaded into the microcontroller. Programs can be drawn in the flow diagram in the picture below.

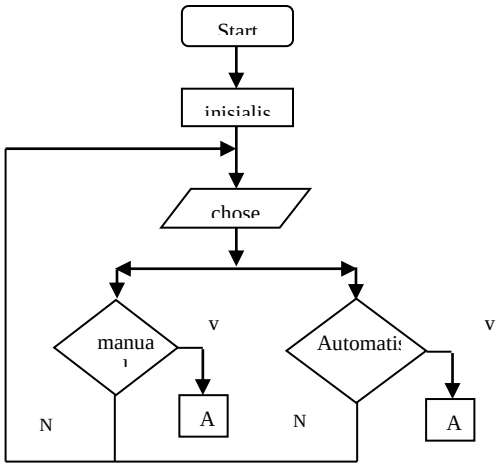


Figure 6. Main Program

III.RESEARCH METHODS

The method of research in implementing the modeling is as diagram below:

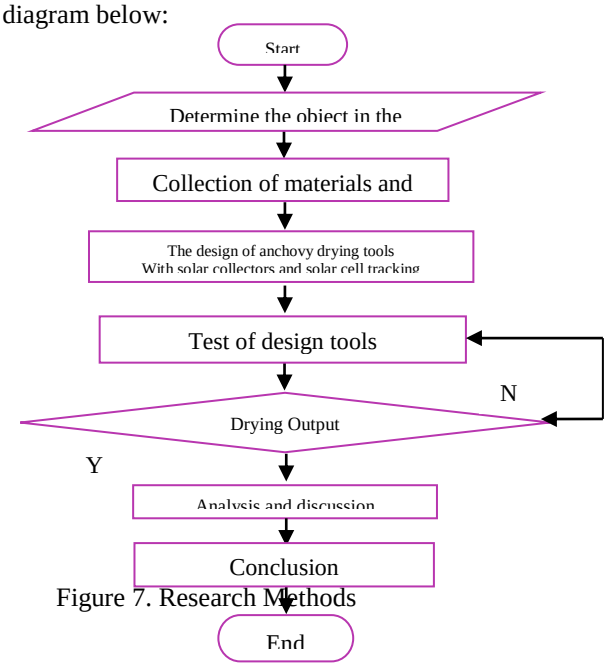


Figure 7. Research Methods

A.Designing

Design Model of Drying Anchovy Drying Using Solar Collector And Solar Cell Panel Position Control, designed with the following steps: Modeling, Designing model, analysis, manufacture and testing.

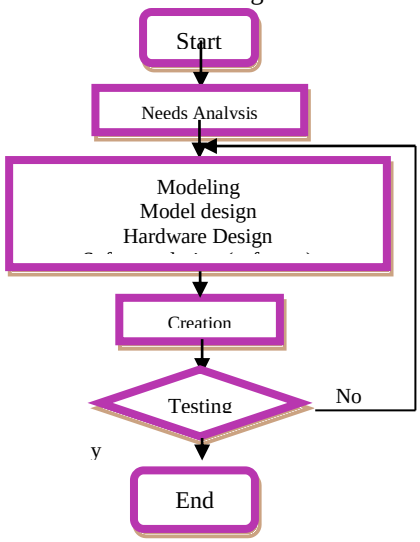


Figure 8. Concept of Modeling and Tool Design

B.Results and Discussion

Simulation results for the sunlight (MPPT) automation have been successfully simulated as shown in Figure 9. The simulation is equipped with four LDRs, one LCD, two servo and one Atmega32 microcontroller. The four LDRs each have different tasks adjusted in the vertical and horizontal direction of the movement of sunlight, so that light absorption at a maximum 90^0 angle can be achieved. As is known the maximum angle of sunlight is at an angle perpendicular to the direction of the sun.

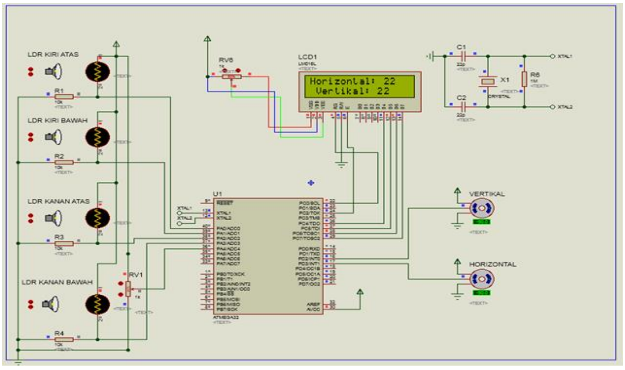


Figure 9. The results of the simulation of sun light.

LCD (liquid crystal display) is used to monitor the movement of the servo direction either in the vertical direction or even horizontally. With this direction

movement marton will make it easier for the user to know whether the servo is working properly or not working. LCD used is 2 x 16 LCD. 2x16 LCD display as shown in figure 10.

Retrieval Number:F12520476S519/19 ©BEIESP

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

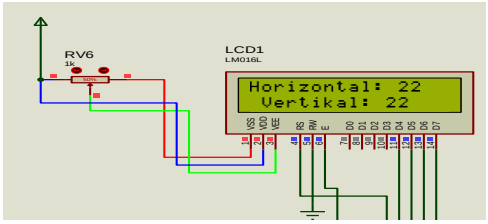


Figure 10. Liquid Crystal Display

The vertical servo is driven to move the solar panels and solar collectors from the east to the west and from the west to the east. For horizontally servo functionalized to drive solar panel along with solar collector from north to south and from south to north direction. Both servo is enabled to automate moving solar panels and solar collectors directly follow the command of Atmega32 microcontroller. Horizontal servo display and servo horizontal as shown in figure 11.

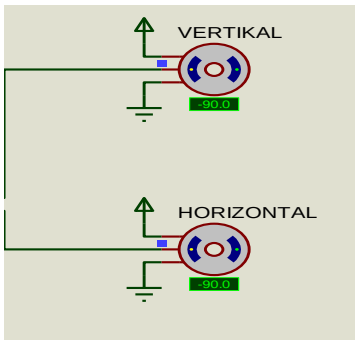
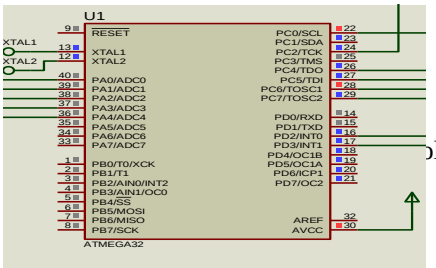


Figure 11. Vertical servo and horizontal servo

Atmega 32 microcontroller functioned to set the input and output of MPPT series (Maximum Power Point Tracking). Inputs derived from the LDR entered into the microcontroller are then processed following the listing of C ++ programs and the instruction output of the program goes into the servo motor in the form of a voltage of 5 volts. So the Output signal coming out of Atmega 32 goes into LCD display and servo. The incoming signal to the LCD gives the appearance of the vertical and horizontal angle of the solar focus point. The servo signal obtained from the microcontroller gives instructions to the servo to drive solar panels and solar collectors. The magnitude of the angle displays the temporary conditions of movement of solar cell panels and solar collectors against the sun. The Atmega32 microcontroller is shown in Figure 12.



oller

Top left and upper right LDR sensors function to follow the light to drive motors with an angle range of 0^0 to 180^0 (vertical conditions). Upper and upper left LDR sensors function according to the sunlight where there is a shift in the detection angle and move the motor with a range of 0^0 to 180^0 (horizontal conditions). The lower right LDR sensor when exposed to light at the bottom position of the solar panel and moves the motor to a vertical condition that moves only the vertical servo motor. Lower left LDR sensor detects a light angle shift and moves the motor with a range of 0^0 to 180^0 vertical and horizontal servo motors rapidly moving the solar panel and collector to the original position. Light diode resistor shown in figure 13.

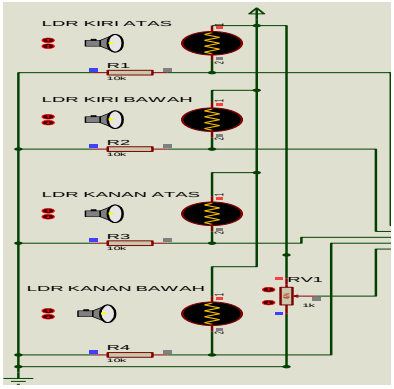


Figure 13. Light Diode Resistor

IV.CONCLUSIONS

After testing the MPPT circuit simulation on Atmega32 microcontroller by entering the listing of C + + program program, it can be concluded that:

1. The MPPT simulation circuit using the Proteus program has been running as it should by paying attention to not the appearance of error listings in the simulation.
2. LDR as light detection from simulation able to drive servo motor according to direction of sunlight with angle range 0^0 - 180^0, and again move motor servo keposisi origin 0^0.
3. LDR is designed by detecting angular shift of light that drive horizontal servo motor is optimal with angle range 0^0 - 180^0 so light light detected very small error to solar panel and collector so that heat generated at collector is very optimal.

REFERENCES

1. Ahmed, T., Soon, T. K., Mekhilef, S. and Electronics, P. (2014) 'A Single Phase Doubly Grounded Semi-Z-Source Inverter for Photovoltaic (PV) Systems with Maximum Power Point Tracking (MPPT)', pp. 3618–3641. doi: 10.3390/en7063618.
2. Andrianto,Heri.2008.Pemrograman Mikrokontroler AVR
3. ATMEGA32MenggunakanBahasa C (CodeVision AVR).Bandung: Informatika.
4. Ambarita,Himsar.2011.*Perpindahan PanasKonveksidanPengantarAlatPenukarKalor.* Medan:DepartemenTeknikMesinFTUSU.
5. Engineering, E. (2012) 'Design of a Charge Controller Circuit with Maximum Power Point Tracker (MPPT) for Photovoltaic System'.
6. S. S., Statistics, O., Voltage, O., Current, O. and Frequency, O. (no date) 'Reference Design for Solar Power MPPT Controller'.
7. Prihandoko,Bambang.2010. LaporanAkhir Program IntensifPeneliti Dan Perekayasa LIPI: Pembuatan Nanomaterial SebagaiBahanPembuatan Lithium. Jakarta: PusatPenelitianFisikaLembagaIlmuPengetahuan Indonesia (LIPI).

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

8. Petreus, D., Moga, D., Rusu, A., Patarau, T. and Munteanu, M. (2010) 'Photovoltaic System with Smart tracking of the Optimal Working Point', 10(3), pp. 40–47.Power, M., Tracking, P., Standard, A. and Conditions, T. (no date) 'and How Does it Work ?'
9. Fadly Rian Arikundo,Mulfi Hazwi,2014,Rancang bangun *prototype* kolektor surya tipe Plat datar untuk penghasil panas pada pengering Produk pertanian dan perkebunan Jurnal ***e***-Dinamis, Volume. 8, No.4 Maret 2014 ISSN 2338-1035.
10. Galuh Renggani Wilis.2014.Variasi sudut kemiringan kolektor surya solar water heater.prosiding seminar Nasional aplikasi sain dan teknologi(SNAST). Yogyakarta,15 Nopember 2014.
11. Junaidi,M.A.2009.Perancangan danSimulasiSistemKontrolPosisiPada Panel Surya denganMenggunakanMetode Fuzzy Sliding Mode Control. Surabaya:InstitutTeknologiSepuluhNopember.
12. Jacobson, MZ.2009, Review of Solutions to Global Warming, Air Pollution, and Energy Security, Energy and Environmental Science.
13. Muhammad Awwaluddin.2007.Analisis perpindahan kalor pada *heat exchanger* pipa Ganda dengan sirip berbentuk *delta wing*.Skripsi.Universitas Negeri Semarang.
14. NugrohoGamaYoga,dkk.2010.KajiEkperimentalPemggunaanPipaKalorDalamKolektorSurya SebagaiPenyerapEnergiTermalSuryaUmtukPenyuplaiPompaKkalorTemperaturTinggi.SeminarNasionalTahunanTeknikMesin(SNTTM)ke-9Palembang,13-15Oktober2010.
15. Na, W., Chen, P. and Kim, J. (2017) 'applied sciences An Improvement of a Fuzzy Logic-Controlled Maximum Power Point Tracking Algorithm for Photovoltic Applications'. doi: 10.3390/app7040326.
16. Noman, A. M., Addoweesh, K. E. and Mashaly, H. M. (2013) 'DSPACE Real-Time Implementation of MPPT-Based FLC Method', 2013.
17. Satwiko,dkk,2011,*StudiRancangBangunSolarWaterHeaterMenggunakanBerbagaiJenisKacaKolektor*,UNJJkt.
18. Sitompul, Rislima. 2011. Manual Pelatihan: TeknologiEnergiTerbarukan Yang TepatUntukAplikasiMasyarakatPedesaan.Jakarta: Program NasionalPemberdayaanMasyarakat (PNPM).
19. Setiadi,I. 2009.Optimalisasi Arah Solar CellTerhadapIntensitasCahayaMatahariDalamDuaSumbuBerbasisMikrokontroller. Surabaya:InstitutTeknologiSepuluhNopember.
20. YanuarRizal,2009,RancangBangunPemanasAirTenagaSuryaArbsorberGelombangtipeSinusoidaldenganPenambahan*Honeycomb*,ITSSurabaya
21. Setiadi,I. 2009.Optimalisasi Arah Solar CellTerhadapIntensitasCahayaMatahariDalamDuaSumbuBerbasisMikrokontroller. Surabaya:InstitutTeknologiSepuluhNopember.
22. YanuarRizal,2009,RancangBangunPemanasAirTenagaSuryaArbsorberGelombangtipeSinusoidaldenganPenambahan*Honeycomb*,ITSSurabaya

Retrieval Number:F12520476S519/19 ©*BEIESP*

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Retrieval Number:F12520476S519/19 ©*BEIESP*