100K

R1

10K
R2

R3

N1

N3

R5

1K

T1

moslets = IRZ44n

Mains
Output
AC

C1
0.1uF

N2

N4

unused gate

N1---N4 = 4093

DESIGNED AND INVENTED BY SWAGATAM

TIP
36

0.1
Ohms

LM 338

in   out

adj

25A
diode

R₃
129

P1
2k

T2

R4

1K

24-0-24V/150 watt

1 Ohm

25A
diode

Solar
Panel

R₄ = 2 R₃

R₃

1N5408

S1

IC
7812

IN   OUT

pin14

BC 547

GND

To IC 4093
supply pins

1uF

1uF

pin7

Battery

Designed By
Swagatam

agatam innova

Solar Charge Controller Circuit With Microcontroller

Mohamed Bendaoud,Amine El Fathi,Farhad Ilahi Bakhsh,Siano Pierluigi

Solar Charge Controller Circuit With Microcontroller:

Electrical Engineering and Control Min Zhu,2011-06-21 This volume includes extended and revised versions of a set of selected papers from the International Conference on Electric and Electronics EEIC 2011 held on June 20 22 2011 which is jointly organized by Nanchang University Springer and IEEE IAS Nanchang Chapter The objective of EEIC 2011 Volume 2 is to provide a major interdisciplinary forum for the presentation of new approaches from Electrical engineering and controls to foster integration of the latest developments in scientific research 133 related topic papers were selected into this volume All the papers were reviewed by 2 program committee members and selected by the volume editor Prof Min Zhu We hope every participant can have a good opportunity to exchange their research ideas and results and to discuss the state of the art in the areas of the Electrical engineering and controls *Handbook of Research on Deep Learning Techniques for Cloud-Based Industrial IoT* Swarnalatha, P.,Prabu, S.,2023-07-03 Today s business world is changing with the adoption of the internet of things IoT IoT is helping in prominently capturing a tremendous amount of data from multiple sources Realizing the future and full potential of IoT devices will require an investment in new technologies The Handbook of Research on Deep Learning Techniques for Cloud Based Industrial IoT demonstrates how the computer scientists and engineers of today might employ artificial intelligence in practical applications with the emerging cloud and IoT technologies The book also gathers recent research works in emerging artificial intelligence methods and applications for processing and storing the data generated from the cloud based internet of things Covering key topics such as data cybersecurity blockchain and artificial intelligence this premier reference source is ideal for industry professionals engineers computer scientists researchers scholars academicians practitioners instructors and students **ACEIVE 2022** S Sriadhi,Ernesto Silitonga,Eka Daryanto,M. Dominique Mendoza,Zulkifli Matondang,2023-05-03 The 4th Annual Conference of Engineering and Implementation on Vocational Education ACEIVE 2022 is a scientific forum for scholars to disseminate their research and share ideas This conference was held virtually on October 20 2022 conducted by the Faculty of Engineering of Universitas Negeri Medan North Sumatra Indonesia The 4th ACEIVE s 2022 theme is Development of Vocational Talent for Educational and Society IR 4 0 Consist of sub themes Teaching Learning and Vocational Education Engineering ICT Food Nutrition and Social Science The conference was attended by researchers experts practitioners and observers from around the globe to explore various issues and debates on research and experiences and discuss ideas of empowering technology in education to develop talent through vocational education for society IR 4 0 **MATLAB Model of an Optimized Battery Charge Controller** SUBRATA PANDEY,2022-09-21 This book contains enhanced way of battery charging that increases battery durability where energy source is variable such as solar wind tidal energy etc The charging algorithm is applied to enhance durability of a lead acid battery charged by a photovoltaic cell Batteries are charged best when it is charged in three different stages In this method battery is first charged with trickle current after a certain voltage it is charged with bulk charging current then again

after a certain voltage it is charged with a constant voltage The current and the voltage supplied by the variable source is unpredictable To maintain the desired current and voltage at different times a DC DC converter is used A micro controller is to be used to control the gate pulse of DC DC converter to control battery charging current and voltage This charging technique can be used for various applications like Hybrid Electric Vehicle battery charging Head light battery charging of coalmine workers solar panel charged batteries used for domestic purpose etc **Proceedings of the International Congress '14 (IntCongress 2014)** Association of Scientists, Developers and Faculties,2014-11-19 Proceedings of the combined volumes of International Congress IntCongress 2014 held at Holiday Inn Silom Bangkok Kingdom of Thailand between 19th November 2014 and 21st November 2014 **Electronic Systems and Intelligent Computing** Pradeep Kumar Mallick,Preetisudha Meher,Alak Majumder,Santos Kumar Das,2020-09-22 This book presents selected high quality research papers from the International Conference on Electronic Systems and Intelligent Computing ESIC 2020 held at NIT Yupia Arunachal Pradesh India on 2 4 March 2020 Discussing the latest challenges and solutions in the field of smart computing cyber physical systems and intelligent technologies it includes papers based on original theoretical practical and experimental simulations developments applications measurements and testing The applications and solutions featured provide valuable reference material for future product development **Practical Solar Tracking Automatic Solar Tracking Sun Tracking Автоматическое удержание Солнечная слежения ВС** 太陽能自動跟踪 Gerro Prinsloo,Robert Dobson,2015-11-01 This book details Practical Solar Energy Harvesting Automatic Solar Tracking Sun Tracking Systems Solar Trackers and Sun Tracker Systems using motorized automatic positioning concepts and control principles An intelligent automatic solar tracker is a device that orients a payload toward the sun Such programmable computer based solar tracking device includes principles of solar tracking solar tracking systems as well as microcontroller microprocessor and or PC based solar tracking control to orientate solar reflectors solar lenses photovoltaic panels or other optical configurations towards the sun Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin parabolic conic or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously In general the book may benefit solar research and solar energy applications in countries such as Africa Mediterranean Italy Spain Greece USA Mexico South America Brazilia Argentina Chili India Malaysia Middle East UAE Russia Japan and China This book on practical automatic Solar Tracking Sun Tracking is in PDF format and can easily be converted to the EPUB MOBI AZW ePub FB2 LIT LRF MOBI PDB PDF TCR formats for smartphones and Kindle by using the ebook online convert com facility The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided In harnessing power from the sun through a solar tracker or practical solar tracking system renewable energy control automation systems require automatic solar tracking software and solar position algorithms to

accomplish dynamic motion control with control automation architecture circuit boards and hardware On axis sun tracking system such as the altitude azimuth dual axis or multi axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun s passage through the sky is traced with high precision in automated solar tracker applications right through summer solstice solar equinox and winter solstice A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system From sun tracing software perspective the sonnet Tracing The Sun has a literal meaning Within the context of sun track and trace this book explains that the sun s daily path across the sky is directed by relatively simple principles and if grasped understood then it is relatively easy to trace the sun with sun following software Sun position computer software for tracing the sun are available as open source code sources that is listed in this book Ironically there was even a system called sun chaser said to have been a solar positioner system known for chasing the sun throughout the day Using solar equations in an electronic circuit for automatic solar tracking is quite simple even if you are a novice but mathematical solar equations are over complicated by academic experts and professors in text books journal articles and internet websites In terms of solar hobbies scholars students and Hobbyist s looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources which leaves many developers in frustration when search for simple experimental solar tracking source code for their on axis sun tracking systems This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller By directing the solar collector directly into the sun a solar harvesting means or device can harness sunlight or thermal heat This is achieved with the help of sun angle formulas solar angle formulas or solar tracking procedures for the calculation of sun s position in the sky Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky In using the longitude latitude GPS coordinates of the solar tracker location these sun tracking software tools supports precision solar tracking by determining the solar altitude azimuth coordinates for the sun trajectory in altitude azimuth tracking at the tracker location using certain sun angle formulas in sun vector calculations Instead of follow the sun software a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems Dynamic sun tracing is also used in solar surveying DNI analyser and sun surveying systems that build solar infographics maps with solar radiance irradiance and DNI models for GIS geographical information system In this way geospatial methods on solar environment interaction makes use use of geospatial technologies GIS Remote Sensing and Cartography Climatic data and weather station or weather center data as well as queries from sky servers and solar resource database systems i e on DB2 Sybase Oracle SQL MySQL may also be associated with solar GIS maps In such solar resource

modelling systems a pyranometer or solarimeter is normally used in addition to measure direct and indirect scattered dispersed reflective radiation for a particular geographical location Sunlight analysis is important in flash photography where photographic lighting are important for photographers GIS systems are used by architects who add sun shadow applets to study architectural shading or sun shadow analysis solar flux calculations optical modelling or to perform weather modelling Such systems often employ a computer operated telescope type mechanism with ray tracing program software as a solar navigator or sun tracer that determines the solar position and intensity The purpose of this booklet is to assist developers to track and trace suitable source code and solar tracking algorithms for their application whether a hobbyist scientist technician or engineer Many open source sun following and tracking algorithms and source code for solar tracking programs and modules are freely available to download on the internet today Certain proprietary solar tracker kits and solar tracking controllers include a software development kit SDK for its application programming interface API attributes Pebble Widget libraries widget toolkits GUI toolkit and UX libraries with graphical control elements are also available to construct the graphical user interface GUI for your solar tracking or solar power monitoring program The solar library used by solar position calculators solar simulation software and solar contour calculators include machine program code for the solar hardware controller which are software programmed into Micro controllers Programmable Logic Controllers PLC programmable gate arrays Arduino processor or PIC processor PC based solar tracking is also high in demand using C Visual Basic VB as well as MS Windows Linux and Apple Mac based operating systems for sun path tables on Matlab Excel Some books and internet webpages use other terms such as sun angle calculator sun position calculator or solar angle calculator As said such software code calculate the solar azimuth angle solar altitude angle solar elevation angle or the solar Zenith angle Zenith solar angle is simply referenced from vertical plane the mirror of the elevation angle measured from the horizontal or ground plane level Similar software code is also used in solar calculator apps or the solar power calculator apps for IOS and Android smartphone devices Most of these smartphone solar mobile apps show the sun path and sun angles for any location and date over a 24 hour period Some smartphones include augmented reality features in which you can physically see and look at the solar path through your cell phone camera or mobile phone camera at your phone s specific GPS location In the computer programming and digital signal processing DSP environment free open source program code are available for VB Net Delphi Python C C C PHP Swift ADM F Flash Basic QBasic GBasic KBasic SIMPL language Squirrel Solaris Assembly language on operating systems such as MS Windows Apple Mac DOS or Linux OS Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab Mathworks Simulink models Java applets TRNSYS simulations Scada system apps Labview module Beckhoff TwinCAT Visual Studio Siemens SPA mobile and iphone apps Android or iOS tablet apps and so forth At the same time PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens HP Panasonic ABB Allan

Bradley OMRON SEW Festo Beckhoff Rockwell Schneider Endress Hauser Fudji electric Honeywell Fuchs Yokonawa or Muthibishi platforms Sun path projection software are also available for a range of modular IPC embedded PC motherboards Industrial PC PLC Programmable Logic Controller and PAC Programmable Automation Controller such as the Siemens S7 1200 or Siemens Logo Beckhoff IPC or CX series OMRON PLC Ercam PLC AC500plc ABB National Instruments NI PXI or NI cRIO PIC processor Intel 8051 8085 IBM Cell Power Brain or Truenorth series FPGA Xilinx Altera Nios Intel Xeon Atmel megaAVR MPU Maple Teensy MSP XMOS Xbee ARM Raspberry Pi Eagle Arduino or Arduino AtMega microcontroller with servo motor stepper motor direct current DC pulse width modulation PWM current driver or alternating current AC SPS or IPC variable frequency drives VFD motor drives also termed adjustable frequency drive variable speed drive AC drive micro drive or inverter drive for electrical mechatronic pneumatic or hydraulic solar tracking actuators The above motion control and robot control systems include analogue or digital interfacing ports on the processors to allow for tracker angle orientation feedback control through one or a combination of angle sensor or angle encoder shaft encoder precision encoder optical encoder magnetic encoder direction encoder rotational encoder chip encoder tilt sensor inclination sensor or pitch sensor Note that the tracker s elevation or zenith axis angle may measured using an altitude angle declination angle inclination angle pitch angle or vertical angle zenith angle sensor or inclinometer Similarly the tracker s azimuth axis angle be measured with a azimuth angle horizontal angle or roll angle sensor Chip integrated accelerometer magnetometer gyroscope type angle sensors can also be used to calculate displacement Other options include the use of thermal imaging systems such as a Fluke thermal imager or robotic or vision based solar tracker systems that employ face tracking head tracking hand tracking eye tracking and car tracking principles in solar tracking With unattended decentralised rural island isolated or autonomous off grid power installations remote control monitoring data acquisition digital datalogging and online measurement and verification equipment becomes crucial It assists the operator with supervisory control to monitor the efficiency of remote renewable energy resources and systems and provide valuable web based feedback in terms of CO2 and clean development mechanism CDM reporting A power quality analyser for diagnostics through internet WiFi and cellular mobile links is most valuable in frontline troubleshooting and predictive maintenance where quick diagnostic analysis is required to detect and prevent power quality issues Solar tracker applications cover a wide spectrum of solar applications and solar assisted application including concentrated solar power generation solar desalination solar water purification solar steam generation solar electricity generation solar industrial process heat solar thermal heat storage solar food dryers solar water pumping hydrogen production from methane or producing hydrogen and oxygen from water HHO through electrolysis Many patented or non patented solar apparatus include tracking in solar apparatus for solar electric generator solar desalinator solar steam engine solar ice maker solar water purifier solar cooling solar refrigeration USB solar charger solar phone charging portable solar charging tracker solar coffee brewing solar cooking or solar dying means Your project may be

the next breakthrough or patent but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance solar generator solar tracker robot solar freezer solar cooker solar drier solar pump solar freezer or solar dryer project Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project solar power kit solar hobby kit solar steam generator solar hot water system solar ice maker solar desalinator hobbyist solar panels hobby robot or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming this publication may help accelerate the development of your solar tracking innovation Lately solar polygeneration solar trigeneration solar triple generation and solar quad generation adding delivery of steam liquid gaseous fuel or capture food grade CO_2 systems have need for automatic solar tracking These systems are known for significant efficiency increases in energy yield as a result of the integration and re use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit form and operate on a plug and play basis Typical hybrid solar power systems include compact or packaged solar micro combined heat and power CHP or mCHP or solar micro combined cooling heating and power CCHP CHPC mCCHP or mCHPC systems used in distributed power generation These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off grid rural island or isolated microgrid minigrid and distributed power renewable energy systems Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink Modelica or TRNSYS platform as well as in automation and control of renewable energy systems through intelligent parsing multi objective adaptive learning control and control optimization strategies Solar tracking algorithms also find application in developing solar models for country or location specific solar studies for example in terms of measuring or analysis of the fluctuations of the solar radiation i e direct and diffuse radiation in a particular area Solar DNI solar irradiance and atmospheric information and models can thus be integrated into a solar map solar atlas or geographical information systems GIS Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic of CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi objective optimization algorithm platforms such as COMPOSE EnergyPLAN or DER CAM A dual axis solar tracker and single axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish solar panel array heliostat array PV panel solar antenna or infrared solar nantenna A self tracking solar concentrator performs automatic solar tracking by computing the solar vector Solar position algorithms TwinCAT SPA or PSA Algorithms use an astronomical algorithm to calculate the position of the sun It uses astronomical software algorithms and equations for solar tracking in the calculation of sun s position in the sky for each location on the earth at any time of day Like an optical solar telescope the solar position algorithm pin points the solar reflector at the sun and locks onto the sun s position to track the sun across the sky as the sun progresses throughout the day Optical sensors such as photodiodes light dependant

resistors LDR or photoresistors are used as optical accuracy feedback devices Lately we also included a section in the book with links to microprocessor code on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be used in infrared solar tracking applications In order to harvest free energy from the sun some automatic solar positioning systems use an optical means to direct the solar tracking device These solar tracking strategies use optical tracking techniques such as a sun sensor means to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun s position In a solar mems sun sensor device incident sunlight enters the sun sensor through a small pin hole in a mask plate where light is exposed to a silicon substrate In a web camera or camera image processing sun tracking and sun following means object tracking software performs multi object tracking or moving object tracking methods In an solar object tracking technique image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame while sun localization is performed with an edge detection algorithm to determine the solar vector coordinates An automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun s energy In such renewable energy systems the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems Automatic on axis solar tracking in a PV solar tracking system can be dual axis sun tracking or single axis sun solar tracking It is known that a motorized positioning system in a photovoltaic panel tracker increase energy yield and ensures increased power output even in a single axis solar tracking configuration Other applications such as robotic solar tracker or robotic solar tracking system uses robotica with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system Automatic positioning systems in solar tracking designs are also used in other free energy generators such as concentrated solar thermal power CSP and dish Stirling systems The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on axis solar tracking a dual axis solar tracker assists to harness energy from the sun through an optical solar collector which can be a parabolic mirror parabolic reflector Fresnel lens or mirror array matrix A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean In steering the dish to face the sun the power dish actuator and actuation means in a parabolic dish system optically focusses the sun s energy on the focal point of a parabolic dish or solar concentrating means A Stirling engine solar heat pipe thermosyphin solar phase change material PCM receiver or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system Hybrid solar power systems used in combination with biogas biofuel petrol ethanol diesel natural gas or PNG use a combination of power sources to harness and store solar energy in a storage medium Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries phase change material thermal heat storage and in cogeneration form converted to the required power

using thermodynamic cycles organic Rankin Brayton cycle micro turbine Stirling with an inverter and charge controller Solar Tracking Tracking Systems Solar Tracker Systems Tracker PC *Solar Photovoltaic System Modelling and Analysis* T. Mariprasath,P. Kishore,K. Kalyankumar,2024-03-04 This book outlines the global opportunity to increase solar photovoltaic PV plant energy yields through modelling and analysis Because it is endlessly available in Earth s atmosphere solar PV energy extraction is rising faster than all other renewable energy sources worldwide Thus technological improvements are needed to lower the cost of solar PV per watt every year Since solar PV efficiency is low modelling and analysis of boost converters maximum power point tracing solar PV cleaners irradiation tracing systems and panel tilt adjustments all help increase solar PV plant energy yield Solar Photovoltaic System Modelling and Analysis covers topics such as Relevance types and growth rate of renewable resources How solar PV systems generate electricity Panel varieties and their importance Solar PV designs and architectures Charge controllers including the latest technologies Boost converter modelling and analysis in MATLAB The necessity of hybrid power plants modelling and analysis Designing a solar PV system including panel selection for a specific application as well as converter and inverter estimation **Power Electronic Converters for Solar Photovoltaic Systems** L. Ashok Kumar,S.Albert Alexander,Madhuvanthani Rajendran,2020-11-01 Power Electronic Converters for Solar Photovoltaic Systems provides design and implementation procedures for power electronic converters and advanced controllers to improve standalone and grid environment solar photovoltaics performance Sections cover performance and improvement of solar photovoltaics under various conditions with the aid of intelligent controllers allowing readers to better understand the nuances of power electronic converters for renewable energy systems With algorithm development and real time implementation procedures this reference is useful for those interested in power electronics for performance improvement in distributed energy resources design of advanced controllers and measurement of critical parameters surrounding renewable energy systems By providing a complete solution for performance improvement in solar PV with novel control techniques this book will appeal to researchers and engineers working in power electronic converters renewable energy and power quality Includes simulation studies and photovoltaic performance analysis Uses case studies as a reference for design and research Covers different varieties of power converters from fundamentals to implementation **Smart Energy and Advancement in Power Technologies** Kumari Namrata,Neeraj Priyadarshi,Ramesh C. Bansal,Jitendra Kumar,2022-11-08 This book comprises peer reviewed proceedings of the International Conference on Smart Energy and Advancement in Power Technologies ICSEAPT 2021 The book includes peer reviewed papers on renewable energy economics and policy renewable energy resource assessment operations management and sustainability energy audit global warming waste and resource management green energy deployment green buildings integration of green energy energy efficiency etc The book serves as a valuable reference resource for academics and researchers across the globe **Automatic Solar Tracking Sun Tracking Satellite Tracking rastreador solar seguimento solar seguidor solar**

automático de seguimiento solar Gerro Prinsloo,Robert Dobson,2015-11-01 Automatic Solar Tracking Sun Tracking This book details Automatic Solar Tracking Sun Tracking Systems Solar Trackers and Sun Tracker Systems An intelligent automatic solar tracker is a device that orients a payload toward the sun Such programmable computer based solar tracking device includes principles of solar tracking solar tracking systems as well as microcontroller microprocessor and or PC based solar tracking control to orientate solar reflectors solar lenses photovoltaic panels or other optical configurations towards the sun Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin parabolic conic or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously seguimiento solar y automatizaci n automatizaci n seguidor solar tracking solar e automa o automa o seguidor solar inseguimento solare inseguitore solare energia termica sole seguito posizionatore motorizzato In harnessing power from the sun through a solar tracker or practical solar tracking system renewable energy control automation systems require automatic solar tracking software and solar position algorithms to accomplish dynamic motion control with control automation architecture circuit boards and hardware On axis sun tracking system such as the altitude azimuth dual axis or multi axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun s passage through the sky is traced with high precision in automated solar tracker applications right through summer solstice solar equinox and winter solstice A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided From sun tracing software perspective the sonnet Tracing The Sun has a literal meaning Within the context of sun track and trace this book explains that the sun s daily path across the sky is directed by relatively simple principles and if grasped understood then it is relatively easy to trace the sun with sun following software Sun position computer software for tracing the sun are available as open source code sources that is listed in this book The book also describes the use of satellite tracking software and mechanisms in solar tracking applications Ironically there was even a system called sun chaser said to have been a solar positioner system known for chasing the sun throughout the day Using solar equations in an electronic circuit for automatic solar tracking is quite simple even if you are a novice but mathematical solar equations are over complicated by academic experts and professors in text books journal articles and internet websites In terms of solar hobbies scholars students and Hobbyist s looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources which leaves many developers in frustration when search for simple experimental solar tracking source code for their on axis sun tracking systems This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller By directing the solar collector directly into the sun a solar

harvesting means or device can harness sunlight or thermal heat This is achieved with the help of sun angle formulas solar angle formulas or solar tracking procedures for the calculation of sun s position in the sky Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky In using the longitude latitude GPS coordinates of the solar tracker location these sun tracking software tools supports precision solar tracking by determining the solar altitude azimuth coordinates for the sun trajectory in altitude azimuth tracking at the tracker location using certain sun angle formulas in sun vector calculations Instead of follow the sun software a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems Dynamic sun tracing is also used in solar surveying DNI analyser and sun surveying systems that build solar infographics maps with solar radiance irradiance and DNI models for GIS geographical information system In this way geospatial methods on solar environment interaction makes use use of geospatial technologies GIS Remote Sensing and Cartography Climatic data and weather station or weather center data as well as queries from sky servers and solar resource database systems i e on DB2 Sybase Oracle SQL MySQL may also be associated with solar GIS maps In such solar resource modelling systems a pyranometer or solarimeter is normally used in addition to measure direct and indirect scattered dispersed reflective radiation for a particular geographical location Sunlight analysis is important in flash photography where photographic lighting are important for photographers GIS systems are used by architects who add sun shadow applets to study architectural shading or sun shadow analysis solar flux calculations optical modelling or to perform weather modelling Such systems often employ a computer operated telescope type mechanism with ray tracing program software as a solar navigator or sun tracer that determines the solar position and intensity The purpose of this booklet is to assist developers to track and trace suitable source code and solar tracking algorithms for their application whether a hobbyist scientist technician or engineer Many open source sun following and tracking algorithms and source code for solar tracking programs and modules are freely available to download on the internet today Certain proprietary solar tracker kits and solar tracking controllers include a software development kit SDK for its application programming interface API attributes Pebble Widget libraries widget toolkits GUI toolkit and UX libraries with graphical control elements are also available to construct the graphical user interface GUI for your solar tracking or solar power monitoring program The solar library used by solar position calculators solar simulation software and solar contour calculators include machine program code for the solar hardware controller which are software programmed into Micro controllers Programmable Logic Controllers PLC programmable gate arrays Arduino processor or PIC processor PC based solar tracking is also high in demand using C Visual Basic VB as well as MS Windows Linux and Apple Mac based operating systems for sun path tables on Matlab Excel Some books and internet webpages use other terms such as sun angle calculator sun position calculator or

solar angle calculator As said such software code calculate the solar azimuth angle solar altitude angle solar elevation angle or the solar Zenith angle Zenith solar angle is simply referenced from vertical plane the mirror of the elevation angle measured from the horizontal or ground plane level Similar software code is also used in solar calculator apps or the solar power calculator apps for IOS and Android smartphone devices Most of these smartphone solar mobile apps show the sun path and sun angles for any location and date over a 24 hour period Some smartphones include augmented reality features in which you can physically see and look at the solar path through your cell phone camera or mobile phone camera at your phone s specific GPS location In the computer programming and digital signal processing DSP environment free open source program code are available for VB Net Delphi Python C C C PHP Swift ADM F Flash Basic QBasic GBasic KBasic SIMPL language Squirrel Solaris Assembly language on operating systems such as MS Windows Apple Mac DOS or Linux OS Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab Mathworks Simulink models Java applets TRNSYS simulations Scada system apps Labview module Beckhoff TwinCAT Visual Studio Siemens SPA mobile and iphone apps Android or iOS tablet apps and so forth At the same time PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens HP Panasonic ABB Allan Bradley OMRON SEW Festo Beckhoff Rockwell Schneider Endress Hauser Fudji electric Honeywell Fuchs Yokonawa or Muthibishi platforms Sun path projection software are also available for a range of modular IPC embedded PC motherboards Industrial PC PLC Programmable Logic Controller and PAC Programmable Automation Controller such as the Siemens S7 1200 or Siemens Logo Beckhoff IPC or CX series OMRON PLC Ercam PLC AC500plc ABB National Instruments NI PXI or NI cRIO PIC processor Intel 8051 8085 IBM Cell Power Brain or Truenorth series FPGA Xilinx Altera Nios Intel Xeon Atmel megaAVR MPU Maple Teensy MSP XMOS Xbee ARM Raspberry Pi Eagle Arduino or Arduino AtMega microcontroller with servo motor stepper motor direct current DC pulse width modulation PWM current driver or alternating current AC SPS or IPC variable frequency drives VFD motor drives also termed adjustable frequency drive variable speed drive AC drive micro drive or inverter drive for electrical mechatronic pneumatic or hydraulic solar tracking actuators The above motion control and robot control systems include analogue or digital interfacing ports on the processors to allow for tracker angle orientation feedback control through one or a combination of angle sensor or angle encoder shaft encoder precision encoder optical encoder magnetic encoder direction encoder rotational encoder chip encoder tilt sensor inclination sensor or pitch sensor Note that the tracker s elevation or zenith axis angle may measured using an altitude angle declination angle inclination angle pitch angle or vertical angle zenith angle sensor or inclinometer Similarly the tracker s azimuth axis angle be measured with a azimuth angle horizontal angle or roll angle sensor Chip integrated accelerometer magnetometer gyroscope type angle sensors can also be used to calculate displacement Other options include the use of thermal imaging systems such as a Fluke thermal imager or robotic or vision based solar tracker

systems that employ face tracking head tracking hand tracking eye tracking and car tracking principles in solar tracking With unattended decentralised rural island isolated or autonomous off grid power installations remote control monitoring data acquisition digital datalogging and online measurement and verification equipment becomes crucial It assists the operator with supervisory control to monitor the efficiency of remote renewable energy resources and systems and provide valuable web based feedback in terms of CO2 and clean development mechanism CDM reporting A power quality analyser for diagnostics through internet WiFi and cellular mobile links is most valuable in frontline troubleshooting and predictive maintenance where quick diagnostic analysis is required to detect and prevent power quality issues Solar tracker applications cover a wide spectrum of solar applications and solar assisted application including concentrated solar power generation solar desalination solar water purification solar steam generation solar electricity generation solar industrial process heat solar thermal heat storage solar food dryers solar water pumping hydrogen production from methane or producing hydrogen and oxygen from water HHO through electrolysis Many patented or non patented solar apparatus include tracking in solar apparatus for solar electric generator solar desalinator solar steam engine solar ice maker solar water purifier solar cooling solar refrigeration USB solar charger solar phone charging portable solar charging tracker solar coffee brewing solar cooking or solar dying means Your project may be the next breakthrough or patent but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance solar generator solar tracker robot solar freezer solar cooker solar drier solar pump solar freezer or solar dryer project Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project solar power kit solar hobby kit solar steam generator solar hot water system solar ice maker solar desalinator hobbyist solar panels hobby robot or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming this publication may help accelerate the development of your solar tracking innovation Lately solar polygeneration solar trigeneration solar triple generation and solar quad generation adding delivery of steam liquid gaseous fuel or capture food grade CO_2 systems have need for automatic solar tracking These systems are known for significant efficiency increases in energy yield as a result of the integration and re use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit form and operate on a plug and play basis Typical hybrid solar power systems include compact or packaged solar micro combined heat and power CHP or mCHP or solar micro combined cooling heating and power CCHP CHPC mCCHP or mCHPC systems used in distributed power generation These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off grid rural island or isolated microgrid minigrid and distributed power renewable energy systems Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink Modelica or TRNSYS platform as well as in automation and control of renewable energy systems through intelligent parsing multi objective adaptive learning

control and control optimization strategies Solar tracking algorithms also find application in developing solar models for country or location specific solar studies for example in terms of measuring or analysis of the fluctuations of the solar radiation i e direct and diffuse radiation in a particular area Solar DNI solar irradiance and atmospheric information and models can thus be integrated into a solar map solar atlas or geographical information systems GIS Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic of CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi objective optimization algorithm platforms such as COMPOSE EnergyPLAN or DER CAM A dual axis solar tracker and single axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish solar panel array heliostat array PV panel solar antenna or infrared solar nantenna A self tracking solar concentrator performs automatic solar tracking by computing the solar vector Solar position algorithms TwinCAT SPA or PSA Algorithms use an astronomical algorithm to calculate the position of the sun It uses astronomical software algorithms and equations for solar tracking in the calculation of sun s position in the sky for each location on the earth at any time of day Like an optical solar telescope the solar position algorithm pin points the solar reflector at the sun and locks onto the sun s position to track the sun across the sky as the sun progresses throughout the day Optical sensors such as photodiodes light dependant resistors LDR or photoresistors are used as optical accuracy feedback devices Lately we also included a section in the book with links to microprocessor code on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be used in infrared solar tracking applications In order to harvest free energy from the sun some automatic solar positioning systems use an optical means to direct the solar tracking device These solar tracking strategies use optical tracking techniques such as a sun sensor means to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun s position In a solar mems sun sensor device incident sunlight enters the sun sensor through a small pin hole in a mask plate where light is exposed to a silicon substrate In a web camera or camera image processing sun tracking and sun following means object tracking software performs multi object tracking or moving object tracking methods In an solar object tracking technique image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame while sun localization is performed with an edge detection algorithm to determine the solar vector coordinates An automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun s energy In such renewable energy systems the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems Automatic on axis solar tracking in a PV solar tracking system can be dual axis sun tracking or single axis sun solar tracking It is known that a motorized positioning system in a photovoltaic panel tracker increase energy yield and ensures increased power output even in a single axis solar tracking configuration Other applications such as robotic solar tracker or robotic solar tracking system

uses robotica with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system Automatic positioning systems in solar tracking designs are also used in other free energy generators such as concentrated solar thermal power CSP and dish Stirling systems The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on axis solar tracking a dual axis solar tracker assists to harness energy from the sun through an optical solar collector which can be a parabolic mirror parabolic reflector Fresnel lens or mirror array matrix A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean In steering the dish to face the sun the power dish actuator and actuation means in a parabolic dish system optically focusses the sun s energy on the focal point of a parabolic dish or solar concentrating means A Stirling engine solar heat pipe thermosyphin solar phase change material PCM receiver or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system Hybrid solar power systems used in combination with biogas biofuel petrol ethanol diesel natural gas or PNG use a combination of power sources to harness and store solar energy in a storage medium Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries phase change material thermal heat storage and in cogeneration form converted to the required power using thermodynamic cycles organic Rankin Brayton cycle micro turbine Stirling with an inverter and charge controller **Renewable Energy and Power Technology II** Mo Jie Sun,2014-10-08 Selected peer reviewed papers from the 2014 2nd International Conference on Renewable Energy and Environmental Technology REET 2014 August 19 20 2014 Dalian China **Microgrid Technologies** Sharmeela Chenniappan,Sivaraman Palanisamy,Sanjeevikumar Padmanaban,Jens Bo Holm-Nielsen,2021-03-10 Microgrid technology is an emerging area and it has numerous advantages over the conventional power grid A microgrid is defined as Distributed Energy Resources DER and interconnected loads with clearly defined electrical boundaries that act as a single controllable entity concerning the grid Microgrid technology enables the connection and disconnection of the system from the grid That is the microgrid can operate both in grid connected and islanded modes of operation Microgrid technologies are an important part of the evolving landscape of energy and power systems Many aspects of microgrids are discussed in this volume including in the early chapters of the book the various types of energy storage systems power and energy management for microgrids power electronics interface for AC DC microgrids battery management systems for microgrid applications power system analysis for microgrids and many others The middle section of the book presents the power quality problems in microgrid systems and its mitigations gives an overview of various power quality problems and its solutions describes the PSO algorithm based UPQC controller for power quality enhancement describes the power quality enhancement and grid support through a solar energy conversion system presents the fuzzy logic based power quality assessments and covers various power quality indices The final chapters in the book present the recent advancements in the microgrids applications

of Internet of Things IoT for microgrids the application of artificial intelligent techniques modeling of green energy smart meter for microgrids communication networks for microgrids and other aspects of microgrid technologies Valuable as a learning tool for beginners in this area as well as a daily reference for engineers and scientists working in the area of microgrids this is a must have for any library   Perovskite Solar Cells Arthur James Swart,Keshav Kumar,Bishwajeet Pandey,Sakshi Sharma,2025-10-28 This book provides a comprehensive overview of the role of modeling in advancing perovskite solar cell technology and its implications for the future of renewable energy It encompasses various aspects of perovskite solar cell modeling including computational modeling and simulation techniques experimental validation methods optimization strategies and performance evaluation metrics Features Discusses the basic principles working mechanisms materials and designing approaches related to the implementation of perovskite solar cells Covers electron and hole transport models computational approaches to charge transport and transport in different perovskite structures Illustrates the crystal structure composition optical and electronic properties stability and degradation mechanisms of perovskite materials Explains tandem solar cell design principles interface engineering for tandems and stability challenges in tandem solar cells Explores the performance parameters related to perovskite solar cells and the implementation of such devices It is primarily written for senior undergraduates graduate students and academic researchers in electrical engineering electrical and communications engineering energy engineering renewable energy and computer science and engineering

Handbook of Dynamic Data Driven Applications Systems Frederica Darema,Erik P. Blasch,Sai Ravela,Alex J. Aved,2023-09-14 This Second Volume in the series Handbook of Dynamic Data Driven Applications Systems DDDAS expands the scope of the methods and the application areas presented in the first Volume and aims to provide additional and extended content of the increasing set of science and engineering advances for new capabilities enabled through DDDAS The methods and examples of breakthroughs presented in the book series capture the DDDAS paradigm and its scientific and technological impact and benefits The DDDAS paradigm and the ensuing DDDAS based frameworks for systems analysis and design have been shown to engender new and advanced capabilities for understanding analysis and management of engineered natural and societal systems applications systems and for the commensurate wide set of scientific and engineering fields and applications as well as foundational areas The DDDAS book series aims to be a reference source of many of the important research and development efforts conducted under the rubric of DDDAS and to also inspire the broader communities of researchers and developers about the potential in their respective areas of interest of the application and the exploitation of the DDDAS paradigm and the ensuing frameworks through the examples and case studies presented either within their own field or other fields of study As in the first volume the chapters in this book reflect research work conducted over the years starting in the 1990 s to the present Here the theory and application content are considered for Foundational Methods Materials Systems Structural Systems Energy Systems Environmental Systems Domain Assessment

address challenges that ML alone does not and also show how ML in combination with DDDAS based methods can deliver the advanced capabilities sought likewise infusion of DDDAS like approaches in NN methods strengthens such methods Moreover the DDDAS based Digital Twin or Dynamic Digital Twin goes beyond the traditional DT notion where the model and the physical system are viewed side by side in a static way to a paradigm where the model dynamically interacts with the physical system through its instrumentation per the DDDAS feed back control loop between model and instrumentation

Advances in Photonics and Electronics Aavishkar Katti,Ritesh Kumar Chourasia,2024-11-21 The book presents the collated and high quality proceedings of the Conference on Recent Technologies in Electronics and Photonics held during 9 10 February 2024 at MIT WPU Pune India The main objective of this book is the introduction of recent innovations and current trends of photonics and electronics along with advanced device applications Photonics and electronics together are shaping up to be the two main pillars of innovation for sustainable development and technological advances The emphasis in this book will be on presenting recent application based research in the mentioned fields rather than purely theoretical ideas The readers will gain insights on recent innovations across many fields of photonics on one hand laser science and nonlinear optics photonic materials nanophotonics solar photovoltaics optoelectronics green photonics and fiber optics and a diverse set of topics in electronics on the other Semiconductor Electronics Electronic Materials Microelectronics AI ML Internet of Things etc The book is useful for early career researchers in Science and Engineering as also university professors and industry professionals **Advances in Control Power Systems and Emerging Technologies** Mohamed Bendaoud,Amine El Fathi,Farhad Ilahi Bakhsh,Siano Pierluigi,2024-05-31 This edited book is an outcome of the selected papers presented at the International Conference on Electrical Systems Automation ICESA 2023 held from 29 to 30 May 2023 at the Faculty of Sciences and Technologies Al Hoce ma Morocco This edited book is divided into two volumes This volume is divided into four parts each devoted to distinct yet interconnected aspects of the subject matter The first part presents the control of electrical machines and power converters It covers a comparative study of different control approaches including Proportional Integral PI Fuzzy Logic and Neural Fuzzy Logic Controllers for Boost Converters It also presents an innovative approach for single phase half bridge inverters and improved direct torque control of dual three phase permanent magnet synchronous motors Part 2 of the book titled Control Systems Automation thoroughly explores advanced control and automation technologies in electrical systems These chapters collectivelyshowcase the latest developments and research across various engineering domains Several control approaches have been discussed such as fuzzy control sliding mode control artificial neural networks ANN and machine learning The third part highlights emerging technologies and applications in various fields such as mobile robots industry 4 0 agriculture and health The chapters cover a wide range of topics including intelligent navigation for autonomous robots self driving car perception and pedestrian detection machine learning for cloud and IoT based smart agriculture outdoor navigation systems for micro tractors healthcare intelligent systems for melanoma image

classification maximizing the performance of Light Emitting Diode Luminaires The research explores innovative solutions and technologies in different domains aiming to improve functionality in various applications Part 4 of this book is dedicated to Advanced Wireless Communication and Antenna Technology This part explores cutting edge developments and innovations in the realm of wireless communication and antenna design with a focus on their applications and impact in various fields

Software Engineering and Knowledge Engineering: Theory and Practice Wei Zhang,2012-06-30 2012 International Conference on Software Engineering Knowledge Engineering and Information Engineering SEKEIE 2012 will be held in Macau April 1 2 2012 This conference will bring researchers and experts from the three areas of Software Engineering Knowledge Engineering and Information Engineering together to share their latest research results and ideas This volume book covered significant recent developments in the Software Engineering Knowledge Engineering and Information Engineering field both theoretical and applied We are glad this conference attracts your attentions and thank your support to our conference We will absorb remarkable suggestion and make our conference more successful and perfect *Embedded Devices and Internet of Things* Adesh Kumar,Surajit Mondal,Gaurav Verma,Prashant Mani,2024-09-11 The text comprehensively discusses machine to machine communication in real time low power system design and estimation using field programmable gate arrays PID hardware accelerators and software integration for service applications It further covers the recent advances in embedded computing and IoT for healthcare systems The text explains the use of low power devices such as microcontrollers in executing deep neural networks and other machine learning techniques This book Discusses the embedded system software and hardware methodologies for system on chip and FPGA Illustrates low power embedded applications AI based system design PID control design and CNN hardware design Highlights the integration of advanced 5G communication technologies with embedded systems Explains weather prediction modeling embedded machine learning and RTOS Highlights the significance of machine learning techniques on the Internet of Things IoT real time embedded system design communication and healthcare applications and provides insights on IoT applications in education fault attacks security concerns AI integration banking blockchain intelligent tutoring systems and smart technologies It is primarily written for senior undergraduates graduate students and academic researchers in the fields of electrical engineering electronics and communications engineering and computer engineering **2024-25 RRB ALP Stage-II Technician Electronics Mechanic Solved Papers** YCT Expert Team , 2024 25 RRB ALP Stage II Technician Electronics Mechanic Solved Papers 784 1495 E This book contains 129 previous solved papers and 8181 OQ

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