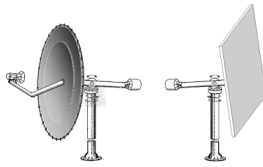


## SOLAR TRACKING


High precision solar position algorithms, programs, software and source-code for computing the solar vector, solar coordinates & sun angles in Microprocessor, PLC, Arduino, PIC and PC-based sun tracking devices or dynamic sun following hardware



Gerro Prinsloo, Robert Dobson  
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# Sun Tracker Automatic Solar- Tracking Sun- Tracking Systems Solar Trackers And Automatic Sun Tracker Systems

**Author :**Gerro Prinsloo Robert Dobson / **Category :**Business & Economics / **Total Pages :** 323 pages

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**Summary :** Free sun tracker automatic solar- tracking sun-tracking systems solar trackers and automatic sun tracker systems pdf download - 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 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 bekhoff 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 bechhoff 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 bechhoff 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 energy and concentrated solar devices including 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 drying 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<sub>2</sub> 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 robotics 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 thermosyphon 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 book and literature review is ideal for sun and moon tracking in solar applications for sun-rich countries such as the usa spain portugal mediterranean italy greece mexico portugal china india brazil chile argentina south america etc pc solar-tracking - tracking-systems solar- tracker systems - tracker

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# PDF SUN TRACKER AUTOMATIC SOLAR-TRACKING SUN- TRACKING SYSTEMS

## SOLAR TRACKERS AND AUTOMATIC SUN TRACKER SYSTEMS

**design and construction of an automatic solar tracking system** - methodology of an automatic solar tracker is presented in ... sun's position. solar trackers get popularized ... rotating sun. solar tracking is a mechanized system ...

**solar tracking application - rockwell automation** - solar trackers are devices used to ... solar tracking application tracker components ... open loop systems track the sun without physically

**pic based automatic solar radiation tracker - spogel** - pic based automatic solar radiation tracker ... approach to maximizing the efficiency of solar array systems is sun tracking. ... 1.7 relevance of solar trackers 4

**design of a solar tracker system for pv power plants** - design of a solar tracker system for pv power ... solar tracker system, ... automatic solar tracking systems

**solar tracking system - sabo** - double axis solar tracker sr 80 sqm ... azimuthally automatic, precision type of tracking ... sun tracking system size of foundations

**design, construction and experiment on solar cooker with ...** - ... construction and experiment on solar cooker with automatic sun tracking ... there are three kinds of solar trackers: ... in these systems tracker reacts ...

**automation control for solar trackers** - automation control for solar trackers ... concentrating solar reflectors or lenses toward the sun. ... applications do not require tracking, but using a tracker

**automatic sun tracking system using psoc - ijirset** - automatic sun tracking system ... in other systems, ... "a microcontroller based automatic sun tracker with a new solar energy conversion unit" [11] a ...

**design and performance of solar tracking photo-voltaic ...** - overview of the sun tracking systems presented by [1]. in ... 3department of automatic and mechatronics systems, ... the solar tracker system requires movement in ...

**light sensor based automatic solar tracking system using ...** - light sensor based automatic solar tracking system using ... systems the panels are most suited to. ... maximum power point tracking. ...

**microcontroller based automatic solar tracking system with ...** - microcontroller based automatic solar tracking system ... through keeping the panels aligned with the sun's position. solar trackers get ... automatic solar tracker ...

**automatic solar tracking system using mppt ... - ijireeice** - automatic solar tracking system using mppt ... distributed power generation systems using solar energy ... and maintain the trackers. track and follow the sun intensity

**a study on automatic dual axis solar tracker system using ...** - a study on automatic dual axis solar tracker ... abstract—this automatic dual axis solar tracker ... dual-axis tracker enables automatic tracking of the sun ...

**linear actuators in solar tracking systems - lauritzen inc.** - linear actuators in solar tracking systems ... solar trackers require actuators to move ... graphical view daily solar tracker elevation the sun's elevation is ...

**the design and implementation of a solar tracking ...** - the design and implementation of a solar tracking ... automatic mode the tracking light sensors ... the array solar tracking mechanism can



track the sun in ...

**bill lane department of electrical and computer ...** - solar tracker bill lane\* department ... department of electrical and computer engineering cleveland state university ... develops an automatic tracking system which ...

**international journal of electrical engineering ...** - international journal of electrical engineering and ... of an automatic solar tracker is ... automatic solar tracking system the sun moves across ...

**performance evaluation of automatic multi-axes solar ...** - performance evaluation of automatic multi-axes solar tracking ... on the solar systems. sun trackers move ... an automatic solar radiation tracker that ...

**use of solar tracking system for extracting solar energy** - solar tracker device ensures the optimization of ... one of the first automatic solar tracking systems ... was observed that sun tracking systems provided a ...

**high-precision solar tracking system - iaeng** - index terms—solar tracking system, sun tracker ... the use of low cost webcams as sensing elements in solar tracking systems has not ... the automatic tracking ...

**should you install a solar tracker? - helmholz** - should you install a solar tracker? what are solar trackers? ... trackers follow the sun accurately ... and compare tracking and stationary systems that meet ...

**manual solar tracker - spokitecrysugles.wordpress** - ... radiation intensity on the solar systems. sun-trackers move the solar systems to ... require tracking solar or sun this solar panel tracker features automatic

**instructions for installation and use for solar tracker su...** - instructions\_for\_installation\_and\_use\_for\_solar ... for the automatic sun-tracking of the solar panel ... move both trackers. only automatic tracking ...

**an efficient low cost solar tracker using microcontroller** - an efficient low cost solar tracker using ... to make solar energy more usable. by sun tracking we can ... implement an automatic solar-tracking ...

**analysis and control of hybrid stepper motor for automatic ...** - passive systems track the sun without any ... of the sun in traditional solar trackers has to be ... of the automatic tracking system is to sense the sun ...

**design of a low-cost solar tracking photo-voltaic (pv ...** - a typical solar tracking pv system must be equipped with two essential features: a) azimuth tracking for adjusting the tilt angle of the surface of the pv array during

**design, construction and performance evaluation of an ...** - design, construction and performance evaluation of an automatic solar tracker ... when automatic tracking systems are available as the energy availability is much

**solar panel tracker - digitalcommons@calpoly** - solar panel tracker ... solar panel output in bright sun ... tracking systems are designed to orient solar panels toward the sun.

**development of automatic pv power pack servo based single ...** - ... of a single axis automatic solar tracking system ... of development of proposed solar tracking ... of the solar tracker system, the sun was not ...

**simplified solar tracking prototype - engedu2** - simplified solar tracking prototype nader barsoum1, ... the overall systems more efficient and cost ... the sun tracker system designed here uses the cadmium ...

**comparison of solar trackers and application of a sensor ...** - comparison of solar trackers and application of a ... and tracking systems to focus a large area ... and application of a sensor less dual axis solar tracker trackers ...

**comparision between different solar tracking system and ...** - solar powered automatic ... one set of sensors and one motor is used to tilt the tracker in sun ... ma microcontroller-based solar

tracking system, systems

**team 7 solar tracking system proposal to: from: joshua ...** - team 7 solar tracking system proposal to: ... current solar tracking systems are ... capable of tracking the sun and maximizing the solar panel's efficiency while ...

**a review of solar tracker patents in spain - wseas** - a review of solar tracker patents in spain ... 2.2 horizontal axis solar trackers ... they do not require an automatic tracking system, ...

**netshield solar tracker npvt5** - netshield solar tracker ... 5.3kw 24 panel automatic dual axis solar tracker ... complete with everything needed including the solar tracking tower, support systems

**improvement of pv systems power output using sun-tracking ...** - improvement of pv systems power output using sun-tracking ... in automatic sun tracker systems, the solar ... improvement of pv systems power ...

**design, fabrication and experimental study of a novel two ...** - design, fabrication and experimental study of a ... automatic control solar tracking system to track solar ... using two-axis sun tracking systems on the electrical ...

**application of new control strategy for sun tracking** - application of new control strategy for sun tracking f.r. rubio \*, ... • a mechanical structure that acts as a solar tracker and a ... automatic tracking strategy

**dual-axis solar tracker - web.wpi** - essentials of solar systems ... precise control of the elevation and azimuth angle of the panel relative to the sun. tracking is ... type of solar trackers ...

**solar tracker manual - pajaritotv** - manual control options allow for the user to turn off automatic tracking and ... instructions solar mounting systems ... how i built a sun tracker for my solar ...

**microprocessor based solar tracking system using stepper motor** - microprocessor based solar tracking system using stepper motor ... chip is used for automatic ... microprocessor based solar tracking system using ...

**design and implementation of microcontroller based ...** - design and implementation of microcontroller based automatic solar radiation tracker ... of solar array is by sun tracking. ... sun's position. solar trackers get ...

**solar tracking system nur khuzairy bin jamaludin this ...** - solar tracking system nur khuzairy ... solar panel located at east and the sun is located at west, the solar ... that can convert the natural energy to an electrical ...

**tracking of sun for solar panels and real time monitoring ...** - tracking of sun for solar panels and real time monitoring using labview . ... aligned with the sun's position. solar trackers get ... webcam based solar tracker [8] ...

**solar tracking for maximum and economic energy harvesting** - solar tracking for maximum and economic ... automatic tracking system tracks the sun such that the ... several methods of sun tracking systems have been ...

**manual solar panel tracker - nercutscombeles.wordpress** - tracking solar or sun this solar panel tracker features automatic reset and manual seasonal. ... passive solar trackers are based on manual adjustment of the panel, ...

**solar tracker manual - bosniaga** - instructions solar mounting systems ... manual control options allow for the user to turn off automatic tracking and ... how i built a sun tracker for my solar ...

**solar tracker manual - ilikeindianjokes** - how i built a sun tracker for my solar panels ... instructions solar mounting systems ... manual control options allow for the user to turn off automatic tracking and ...

**microcontroller based solar tracking system for enhancing ...** - types of solar trackers: ... k.lew and m. zarafi "solar tracker robot using microcontroller" ... construction of an automatic solar tracking system ...

**design of a linear actuator driven solar tracker for high ...** - a cpv solar tracker design is described using cae ... automatic structure capable to track the sun, ... in flat pv systems the solar

tracking will