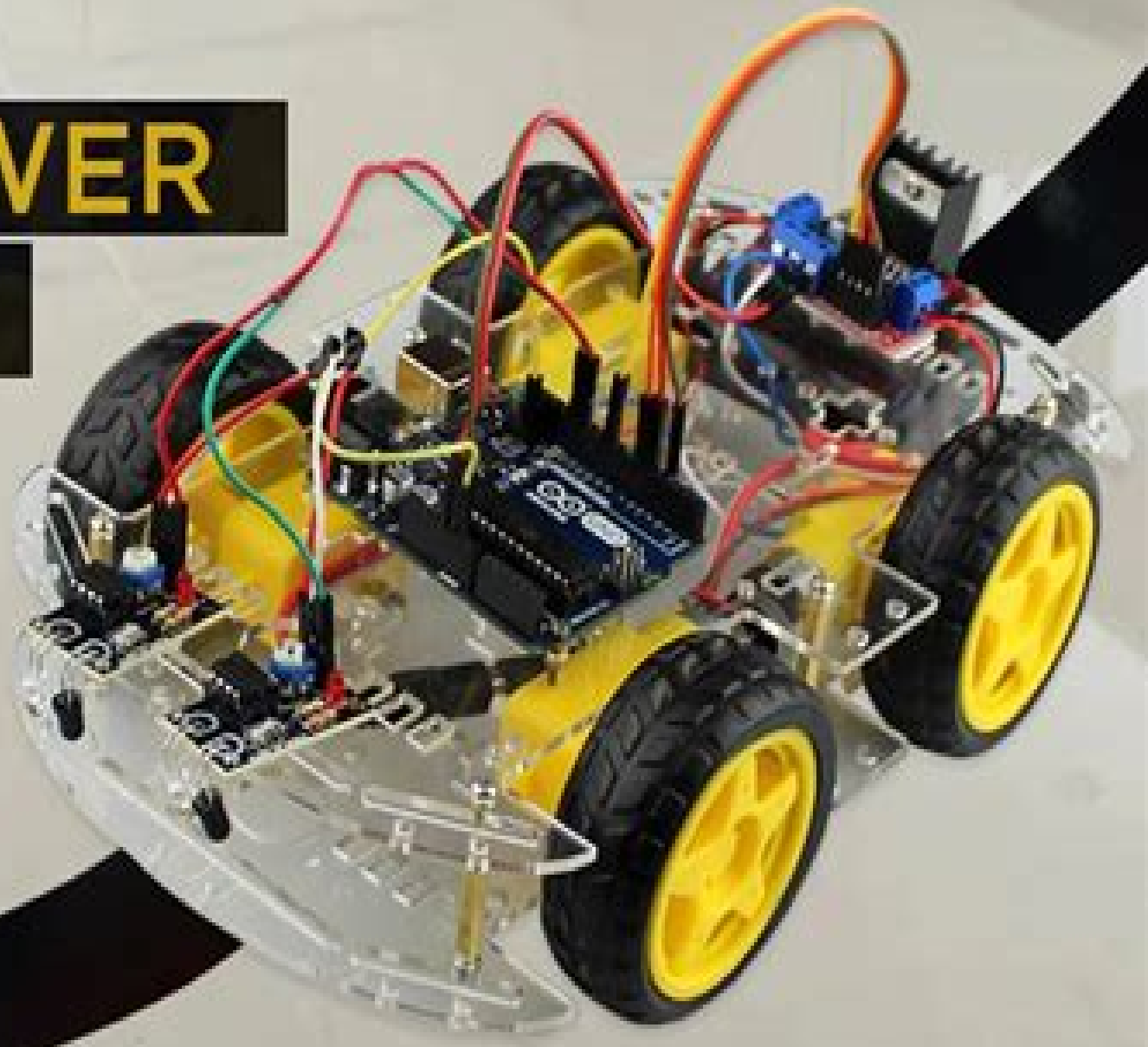LINE FOLLOWER ROBOT

Object Follower Robot Circuit

Clemens Wendtner

Object Follower Robot Circuit:

Hands-On Robotics Programming with C++ Dinesh Tavasalkar,2019-03-30 Enhance your programming skills to build exciting robotic projects Key Features Build an intelligent robot that can detect and avoid obstacles and respond to voice commands Detect and track objects and faces using OpenCV Control your robot with a GUI button designed using Qt5 Book DescriptionC is one of the most popular legacy programming languages for robotics and a combination of C and robotics hardware is used in many leading industries This book will bridge the gap between Raspberry Pi and C C programming and enable you to develop applications for Raspberry Pi You ll even be able to implement C programs in Raspberry Pi with the WiringPi library The book will guide you through developing a fully functional car robot and writing programs to move it in different directions You ll then create an obstacle avoiding robot using an ultrasonic sensor In addition to this you ll find out how to control the robot wirelessly using your PC or Mac This book will also help you work with object detection and tracking using OpenCV and guide you through exploring face detection techniques Finally you will create an Android app and control the robot wirelessly with an Android smartphone By the end of this book you will have gained experience in developing a robot using Raspberry Pi and C C programming What you will learn Install software on a Raspberry Pi compatible with C programming Program the Raspberry Pi in C to run a motor Control a Raspberry Pi powered robot wirelessly with your laptop or PC Program a Raspberry Pi camera using OpenCV Control a Raspberry Pi robot with voice commands Implement face and object detection with Raspberry Pi Who this book is for This book is for developers programmers and robotics enthusiasts interested in leveraging C to build exciting robotics applications Prior knowledge of C is necessary to understand the projects covered in this book *Advances in Power Systems and Energy Management* Neeraj Priyadarshi,Sanjeevikumar Padmanaban,Ranjan Kumar Ghadai,Amiya Ranjan Panda,Ranjeeta Patel,2021-01-20 This book comprises select proceedings of the international conference ETAEERE 2020 and focuses on contemporary issues in energy management and energy efficiency in the context of power systems The contents cover modeling simulation and optimization based studies on topics like medium voltage BTB system cost optimization of a ring frame unit in textile industry rectenna for RF energy harvesting ecology and energy dimension in infrastructural designs study of AGC in two area hydro thermal power system energy efficient and reliable depth based routing protocol for underwater wireless sensor network and power line communication This book can be beneficial for students researchers as well as industry professionals **Computational Modelling of Objects Represented in Images III** Paolo Di Giamberardino,Daniela Iacoviello,João Manuel R.S. Tavares,R.M. Natal Jorge,2012-08-24 Computational Modelling of Objects Represented in Images Fundamentals Methods and Applications III contains all contributions presented at the International Symposium CompIMAGE 2012 Computational Modelling of Object Presented in Images Fundamentals Methods and Applications Rome Italy 5 7 September 2012 The contributions cover the state of art and new trends in the fields of 3D Vision Biometric Recognition Computational Bioimaging and Visualization

Computer Vision in Robotics and Automation Data Acquisition Interpolation Registration and Compression Image Enhancement and Restoring Image Processing and Analysis Image Segmentation Medical Imaging Modeling and Simulation Motion and Deformation Analysis Remote Sensing Scientific Visualization Computational Modelling of Objects Represented in Images Fundamentals Methods and Applications III addresses different techniques such as optimization methods geometry finite element method principal component analysis stochastic methods neural networks and fuzzy logic The book is useful to researchers and students with multidisciplinary interests related to Computational Vision Computational Mechanics Medicine Engineering and Architecture   123 Robotics Experiments for the Evil Genius Myke Predko,2003-05-21 123 ROBOT EXPERIMENTS 123 STEPS NEEDED TO BRING OUT THE GENIUS IN EVERY BASEMENT HOBBYIST If you enjoy tinkering in your workshop and have a fascination for robotics you ll have hours of fun working through the 123 experiments found in this innovative project book More than just an enjoyable way to spend time these exciting experiments also provide a solid grounding in robotics electronics and programming Each experiment builds on the skills acquired in those before it so you develop a hands on nuts and bolts understanding of robotics from the ground up 123 Robotics Projects for the Evil Genius Introduces you to robotics electronics and programming for robotics step by step you don t need to be a science whiz to get started but you will be when you have finished Vividly explains the science behind robots and the technologies needed to build them including Electronics Mechanical assembly Motors and batteries Programming and microcontrollers Shows how you can create simple robots and models using materials found around the house and workroom Requires only inexpensive easily obtained parts and tools Provides a PCB printed circuit board that will make it easy to create the circuits used in this book as well as your own experiments Gives you directions for building a maze solving robot two different designs for a light seeking robot an artificial intelligence program that will respond to you and much more Explains underlying principles and suggests other applications Supplies parts lists and program listings IMAGINATIVE EXPERIMENTS THAT TEACH THE BASICS WHILE PROVIDING HOURS OF FUN   Tracking of Moving Objects in Video Sequences S R Boselin Prabhu,, S Sheeba Rani and V Kamatchi Sundari,V Kamatchi Sundari,2018-09-10 Object tracking could be a terribly difficult task within the presence of variability illumination condition background motion complicated object form partial and full object occlusions The main intention of an object trailer is to make the path of an object over time by characteristic its position in all frames of the video This book is intended to educate the researchers in the field of tracking of moving object s in a video sequence This book provides a path for the researchers to identify the works done by others in the same field and thereby to figure out the gap in the current knowledge This book is organized into three Modules Module 1 talks about the introduction of object detection and tracking Module 2 discusses about the various studies of object tracking and motion detection The views of the various authors about this hot research topic are discussed in this Module and Module 3 gives the conclusion of the entire research review Object tracking could be a terribly difficult task within the presence of variability illumination

condition background motion complicated object form partial and full object occlusions The main intention of an object trailer is to make the path of an object over time by characteristic its position in all frames of the video This book is intended to educate the researchers in the field of tracking of moving object s in a video sequence This book provides a path for the researchers to identify the works done by others in the same field and thereby to figure out the gap in the current knowledge This book is organized into three Modules Module 1 talks about the introduction of object detection and tracking Module 2 discusses about the various studies of object tracking and motion detection The views of the various authors about this hot research topic are discussed in this Module and Module 3 gives the conclusion of the entire research review

Measurement, Instrumentation, and Sensors Handbook John G. Webster,Halit Eren,2017-12-19 The Second Edition of the bestselling Measurement Instrumentation and Sensors Handbook brings together all aspects of the design and implementation of measurement instrumentation and sensors Reflecting the current state of the art it describes the use of instruments and techniques for performing practical measurements in engineering physics chemistry and the life sciences and discusses processing systems automatic data acquisition reduction and analysis operation characteristics accuracy errors calibrations and the incorporation of standards for control purposes Organized according to measurement problem the Electromagnetic Optical Radiation Chemical and Biomedical Measurement volume of the Second Edition Contains contributions from field experts new chapters and updates to all 98 existing chapters Covers sensors and sensor technology time and frequency signal processing displays and recorders and optical medical biomedical health environmental electrical electromagnetic and chemical variables A concise and useful reference for engineers scientists academic faculty students designers managers and industry professionals involved in instrumentation and measurement research and development Measurement Instrumentation and Sensors Handbook Second Edition Electromagnetic Optical Radiation Chemical and Biomedical Measurement provides readers with a greater understanding of advanced applications **Autonomous Robots and Agents** Gourab Sen Gupta,2007-08-14 This book collects the extended versions of the best papers presented at the 3rd International Conference on Autonomous Robots and Agents ICARA 2006 held at Palmerston North New Zealand December 2006 It covers theoretical and methodological aspects of incorporating intelligence in autonomous robots and agents detailing the collaborative efforts and methods needed to overcome challenges faced in the real world and accomplish complex tasks **Handbook of Modern Sensors** Jacob Fraden,2010-09-22 Since publication of the previous the 3rd edition of this book the sensor tech logies have made a remarkable leap ahead The sensitivity of the sensors became higher the dimensions smaller the selectivity better and the prices lower What have not changed are the fundamental principles of the sensor design They still are governed by the laws of Nature Arguably one of the greatest geniuses ever lived Leonardo Da Vinci had his own peculiar way of praying It went like this Oh Lord thanks for Thou don t violate Thy own laws It is comforting indeed that the laws of Nature do not change with time it is just that our appreciation of them becomes re ned

Thus this new edition examines the same good old laws of Nature that form the foundation for designs of various sensors This has not changed much since the previous editions Yet the sections that describe practical designs are revised substantially Recent ideas and developments have been added while obsolete and less important designs were dropped This book is about devices commonly called sensors The invention of a microprocessor has brought highly sophisticated instruments into our everyday life Numerous computerized appliances of which microprocessors are integral parts wash clothes and prepare coffee play music guard homes and control room temperature Sensors are essential components in any device that uses a digital signal processor **Methodologies For The Conception, Design, And Application Of Intelligent Systems - Proceedings Of The 4th International Conference On Soft Computing (In 2 Volumes)** Gen Matsumoto,Takeshi Yamakawa,1996-08-31 IIZUKA 96 the 4th International Conference on Soft Computing emphasized the integration of the components of soft computing to promote the research work on post digital computers and to realize the intelligent systems At the conference new developments and results in soft computing were introduced and discussed by researchers from academic governmental and industrial institutions This volume presents the opening lectures by Prof Lotfi A Zadeh and Prof Walter J Freeman the plenary lectures by seven eminent researchers and about 200 carefully selected papers drawn from more than 20 countries It documents current research and in depth studies on the conception design and application of intelligent systems **Computational Modeling of Objects Presented in Images** Paolo Di Giamberardino,Daniela Iacoviello,Renato Natal Jorge,João Manuel R. S. Tavares,2014-02-01 This book contains extended versions of selected papers from the 3rd edition of the International Symposium CompIMAGE These contributions include cover methods of signal and image processing and analysis to tackle problems found in medicine material science surveillance biometric robotics defence satellite data traffic analysis and architecture image segmentation 2D and 3D reconstruction data acquisition interpolation and registration data visualization motion and deformation analysis and 3D vision Sun Tracking and Solar Renewable Energy Harvesting Gerro Prinsloo,Robert Dobson,2015-11-02 Free to download eBook on Practical Solar Tracking Design Solar Tracking Sun Tracking Sun Tracker Solar Tracker Follow Sun Sun Position calculation Azimuth Elevation Zenith Sun following Sunrise Sunset Moon phase Moonrise Moonset calculators In harnessing power from the sun through a solar tracker or solar tracking system renewable energy system developers require automatic solar tracking software and solar position algorithms 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 Eco Friendly and Environmentally Sustainable Micro Combined Solar Heat and Power m CHP m CCHP m CHCP with Microgrid Storage and Layered Smartgrid Control towards Supplying Off Grid Rural Villages in developing BRICS countries such as Africa India China and Brazil Off grid rural villages and isolated islands areas require mCHP and trigeneration solar power

plants and associated isolated smart microgrid solutions to serve the community energy needs This article describes the development progress for such a system also referred to as solar polygeneration The system includes a sun tracker mechanism wherin a parabolic dish or lenses are guided by a light sensitive mechanique in a way that the solar receiver is always at right angle to the solar radiation Solar thermal energy is then either converted into electrical energy through a free piston Stirling or stored in a thermal storage container The project includes the thermodynamic modeling of the plant in Matlab Simulink as well as the development of an intelligent control approach that includes smart microgrid distribution and optimization The book includes aspects in the simulation and optimization of stand alone hybrid renewable energy systems and co generation in isolated or islanded microgrids It focusses on the stepwise development of a hybrid solar driven micro combined cooling heating and power mCCHP compact trigeneration polygeneration and thermal energy storage TES system with intelligent weather prediction weak ahead scheduling time horizon and look ahead dispatch on integrated smart microgrid distribution principles The solar harvesting and solar thermodynamic system includes an automatic sun tracking platform based on a PLC controlled mechatronic sun tracking system that follows the sun progressing across the sky An intelligent energy management and adaptive learning control optimization approach is proposed for autonomous off grid remote power applications both for thermodynamic optimization and smart micro grid optimization for distributed energy resources DER The correct resolution of this load following multi objective optimization problem is a complex task because of the high number and multi dimensional variables the cross correlation and interdependency between the energy streams as well as the non linearity in the performance of some of the system components Exergy based control approaches for smartgrid topologies are considered in terms of the intelligence behind the safe and reliable operation of a microgrid in an automated system that can manage energy flow in electrical as well as thermal energy systems The standalone micro grid solution would be suitable for a rural village intelligent building district energy system campus power shopping mall centre isolated network eco estate or remote island application setting where self generation and decentralized energy system concepts play a role Discrete digital simulation models for the thermodynamic and active demand side management systems with digital smartgrid control unit to optimize the system energy management is currently under development Parametric simulation models for this trigeneration system polygeneration poligeneration quadgeneration are developed on the Matlab Simulink and TrnSys platforms In terms of model predictive coding strategies the automation controller will perform multi objective cost optimization for energy management on a microgrid level by managing the generation and storage of electrical heat and cooling energies in layers Each layer has its own set of smart microgrid priorities associated with user demand side cycle predictions Mixed Integer Linear Programming and Neural network algorithms are being modeled to perform Multi Objective Control optimization as potential optimization and adaptive learning techniques **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 **Algorithmic Foundations of Robotics XI** H. Levent Akin,Nancy M. Amato,Volkan Isler,A. Frank van der Stappen,2015-04-30 This carefully edited volume is the outcome of the eleventh edition of the Workshop on Algorithmic Foundations of Robotics WAFR which is the premier venue showcasing cutting edge research in algorithmic robotics The eleventh WAFR which was held August 3 5 2014 at Bo azi i University in Istanbul Turkey continued this tradition This volume contains extended versions of the 42 papers presented at WAFR These contributions highlight the cutting edge research in classical robotics problems e g manipulation motion path multi robot and kinodynamic planning geometric and topological computation in robotics as well novel applications such as informative path planning active sensing and surgical planning This book rich by topics and authoritative contributors is a unique reference on the current developments and new directions in the field of algorithmic foundations Practical Solar Tracking Automatic Solar Tracking Sun Tracking Автоматическое удержание Солнечная слежения BC 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 CO_2 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   **Robotic Systems: Concepts, Methodologies, Tools, and Applications** Management Association, Information Resources,2020-01-03 Through expanded intelligence the use of robotics has fundamentally transformed a variety of fields including manufacturing aerospace medicine social services and agriculture Continued research on robotic design is critical to solving various dynamic obstacles individuals enterprises and humanity at large face on a daily basis Robotic Systems Concepts Methodologies Tools and Applications is a vital reference source that delves into the current issues methodologies and trends relating to advanced robotic technology in the modern world Highlighting a range of topics such as mechatronics cybernetics and human computer interaction this multi volume book is ideally designed for robotics engineers mechanical engineers robotics technicians operators software engineers designers programmers industry professionals researchers students academicians and computer practitioners seeking current research on developing innovative ideas for intelligent and autonomous robotics systems   **Memristors and Memristive Systems** Ronald Tetzlaff,2013-12-11 This book provides a comprehensive overview of current research on memristors memcapacitors and meminductors In addition to an historical overview of the research in this area coverage includes the theory behind memristive circuits as well as memcapacitance and meminductance Details are shown for recent applications of memristors for resistive random access memories neuromorphic systems and hybrid CMOS memristor circuits Methods for the simulation of memristors are demonstrated and an introduction to neuromorphic modeling is provided   *Neuromorphic Engineering Systems and Applications* Chiara Bartolozzi,Emre O. Neftci,Elisabetta Chicca,2021-12-01   *Neural Systems for Robotics* Omid Omidvar,Patrick van der Smagt,1997-04-10 Neural Systems for Robotics represents the most up to date developments in the rapidly growing aplication area of neural networks which is one of the hottest application areas for neural networks technology The book not only contains a comprehensive study of neurocontrollers in complex Robotics systems written by highly respected researchers in the field but outlines a novel approach to solving

Robotics problems The importance of neural networks in all aspects of Robot arm manipulators neurocontrol and Robotic systems is also given thorough and in depth coverage All researchers and students dealing with Robotics will find Neural Systems for Robotics of immense interest and assistance Focuses on the use of neural networks in robotics one of the hottest application areas for neural networks technology Represents the most up to date developments in this rapidly growing application area of neural networks Contains a new and novel approach to solving Robotics problems **Smart Agriculture Automation Using Advanced Technologies** Amitava Choudhury,Arindam Biswas,T. P. Singh,Santanu Kumar Ghosh,2022-01-01 This book addresses the challenges for developing and emerging trends in Internet of Things IoT for smart agriculture platforms It also describes data analytics machine learning cloud architecture automation robotics and aims to overcome existing barriers for smart agriculture with commercial viability It discusses IoT based monitoring systems for analyzing the crop environment and methods for improving the efficiency of decision making based on the analysis of harvest statistics The book explores a range of applications including intelligent field monitoring intelligent data processing and sensor technologies predictive analysis systems crop monitoring and weather data enabled analysis in IoT agro systems This volume will be helpful for engineering and technology experts and researchers as well as for policy makers Proceedings of International Conference on Computational Intelligence and Data Engineering Nabendu Chaki,Nagaraju Devarakonda,Agostino Cortesi,2023-06-17 This book is a collection of high quality research work on cutting edge technologies and the most happening areas of computational intelligence and data engineering It includes selected papers from the International Conference on Computational Intelligence and Data Engineering ICCIDE 2022 It covers various topics including collective intelligence intelligent transportation systems fuzzy systems Bayesian network ant colony optimization data privacy and security data mining data warehousing big data analytics cloud computing natural language processing swarm intelligence and speech processing

The book delves into Object Follower Robot Circuit. Object Follower Robot Circuit is a crucial topic that needs to be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Object Follower Robot Circuit, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:

   - Chapter 1: Introduction to Object Follower Robot Circuit
   - Chapter 2: Essential Elements of Object Follower Robot Circuit
   - Chapter 3: Object Follower Robot Circuit in Everyday Life
   - Chapter 4: Object Follower Robot Circuit in Specific Contexts
   - Chapter 5: Conclusion

2. In chapter 1, the author will provide an overview of Object Follower Robot Circuit. The first chapter will explore what Object Follower Robot Circuit is, why Object Follower Robot Circuit is vital, and how to effectively learn about Object Follower Robot Circuit.
3. In chapter 2, this book will delve into the foundational concepts of Object Follower Robot Circuit. The second chapter will elucidate the essential principles that must be understood to grasp Object Follower Robot Circuit in its entirety.
4. In chapter 3, the author will examine the practical applications of Object Follower Robot Circuit in daily life. The third chapter will showcase real-world examples of how Object Follower Robot Circuit can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Object Follower Robot Circuit in specific contexts. The fourth chapter will explore how Object Follower Robot Circuit is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, the author will draw a conclusion about Object Follower Robot Circuit. This chapter will summarize the key points that have been discussed throughout the book.
   The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Object Follower Robot Circuit.

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Object Follower Robot Circuit Introduction

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