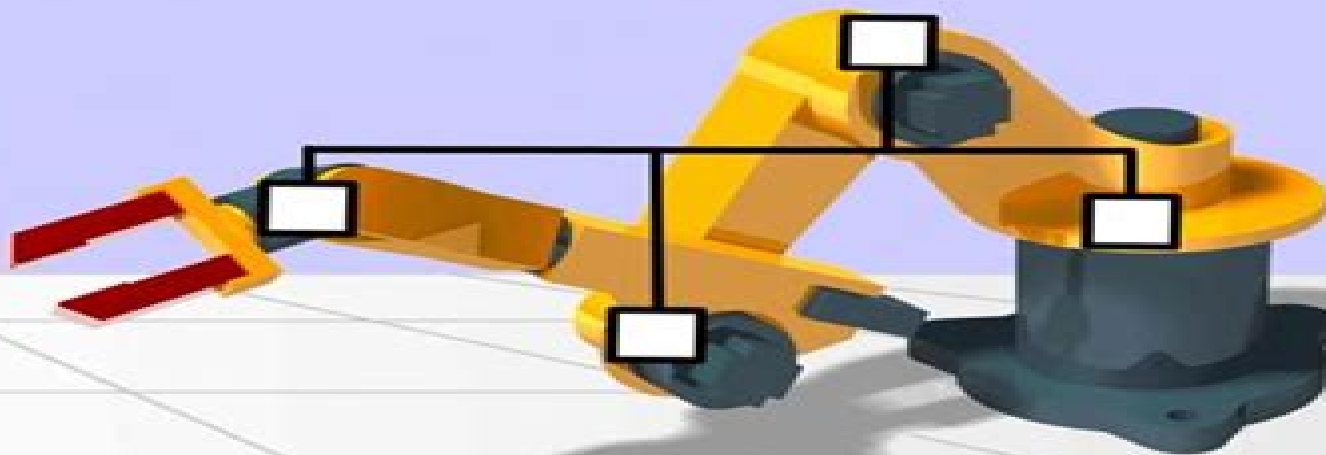Olaf Pfeiffer, Andrew Ayre, and Christian Keydel

Embedded Networking with
CAN and CANopen

- Requirements for understanding embedded networking code and communications
- The underlying CAN technology
- Selecting CAN controllers
- Implementation options
- Application-specific examples of popular device profiles

Embedded Networking With Can And Canopen

Karin Nielsen-Saines

Embedded Networking With Can And Canopen:

    Embedded Networking with CAN and CANopen Olaf Pfeiffer,Andrew Ayre,Christian Keydel,2008 CAN Controller Area Network is a serial communication protocol that was originally developed for the automobile industry CAN is far superior to conventional serial technologies such as RS232 in regards to functionality and reliability and yet CAN implementations are more cost effective CANopen a higher layer protocol based on CAN provides the means to apply the ingenious CAN features to a variety of industrial strength applications Many users for example in the field of medical engineering opted for CANopen because they have to meet particularly stringent safety requirements Similar requirements had to be considered by manufacturers of other equipment with very high safety or reliability requirements e g robots lifts and transportation systems Providing a detailed look at both CAN and CANopen this book examines those technologies in the context of embedded networks There is an overview of general embedded networking and an introduction to the primary functionality provided by CANopen Everything one needs to know to configure and operate a CANopen network using off the shelf components is described along with details for those designers who want to build their own CANopen nodes The wide variety of applications for CAN and CANopen is discussed and instructions in developing embedded networks based on the protocol are included In addition references and examples using MicroCANopen PCANopen Magic and Vector s high end development tools are provided   *Embedded Networking with CAN and CANopen* Olaf Pfeiffer,Andrew Ayre,Christian Keydel,2016-06-28 CAN Controller Area Network is a serial communication protocol that was originally developed for the automobile industry CAN is far superior to conventional serial technologies such as RS232 in regards to functionality and reliability and yet CAN implementations are more cost effective CANopen a higher layer protocol based on CAN provides the means to apply the ingenious CAN features to a variety of industrial strength applications Many users for example in the field of medical engineering opted for CANopen because they have to meet particularly stringent safety requirements Similar requirements had to be considered by manufacturers of other equipment with very high safety or reliability requirements e g robots lifts and transportation systems Providing a detailed look at both CAN and CANopen this book examines those technologies in the context of embedded networks There is an overview of general embedded networking and an introduction to the primary functionality provided by CANopen Everything one needs to know to configure and operate a CANopen network using off the shelf components is described along with details for those designers who want to build their own CANopen nodes The wide variety of applications for CAN and CANopen is discussed and instructions in developing embedded networks based on the protocol are included In addition references and examples using MicroCANopen PCANopen Magic and Vector s high end development tools are provided   *A Comprehensible Guide to Controller Area Network* Wilfried Voss,2008 Controller Area Network CAN is a serial network technology that was originally designed for the automotive industry but has also become a popular bus in industrial automation The CAN bus is primarily used in embedded solutions and provides communication

among microprocessors up to real time requirements A Comprehensible Guide To Controller Area Network represents a very thoroughly researched and complete work on CAN It provides information on all CAN features and aspects combined with high level of readability Book jacket **Implementing Scalable CAN Security with CANcrypt** Olaf Pfeiffer,2017-03-15 When the Controller Area Network CAN was designed security was not a requirement The primary usage of CAN was considered closed possible intruders or attackers would simply not get physical or remote access to the network However today it is more and more common that devices connected to a CAN system also have connections to other networks including the Internet Recent car hacks have shown that attackers may get access to CAN systems Without strong security features an attacker automatically gains full access to everything connected allowing active control commands to be recorded and replayed In this book we examine which options developers of CAN based systems realistically can use to provide adequate security features What can we do Without introducing classical security features To detect possibly injected messages Without any hardware change With minimal software change and integration effort We introduce the open CANcrypt protocol and software interface which provides a scalable and customizable CAN security system Depending on the application requirements and resources available in the individual devices various protection levels can be realized

Understanding and Using the Controller Area Network Communication Protocol Marco Di Natale,Haibo Zeng,Paolo Giusto,Arkadeb Ghosal,2012-01-19 This book to offers a hands on guide to designing analyzing and debugging a communication infrastructure based on the Controller Area Network CAN bus Although the CAN bus standard is well established and currently used in most automotive systems as well as avionics medical systems and other devices its features are not fully understood by most developers who tend to misuse the network This results in lost opportunities for better efficiency and performance These authors offer a comprehensive range of architectural solutions and domains of analysis It also provides formal models and analytical results with thorough discussion of their applicability so that it serves as an invaluable reference for researchers and students as well as practicing engineers **Fieldbus Systems and Their Applications 2005** Miguel Leon Chavez,2006-11-23 The FeT series Fieldbus Systems and their Applications Conferences started in 1995 in Vienna Austria Since FeT 2001 in Nancy France the conference became an IFAC International Federation of Automatic Control sponsored event These proceedings focus on 13 sessions covering fieldbus based systems services protocols and profiles system integration with heterogeneous networks management real time safety dependability and security distributed embedded systems wireless networking for field applications education and emerging trends Two keynote speeches from experts outside Europe are featured The first one entitled Bandwidth Allocation Scheme in Fieldbuses by Prof Seung Ho Hanyang University Korea The second by Prof I F Akyildiz Georgia Institute of Technology USA Key Technologies for Wireless Networking in the Next Decade Featuring 36 high quality papers from 13 countries Keynote speech reflecting the current interest of wireless communications for industrial applications FeT 2005 was supported by a

International Program Committee of around 40 members from 15 countries 6 from Europe   CAN System Engineering Wolfhard Lawrenz,2013-12-05 This book addresses the various challenges and open questions relating to CAN communication networks Opening with a short introduction into the fundamentals of CAN the book then examines the problems and solutions for the physical layout of networks including EMC issues and topology layout Additionally a discussion of quality issues with a particular focus on test techniques is presented Each chapter features a collection of illuminating insights and detailed technical information supplied by a selection of internationally regarded experts from industry and academia Features presents thorough coverage of architectures implementations and application of CAN transceiver data link layer and so called higher layer software explains CAN EMC characteristics and countermeasures as well as how to design CAN networks demonstrates how to practically apply and test CAN systems includes examples of real networks from diverse applications in automotive engineering avionics and home heating technology   **Autonomic and Trusted Computing** Jose M. Alcaraz Calero,Laurence T. Yang,Felix Gomez-Marmol,Luis Javier García Villalba,Andy Xiaolin Li,Yan Wang,2011-08-19 This book constitutes the refereed proceedings of the 8th International Conference on Autonomic and Trusted Computing ATC 2011 held in Banff Canada September 2011 The 17 revised full papers presented together with 1 keynote speech were carefully reviewed and selected from numerous submissions The papers address all current issues in autonomic architectures models and systems autonomic communications trusted and secure computing reliable secure and trust applications   **Sliding-Mode Fuzzy Controllers** Mojtaba Ahmadieh Khanesar,Okyay Kaynak,Erdal Kayacan,2021-07-21 This book addresses some of the challenges suffered by the well known and robust sliding mode control paradigm The authors show how the fusion of fuzzy systems with sliding mode controllers can alleviate some of these problems and promote applicability Fuzzy systems used as soft switches eliminate high frequency signal oscillations and can substantially lower the noise sensitivity of sliding mode controllers The amount of a priori knowledge required concerning the nominal structure and parameters of a nonlinear system is also shown to be much reduced by exploiting the general function approximation property of fuzzy systems so as to use them as identifiers The main features of this book include a review of various existing structures of sliding mode fuzzy control a guide to the fundamental mathematics of sliding mode fuzzy controllers and their stability analysis state of the art procedures for the design of a sliding mode fuzzy controller source codes including MATLAB and Simulink codes illustrating the simulation of these controllers particularly the adaptive controllers a short bibliography for each chapter for readers interested in learning more on a particular subject and illustrative examples and simulation results to support the main claims made in the text Academic researchers and graduate students interested in the control of nonlinear systems and particularly those working in sliding mode controller design will find this book a valuable source of comparative information on existing controllers and ideas for the development of new ones   **Event Data Recorder (EDR) Interpretation** Christopher D Armstrong,2018-11-02 Collision Reconstruction

Methodologies Volume 7A The last ten years have seen explosive growth in the technology available to the collision analyst changing the way reconstruction is practiced in fundamental ways The greatest technological advances for the crash reconstruction community have come in the realms of photogrammetry and digital media analysis The widespread use of scanning technology has facilitated the implementation of powerful new tools to digitize forensic data create 3D models and visualize and analyze crash vehicles and environments The introduction of unmanned aerial systems and standardization of crash data recorders to the crash reconstruction community have enhanced the ability of a crash analyst to visualize and model the components of a crash reconstruction Because of the technological changes occurring in the industry many SAE papers have been written to address the validation and use of new tools for collision reconstruction Collision Reconstruction Methodologies Volumes 1 12 bring together seminal SAE technical papers surrounding advancements in the crash reconstruction field Topics featured in the series include Night Vision Study and Photogrammetry Vehicle Event Data Recorders Motorcycle Heavy Vehicle Bicycle and Pedestrian Accident Reconstruction The goal is to provide the latest technologies and methodologies being introduced into collision reconstruction appealing to crash analysts consultants and safety engineers alike **Real-Time Sensor Networks and Systems for the Industrial IoT** Christos Koulamas,Mihai T. Lazarescu,2020-11-18 The Industrial Internet of Things Industrial IoT IIoT has emerged as the core construct behind the various cyber physical systems constituting a principal dimension of the fourth Industrial Revolution While initially born as the concept behind specific industrial applications of generic IoT technologies for the optimization of operational efficiency in automation and control it quickly enabled the achievement of the total convergence of Operational OT and Information Technologies IT The IIoT has now surpassed the traditional borders of automation and control functions in the process and manufacturing industry shifting towards a wider domain of functions and industries embraced under the dominant global initiatives and architectural frameworks of Industry 4 0 or Industrie 4 0 in Germany Industrial Internet in the US Society 5 0 in Japan and Made in China 2025 in China As real time embedded systems are quickly achieving ubiquity in everyday life and in industrial environments and many processes already depend on real time cyber physical systems and embedded sensors the integration of IoT with cognitive computing and real time data exchange is essential for real time analytics and realization of digital twins in smart environments and services under the various frameworks provisions In this context real time sensor networks and systems for the Industrial IoT encompass multiple technologies and raise significant design optimization integration and exploitation challenges The ten articles in this Special Issue describe advances in real time sensor networks and systems that are significant enablers of the Industrial IoT paradigm In the relevant landscape the domain of wireless networking technologies is centrally positioned as expected **Industrial IoT** Ismail Butun,2020-07-01 The proliferation of Internet of Things IoT has enabled rapid enhancements for applications not only in home and environment scenarios but also in factory automation Now Industrial Internet of Things IIoT offers all the advantages of IoT

to industry with applications ranging from remote sensing and actuating to de centralization and autonomy In this book the editor presents the IIoT and its place during the new industrial revolution Industry 4 0 as it takes us to a better sustainable automated and safer world The book covers the cross relations and implications of IIoT with existing wired wireless communication networking and safety technologies of the Industrial Networks Moreover the book includes practical use case scenarios from the industry for the application of IIoT on smart factories smart cities and smart grids IoT driven advances in commercial and industrial building lighting and in street lighting are presented as an example to shed light on the application domain of IIoT The state of the art in Industrial Automation is also presented to give a better understanding of the enabling technologies potential advantages and challenges of the Industry 4 0 and IIoT Finally yet importantly the security section of the book covers the cyber security related needs of the IIoT users and the services that might address these needs User privacy data ownership and proprietary information handling related to IIoT networks are all investigated Intrusion prevention detection and mitigation are all covered at the conclusion of the book **HVAC Control in the New Millennium** Michael F. Hordeski,2001 1 Heat Ventilation and Damper Control Trends2 Energy and Power Management Distributed Control Trends3 Control Technology Microelectronics and Nanotechnology4 Advance HVAC Control Information Technology and Open Systems5 PC based Control Software and Bus Trends6 Artificial Intelligence Fuzzy Logic and Control7 Computer Networks and Security8 Systems and Device Networks9 Building automation Wireless Technology and the InternetIndex Industrial Sensors and Controls in Communication Networks Dong-Seong Kim,Hoa Tran-Dang,2018-12-11 This informative text reference presents a detailed review of the state of the art in industrial sensor and control networks The book examines a broad range of applications along with their design objectives and technical challenges The coverage includes fieldbus technologies wireless communication technologies network architectures and resource management and optimization for industrial networks Discussions are also provided on industrial communication standards for both wired and wireless technologies as well as for the Industrial Internet of Things IIoT Topics and features describes the FlexRay CAN and Modbus fieldbus protocols for industrial control networks as well as the MIL STD 1553 standard proposes a dual fieldbus approach incorporating both CAN and ModBus fieldbus technologies for a ship engine distributed control system reviews a range of industrial wireless sensor network IWSN applications from environmental sensing and condition monitoring to process automation examines the wireless networking performance design requirements and technical limitations of IWSN applications presents a survey of IWSN commercial solutions and service providers and summarizes the emerging trends in this area discusses the latest technologies and open challenges in realizing the vision of the IIoT highlighting various applications of the IIoT in industrial domains introduces a logistics paradigm for adopting IIoT technology on the Physical Internet This unique work will be of great value to all researchers involved in industrial sensor and control networks wireless networking and the Internet of Things **Fieldbus Technology** D. Dietrich,P. Neumann,H. Schweinzer,2012-12-06

Applications of communication networks lead to radical changes in human life Fieldbus technology is part of this development acting in close connection to systems control and in critical domains Equipped with sensitive sensors fieldbus technology becomes the backbone of many processes of our daily life In automation technology fieldbus systems are essential parts of modern applications In airplanes and in near future also in automobiles mechanical control is replaced by x by wire systems based on fieldbusses a technique more efficient and flexible but also cheaper Moreover fieldbus technology used in factories hospitals laboratories for the collection of numerous data enables a more efficient and reliable operation of these complex environments This book is a collection of articles submitted to the fieldbus conference FeT 99 in Magdeburg Germany The articles were reviewed by an international program committee which decided to include some high quality articles not presented at the conference The book comprises chapters dealing with important aspects of fieldbus technology and reflecting areas of main activity in science and industry real time aspects networking management OPC system aspects realization protocol specifications supplements to introduced fieldbus systems validation profile development i e specification of application semantics and research projects A further chapter reports on the European harmonization project NOAH

Principles of Electrical Measurement Slawomir Tumanski,2006-01-20 The field of electrical measurement continues to grow with new techniques developed each year From the basic thermocouple to cutting edge virtual instrumentation it is also becoming an increasingly digital endeavor Books that attempt to capture the state of the art in electrical measurement are quickly outdated Recognizing the need for a tex *Advanced Manufacturing Processes V* Volodymyr Tonkonogyi,Vitalii Ivanov,Justyna Trojanowska,Gennadii Oborskyi,Ivan Pavlenko,2023-08-30 This book offers a timely snapshot of innovative research and developments at the interface between design manufacturing materials mechanical and process engineering and quality assurance It covers various manufacturing processes such as grinding milling broaching and gear machining including additive manufacturing vibrational centrifugal strengthening laser ultrasonic surface hardening and antifriction coatings It focuses on computer and numerical simulation mathematical and integrated process modeling parametric synthesis virtual prototyping automatic control design of manufacturing mechanical and mechatronics systems It describes innovative cutting and abrasive processes and combined technologies It also covers the formation strengthening and thermomechanical rolling It also investigates the temperature field behavior thermal stability wear resistance and other processes of various materials Gathering the best papers presented at the 5th Grabchenko s International Conference on Advanced Manufacturing Processes InterPartner 2023 held on September 5 8 2023 in Odessa Ukraine this book provides a comprehensive and up to date examination of design manufacturing mechanical materials and process engineering as well as quality assurance trends and technologies Yet it also aims at fostering international and interdisciplinary communication and collaborations offering a bridge between the academic and industrial sector *Collimator-Based Tracking with an Add-On Multileaf Collimator* Andreas Böhler,2015-09-29 In this thesis a tracking system was developed by modifying an add on

collimator the Siemens Moduleaf for realtime applications in radiotherapy As the add on collimator works almost completely autonomously of the linear accelerator LinAc no modifications to the latter were necessary The adaptations to the Moduleaf were mainly software based In order to reduce the complexity of the system outdated electronic parts were replaced with newer components where practical Verification was performed by measuring the latency of the system as well as the impact on applied dose to a predefined target volume moving in the leaf s travel direction Latency measurements in software were accomplished by comparing the target and current positions of the leaves For dose measurements a Gafchromic EBT2 film was placed beneath the target 4D phantom in between solid water plates and moved alongside with it Based on the results a tracking capable add on collimator seems to be a useful tool for reducing the margins for the treatment of small slow moving targets Radiotherapy is one of the most important methods used for the treatment of cancer Irradiating a moving target is also one of the most challenging tasks to accomplish in modern radiotherapy **Towards Intelligent Engineering and Information Technology** Imre J. Rudas,János Fodor,2009-09-30 Intelligent engineering systems try to replicate fundamental abilities of humans and nature in order to achieve sufficient progress in solving complex problems In an ideal case multi disciplinary applications of different modern engineering fields can result in synergistic effects Information technology and computer modeling are the underlying tools that play a major role at any stages of developing intelligent systems Chapters in the present volume have been written by eminent scientists from different parts of the world dealing with challenging problems for efficient modeling of intelligent systems The reader can find different characteristics and methodologies of computational intelligence with real life applications Various facets of intelligent engineering and information technology are addressed Starting with theoretical issues from pseudo analysis to parametric classes of digital fuzzy conjunctions for hardware implementation of fuzzy systems diverse aspects of control including quantum as well as fuzzy control and hybrid approaches intelligent robotics dealing with mobile and autonomous robots and new trends approaches and results on information technology machines materials and manufacturing and issues of intelligent systems and complex processes are covered **AUTOMOBILE ENGINEERING: A TEXT BOOK FOR B.TECH AND DIPLOMA ENGINEERING** Intezar Mahdi,2025-09-20 Automobile Engineering is a comprehensive guide designed to equip students professionals and enthusiasts with a solid understanding of the principles design and functioning of modern automobiles Covering both fundamental concepts and advanced technologies this book serves as a valuable resource for learners at various stages of their academic or professional journey The text begins with the basics of vehicle layout engine types and power transmission systems progressing into detailed discussions on automotive components such as the engine gearbox brakes suspension steering and electrical systems It explains the science behind internal combustion engines alternative powertrains and emerging trends like electric vehicles and hybrid technology Special emphasis is given to maintenance practices safety systems emission control and environmental considerations helping readers understand the engineering

solutions required for efficient safe and sustainable mobility The book also includes real world case studies diagrams and simplified explanations to make complex topics accessible Aligned with current industry standards and academic curricula this book integrates theoretical knowledge with practical insights It is ideal for diploma and degree students in mechanical and automobile engineering as well as practicing engineers looking to update their knowledge By blending technical accuracy with clarity Automobile Engineering ensures readers not only grasp how vehicles work but also develop the analytical skills to innovate and solve problems in the automotive field

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