

# C Programming of Microcontrollers for Hobby Robotics

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**Abstract.** This handout supplies the necessary start up information for programming microcontrollers in C language. The examples of the handout is selected on the amateur robotics applications such as line tracking by a mobile platform, on-off, proportional, proportional-integral-derivative control for servomotor control.

**Keywords:** PIC microcontroller, C for hobby robotics, line tracking, PID controller.

## 1 Introduction

This article is written for the novice robotics hobbyists who want to have a quick start in microprocessor programming, for the IIRC 2008 Robotics Competition. It is a great opportunity for a hobbyist to enjoy the competition with a home-made robot.

A *microcontroller* (or MCU) [1] is a computer-on-a-chip used to control electronic devices. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor used in a PC. A typical microcontroller contains all the memory and interfaces needed for a simple application, whereas a general purpose microprocessor requires additional chips to provide the same functions.

The microcontroller applications are mainly categorized into the following fields in an alphabetic listing: Audio; Automotive; Wired communication; Computers and peripherals; Consumer Appliances; Industrial Instrumentation; Imaging and video application; Medical Instrumentation; Military and aerospace instrumentation; Mobile and wireless devices; Motor control; Security Equipments; General Purpose Devices; and Miscellaneous Applications. From these fields, robotics uses the wired and wireless communication, image processing, and motor control extensively.

A microcontroller is a must of a mechatronics device which combines intelligence, mechanical actions, and sensory devices for a goal. Robotics and Hobby Robotics are typical fields of mechatronics. In a robot, microcontrollers are embedded to implement intelligent control algorithms.

A low-end microcontroller can execute most of the robotics control algorithms. Implementation of robotics microcontroller applications requires two main components, a microcontroller and its IC-programming tool, and a convenient programming language to express the algorithms. The main objective of this article is an introduction to these item.

# C Programming Of Microcontrollers For Hobby Robotics

**Chi N. Thai**



## **C Programming Of Microcontrollers For Hobby Robotics:**

**Robot Programmer's Bonanza** John Blankenship, Samuel Mishal, 2008-06-14 The first hands on programming guide for today's robot hobbyist Get ready to reach into your programming toolbox and control a robot like never before Robot Programmer's Bonanza is the one stop guide for everyone from robot novices to advanced hobbyists who are ready to go beyond just building robots and start programming them to perform useful tasks Using the versatile RobotBASIC programming language you'll discover how to prototype your creative ideas using the integrated mobile robot simulator and then port your finished programs to nearly any hardware software configuration You can even use the built in wireless protocol to directly control real world robots that can be built from readily available sensors and actuators Start small by making your robot follow a line hug a wall and avoid drop offs or restricted areas Then enable your robot to perform more sophisticated actions such as locating a goal sweeping the floor or navigating a home or office Packed with illustrations and plenty of inspiration the unique Robot Programmer's Bonanza even helps you teach your robot to become intelligent and adapt to its behavior Everything you need to program and control a robot In depth coverage of the RobotBASIC simulator as well as how it can be used to control real world robots either directly or through the integrated wireless protocol A companion website with a FREE download of the full version of the RobotBASIC robotic simulator and control language Remote control algorithms as well as autonomous behaviors Integrated debugger facilitates program development Appendices that detail RobotBASIC's extensive commands and functions as well as the integrated programming environment Adaptable and customizable programs that solve realistic problems use simulations to prototype robots that can mow a yard deliver mail or recharge a battery then port your algorithms to real world robots Chapters devoted to creating contests with RobotBASIC and utilizing RobotBASIC in the classroom to teach programming Intermediate Robot Building David Cook, 2010-08-13 For readers of Robot Building for Beginner Apress 2002 and 2009 welcome to the next level Intermediate Robot Building Second Edition offers you the kind of real world knowledge that only renowned author David Cook can offer In this book you'll learn the value of a robot heartbeat and the purpose of the wavy lines in photocells You'll find out what electronic part you should sand You'll discover how a well placed switch can help a robot avoid obstacles better than a pair of feelers And you'll avoid mistakes that can cause a capacitor to explode Want a robot that can explore rooms follow lines or battle opponents in mini sumo This book presents step by step instructions and circuit and part descriptions so that you can build the robot featured in the book or apply the modules to your own robot designs Finally you'll find the complete schematics for Roundabout a room explorer that requires no programming and uses only off the shelf electronics With Roundabout you'll use many of the same techniques used by professional robotics engineers and you'll experience many of the same challenges and joys they feel when a robot comes to life **Programming Robot Controllers** Myke Predko, 2003 Details the PICmicro microcontroller Covers designing the robot system software development and advanced programming

Explains microcontroller connections      **OpenNI Cookbook** Soroush Falahati,2013-01-01 This is a Cookbook with plenty of practical recipes enriched with explained code and relevant screenshots to ease your learning curve If you are a beginner or a professional in NIUI and want to write serious applications or games then this book is for you Even OpenNI 1 and OpenNI 1 x programmers who want to move to new versions of OpenNI can use this book as a starting point This book uses C as the primary language but there are some examples in C and Java too so you need to have about a basic working knowledge of C or C for most cases      **Robot Builder's Sourcebook** Gordon McComb,2003 A much needed clearinghouse for information on amateur and educational robotics containing over 2 500 listings of robot suppliers including mail order and local area businesses Contains resources for both common and hard to find parts and supplies Features dozens of sidebars to clarify essential robotics technologies Provides original articles on various robot building topics      **The Robot Builder's Bonanza** Gordon McComb,2001 Provides instructions for building 99 inexpensive robots      **Robot Builder's Bonanza, 4th Edition** Gordon McComb,2011-05-23 The Bestselling Robotics Book Now with New Projects and Online Tools Amazing should be required reading for any budding robot builder GeekDad Wired com Have fun while learning how to design construct and use small robots This richly illustrated guide offers everything you need to know to construct sophisticated fully autonomous robots that can be programmed from your computer Fully updated with the latest technologies and techniques Robot Builder s Bonanza Fourth Edition includes step by step plans that take you from building basic motorized platforms to giving the machine a brain and teaching it to walk talk and obey commands This robot builder s paradise is packed with more than 100 affordable projects including 10 completely new robot designs The projects are modular and can be combined to create a variety of highly intelligent and workable robots of all shapes and sizes Mix and match the projects to develop your own unique creations The only limit is your imagination Robot Builder s Bonanza Fourth Edition covers Parts materials and tools Building motorized wooden plastic and metal platforms Rapid prototyping methods Drafting bots with computer aided design Constructing high tech robots from toys Building bots from found parts Power motors and locomotion Robots with wheels tracks and legs Constructing robotic arms and grippers Robot electronics and circuit making Computers and electronic control Microcontrollers Arduino PICAXE and the BASIC stamp Remote control systems Sensors navigation and visual feedback Robot vision via proximity light and distance New FREE online content at [www.robotoid.com](http://www.robotoid.com) My First Robot tutorial lessons Project parts finder Animated interactive learning tools How to videos robot e plans bonus articles links and more Plus go to [www.mhprofessional.com/rbb4](http://www.mhprofessional.com/rbb4) for Downloadable programs RBB app notes Bonus chapters Make Great Stuff TAB an imprint of McGraw Hill Professional is a leading publisher of DIY technology books for makers hackers and electronics hobbyists      *Robot Builder's Bonanza, 5th Edition* Gordon McComb,2018-12-14 The bestselling guide to hobby robotics fully updated for the latest technologies Learn to build your own robots using the hands on information contained in this thoroughly revised TAB guide Written by the godfather of hobby robotics the book clearly explains the essential

hardware circuits and brains and contains easy to follow step by step plans for low cost cool robotics projects Robot Builders Bonanza Fifth Edition contains more than two dozen new projects for hobbyists of all ages and skill levels The projects are modular and can be combined to create a variety of highly intelligent and workable custom robots Discover how to Wire up robotics circuits from common electronic components Get up and running building your own robots Attach motors wheels legs arms and grippers Make your robots walk talk and obey commands Build brains from Arduino BBC Micro bit Raspberry Pi and other microcontrollers Incorporate touch proximity navigation and environmental sensors Operate your bot via remote control Generate sound and interpret visual feedback Construct advanced robots that can see light and follow pre drawn paths

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*Proceedings of the ... National Conference on Undergraduate Research* ,1997    *Nuts & Volts* ,2005    [Exploring Robotics with ROBOTIS Systems](#) Chi N. Thai,2017-07-31 This 2nd edition textbook has been expanded to include of 175 additional pages of additional content created in response to readers feedback as well as to new hardware and software releases The book presents foundational robotics concepts using the ROBOTIS BIOLOID and OpenCM 904 robotic systems and is suitable as a curriculum for a first course in robotics for undergraduate students or a self learner It covers wheel based robots as well as walking robots Although it uses the standard Sense Think Act approach communications bot to bot and PC to bot programming concepts are treated in more depth wired and wireless ZigBee BlueTooth Algorithms are developed and described via ROBOTIS proprietary RoboPlus IDE as well as the more open Arduino based Embedded C environments Additionally a vast array of web based multimedia materials are used for illustrating robotics concepts code implementations and videos of actual resulting robot behaviors Advanced sensor interfacing for gyroscope inertial measuring unit foot pressure sensor and color camera are also demonstrated

*Electronics For Dummies* Cathleen Shamieh,2019-11-13 Build your electronics workbench and begin creating fun electronics projects right away Packed with hundreds of diagrams and photographs this book provides step by step instructions for experiments that show you how electronic components work advice on choosing and using essential tools and exciting projects you can build in 30 minutes or less You ll get charged up as you transform theory into action in chapter after chapter Circuit basics learn what voltage is where current flows and doesn t flow and how power is used in a circuit Critical components discover how resistors capacitors inductors diodes and transistors control and shape electric current Versatile chips find out how to use analog and digital integrated circuits to build complex projects with just a few parts Analyze circuits understand the rules that govern current and voltage and learn how to apply them Safety tips get a thorough grounding in how to protect yourself and your electronics from harm P S If you think this book seems familiar you re probably right The Dummies team updated the cover and design to give the book a fresh feel but the content is the same as the previous release of *Electronics For Dummies* 9781119117971 The book you see here shouldn t be considered a new or

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**Robotics Age** ,1982 **Robotics in Education** Wilfried Lepuschitz,Munir Merdan,Gottfried Koppensteiner,Richard Balogh,David Obdržálek,2017-08-28 This proceedings volume highlights the latest achievements in research and development in educational robotics which were presented at the 8th International Conference on Robotics in Education RiE 2017 in Sofia Bulgaria from April 26 to 28 2017 The content will appeal to both researchers and educators interested in methodologies for teaching robotics that confront learners with science technology engineering arts and mathematics STEAM through the design creation and programming of tangible artifacts giving them the chance to create personally meaningful objects and address real world societal needs This also involves the introduction of technologies ranging from robotics controllers to virtual environments In addition the book presents evaluation results regarding the impact of robotics on students interests and competence development The approaches discussed cover the whole educational range from elementary school to the university level in both formal as well as informal settings

**Exploring Programmable ICs** Clement S. Pepper,2001 Programmable ICs are devices designed for operation under program control from a computer or microcontroller This book takes the reader through an introduction to the world of ICs and explores varied programmable ICs along with selected applications with relevance to popular projects

**Computerised Systems Architecture** S Mathioudakis,2024-11-08 This is the first edition of an investigation into the design of computer architecture and the methods of creating digital systems Throughout the book are diagrams and notes pertaining to the structures found within computer hardware The book offers a detailed account of embedded systems and more complex computing processes Suitable for those with an intermediate knowledge of embedded systems design The book covers the following topics Embedded system design Digital logic and mathematical methods Methodological approaches Structure of a microchip Programming in assembler Complex computer structures Operating systems Software programming and design First Edition

**Nuts & Volts Magazine** ,2003 *Programming 8-bit PIC Microcontrollers in C* Martin Bates,2008 PIC Microcontrollers are present in almost every new electronic application that is released from garage door openers to the iPhone With the proliferation of this product more and more engineers and engineers to be students need to understand how to design develop and build with them Martin Bates best selling author has provided a step by step guide to programming these microcontrollers MCUs with the C programming language With no previous knowledge of C necessary to read this book it is the perfect for entry into this world for engineers who have not worked with PICs new professionals students and hobbyists As MCUs become more complex C is the most popular language due to its ability to process advanced processes and multitasking RTOSs that is a need to know for engineers is also discussed as more advanced MCUs require timing and organization of programming and implementation of multitasking The book includes lots of source code circuit schematics and hardware block diagrams Microchip s PICDEM Mechatronics board is used to detail the examples throughout the book

Focuses on the C programming language which is by far the most popular for microcontrollers MCUs Features Proteus VSMg the most complete microcontroller simulator on the market along with CCS PCM C compiler both are highly compatible with Microchip tools Extensive downloadable content including fully worked examples *Robot Science & Technology* ,1998

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