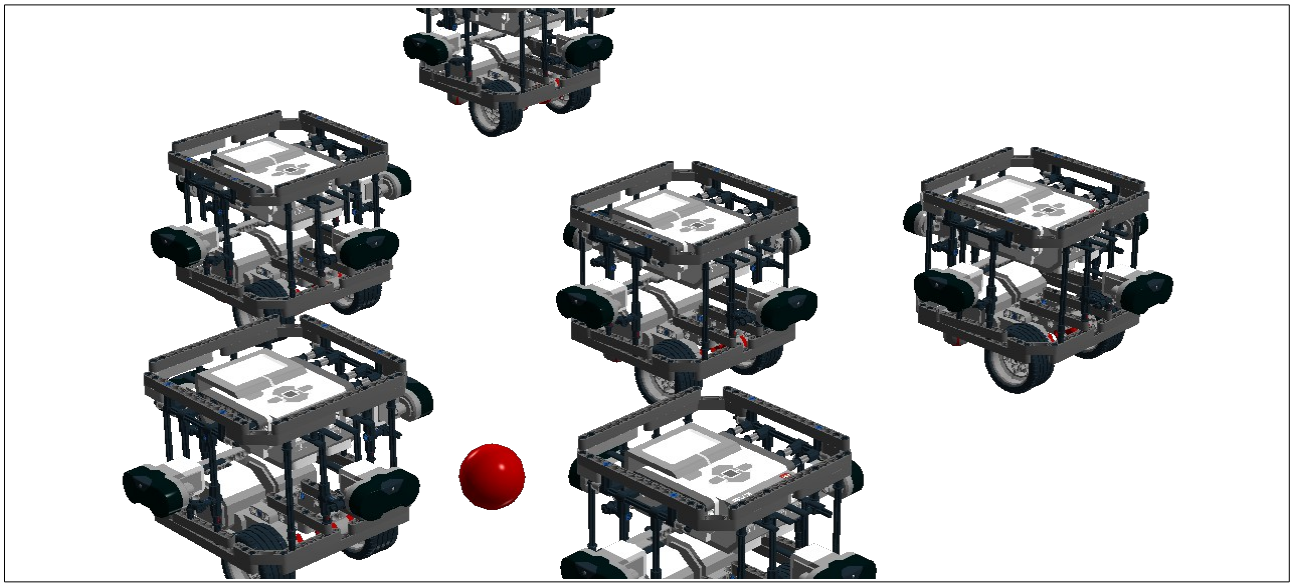
Living Robots with EV3



Version 0.1

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History

This section show the evolution of this project

- **0.1 (24/04/2014)**
  Initial Release

Preface

Introduction

The line of products Lego Mindstorms are an excellent hardware platform to learn concepts about **Robotics** and others fields as Engineering, IT Technology and Electronics. With the time, this platform has reached a huge popularity in many educational segments as High School and University.
This platform has his own software to operate using a visual programming language, NXT-G which is really useful to understand basics concepts about robot programming and it is a right way to get fast results but in my personal opinion, this approach is not really useful to solve complex problems and others alternatives are better for this purpose. In this point, one alternative is **LeJOS project** an Open Source project created to develop a Java virtual machine and a API designed to develop your own software for robots using the programming languaje **Java**. This ebook will help the reader in the usage of this Open Source project. **This ebook covers Java and LeJOS project to develop software for robots.**

Since 2008, I have been working in this educational project to help Mindstorms Community to solve many doubts about how to use the product Lego Mindstorms NXT and now EV3. I remember when I bought my first Lego Mindstorms kit (LEGO Mindstorms Robotics Invention 2.0) which it included a RCX inside and I didn't have many ideas about how to create my first projects and Internet didn't have many sites with solutions and ideas. In that days, build software for robots was very hard. But now exist several sources of information and alternatives and this is the new challenge for a newbie users: What is the best alternative to learn?

In last 2 years, users has more alternatives in the market to develop robots as **Arduino**, R**aspberry PI**, Ollo, **Bioloid**, ArDrone & the Smartphones but in my personal opinion, I continue recommending Lego Mindstorms as the first way to explore Robotics at secondary school, university bachelors, and postgraduate programs / Phd.

In next 10 years, **Robotics** will become in one of the most helpfully technology for the society. Currently, robotics field is not in a mature phase and it needs new ideas to evolve but this goal is not easy because robotics is a complex science and it has several research lineas.

This ebook is a project to spread the knowledge about Java programming for robots using the platform Lego Mindstorms NXT as the main platform and the API from leJOS project to develop software for robots. This ebook is live and every 3-6 months, I will try to update with new ideas and techniques from the projects and the readers.

Enjoy, Learn, ***Contact with me*** to improve the eBook and share ideas.

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Audience

The ebook has been written to be read by the following kind of users:

- Roboticist
- Lego Mindstorms users
- LeJOS Developers
- Java Developers
- Teachers who teach robotics courses
- Students in Secondary School
- Students in University
- Students in Postgraduate/PhD programs
- Scientifics
- Engineers
- Electronics hobbyist

Organization

The ebook has been organized in the following chapters:

Chapter 1: Introduction
This chapter will show the reader the state of art in educative robotics.

Lego mindstorms
LeJOS Project

Chapter 2: Fundamentals of Robotics
This chapter explain the basic concepts about robotics.

Chapter 3: Sensors
This chapter explains how to use sensors from EV3 Kit or third party sensors.

Chapter 4: Actuators
This chapter explains how to use actuators. This chapter includes EV3/NXT Motors, PF Motors, Servos, DC Motors and RCX Legacy Motors.

Chapter 5: Navigation
This chapter explains concepts about Navigation. The chapter put the focus on:

- Local navigation
- Global navigation

Chapter 6: Cognition
This chapter explains explore some ways to design the way to execute task on robots.

- Finite State Machines
- Hierarchical State Machines
- Subsumption architecture

Chapter 7: Computer vision
This chapter explains how to use Computer Vision on your EV3 robots.

Chapter 8: Web interfaces
This chapter explains the different ways to communicate from a EV3 robot with another EV3 Brick, NXT Brick, PC, Smartphone or a Internet Service.

Chapter 9: Communications
This chapter explains the different ways to communicate from a EV3 robot with another EV3 Brick, NXT Brick, PC, Smartphone or a Internet Service.

Changes in relation to previous releases or books

In this release exist many changes in relation to previous releases/books due to:

1. **Modular format.**
   Now, you download the ebook in a zip file which includes the whole book organized in small PDF documents. For maintenance purposes, it is better to update chapters with small sizes that maintain big documents. With this change, ebook is modular and students and teachers can print chapters easily
2. **Focus on Ubuntu/Mac.**
   When I started studying my Master for PhD in robotics, I learnt more advantages on Ubuntu and Mac.
3. **Java way.**
   In this new release, I will put focus in the educational way to learn Java and how to apply Object Oriented Programming in robotics projects. I think that it is very important to teach Java in a right way to do robust projects.
4. **Integration with other projects.**
   In this release, we will learn how to integrate with other platforms as ROS, Arduino, Raspberry Pi or Android

Comments & Questions

Please, I would like to receive your feedback about the ebook to improve it. With last ebook, I have received more than 5000 downloads and every week I received many mails about comments, doubts and proposals around the world. Please send me your feedback to improve this project.

Acknowledgments

This Project has been possible with the help and support of my family and friends as Antonio Tejero, Isaac Olmos, Marina Perez, Victor Herraiz, Juan Jose Ramirez & Sergio Ortiz.

Ebook requirements

This ebook needs the following requirements to use correctly

1. Robot Platform: Lego Mindstorms EV3 Kit
2. PC: Ubuntu 14.04 LTS / Mac OX

About the author

Juan Antonio Breña Moral has collaborated on leJOS project since 2006. He works in Europe leading Banking, Marketing, Engineering and IT projects for middle and large customers in several markets. Currently, he teaches EV3 courses and research in Robotics and Artificial Intelligence in Spain.

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