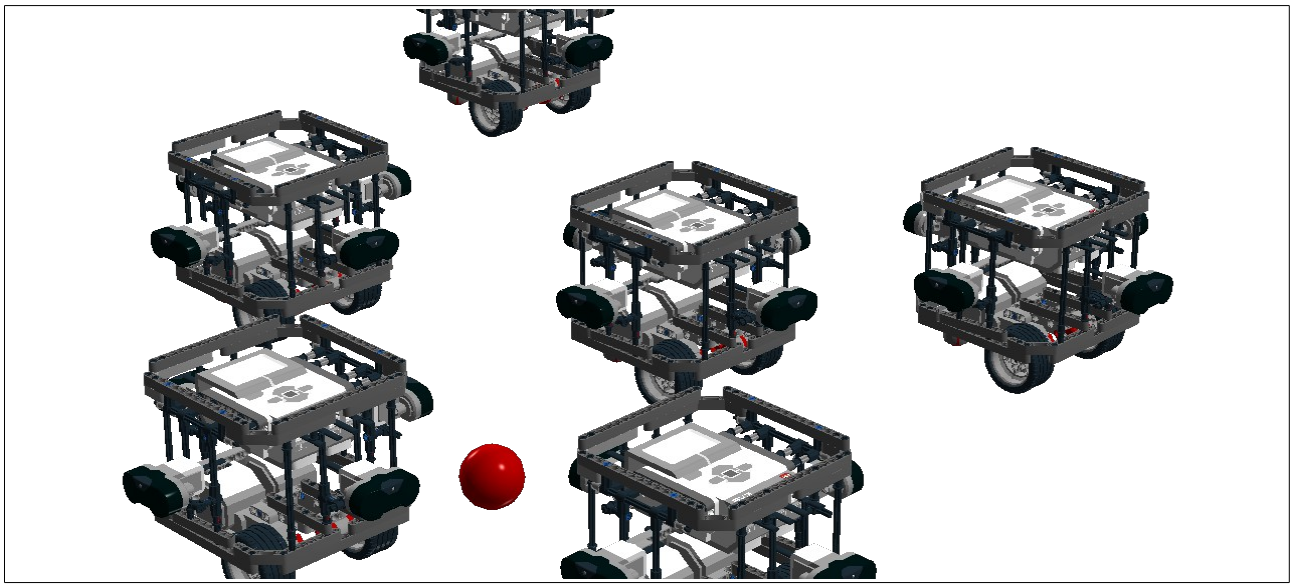
Living Robots with EV3



Version 0.1

Juan Antonio Breña Moral

10-May-2014

Table of Contents

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 and software platform to learn STEM (Science, Technology, Engineering & Maths) meanwhile the student develop **Robots**. With the time, this platform has reached a huge popularity in many educational segments as High School and University. The platform has a software platform to develop software using a visual environment which is pretty useful to understand basics concepts about programming but in the personal opinion of the author, this approach is not really useful to solve complex problems and others alternatives are better for this purpose. In this point, one available alternative is **LeJOS project** an Open Source project created to develop a robotics API to develop software for robots using the programming languaje **Java**.

In last 2 years, users has more alternatives in the market to develop educational & personal robots as **Arduino**, **Raspberry PI**, Ollo, **Bioloid**, ArDrone & the Smartphones but the ebook put the focus in the platform Lego Mindstorms as the first way to explore robotics at secondary school, university bachelors, and postgraduate programs / Phd because in general, the platform has a better features of the rest of the alternatives.

Robotics is a disruptive technology but current results are so far to see the kind of robots that you see in the SciFi movies. You have the opportunity to learn and add new ideas to improve the robotics.

This ebook is a project to spread the knowledge about **the development of robots with the programming language Java and the platform Lego Mindstorms**. This Ebook is live and every 3-6 months, I will try to update with new ideas and techniques.

Enjoy, Learn, Share ideas and ***Contact with me*** to improve the EBook.

Juan Antonio Breña Moral.
http://juanantonio.info/lejos-ebook/
http://www.iloveneutrinos.com/
@juanantoniobm

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 personal & educative robots.

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

Chapter 3: Sensors
This chapter explains how to use sensors with your Lego Mindstorms Robot.

Chapter 4: Actuators
This chapter explains how to use actuators with your Lego Mindstorms Robot.

Chapter 5: Navigation
This chapter explains concepts about local and global navigation.

Chapter 6: Cognition
This chapter explains explore some to model the way to execute robots's tasks.

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

Chapter 8: Internet, web services & web interfaces
This chapter explains how to use Internet and related technologies to develop better robots. The chapter covers http, web services and web development to develop human-machine interfaces (HCI)

Chapter 9: Integrations with third parties
This chapter covers the technologies used to integrate your robot with third parties as Arduino, New Sensors, Internet, etc...

Chapter 15: Hacking robots
This chapter explain the importance to ensure that your robot operates in a secure environment. Learn some stuff about security for Robots and avoid future robot's hacks.

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 Smartphones

Comments & Questions

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

Acknowledgments

This Project has been possible with the help and support of my family and friends.

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 is a old collaborator in LeJOS project and he has participated in the project since 2006. The author has a strong experience teaching technology in high school. In the University, he has participarted in some university activities and he has supervised several Master Thesis in the past. In 2013, he founded the educational project **I Love Neutrinos**, an annual STEM program to develop robots with Lego Mindstorms.

Robots

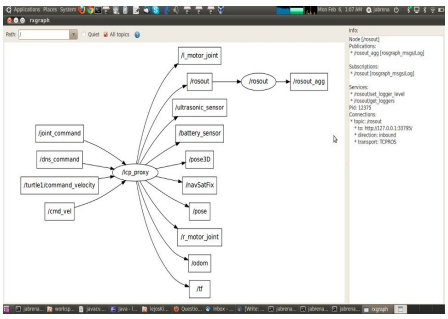
My favorite creations in the time:

Year	Name	Description	Picture
2014	Brity V2	This model has been used in the ebook “Living Robots with EV3” The main components of this robot are: an EV3 Brick, 2D LIDAR & Arduino.	Pending
2012	ROS Robot	This model was built to test the ROS package with LeJOS. This huge robot used a notebook with Linux to run ROS and a NXT Brick with LeJOS NXJ. https://www.youtube.com/watch?v=YlqptE8LHc0	
2010	LeJOS NXT RC CAR V2	This model replaced the old RC platform with a better structure to operate in a autonomous way. https://www.youtube.com/watch?v=ZJN38XfvmPo	

2010	TurtleNXT	This educative used in a course was very useful to test the sensor NXTCam. In a room several NXT robots operated in a project named: Jungle Project. https://www.youtube.com/watch?v=BbWRlLukn3M	
2009	LeJOS NXT RC CAR	This is the first attempt to develop an autonomous robot with Lego Mindstorms. I combined a RC Car with NXT Brick using the Motor Controller from Lattebox. https://www.youtube.com/watch?v=Xm6khrdnATo	

Software

Main pieces of code which I have participated in robotics:

Year	Name	Description	Picture
2012	ROS support for LeJOS	Using ROSJava, Lawrie and me developed the ROS support for LeJOS project. http://wiki.ros.org/nxt_lejos	

Further information:
http://juanantonio.info/lejos-ebook/
http://www.iloveneutrinos.com/
@juanantoniobm