

# Israel|Chaves Arbaiza

Date and place of birth: November 1st, 1992. San José, Costa Rica.  
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Researcher and junior lecturer working in the fields of robot manipulators and collaborative robots, autonomous robots, robot kinematics and service robotics, currently working at the ARCOS-Lab (Autonomous Robots and Cognitive Systems Lab) at the University of Costa Rica and at the Mechanical Engineering department.

## AREAS OF INTEREST

- Planning
- Robotic manipulators
- Reachability map
- Machine Learning
- Mechatronics
- Artificial Intelligence
- Machine design
- Compliant control techniques
- Autonomous robots
- Human-robot interaction

## EDUCATION

### UNIVERSIDAD DE COSTA RICA) | COMPUTING SCIENCE MASTER'S DEGREE

2019 - On course | San José, Costa Rica

Learning about artificial intelligence for entertainment and for planning, neural networks, Agile methodologies, hardware-software interconnection and other topics. My thesis consists on developing and implementing algorithms that allow a two handed and two arm humanoid robot, to manipulate objects depending on the task, the physics properties and kinematics of the object, the paths and others.

### TECNOLÓGICO DE COSTA RICA (TEC) | BACHELOR DEGREE (LICENCIATURA) MECHATRONICS ENGINEERING

2010-2016 | Cartago, Costa Rica

Developing great theoretical and practical components, learning to design and automate systems. Worked as part of student's association since 2010 to 2014, as president since 2012 to 2014.

### CENTRO UNIVERSITARIO MIRAVALLES | PROFESSIONAL DEVELOPMENT PROGRAM (PDP)

2013 | San José, Costa Rica • Integral program for certain college student, to develop leadership and soft skills • Website: [www.cumiravalles.org](http://www.cumiravalles.org)

### OMAR DENG0 FOUNDATION (F.O.D.) | ROBOTICS: LEARNING BY DESIGN AND ROBOSPORTS

2006-2010 | San José, Costa Rica • Learning basics of robotics by a serial of courses developed by Seymour Papert (MIT Media Lab Professor) implemented by F.O.D. • Active Robosports participation, Costa Rican's first robotics team going to Robocup LARC 2009 (Chile) and 2010 (Brazil)

## PUBLICATIONS

### SMART PLACEMENT OF A TWO-ARM ASSEMBLY FOR AN EVERYDAY OBJECT MANIPULATION HUMANOID ROBOT BASED ON CAPABILITY MAPS | PAPER

2018 IEEE International Work Conference on Bioinspired Intelligence (IWObI) | San José, Costa Rica

- Working with ARCOS-Lab kinematics simulator to try manipulation tasks in a collaborative way accord to dual capability map analysis in our mobile torso and choose the best KUKA LWR4+ arms setup. DOI: 10.1109/IWObI.2018.8464192

### DEVELOPMENT OF A FULL BODY HUMANOID ROBOT FOR OBJECT MANIPULATION | PAPER (SPANISH)

2021 III Jornadas de Investigación de la Facultad de Ingeniería, UCR | San José, Costa Rica

- In this work we explained the development of ARCOS-Lab's humanoid robot as a whole body (View PDF)

### TORSO, MOBILE PLATFORM AND HEAD INTEGRATION FOR A HUMANOID ROBOT | PAPER (SPANISH)

2019 I Jornadas de Investigación de la Facultad de Ingeniería, UCR | San José, Costa Rica

- This paper details the considerations to integrate the three main satellite parts for the humanoid robot, the torso, the mobile platform and the head (View PDF)

## RESEARCH EXPERIENCE

### **DESIGN AND PROTOTYPE OF A GRIPPER FOR SUPERMARKETS STOCKING | SHORT INTERNSHIP**

2020 (January - March) IAI Institute for Artificial Intelligence | Bremen, Germany

- Implementation of a vacuum gripper with a UR5 cobot robot for pick and place tasks with different supermarket's objects as part of the H2020 REFILLS Research and Innovation Action "(Robotics Enabling Fully-Integrated Logistics Lines for Supermarkets)" project of the European Commission of the European Union.

### **FULL BODY HUMANOID ROBOT ARCOS-LAB | CONSTRUCTION**

2016 - Actually | San José, Costa Rica

- Humanoid robot with two KUKA LWR4+ arms, one DLR II hand, Kinect v2, thermal camera, HD camera, omnidirectional mobile base. Research related to the project: "Torso, mobile platform and head integration for a humanoid robot, 731-B7-220." funded by the Research Agency of the University of Costa Rica (Vicerrectoría de Investigación)

### **DESIGN OF A MOBILE TORSO FOR AN HUMANOID ROBOT | DEGREE THESIS**

2015 | San José, Costa Rica

- Work developed at the ARCOS-Lab, with a new set for KUKA LWR4+ robotic arms by the capability map analysis, using DLR work about capability map.

### **SEGWAY CONTROL | AUTONOMOUS CONTROL PROJECT**

2014 | Cartago, Costa Rica

- Worked on the model, analysis, simulation, construction and control of a real scale segway platform

### **STAÜBLI ROBOT CONTROL | ROBOTICS PROJECT**

2014 | Cartago, Costa Rica

- Developed a Processing interface to control the kinematics of a Staübli robot to move to a given point

### **OBJECT DISCARDING BY COMPUTER VISION | COMPUTER VISION PROJECT: OPENCV**

2013 | Cartago, Costa Rica

- Worked on software recognition of object features to discard in an production line

## **CONFERENCES, WORKSHOPS, SUMMER SCHOOLS, DEMONSTRATIONS, EXHIBITIONS, PARTICIPATIONS:**

- Author and participant on 2018 IEEE International Work Conference on Bioinspired Intelligence (IWOB)
- Participation on EASE & REMARO Fall School 2021, organized by the CRC EASE & the European REMARO Network
- Participation on Costa Rica Big Data School 2021, organized by CONARE & CeNAT.
- Author and participant on Jornadas de Investigación de la Facultad de Ingeniería, University of Costa Rica, 2019 & 2021
- ARCOS-Lab Robotics Workshop: 2 weeks workshop teaching ROS and YARP software to general public
- National Robotics Olympics: Judge and trainer (2011-2017)
- Youth Talent Program, Ministerio de Ciencia, Tecnología y Telecomunicaciones (MICITT): Leader, teacher and project manager (2011-2014). Teaching high school students science and technology, to increase the engineer students in the country.
- Mechatronics Students Association: President, workshops and conferences organizer. (2011-2014).
- Conference Nanotechnology: Medics Applications: Participant. (2015) Conference by PhD. Meyya Meyyapan: NASA Nanotechnology Lab Chief
- AT10 Automation and Technology Congress: Participant. (2014). Tecnológico de Monterrey, Monterrey, México
- CLEIN Congress: Participant. (2011). San José, Costa Rica.
- BYND 2015 Global Youth Summit (2013). Young people from around the world had gathered in San José, Costa Rica to shape the ONU's sustainable development agenda in the post-2015 era.

## TEACHING EXPERIENCE

### **UNIVERSIDAD DE COSTA RICA - MECHANICAL ENGINEERING | ELECTROMECHANICS PRINCIPLES AND BASIC ELECTRONICS INSTRUCTOR**

2017, August - Actuality | San José, CR

Teaching basic of electronics, circuit analysis, motors and electric machines and electrical diagrams

## **UNIVERSIDAD DE COSTA RICA - MECHANICAL ENGINEERING | BASIC ELECTRONICS INSTRUCTOR**

2017, March - Actuality | San José, CR

Teaching semiconductor components, analog and digital circuits, basic of microcontrollers and PLC systems

## **UNIVERSIDAD INVENIO - MECHATRONICS ENGINEERING | INSTRUCTOR**

2021, July - Actuality | San José, CR

Teaching different courses about EMC, actuators, and artificial intelligence

## **UNIVERSIDAD DE COSTA RICA - ELECTRICAL ENGINEERING | SYSTEM ANALYSIS INSTRUCTOR**

2016, August - 2019, March | San José, CR

Course about model, analyze and simulate physical dynamic systems. (MATLAB-Modelica-Simulink)

## **UNIVERSIDAD LATINA - FUNDACIÓN REAL MADRID | ROBOTICS INSTRUCTOR**

2016 - 2019 | Heredia, CR

Teaching basic of robotics to primary students from Heredia; using NXT and EV3 platforms. Including participation in Costa Rican WRO 2017.

## **COLEGIO SAN JORGE | ROBOTICS INSTRUCTOR**

2014-2016 | San José, CR

Teaching basic of robotics to primary and high school students, competing in National Robotics Olympics.

Teaching: LEGO NXT, EV3, ARDUINO, SCRATCH, PROCESSING, FRITZING.

## **FUNDACIÓN OMAR DENGÓ | ROBOTICS AND SCRATCH INSTRUCTOR**

2013 | San José, CR

Teaching basics of programming, robotics, physics and mechanics to children

## **MICITT YOUTH TALENT PROGRAM | TUTOR AND COORDINATOR**

2011-2014 | San José, CR

Teaching science and technology through workshops, camps, and online classes to high school students from all the country

## TECHNICAL SKILLS

### **SOFTWARE**

Computer Languages:

Python • Shell • C • Matlab • C++ • Assembly language • HTML •  $\text{\LaTeX}$

Robotics-software:

ROS • YARP • Gazebo • V-Rep • Morse-simulator

CAD-CAM:

Kicad • AutoCAD • Solidworks • Creo Parametric • Autodesk Inventor •

EdgeCAM • COMSOL Multiphysics • FreeCAD

Operating systems:

GNU/Linux • Windows

### **HARDWARE**

Robotics Hardware:

Currently building a fullsize humanoid robot with two KUKA LWR4+ arms, one quadcopter, an omnidirectional mobile base with impedance control, emotional face, haptic glove system for DLR II Hand

General Hardware:

PLC • Pneumatic and hydraulic systems • Embedded systems: AVR (arduino), STM32, RaspberryPi, NI-myRio • CNC machines • 3D printers • Manufacture equipment

## LANGUAGE SKILLS

Spanish (native), English (fluent), German (basic)

## PERSONAL INTERESTS AND HOBBIES:

- Robotics
- Fencing
- Digital drawing
- Photography
- GNU/Linux
- Social entrepreneurship
- Entrepreneurship
- Digital animation
- Domotics
- Mechanics
- Prototyping
- Mixology
- 3D printing and 3D scanning

## PERSONAL PROJECTS:

- Automatic house-lights control
- Mobile robot by Theo-Jensen inspiration
- Two axis mobility system for solar panel to improve its efficiency
- Quadcopter controlled by hand gestures (on course)
- Design of a bumper car
- House assistant software (on course)
- Social Shot Latam, social entrepreneurship organization

## REFERENCES

- Federico Ruiz Ugalde, Dr.rer.nat. ARCOS-Lab Coordinator. Email: federico.ruizugalde@ucr.ac.cr
- Pietro Scaglioni Solano, PhD. Mechanical Engineering Department Director. Email: pietro.scaglioni@ucr.ac.cr