Pablo César Ruíz Hernández
Monterrey, Nuevo León, México
Tecnólogico de Monterrey, Campus Monterrey (ITESM) Email: pcruiher089@gmail.com
School of Science and Engineering Tel: +52 1 821109379
github.com/pcruiher08 - linkedin.com/in/pablocesarruiz

EDUCATION

- Digital Systems and Robotics Engineering, Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), August 2017 – June 2021 (Expected graduation)
- High School, International Baccalaureate, Tecnológico de Monterrey, Campus Eugenio Garza Sada, August 2014 – May 2017

RESEARCH EXPERIENCE

***Aerospace Research and Development Laboratory**, November 2019 – present*

UNAM – Iberoamerican University Space Program CANSAT

- Developed a telemetry station, designed and manufactured the electronics of the subsystems, programmed all the subsystems in C utilizing a Teensy 4.0 board.

Spaceport America Cup – 10km Rocket (In progress)

- Avionics and Programming Leader: My main task is the design of the software implemented in the rocket, which includes communication between the embedded systems of the rocket (which I designed in collaboration with other research fellows), telemetry between the rocket and the ground station, propulsion control, and the recovery system. (EAGLE, C, Python)

*Gamma Radiation Sensor – **Principal Investigator** (In progress)*

- **Principal Investigator** with Ph.D. Paloma Gonzalez and Ph.D. Artemio Aguilar as Institutional Review Board.
- Pressurized Xenon in a carbon fiber tank with an anode inside which detects the presence of Gamma Radiation.
- We intend to include this sensor as a Payload inside the rocket of the project described above.
- My tasks include the programming and design of the electronics for sampling the presence of Gamma Radiation, the communication of the payload with the rocket's sensor board, and the mathematical model that describes the interaction between Gamma Radiation and Pressurized Xenon. (EAGLE, C)

***Intelligent Systems Laboratory**, September 2017 – present*

TurtleBot Mapping and Navigation with custom made control over ROS (Sept. 2017)

- This individual project was a test to become a member of the laboratory.
- Localization was made with a camera on the ceiling and a colored marker over the robot (C++ OpenCV).
- Mapping was made with a Kinect Sensor using OpenNI and displayed in Gazebo.
- Dynamic Control was made with simple mathematics (C++).
- Each part of the system was a node on the ROS computation graph.

On a mathematical model of the speed for "n" motors on an omnidirectional robot (Nov. 2018)

- **Principal Investigator** with Ph.D. Andrés Guerrero as Institutional Review Board
- Developed a dynamic control model to describe the behavior of an omnidirectional robot with any amount of motors greater than 2.
- Later tested on RoboCup soccer robots (C++).

Soccer NAO Robots – Research Assistant – Mc.S. Juan Pablo Estrada (Jan. 2018 – June 2018)

- Designed an algorithm to make a team of NAO robots able to play soccer based on swarm optimization. (C++)
- Trained a cascade classifier to detect a miniature soccer ball and other robots. (Python OpenCV)

RoboBoat – RoboNation 2020

- Part of the team that built an autonomous boat to navigate in moving water. All the subsystems were controlled over ROS.

- Designed part of the electronics of the boat. (EAGLE)
- Trained a CNN to detect buoys in moving water. The location of the buoys was later used to plan the optimal route between them. (Python OpenCV)
- Developed the algorithm that confirmed the location of the buoys with a LIDAR. (C++)
- Tested the dynamic control model utilized to make the boat navigate in a straight line through water waves. (C++)

RoboSub – RoboNation 2020

- Part of the team that built an autonomous submarine to navigate in water utilizing a sonar and computer vision. All the subsystems were controlled over ROS.
- Trained a CNN to detect markers to be found in water. (YOLO with Python on OpenCV)
- Developed an algorithm to find obstacles with the sonar.

Self-Balancing Robot – (Oct. 2020)

- Designed and built a self-balancing robot. (Solidworks, EAGLE)
- Controlled with an ESP32 microcontroller. (C)
- Designed a pair of high friction wheels with rubber resin.
- The control model was almost completely mathematical but a PID was used to control the stepper motors.

***Innovation and Technology Transfer Institute of Nuevo León**, May 2015 – August 2017*

CONACYT National Science and Engineering Fair – 2015, Jalisco, México

- Designed an experiment to test mechanical to electrical energy transformation with sound waves.
- Presented the project in the National Science and Engineering Fair after winning the State Fair.

CONACYT National Science and Engineering Fair – 2016, Veracruz, México

- Designed an experiment to test thermal to electrical energy transformation with body temperature utilizing Peltier Tiles with the Seebeck Effect.
- Presented the project in the National Science and Engineering Fair after winning the State Fair.

***Particle Accelerators Laboratory**, March 2018 – May 2018*

Design of a low-cost Spectrometer – Research Assistant – R. Ruz, J.P. Ruz

- Programmed a Sony ILX751A sensor with an FPGA using VHDL.

***International Baccalaureate**, August 2015 – May 2017*

Contrast between the "Joule Thief" and an oscillator optimizing the transformation of thermal to electrical energy through the Seebeck Effect on a Peltier tile. Physics Extended Essay – Grade: A

- *Designed, proposed, and developed the experiment.*

PROJECTS

***Lions Robotics Club**, June 2017 – present*

Club Founder and Mentor
RoboCupMajor 2018 – Rescue Mini, Montreal, Canada
RoboCupJunior, 2018 – Rescue Maze
General Circuit Board
Soccer Robots Testing 2018
Water Saver AI – Accenture Global Hackathon, 2018

Multiple-Institution Projects

Tank Challenge 2015
Tank Challenge 2016
Tank Challenge 2017
Robotic Arms 2017
RoboCupJunior, 2012, Mexico City, Mexico

RoboCupJunior, 2013, Eindhoven, The Netherlands
RoboCupJunior, 2014, Joao Pessoa, Brazil
RoboCupJunior 2015, Hefei, China
RoboCupJunior 2016 – National Stages
RoboCupJunior 2017, Nagoya, Japan
RoboCupJunior 2018, Montreal, Canada
FIRST – FRC 2014
FIRST – FRC 2015
FIRST – FRC 2016

Hackathons

Major League Hacking – HackMTY 2015
Major League Hacking – HackMTY 2016
Major League Hacking – HackMTY 2017
Major League Hacking – HackMTY 2018
Hack-BBVA 2018
Hack-CEMEX 2018
Major League Hacking – HackMTY 2019
Major League Hacking – HackMTY 2020

Math Olympiad *(2010 – 2017)*
Physics Olympiad *(2012 – 2017)*
Informatics Olympiad *(2012 – 2017)*
ICPC *– Competitive Programming – Tecnológico de Monterrey*

WORK EXPERIENCE

Microsoft *– Redmond, Washington – Software Engineer Intern*
Scitum *– Cofounder (2015 - 2018)*
Scintia – 3D Factory MX – *Robotics Intern*

PRESENTATIONS AND TALKS

TEDxYouth@GarzaGarcia – *Robotics is not just about building robots (Oct. 2015)*
GrafTech
UANL Preparatoria #22

TEACHING EXPERIENCE

Scitum *(2015 - 2018)*
Lions Robotics Club
Autonomous University of Nuevo León – *Competitive High School Robotics Consultor*
Monterrey Programming Hub

LANGUAGES

- Spanish: Native speaker
- English: Full professional proficiency

AWARDS

RoboCupJunior 2013 Dance, Eindhoven, The Netherlands – 1st Place
RoboCupJunior 2015 OnStage, Hefei, China – 1st Place
RoboCupJunior 2017 OnStage, Nagoya, Japan – 1st Place
RoboCupMayor 2018 Rescue, Montreal Canada – Best use of sensors
Major League Hacking – HackMTY 2016 – Facebook Award
Major League Hacking – HackMTY 2019 – 1st Place and Facebook Award
Major League Hacking – HackMTY 2020 – 3rd Place
RoboBoat – RoboNation 2020 – 1st Place
RoboSub – RoboNation 2020 – 3rd Place

PROGRAMMING LANGUAGES AND TECHNOLOGIES

Deep knowledge, able to implement about any data structure: C, C++, C#, Java, Python, Go.
Proficient: VHDL, Assembly.
Could improve my knowledge in: Verilog, SQL, JavaScript.
Deep knowledge in: Arduino, Raspberry Pi (ARM), RoboRio, MyRio, PICs.
Operative Systems: macOS, Ubuntu 16, Ubuntu 18, Windows, Arch Linux.
Relevant Software: EAGLE, KiCad, SolidWorks, Fusion 360, LabView, LaTeX, MATLAB.