Ala Eddine Kraiem

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Education

Engineering Degree in Industrial automation and Computer science **Sep. 2017 – Nov. 2022**
National Institute of Applied Science and Technology INSAT *Tunisia*

Relevent experience

Freelance: Robot's position and velocity estimator using sensor fusion **April 2023 – present**
Self-employed *Remote*

- Develop a C++ state-estimator for an autonomous vehicle simulated on Linux using Extended and Unscented Kalman filter
- Develop an odometry estimator for a mobile robot using Kalman filters and Sensor inputs: Lidar, IMU, GPS...
- Set up localization, path planning and navigation stack for an autonomous robot using ROS and Gazebo simulation
- Develop a Robot Operating System(ROS) package to test the developed estimator using Gazebo simulations

Freelance: C++ Robotic arm module **January 2023 – Mars 2023**
Self-employed *Remote*

- Developed a library for Robot forward and inverse kinematics, DH transformations, quaternion and dual-quaternion representation, motion planning
- Developed an inverse kinematics solvers' module for Numerical Solution : Newton-Raphson solver, cyclic coordinate descent solver, FABRIK solver, etc...
- Developed a path planning and trajectory generation module: polynomial trajectory, RRT, Dijkstra and A* algorithm
- Developed Direct and Inverse robot dynamics solvers: recursive Newton-Euler inverse dynamics solver
- Developed a Robot Operating System package to test the developed module using PID controllers and Gazebo/Rviz simulations

Robotics Software Engineer Intern : Graduation project **February 2022 – July 2022**
University of Quebec at Trois-Rivières: Hydrogen research institute *Quebec, Canada*

- Implemented SLAM, localization, navigation and perception software solutions for autonomous robots using ROS and Gazebo simulation
- Designed, tested and developed a dynamic obstacles' velocity estimator using robot operating system (ROS) for autonomous mobile robot (AMR)
- Generated a new conflict-zones costmap layer for energy-efficient navigation system using Kernel Density Estimation (KDE) and Time To Conflict (TTC)
- Set up a simulation environment in Gazebo (3D models design, models placement, Mapping, simulation scenarios...) and developed Gazebo plugins to animate models for closer real world situation
- Logged the robot's data from the simulation into a CSV file and use it in Matlab to generate the new costmap layer
- Developed a costmap-plugin to integrate the new layer into the global costmap for the robot's navigation stack
- Modified the local path planner's cost function (TEB_local_planner) for multi-objective optimization by adding the energy and conflict estimation cost for an energy-saving navigation system

Publications and Scientific contribution

Multi-Layer Costmap for Multi-Type Semantics of Self-Guided Vehicle Navigation for Safe and Efficient Material Handling Applications CIGI QUALITA MOSIM 2023

Towards a Safe Trajectory Planning of AGVs for an Autonomous Handling System In a Dynamic Environment International Innovation Forum 5.0 Montreal 2022

Technical Skills

Programming languages: C/C++, Python, QT5, Java, Matlab , Linux bash scripting, CMake , Embedded C
Development Tools: VS Code, STM32CubeMX, Keil, Atmel studio, Gazebo, Rviz
Development Boards: STM32, Raspberry pi, Arduino, ESP32
Developmed Algorithms: SLAM, Navigation, Perception, Sensor fusion, Graph based Path Planning
Others: Linux, Robot Operating System(ROS), Opencv, TensorFlow, PyTorch, YOLO, Mask_RCNN, GitHub ,Solidworks

Academic projects

Warehouse management: An automated storage and retrieval systems using AMRs **Mars 2021–June 2021**

- Set up a multi-robot navigation architecture in the Gazebo environment
- Designed and Developed a navigation system using predefined warehouse layout and QR-code tags for localization
- Set up a custom navigation and Path Planing software stack on the ROS framework
- Designed the warehouse 3D layout using CAD software and a 3D model of the robot equipped with IMU and LIDAR
- Implemented and developed the robots navigation command loop using PID controllers and tuned it using dynamic-rqt-reconfigure package
- Designed and developed a fleet-control server for path planning, task allocation and multi-robots coordination using Linux shell scripts, C++ and Graph based path planning algorithm
- Deployed and tested the custom navigation stack on a real world robot using Raspberry-Pi and STM32

Eurobot OPEN - Planete Science - France **Sept. 2020 – Aug 2021**

- Prototyped and Built Four autonomous robots within the regulations to perform tasks set by the rule book of the competition
- Developed and debugged velocity control loop of the robots using C++ on an STM32 board
- Designed and Built a Lighthouse activated by the robot during the match, the light sweeper is a custom FPGA board designed and printed by my-self based on Timers and flip flop circuits for energy-efficiency
- Responsible of the R&D and electronics systems of the robot from designing to testing including board printing like the motherboards, the light sweepers and servo motor drivers

Certificates & Online courses

Entry-level python programmer Certification **Sep. 2019**
Python Software Foundation

Mastering Microcontroller with Embedded Driver Development **Nov. 2022**
FastBit Embedded Brain Academy on Udemy

ARM Cortex M Microcontroller DMA Programming Demystified **Nov. 2022**
FastBit Embedded Brain Academy on Udemy