Miguel Garcia Naude

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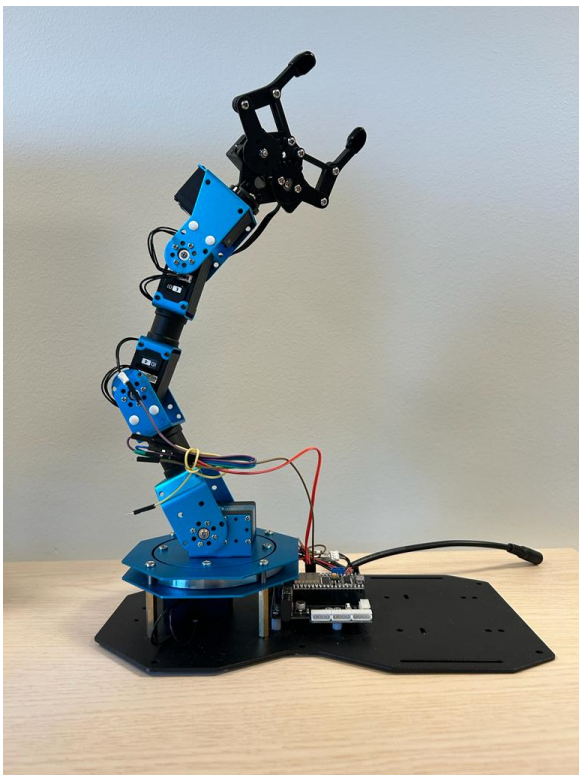
github/migsdigs

KTH Robotics, Perception & Learning Lab Projects

KTH Royal Institute of Technology - RPL Lab 2023



The image on the left shows the iRobot-ATRV robot owned by the KTH RPL lab. The robot was released in 2007, prior to many modern-day robotics frameworks used by developers. The task was to “revive” the ATRV, building on it with newer hardware, and integrating the commonly used ROS framework. The robot is to be used for mapping and surveying on off-road terrains, and plans to use an array of sensors, shown on the attached sensor module.
The servo-robot arm in the right image is the Hiwonder xArm, which forms part of a module used for a robotics project course at KTH. The current servo driver is Raspberry PI with a large auxiliary board that takes up large amounts of space, and provides unnecessary computing power. The task was to move driver functionality for the servos from the PI to an ESP32 micro-controller. Control of the motors is thus facilitated through the ESP32, which communicates with a higher level computer (NUC) via a serial line and micro-ROS.

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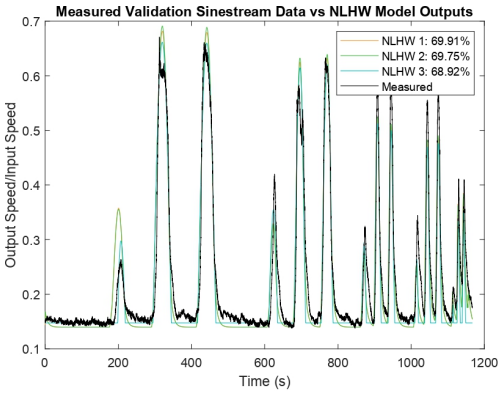
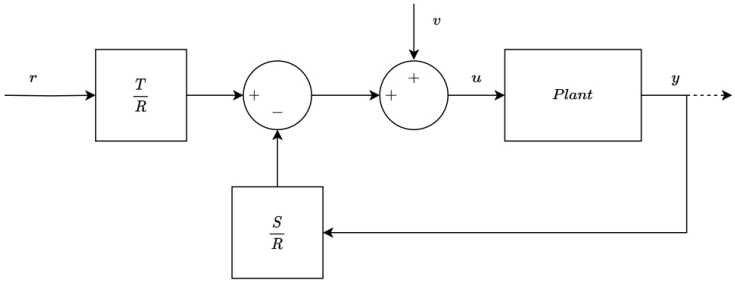
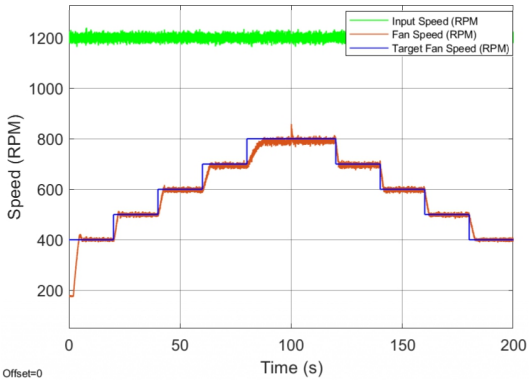
System Identification & Adaptive Control for Viscous Clutch Fans of Heavy Commercial Vehicles

Scania AB 2023







My master thesis project was conducted at Scania in Stockholm, with the topic being Adaptive Control of Viscous Clutch fans. Prior to performing any controller design, system identification of a generic viscous clutch fan was performed. The system identification process revealed the highly nonlinear and stochastic nature of the viscous clutch. Nonlinear Hammerstein-Wiener models were used to capture the nonlinear properties, and provided a satisfactory fit to represent the system To address these issues and having read relevant literature, it was decided to make use of a self-tuning regulator adaptive controller, which builds upon the traditional self-tuning regulator by utilizing a recursive least square online model estimator with an adaptive forgetting factor based on fuzzy logic. The final implementation was evaluated in simulation, and provided positive results, improving upon the results obtained by related works.

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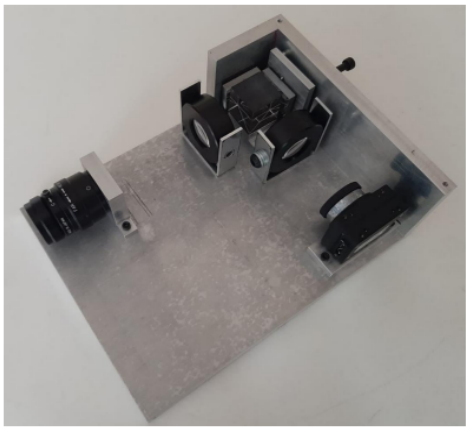
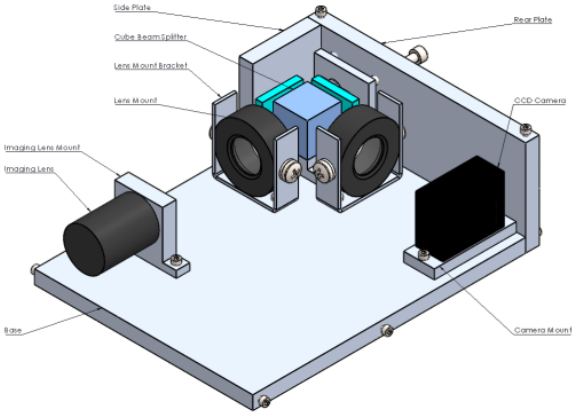
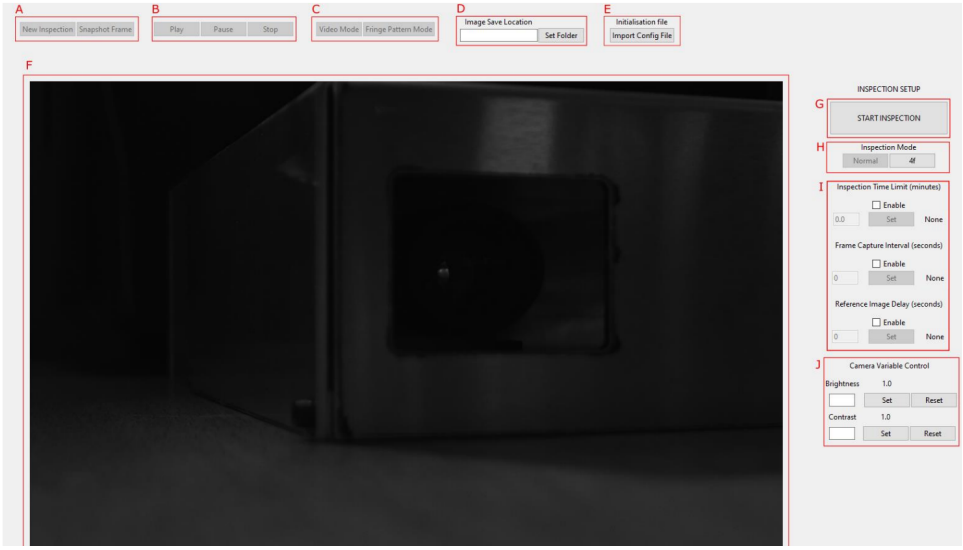
Non-destructive Testing (NDT) Prototype & GUI

University of Cape Town 2020







This prototype, which improves on a previously built device that was designed based on a modified Digital Shearography optical NDT technique, is used to inspect components for defects. This design improves on traditional Digital Shearography based designs by ensuring that the field of view is no longer limited by internal components, but rather is solely dependent on the camera lens. A user-friendly GUI was also developed to facilitate the component inspection process, providing access to inspection/camera parameters and image acquisition. This project included CAD design in Solidworks, coordination of manufacturing, GUI design/development in Python/C.

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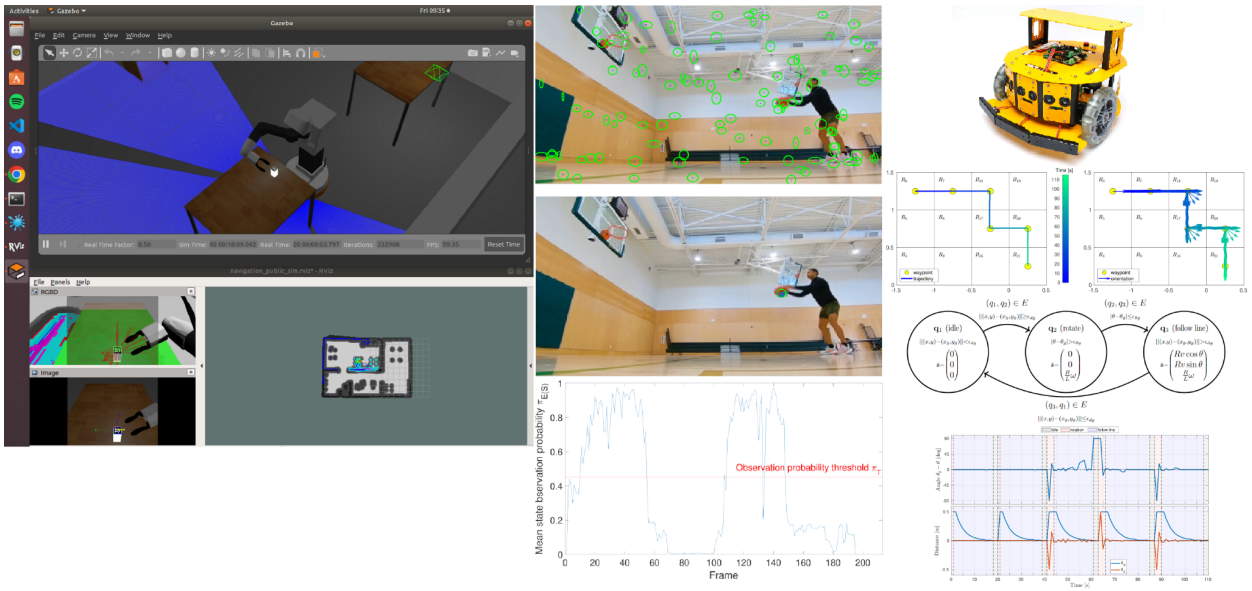
Master's course projects

KTH Royal Institute of Technology 2021-2022



1. Robotics - Tasked with designing and implementing a robust behavior tree for a robot to pick up and move a cube between tables. Furthermore, the partial implementation of the SLAM (using particle filter) and locomotion of the robot using Python ROS in a Gazebo environment.
2. Applied estimation project - Review and Implementation of an existing colour-based particle filter to identify and track a target. Using the adapting colour distribution of the target to try address changes in illumination and object appearance. Designed and implemented in Matlab.
3. Hybrid & Embedded Control - Tasked with designing and implementing a hybrid controller for a differential-drive robot to make it follow a predefined path in a workspace with constraints. Controller design was done in Matlab and implemented in C++. Lastly performance was evaluated on a differential-drive Nexus Robot.

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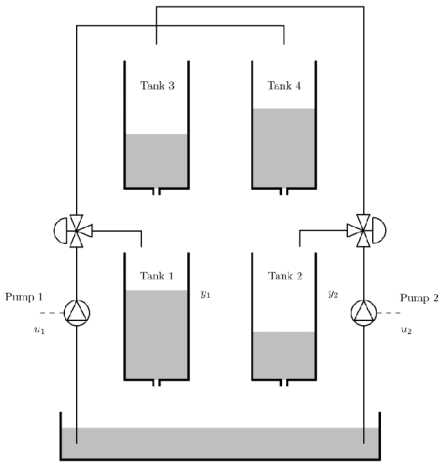

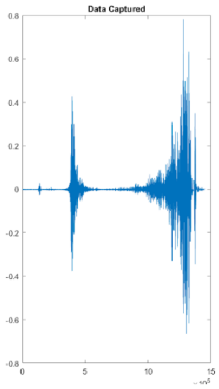

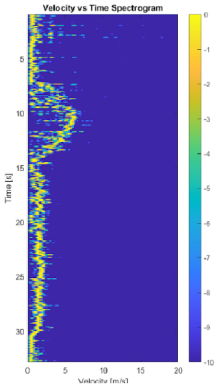

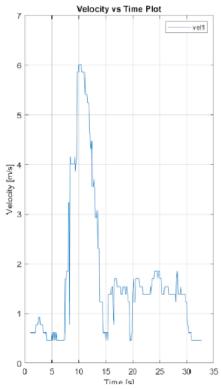

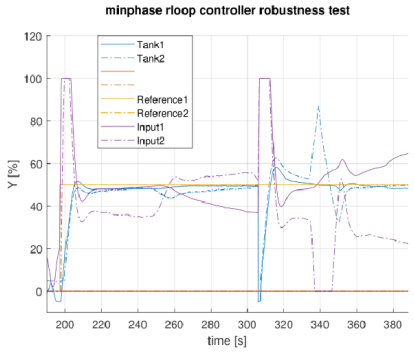

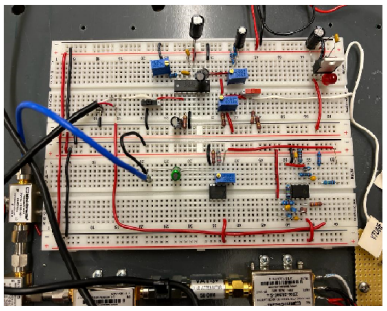

4. Multivariable Robust Control - Tasked with implementing (Matlab) a Glover-McFarlane robust controller for reference tracking in a four-tank multivariable system.
5. Radar Build Project - Tasked with building our own COTS radar (Continuous-wave (CW) & Frequency-modulated CW) and implementing algorithms (Matlab) to extract velocity and range measurements. We also implemented a basic SAR and implemented a basic SDR using GNU-Radio.

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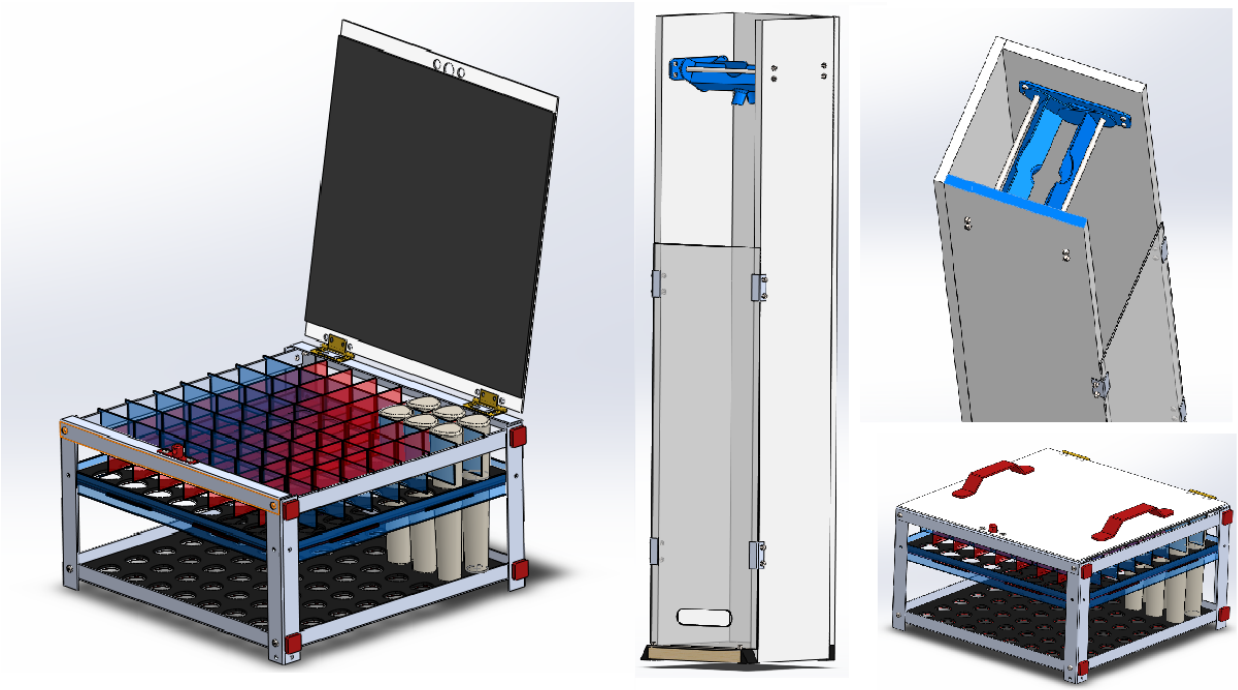
Medical Device ISO Evaluation

Impulse Biomedical 2020-2021



Impulse Biomedical is developing a reloadable Adrenaline auto-injector to treat severe allergic reactions at a fraction of the standard market cost. During my time there I was tasked with the design, material acquisition, assembly and evaluation of devices to test their product against relevant ISO standards. This included a unit for storage, viewing and traceability of the product that would be suitable for placement in an Environment Chamber, a drop test device, as well a jig to assist with assembly of prototypes.

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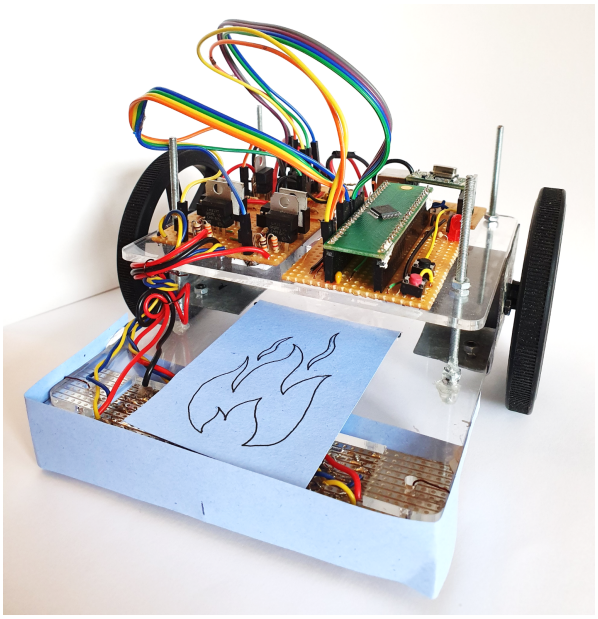
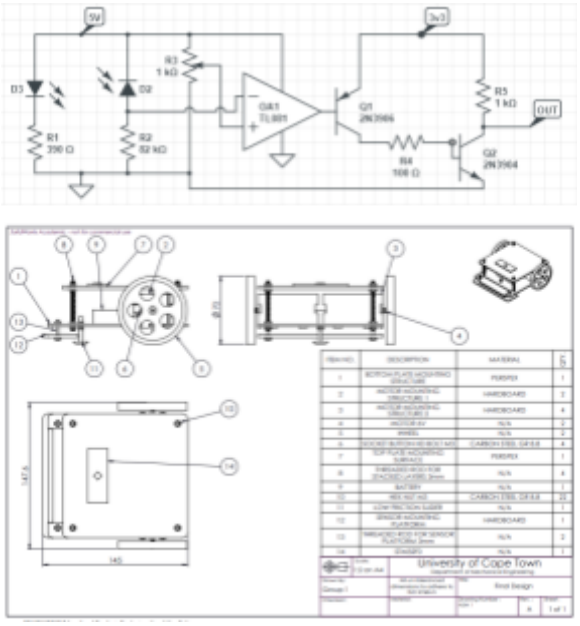
Bachelor's course projects

University of Cape Town





Tasked with developing an autonomous line-following robot to solve a line maze as quickly as possible. This involved the mechanical design of the robot in Solidworks, relevant circuitry design and implementation on a veroboard.. We were also responsible for procuring our own components such as motors and motor drivers ourselves..The robot made use of an array of infrared sensors to detect the position of the black line against a white background and the locomotion algorithm was implemented on an STM32 microcontroller using C.