Sayyed Omar Kamal

Electrical/Electronics/Mechatronics Engineering trained with 4+ years experience, enjoys working on electronic circuits, PCB design, fabrication and rework, as well as software writing and verification. Keen interest in technical writing, documentation, reviewing, proofreading and editing.

Tampines St 22 Blk 289 #02-458
Singapore 520289
(+65) 9296 9814
somark213@gmail.com
tp_omar213@outlook.com

EMPLOYMENT HISTORY

Second Charm — *General Manager*

NOVEMBER 2020 - PRESENT

- Manage day-to-day operations in the storefront, including Sales, Customer Relations, Inventory, Order and Delivery, etc.
- Developed digitized processes for Inventory Control, Invoice Management and Staff Monitoring and Records.
- Managing online storefront on Shopify for online sales orders and fulfillment. Updating of product listings, including price, details, options and adding of new items and designs.
- Supervise logistics staff in the handling of furniture from arrival of order shipment, defect recognition, corrective actions and preparation for delivery or collection.
- Liaise with customers on all aspects of their order, from enquiries, order confirmation, adjustments to existing orders, updates on order status and scheduling of delivery of orders.
- Ensure necessary utilities are up-to-date and running as intended.
    - Updated company's business telecommunications account to a relevant business plan with broadband internet and company mobile line.

Transforma Robotics— *Mechatronics Engineer*

SEPTEMBER 2017 - OCTOBER 2019

- Developed and delivered a stand-alone system for ID Card info replacement using a single microcontroller to manipulate 8 stepper motors, 2 DC brushed motors, 1 vacuum pump and 1 heat gun to remove existing info label, scratch out surface and apply new info label from externally printed source.
    - *Designed and fabricated* electrical system network with Arduino MCU core and **custom PCBs** for relays, sensors, stepper drivers and related peripherals' circuits.
    - Wrote and tested control code for overall system process, controlling multiple blocks of motors and peripherals in *alternating sequences* to prevent overloading of power supply.
- Designed and implemented lithium battery based power distribution circuits and systems for 2 different robotic platforms:

SKILLS

Microcontroller system design and coding

Electrical circuits design and verification

PCB design and reworking

Integrated hardware/software system design and prototyping

C/C++ general coding

ACHIEVEMENTS

ICRA 2015 Participant, part of Amazon Picking Challenge team for NTU, officially placed 9th due to a technical fault (unofficially scored higher than MIT).

Author for Technology Disclosures for research work done in NTU for jet engine blade inspection, copyrights acquired.

Research Paper in ROBIO 2014, assisted in work done on optical tweezers cell recognition and optimal grip determination.

LANGUAGES

English (Main, Excellent)
Malay (Secondary, Average)

- Luggage case sized Mobile Inspection Robot for interior room inspection. *Military performance lithium-ion battery pack* used for power distribution between PC core, Laser Scanner, Integrated Servo Motors, Inclinometer and Network Router using a microcontroller platform as system manager (**Arduino** and **STM32**) on **custom PCB boards**.
- 2m tall Interior Wall Painting Robot. *High density lithium-polymer battery*, converted from 24V DC to 240V AC through DC-AC Inverter to provide power to multiple systems, including AC powered water pumps, UR10 robotic arm manipulator, NVidia Jetson TX2 module, multiple infrared/laser scanners, touchscreen LCD display and peripheral circuits.

Nanyang Technological University — *Research Assistant*

AUGUST 2014 - FEBRUARY 2017

- Contributed to the development of a 3D vision based object recognition algorithm to identify an assortment of consumer products placed randomly in shelving units, extracting the desired identity and estimated pose, allowing an industrial UR5 robot with customized grippers to pick the specified item from the shelf into a designated order bin using C++ language in Visual Studio.
  - Results shown in the **Amazon Picking Challenge** as part of **ICRA 2015**. Officially, Team NTU placed 9th.
- Assisted in the development of a Matlab script to determine the intrinsic calibration of Kinect 1 RGB-D cameras *without using the classic checkerboard method*.
- Contributed to the *improvement of the stability* of a cell-tracking algorithm for optical trapping and manipulation of biological cells in an optical tweezer using LabView. Developed a new algorithm to identify cell shapes and determine optimal grip cell positions for stable cell manipulation.
  - Work was co-published in a **Research Paper in ROBIO 2014**.
- *Independently developed* a **semi-automated inspection system for jet engine blades edge profiling**, *augmenting* current inspection systems with image processing software to analyse basic inspection properties (thickness, sharpness, shape, etc) and to detect and localize defects and highlight them to the human inspector. System automates the inspection of standard, non-defective units, *allowing inspectors to focus on the more complex task* of correcting defects.
  - Research work culminated in **2 Technology Disclosures** and **Copyrights** acquired for work done.

Outcomes Singapore — *Conference Assistant Coordinator*

AUGUST 2010 - NOVEMBER 2010

- Assisted in the planning and organizing of an international conference for childhood educators and social services providers held in November 2010.

EDUCATION

Nanyang Technological University, Singapore — *Bachelor of Engineering (Electrical & Electronic Engineering)*

AUGUST 2011 - AUGUST 2014

- Developed a hardware interface to monitor the temperature of a PSG's (pressurised steam generator) soleplate, AC boiler, pump and electronic valve on/off status using a zener diode based AC voltage step-down circuit, bridge converters to convert AC supply to DC, low voltage DC relays and heat sensitive thermistors with a PIC16F1936 microcontroller while attached to Philips Electronics Singapore.
    - A year after the internship,the internship supervisor informed me that the system was then improved upon by their engineers and is used in their labs for quick monitoring of their products, providing a simpler and cheaper alternative to their previous use of costly industrial datalogger hardware/software.
- Adapted a Kinect depth sensing camera to monitor and track the workspace of a SCARA robot to ensure safe human-robot interaction through the use of Processing IDE and Visual Basic as my Final Year Project.
- Developed a program for Android smartphones to connect to web-cameras and obtain still images or live video feed using Eclipse IDE as part of a group project module in the 2nd semester of studies.
- Excelled in Laboratory classes and Projects.

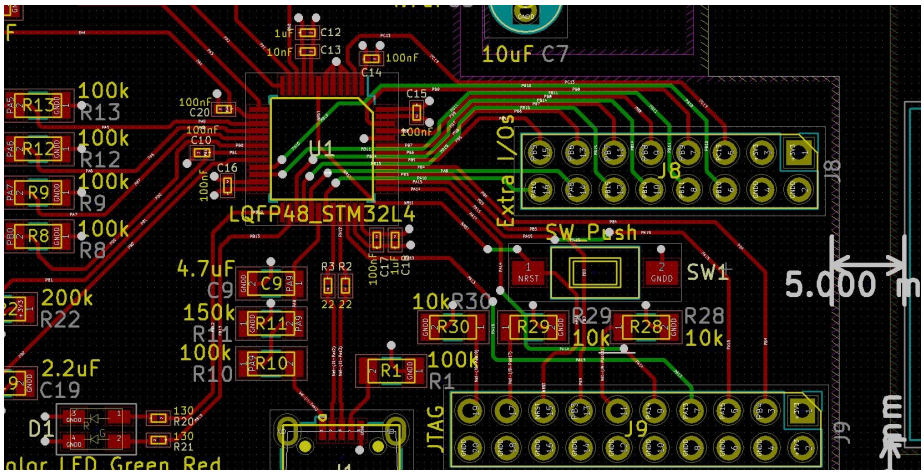
Temasek Polytechnic, Singapore — *Diploma in Electronics*

JUNE 2005 - JUNE 2008

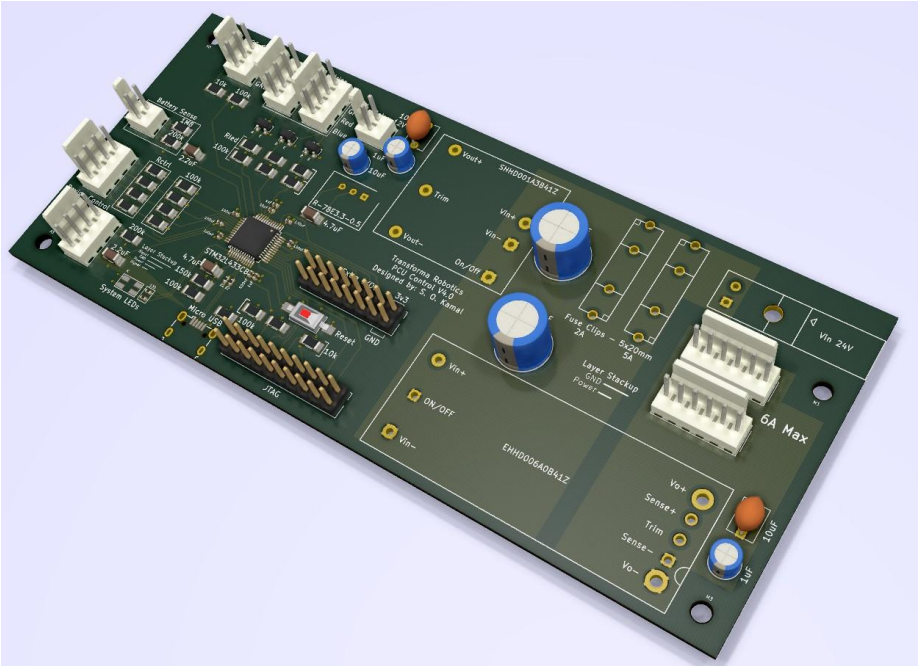
- Utilised WideField2 Ladder Programming software to create ladder programs in the operation and automation of AC motors and sensors to control a group of AC winches used to guide a wall-cleaning robotic platform across the facade of a building as part of my Final Year Project, which was done in partnership with Yokogawa Corporation.
- Excelled in coding lessons, earning a Distinction in C language Programming module.

Past Work Samples

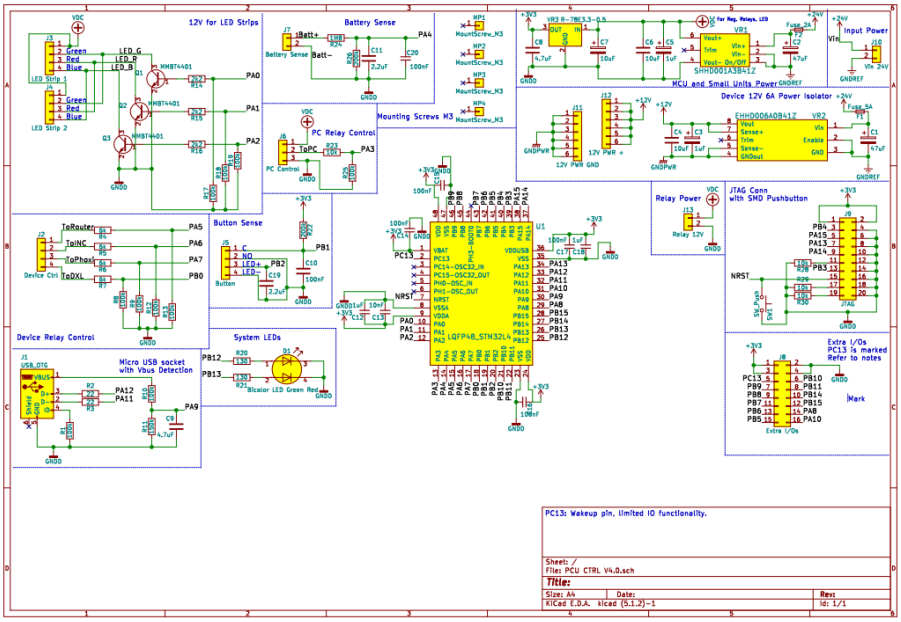
TRANSFORMA



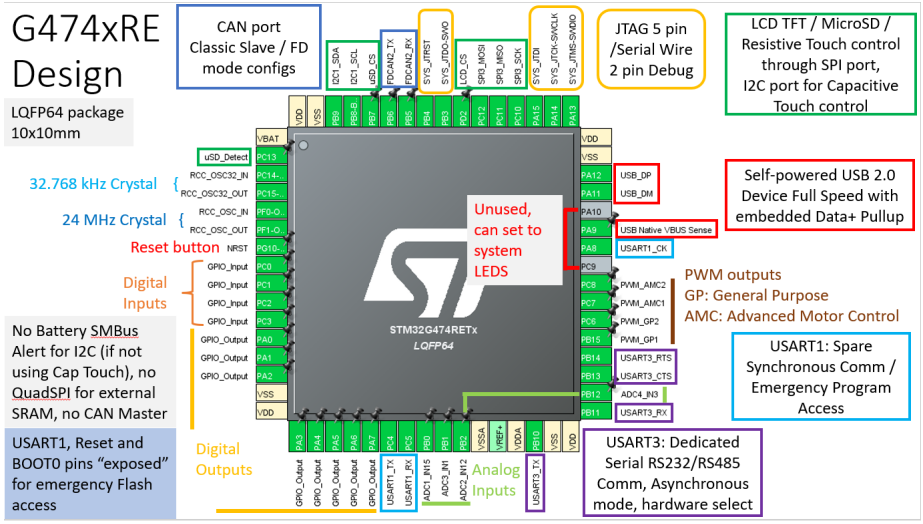
Power Regulation and Monitoring Circuit for Inspection Robot Prototype - Closeup of microcontroller chip copper routing



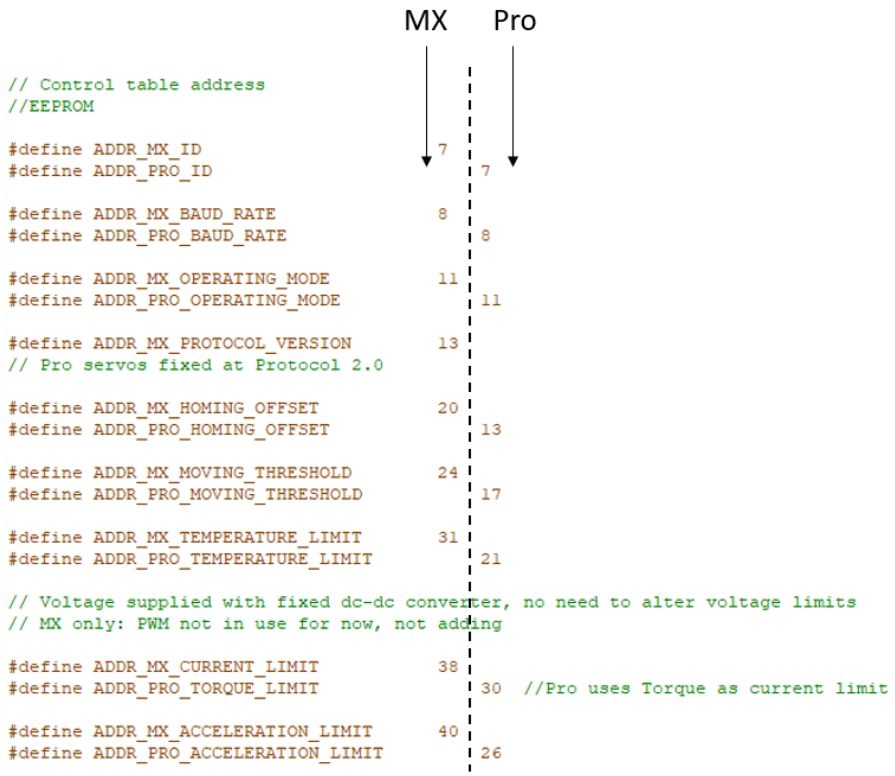
Power Regulation and Monitoring Circuit for Inspection Robot Prototype - 3D render of designed PCB



Power Regulation and Monitoring Circuit for Inspection Robot Prototype - Schematic diagram of designed PCB



STM32 Microcontroller chip Pinout Diagram - Prototype proposal



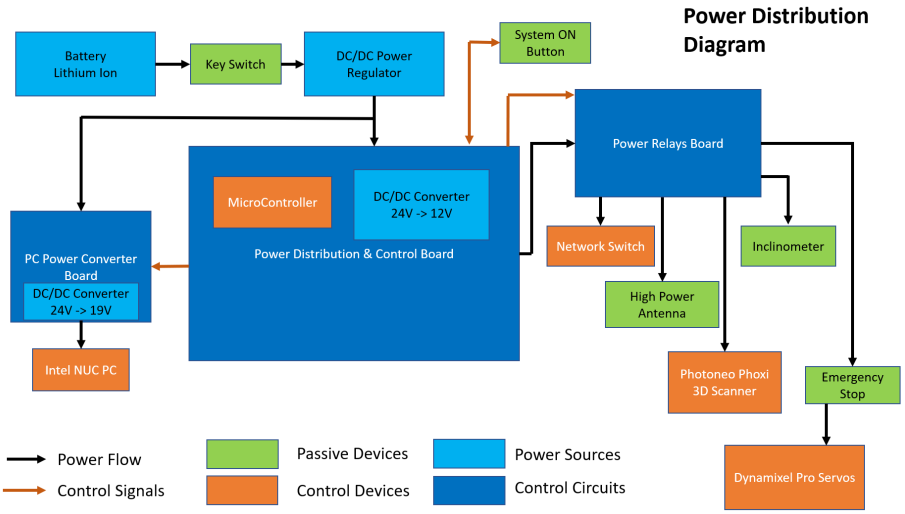
Code Description Snippet - Dynamixel Servo Motors C++ Library for use with MX and Pro series servos

Intro

C++ code for Dynamixel MX and Pro servo control. All MX series servos (MX 28/64/106 R/T) supported (same control tables) under Protocol 2.0 but code specifically made for MX-64 servos. Pro series servos share same control table (same register addresses, size, etc) but certain data limits and variables differ (e.g. max position, velocity scale factor), current code designed specifically for M42-10-S260-R servos. May add other models and series as used by project. MX functions tested, verified functional in Linux. Pro positioning functions updated and tested, accurate movements achievable (0 or 0.01° variance between target and final position). External Port functions to be tested soon. Shutdown check function untested, will devise method to test.

Code allows use of both servos simultaneously, register addresses selected automatically within function with declared variables entered can use either high-level (position in degrees, velocity in rpm, acceleration in rpm^2, current (torque) in amps) or low-level direct integer for transmission to servo, conversions between high- and low-level data available (e.g. position in degrees to integer for transmission). Control is focused on Position (Single turn) Control mode, other operating modes to be added as required. Position values can be preloaded into servo through vector data arrays, either in direct integer form or in floating point values in degrees from -180 to +180 degrees. Vector arrays can be stored into internal class memory for permanent allocation and data protection (move vector arrays into private or protected member accessor).

Documentation for Dynamixel Servo Motors C++ Library - Introduction



Power Distribution Diagram for Inspection Robot Circuit

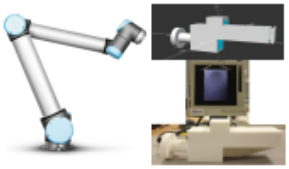
Automated Finishing Profile Inspection System for Jet Engine Blades

WP2

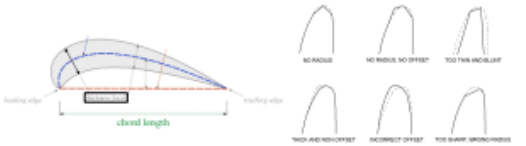
A/P Cheah Chien Chern (eccheah@ntu.edu.sg), Mr Sayyed Omar Kamal (sayyedomar@ntu.edu.sg)

Problem Statement

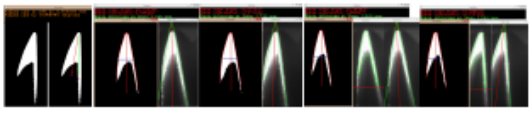
- Currently, finishing profile inspection handled manually takes a long time for a set of blades belonging to one engine
- Inspection conducted at specific intervals along blade edge
- Requires multiple tools and processes (inspector needs to manually mark out inspection points, each inspection point requires different equipment for the different properties)
- Three main properties inspected:
  - Chord length
  - Blade thickness
  - Leading edge contour
- Defects found are marked on the blade so that maintenance can correct them, which adds a consideration for the chemical properties of the marking tool used (special welder's pencils or industry certified markers only) so as not to damage the chemical coating on the blades
- High dependency on operators' skills



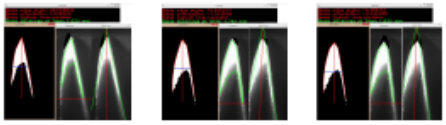
UR10 robot arm to be used in conjunction with edge profile comparator with custom 3D printed sensor mount



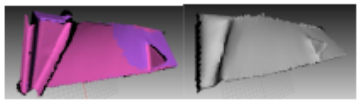
Examples of the 3 main inspected properties



(Leftmost) Orientation of sensor measured and used to correct position to maintain optimal inspection pose. Inspection of blade thickness insensitive to tilt of blade



Blunting defects commonly seen, on either side of blade or sharpening defect



3D reconstruction of fan blade using high cost, high resolution Artec (left) and low cost, low resolution Kinect (right). While Kinect gives a noisier result, the overall size of blade is consistent with the Artec result. Noisy edge expected due to sensors' inability to obtain the thin edges. Plan is to complete reconstruction using data from the comparator for edge details.

Solution

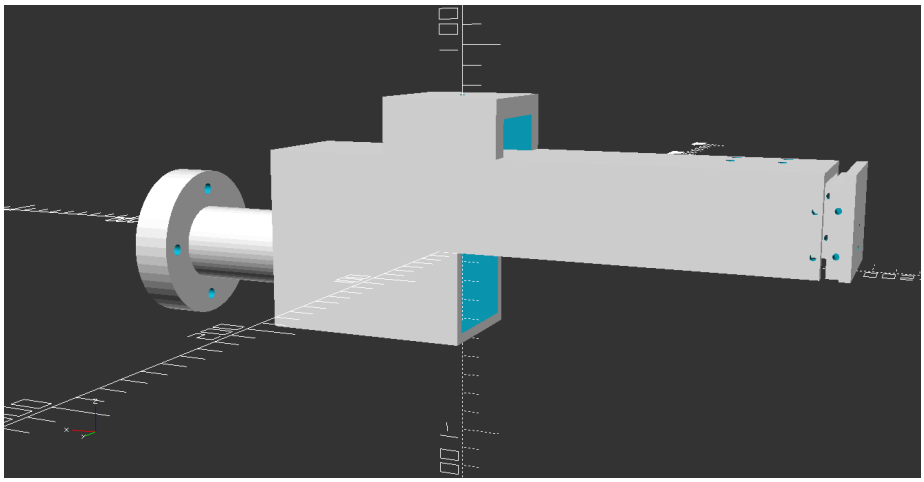
- Automated system consisting of industrial robot arm (UR10), edge profiling camera (H&L edge profile comparator 900B, currently used in aerospace industry), Kinect RGB-D sensor (future work)
- Intent: Significantly reduce inspection processing time to expedite redeployment
- Continuous inspection along blade edge possible, instead of only specific points
- Semi-autonomous operation available, human operator wields sensor as per normal, system measures properties and records defects, user can immediately cross-check readings or perform certain checks that system may have trouble with (i.e. leading edge contour)
- In-development: Ability to reconstruct blade model allowing for a digital record of the blade, its measured properties and any defects (fully digital records [easily transcribed if necessary], no markings needed on blade)

Impact / Benefits

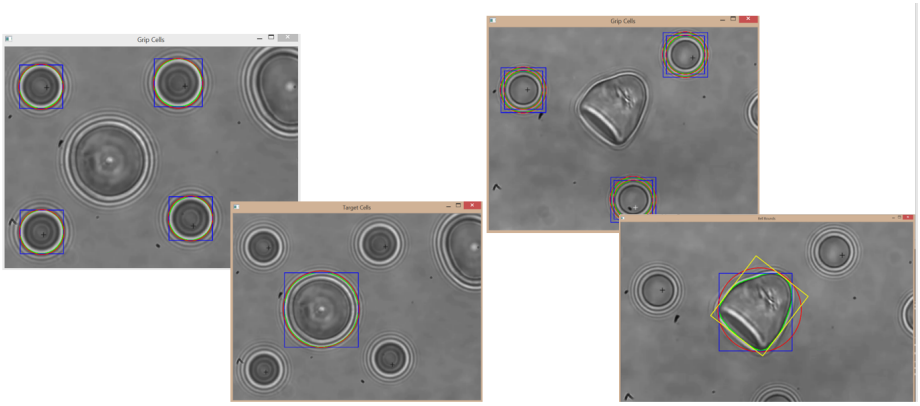
- Greatly reduced time between maintenance, inspection and redeployment
- Less equipment required for overall process
- Can be fully autonomous (UR10) or semi-autonomous (user assisted)
- Semi-autonomous mode: Able to train new inspectors without removing the experienced ones from the inspection line
- Digitized markings negate the need for markings on actual blade, removing the concern of chemical damage to blade coating

Agency for Science, Technology and Research SINGAPORE | Industrial Robotics Program | NUS National University of Singapore | NANYANG TECHNOLOGICAL UNIVERSITY | SIMTech A*STAR | A*STAR IPR

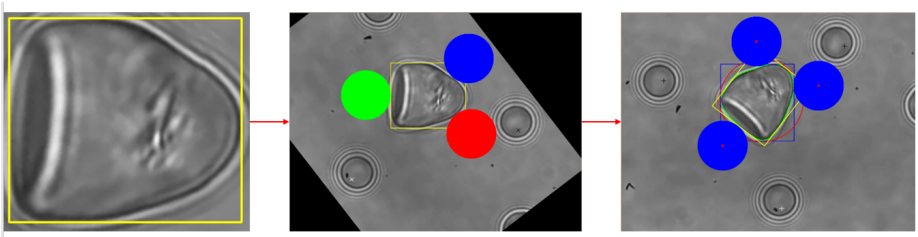
Poster for NTU-AStar Collaboration Research Project on an Automated Jet Engine Fan Blade Inspection System



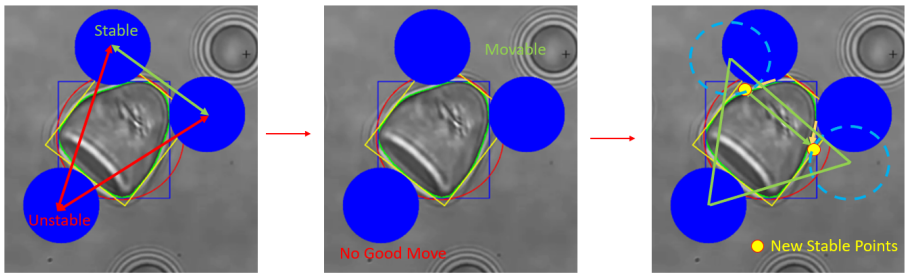
Custom Mount for Jet Engine Blade Inspection Camera for UR10 Robot - 3D render



Identification and separation of Target and Grip cells in an Optical Tweezers Research - Circle and Bell shaped cell targets



Determination of optimal Grip Cell positioning in Optical Tweezers Research



Planned future work for Dynamic Stability Adjustment of Grip Cell positioning