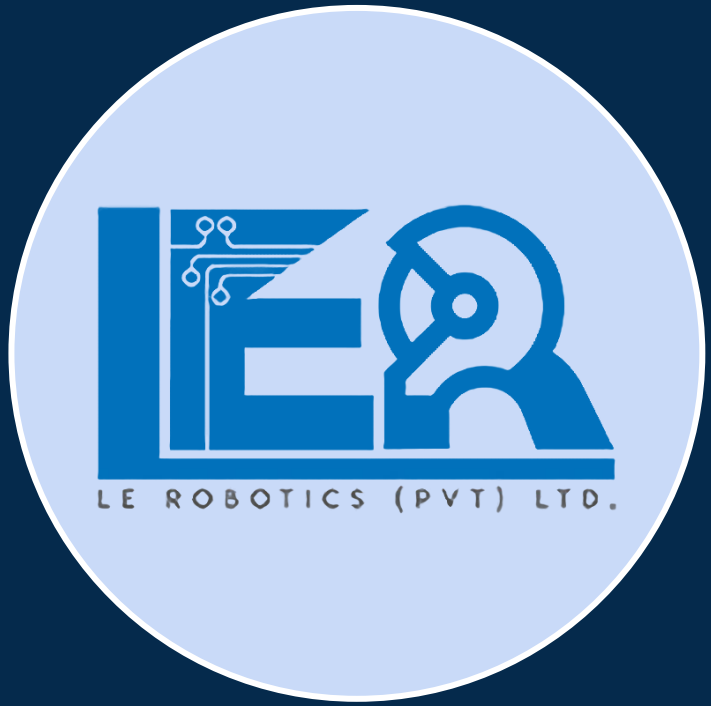
In18-IT-EN3992 Industrial Training

@ L.E. Robotics (Pvt.) Ltd.

Bimalka
(Former Engineering Intern)



Supervised By
Prof. J.A.K.S. Jayasinghe

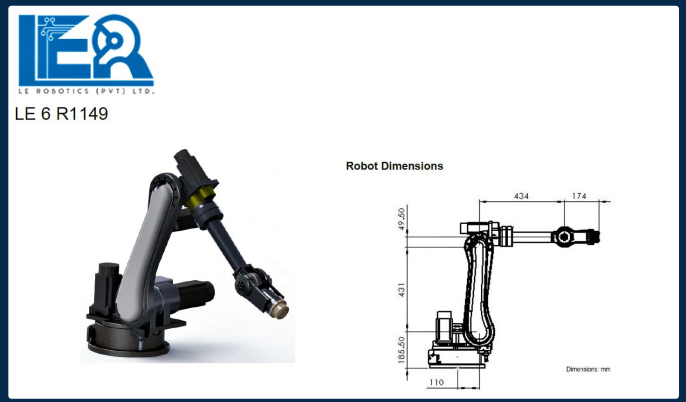
Engineer In-Charge
Miss. J.A.L. Jayasinghe

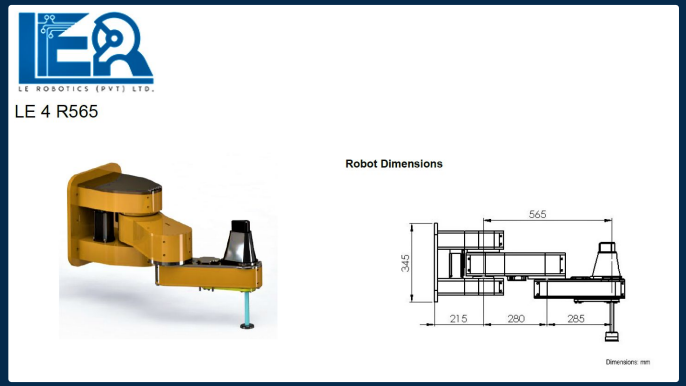
http://www.lerobotics.lk/

ENTC
Electronic and Telecommunication Engineering

Contents

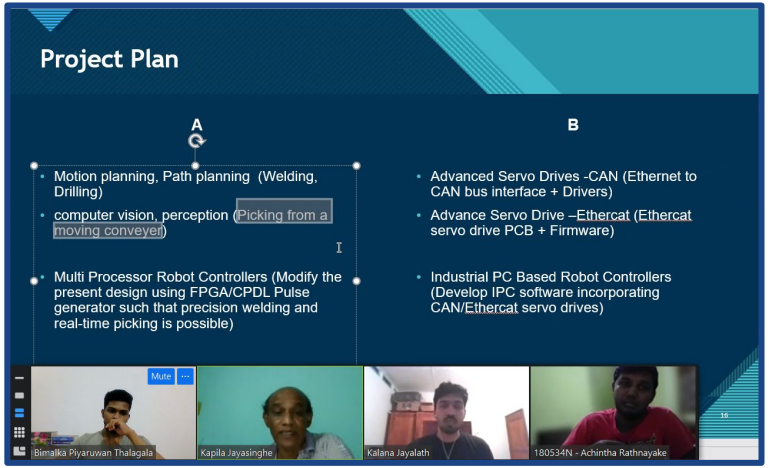
Description of the Organization





- L.E. Robotics (Pvt.) Ltd. is a local R&D facility located in Minuwangoda, Sri Lanka.
- Offers fully customisable robotics solutions for various automation needs
- Established in 2005 by Prof. J.A.K.S. Jayasinghe who is a senior professor in ENTC
- Products manufactured:
  - **6 DOF Robots** - Robots with six degrees of freedom
  - **4 DOF Robots** - Robots with four degrees of freedom
  - R&D of the related technologies (servo motors and their drivers)

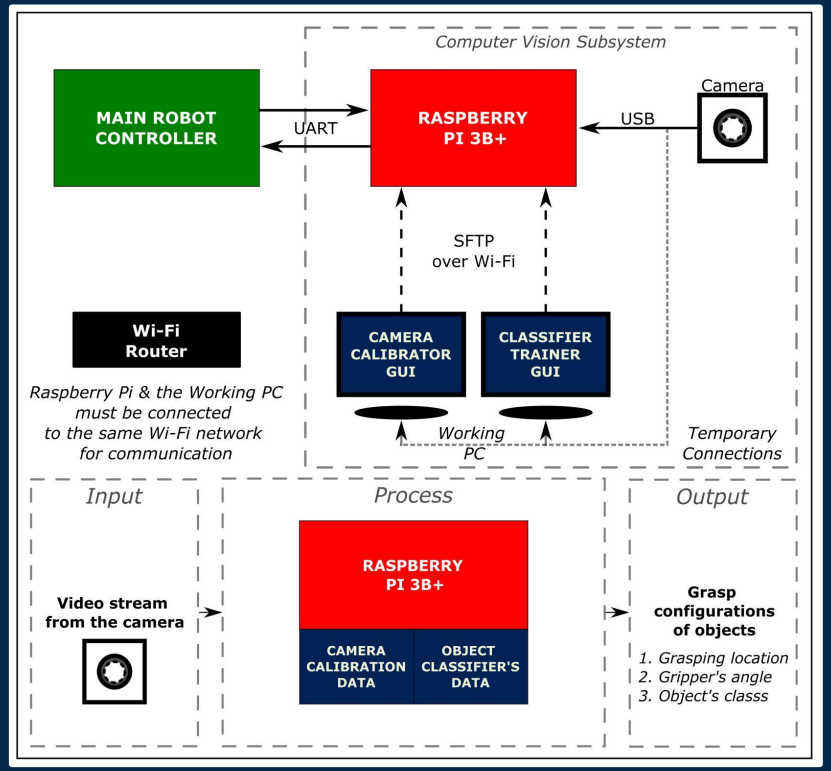
Familiarization work carried out



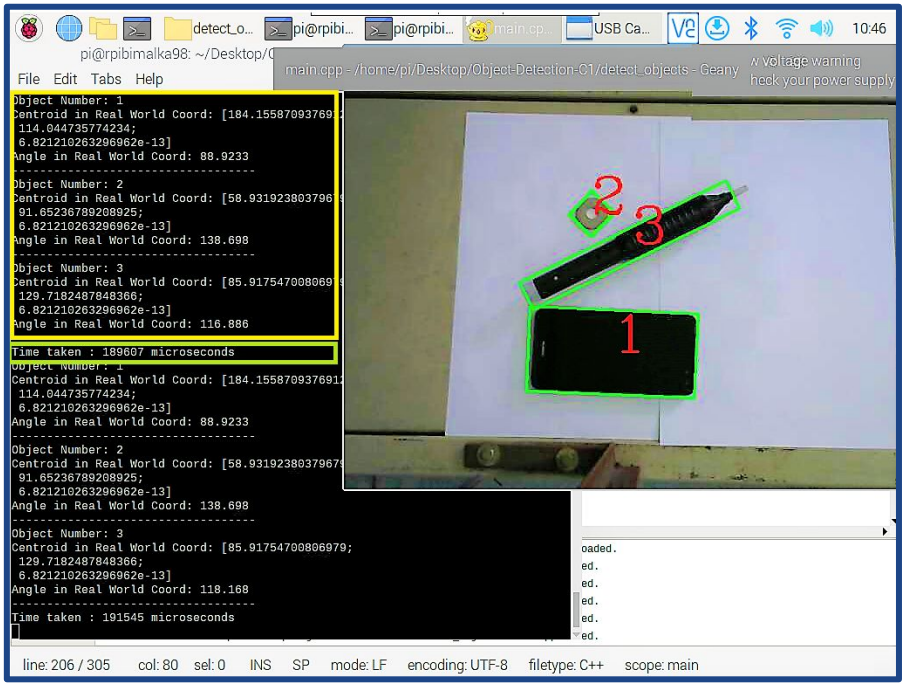
- Projects Assignment was done about a month prior to the commencement of internship
  - two project plans were offered
  - we agreed to move forward with plan A (on left)
- Facility familiarization after commencement of the internship
  - introduction to industrial robot arm designing
  - machinery required for industrial robot arm designing (CNC,Lathe,…)
- Non-Disclosure agreement

Project Work

- By title, the project that I was assigned, was "*Machine vision based Real-time Motion Planning for an Industrial Articulated Robot Arm*".
- My contribution to that project
  - Developed an object detection framework
  - Developed an application for camera calibration (Camera Calib. GUI)
  - Developed an application to train an object classification model (Classifier Trainer GUI)

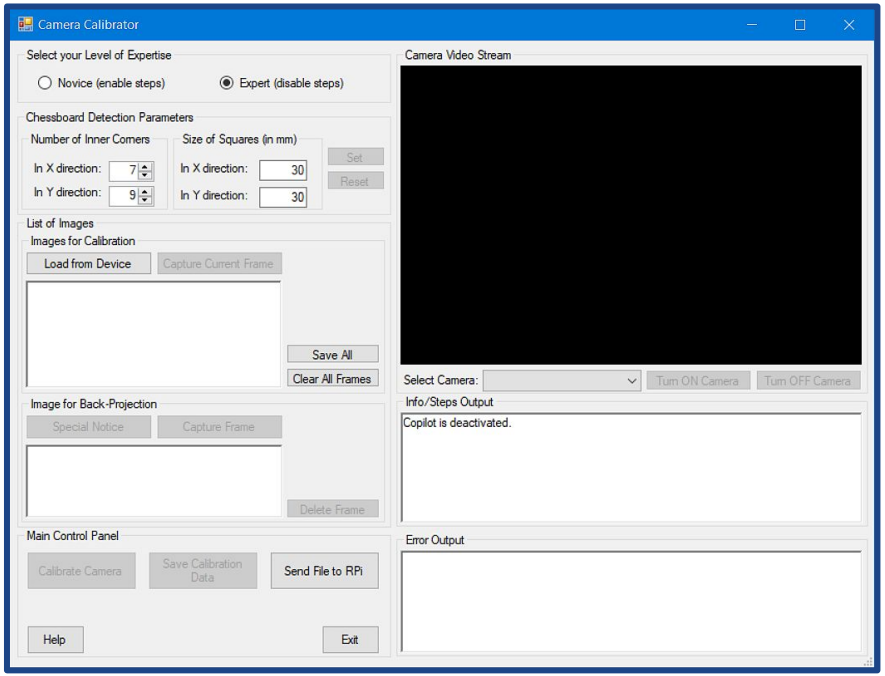


Object Detection Framework



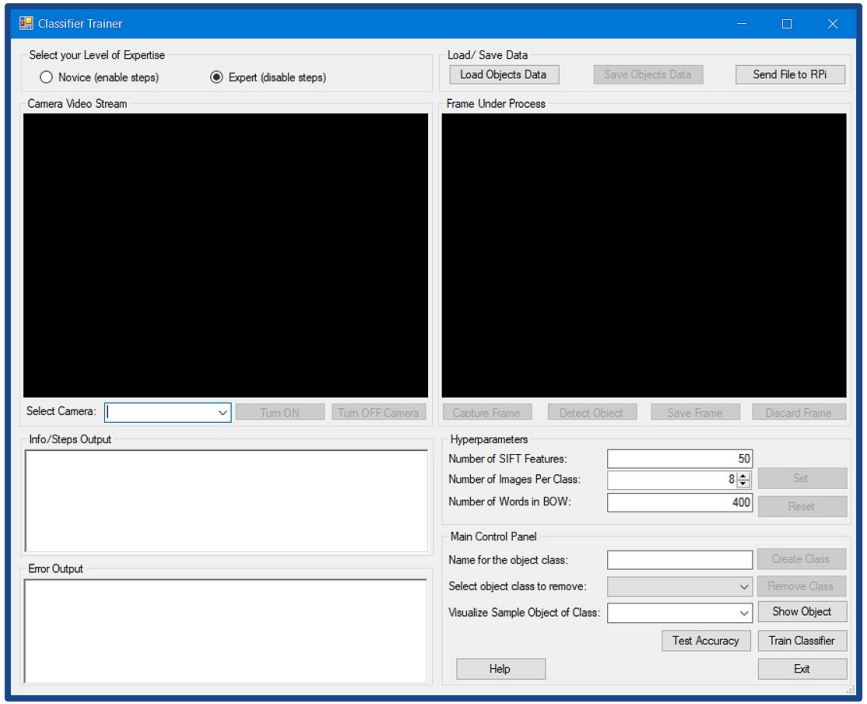
- Engineered from scratch
- Developed two associated Windows GUIs (coming up next)
- Capable of determining grasping configurations (location, orientation and object class) for a given object
- Implemented all the algorithms using C++ and OpenCV (a traditional Computer Vision approach)
- Documented working principles and guidelines to deploy the framework to the vision subsystem of pick and place machine

Camera Calibrator GUI



- Designed the user interface
- Developed required algorithms using C# and Emgu CV
- Composed the user manual for the software.
- Can be used to calibrate any monocular camera to be used in automatic pick and place machines
- Application is capable of generating required data, to remove the distortions of captured images to transform 2D image points back to a given 3D real world coordinate system with an accuracy of ± 0.5 mm.

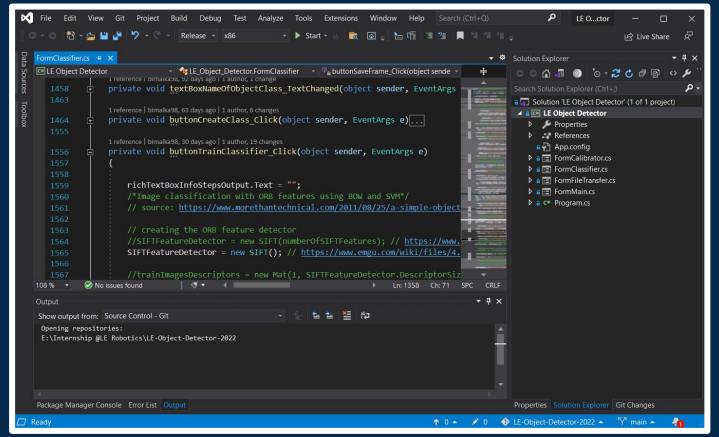
Classifier Trainer GUI

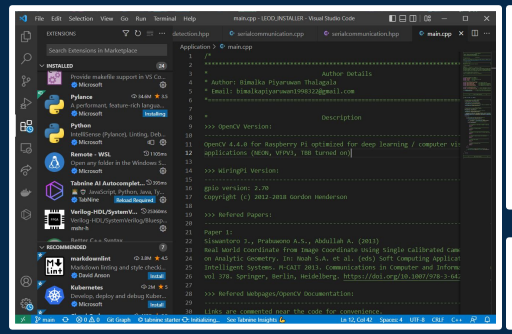


- Designed the user interface
- Implemented required algorithms using C# and Emgu CV
- Trained and tested the accuracy of the model on industrial robot parts classification
- Composed software's user manual
- Classification model uses, SIFT for feature extraction; K-Means clustering to create the Bag of Words (BOW); and Support Vector Machines (SVMs) for classification in One-vs-All approach.

Hands-on Experiences

- LE robotics Pvt. Ltd. had no experts in the CV field. I had to learn most of the things related to my assigned projects by actually doing them.
- An ideal opportunity to learn, unlearn and relearn various technologies really fast and with minimum supervision.
- Resources for Self-Learning
  - *Google Search • Stack Overflow • OpenCV Documentations • EmguCV Documentations • Research Publications*
- Usage of Open Source Software
- Usage of Modern Tools (CV & SE related)
  - *Visual Studio 2019 • Visual Studio Code • Git • CMake*





Soft Skills Development

- Learning a new technical skill is not a big deal with the advancements in technology as everything is available at the fingertip
- However, mastering a soft skill is much harder and takes time
- LE Robotics Pvt. Ltd. was absolutely an ideal place to improve existing soft skills as well as to learn a new set of soft skills
  - **Problem-solving:** *exposure to the world of 'Research publications', exposure to entire prototype development process (idea generation, research, planning and prototyping)*
  - **Adaptability:** *Companies and working environments are different from one another, have to deal with human beings with diverse mindsets*
  - **Time management:** *Proper planning and organization of the assigned tasks depending on their priority, knowledge of modern tools was also a plus point*
  - **Professional work ethic:** *Punctuality, Trustworthiness and obeying the NDAs, Respect the Intellectual Property (IP) of others*
  - **Communication :** *project demonstrations, various presentations and technical documentation preparations*

SWOT Analysis

	Organization	Self
S	• Great vision towards “Made in Sri Lanka” • Decades of experience in the industry • R&D of very advanced technologies	• Can work under minimum supervision • A team player with critical thinking abilities • Fast learner who learns as needed
W	• Heavily depends on the interns • Well-being or the career growth of the employees was not of their concern	• Underestimate myself when a new challenge is introduced • Can not tolerate any kind of injustice
O	• Industrial automation is a fast growing field • Very few competitors in the market	• Industrial automation is a fast growing field • Professionals with both AI and Embedded Systems Engineering knowledge have a higher demand
T	• Slow product development speed in a fast moving industry • Competitors who dominate the global market (KUKA)	• Below the average GPA in the department! (LOL)

Conclusion

- A whole new challenge which demanded a diverse set of technical skills as well as soft skills
- An opportunity to experience my full potential as an engineering student and revealed my true calibre
- No one is there to spoon-feed you in the industry and one must build a mindset of working under minimum supervision
- Being a team player and completing the assigned tasks well in advance, is a must to be successful in product development in the current fast moving industry
- Inner peace matters and one should maintain work-life balance to be a successful professional.

Thank You

Bimalka Piyaruwan Thalagala
Thalagala B P
180631J
t: +94 75 029 6594
e: bimalkapiyaruwan1998322@gmail.com

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