FREE

Webinar Series #1

Magister Terapan PENS

Robotics

Dr. Ir. Endra Pitowarno, M.Eng
Recent Topics on Robotics Vehicle and Its Applications

Ir. Dadet Pramadihanto, M.Eng, Ph.D
Robot in Cyber Physical Systems

Dr. Ir. Son Kuswadi
Disaster Robotics

Dr. Eng. Indra Adji Sulistijono, ST, M.Eng
Robotics - From Competition Towards Its Applications

Waktu Pelaksanaan:
Senin, 24 Agustus 2020
Pukul 13.00 - 16.00 WIB

Link Registrasi:
bit.ly/webinarPascaPENS#1

Moderator:
Dr. Eng. Bima Sena Bayu Dewantara, S.ST, MT

Fasillitas e-certificate
*Pastikan telah melakukan registrasi

Terbuka untuk umum

zoom

YouTube

Contact Person:
Puspa - 081230008675

Webinar Series #1 Program Pascasarjana PENS, Senin 24 Agustus 2020

Robotics - From Competition Towards Its Application

Dr.Eng. Indra Adji Sulistijono

Politeknik Elektronika Negeri Surabaya (PENS)
Kampus PENS, Jalan Raya ITS Sukolilo, Surabaya 60111
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Dr.Eng. Indra Adji Sulistijono, ST, M.Eng.

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Tel: +62 31 594 7280; Fax: +62 31 594 6114
Websites: www.pens.ac.id

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Email: sulistijono@gmail.com

- Dosen di Program Studi D4 Teknik Mekatronika dan Program Pascasarjana Terapan S2 Teknik Elektro, **Politeknik Elektronika Negeri Surabaya (PENS)**.
- SDN Endrakila, SMPN 1 dan SMAN 2 Madiun
- S1 – Jurusan Teknik Mesin – **Institut Teknologi Sepuluh Nopember Surabaya**, Indonesia
- S2 – Dept. of Human and Artificial Intelligent Systems – **University of Fukui**, Japan.
  Bidang kajian: **visual control**.
- S3 – Dept. of Human Mechatronics System – **Tokyo Metropolitan University**, Japan.
  Bidang kajian: **robot vision (Robotika)**.

Research Topic

- Intelligent Mechatronics, Computational Intelligence
- Visual Control, Robot Vision, Industrial Automation
- Robot for Disable, Disaster, and Agriculture
- Scopus H-Index: **6,** GoogleScholar H-Index: **9**
- Journal Paper: **12**; Int'l Conf: **55**+3; Nat. Conf: **29**

Expert (Mobile Robotics)

- WorldSkills Competition 2009, 2011, 2013, 2015, 2017, (2019)
- ASEAN Skills Competition 2014, 2016, (2018), (2020)
- Juri LKS Nasional 2010 – 2017, 2020.

Outline

- What is Robotics
- (Mobile) Robotics Competition
- Road to Champion
- Implementation Robot Technology
- Conclusion/Kesimpulan

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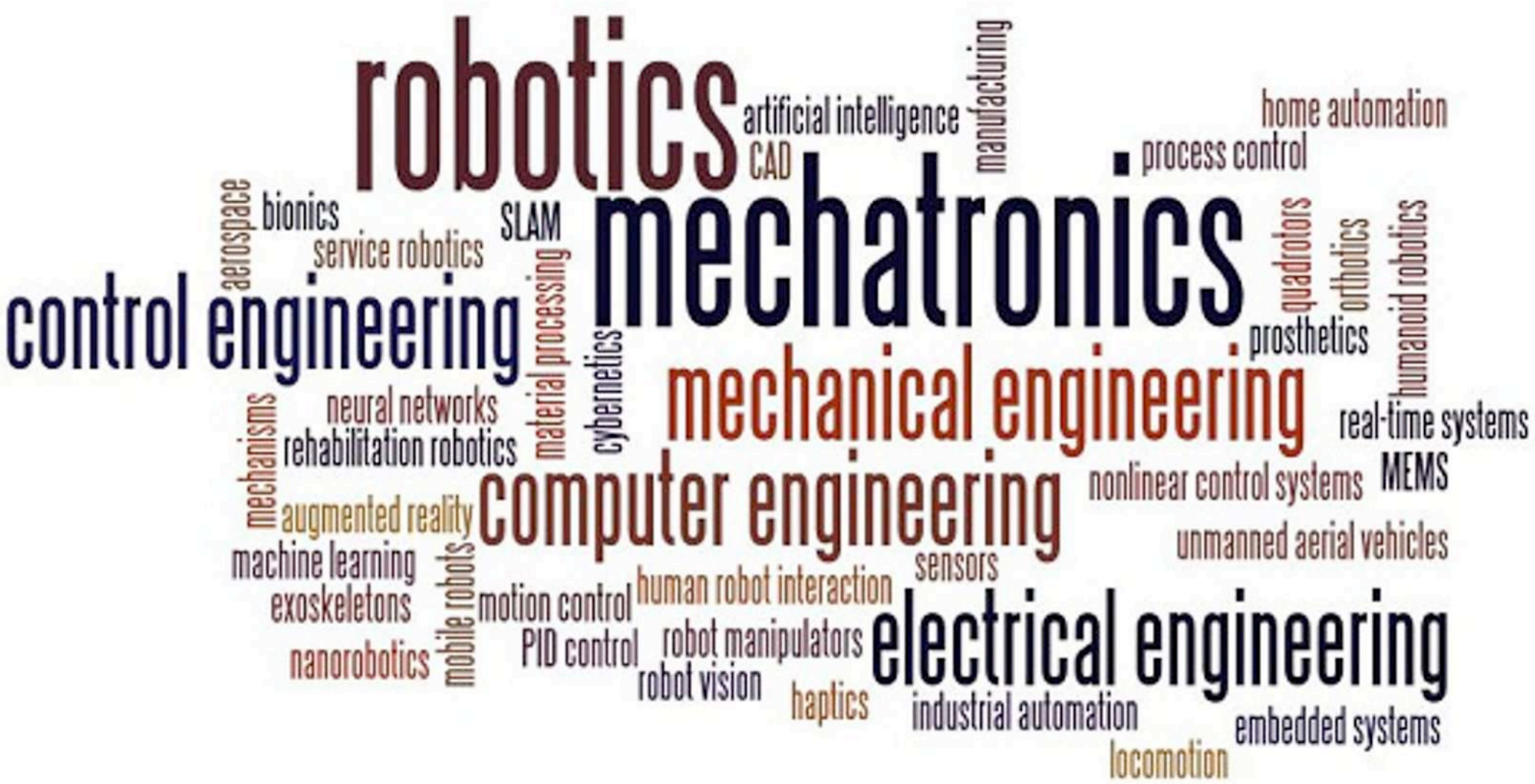
Intelligent Mechatronics and Industrial Automation Lab.
Human Mechatronics Systems Research Group (HuMeX)
Training Center for Mobile Robotics
Gedung Pascasarjana Terapan Lantai 3

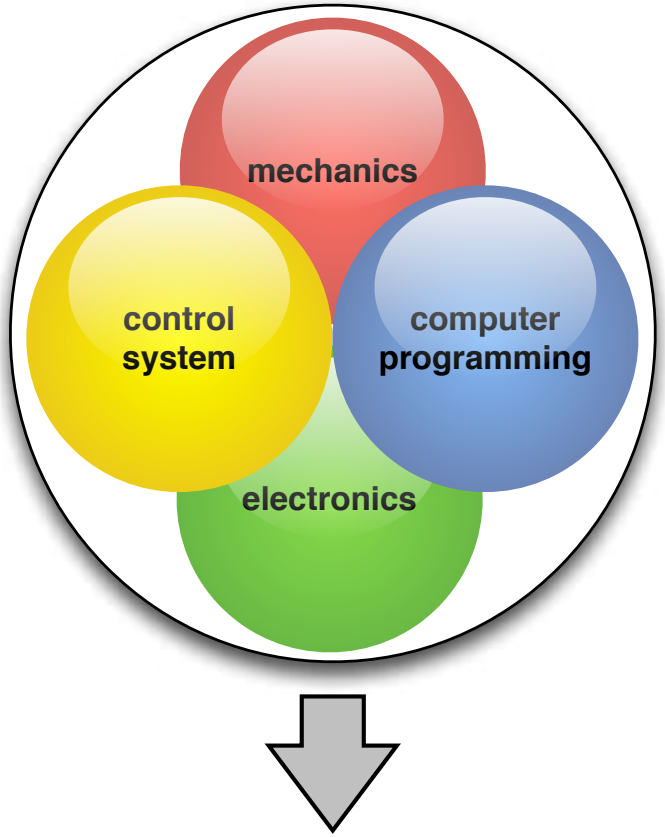
What is Robotics?



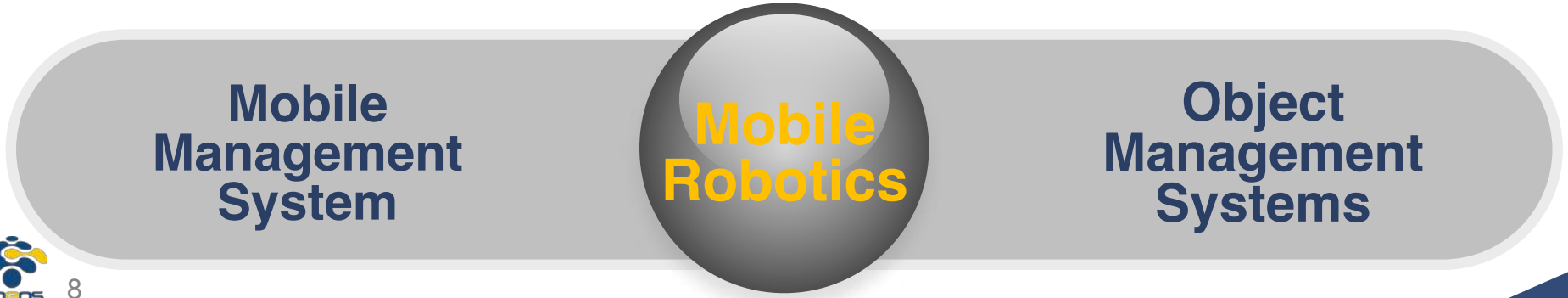
Referensi: https://www.google.com

What is Mobile Robotics?

MOBILE ROBOTICS



Designing, building, and maintaining robots to solve problems in industries from manufacturing to aerospace, mining to medicine



Mobile Robotics

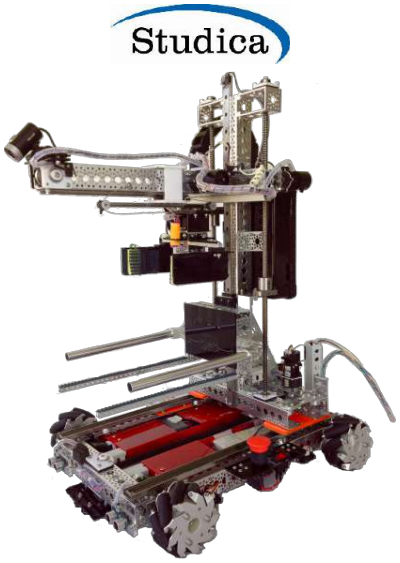
Dari Kompetisi Menuju Implementasi

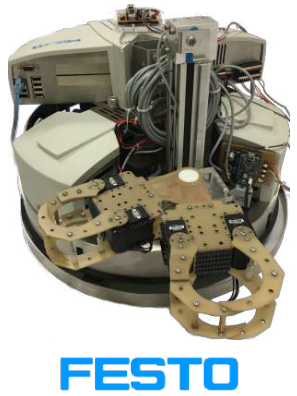
Tujuan Kompetisi: Mendesain, membuat dan merakit, memprogram, mengoperasikan dan melakukan pengujian robot yang dapat bergerak dari tempat start ke tempat tujuan yang telah ditetapkan serta menyelesaikan tugas yang telah ditentukan sebelumnya secara tuntas.

Teknisi/engineer robotika yang bekerja di industri, laboratorium atau office tertentu, mereka merancang, menjaga, mengembangkan aplikasi baru dan melakukan penelitian untuk memperluas potensi robot. Peran robot dimulai pada masalah industri tertentu, di sektor tertentu. Misalnya, dalam manufaktur, mungkin ada kebutuhan untuk meningkatkan kapasitas dengan membuat robot untuk tugas yang dapat diotomatisasi. Mobile robot juga dapat dirancang untuk menjelajahi area yang tidak dapat diakses atau berbahaya bagi manusia.

Mobile robotics adalah bagian penting dari industri, dengan aplikasi di berbagai sektor, termasuk manufaktur, pertanian, aerospace, pertambangan, kedokteran dan lain-lain.

Pemetaan Standar Kompetensi Mobile Robotics





Tujuan Utama

Mendesain, membuat dan merakit, memprogram, mengoperasikan dan melakukan pengujian robot yang dapat bergerak dari tempat start ke tempat tujuan yang telah ditetapkan serta menyelesaikan tugas yang telah ditentukan sebelumnya secara tuntas

Fungsi Kunci

- Preparation dan programming
- Implementasi ke hardware
- Mendesain, Membuat dan merakit hardware elektronik serta memprogram dan mengoperasikan kontroller pada mobile robot
- Menganalisis, mendesain, membuat dan merakit mekanik robot

Fungsi Utama

- Tools dan software
- Algoritma terstruktur
- Akses low level
- Akses high level
- Mengendalikan atau mengoperasikan perangkat keras elektronika dan kelistrikan pada mobile robot
- Membuat perangkat keras dan kelistrikan pada mobile robot
- Melakukan kegiatan project manajerial
- Melakukan analisis kebutuhan
- Mengembangkan desain model robot
- Membuat model robot

World Framework/Platform

FESTO

worldskills

Studica

World Skills Competition
WSC 2007 Toyohashi, Japan
WSC 2009 Calgary, Canada
WSC 2011 London, UK
WSC 2013 Leipzig, Germany

ASEAN Skills Competition
ASC 2014 Hanoi, Vietnam
ASC 2016 Kuala Lumpur, Malaysia
ASC 2018 Bangkok, Thailand

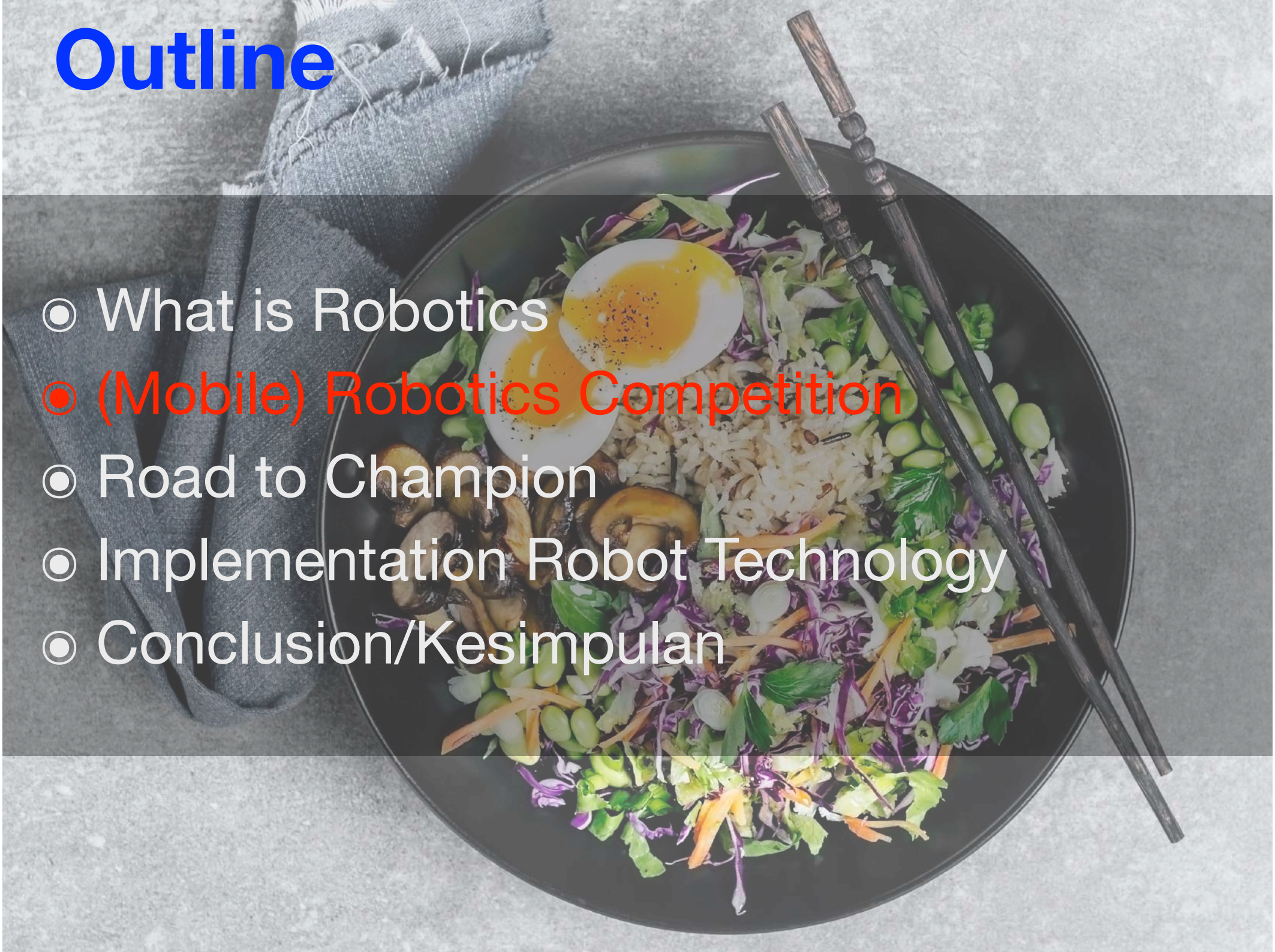
World Skills Competition
WSC 2015 Sao Paulo, Brasil
WSC 2017 Abu Dhabi, UAE
WSC 2019 Kazan, Russia
WSC 2021 Shanghai, China

ASEAN Skills Competition
ASC 2020 Singapore
(postpone to April 2021)

Prepare Before You Go

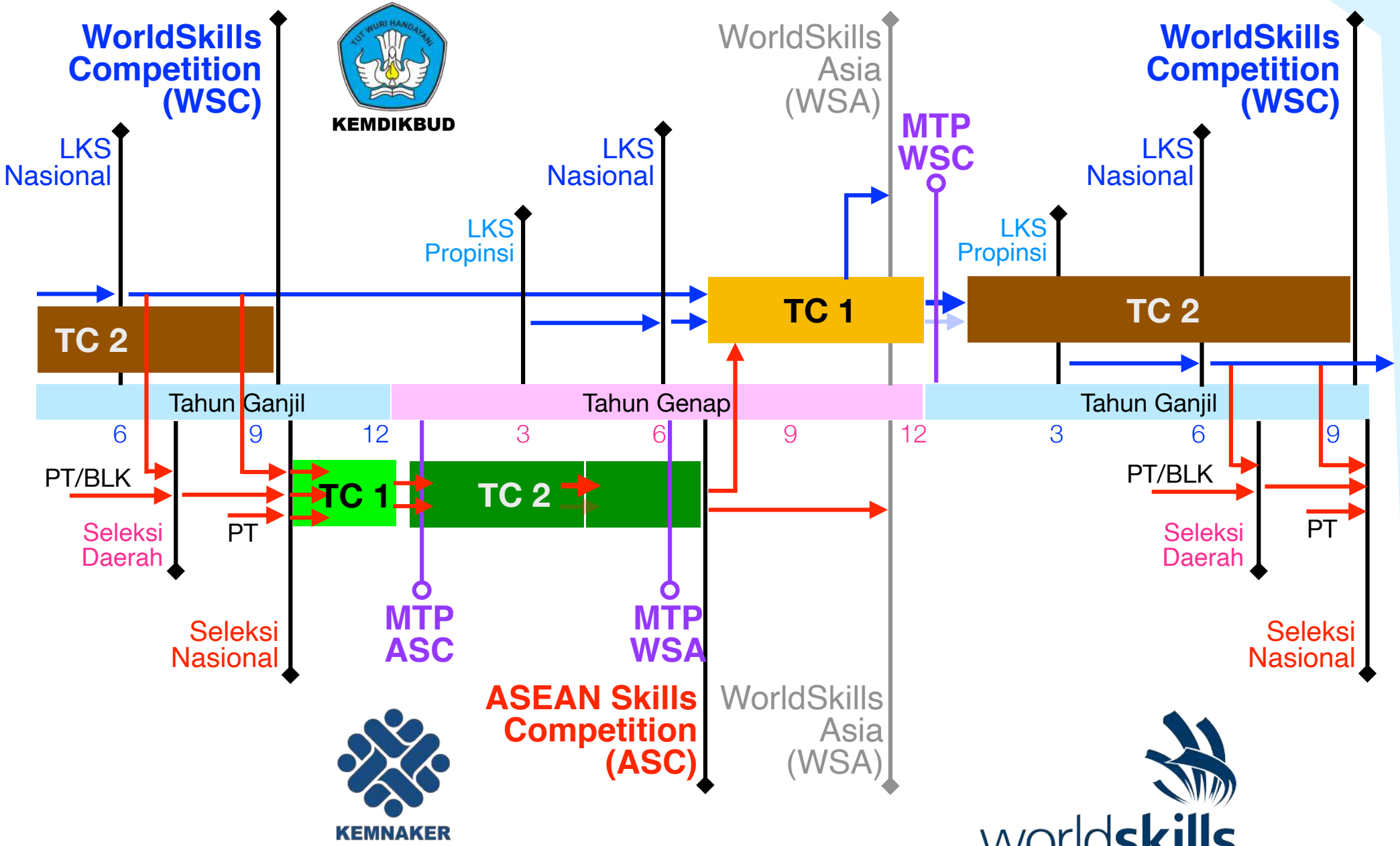
- CPU:
  - NI myRIO from National Instruments (NI)
  - LabVIEW software
- Sensor:
  - 3 infrared
  - 2 ultrasonic
  - 1 QTI (line sensor)
  - 1 gyro sensor
- Actuator:
  - 4 motor DC + driver
  - 4 motor + driver
  - Indicator Lamps
- Frame
- Displacement gear

Outline



- What is Robotics
- (Mobile) Robotics Competition
- Road to Champion
- Implementation Robot Technology
- Conclusion/Kesimpulan

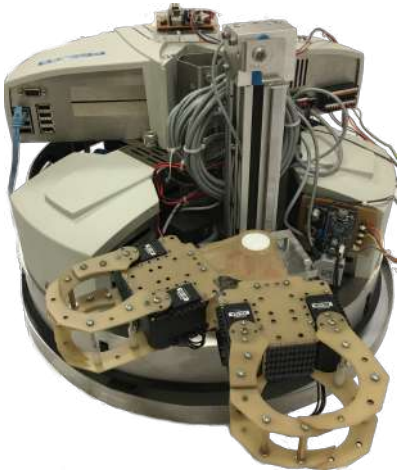
Kalender WorldSkills Indonesia



Mobile Robotics

worldskills

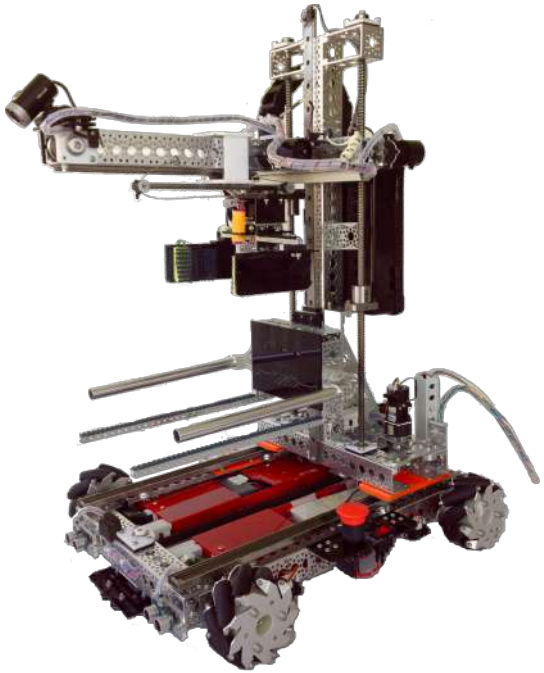
ASC 2016



ASC 2018

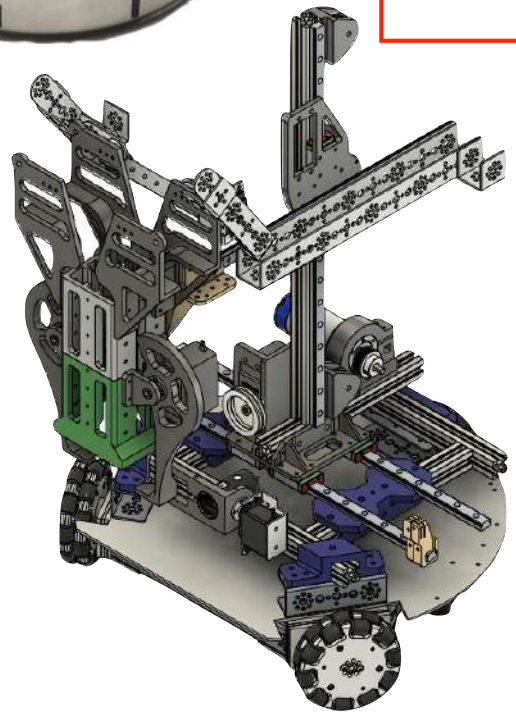
ASC 2020

Postpone to April 2021



WSC 2015

WSC 2017



WSC 2019

September 2021

WSC 2021

Prestasi Mobile Robotics Indonesia

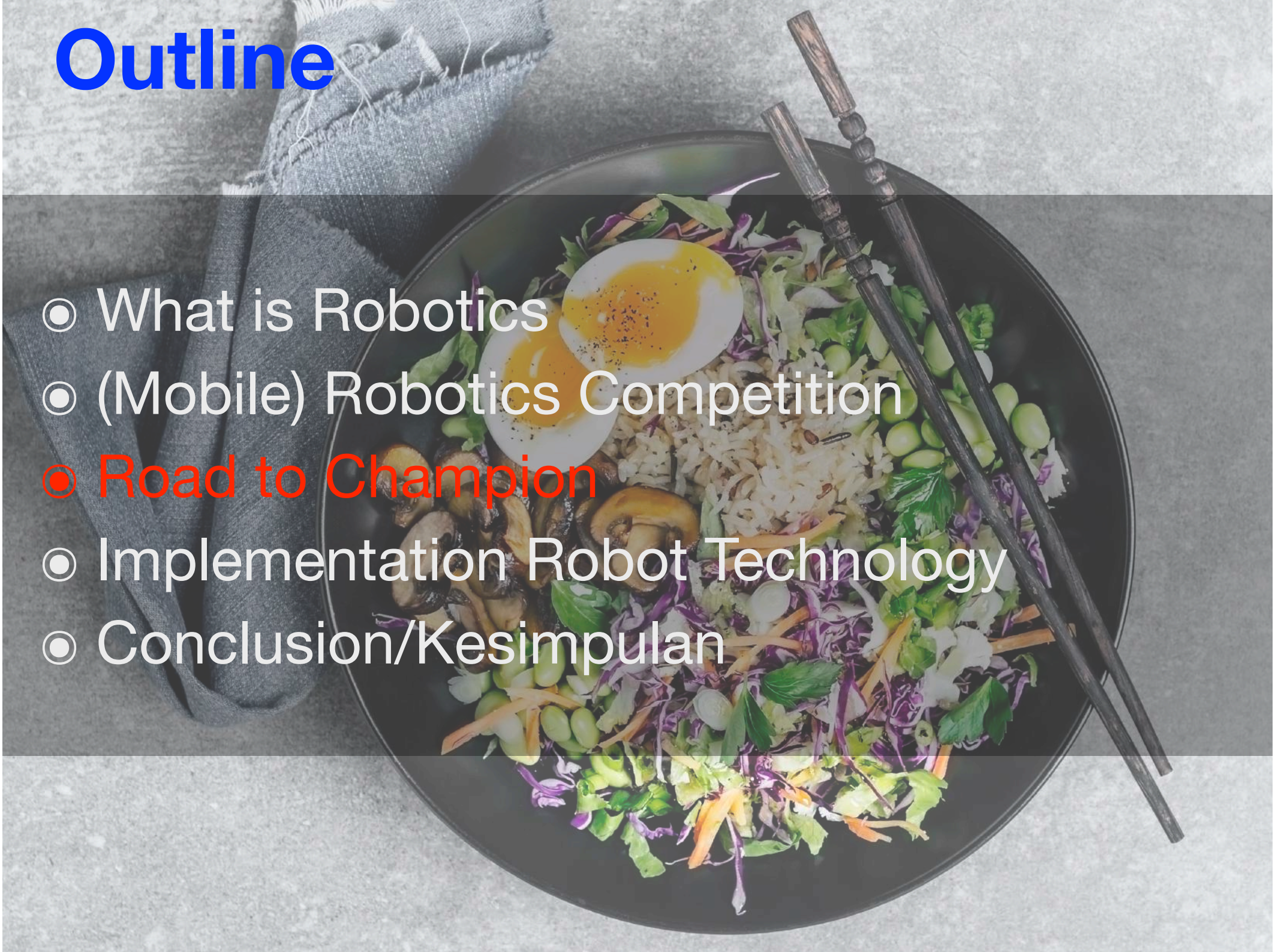
worldskills

Tahun	Kompetisi		Nama Competitor	Nilai	Peringkat/Prestasi
2009	**WSC 2009 Calgary, Canada**		A. Arif Gunawan Amri Ivan Afandi	**489 (*600*)**	10 besar dari 14 negara
2010					
2011	**WSC 2011 London, United Kingdom**		Muhammad Tawakkal Deni Setiawan	**539 (*600*)**	**Bronze Medal**
2012					
2013	**WSC 2013 Leipzig, Germany**		Kevin Wincharso Muh. Luthfi Musrah	**499 (*600*)**	12 besar dari 19 negara
2014	**ASC 2014 Hanoi, Vietnam**		Alfin Junaedy Teguh Satrio Wibowo		**Gold Medal**
2015	**WSC 2015 Sao Paulo, Brasil**		Hendriana Helda Pratama Lutfi Nur Indrawan	**538 (*600*)**	**Medal of Excellence & Best of Nation**
2016	**ASC 2016 Kuala Lumpur, Malaysia**		Andy Yuniawan Eko Mustofa		**Gold Medal**
2017	**WSC 2017 Abu Dhabi, Uni Arab Emirate**		Andy Yuniawan Eko Mustofa	**709 (*800*)**	**Medal of Excellence**
2018	**ASC 2018 Bangkok, Thailand**		Moch. Rifki Ramadhani Muhammad Rois		**Bronze Medal**
2019	**WSC 2019 Kazan, Russia**		Wahyu Arga Pratama Muh. Rizqi Pratama	**690 (*800*)**	16 besar dari 24 negara
2020	**ASC 2020 Singapore** *(postpone April 6-11, 2021)*				
2021	**WSC 2021 Shanghai, China**				

pens

MOBILE ROBOTICS

Outline



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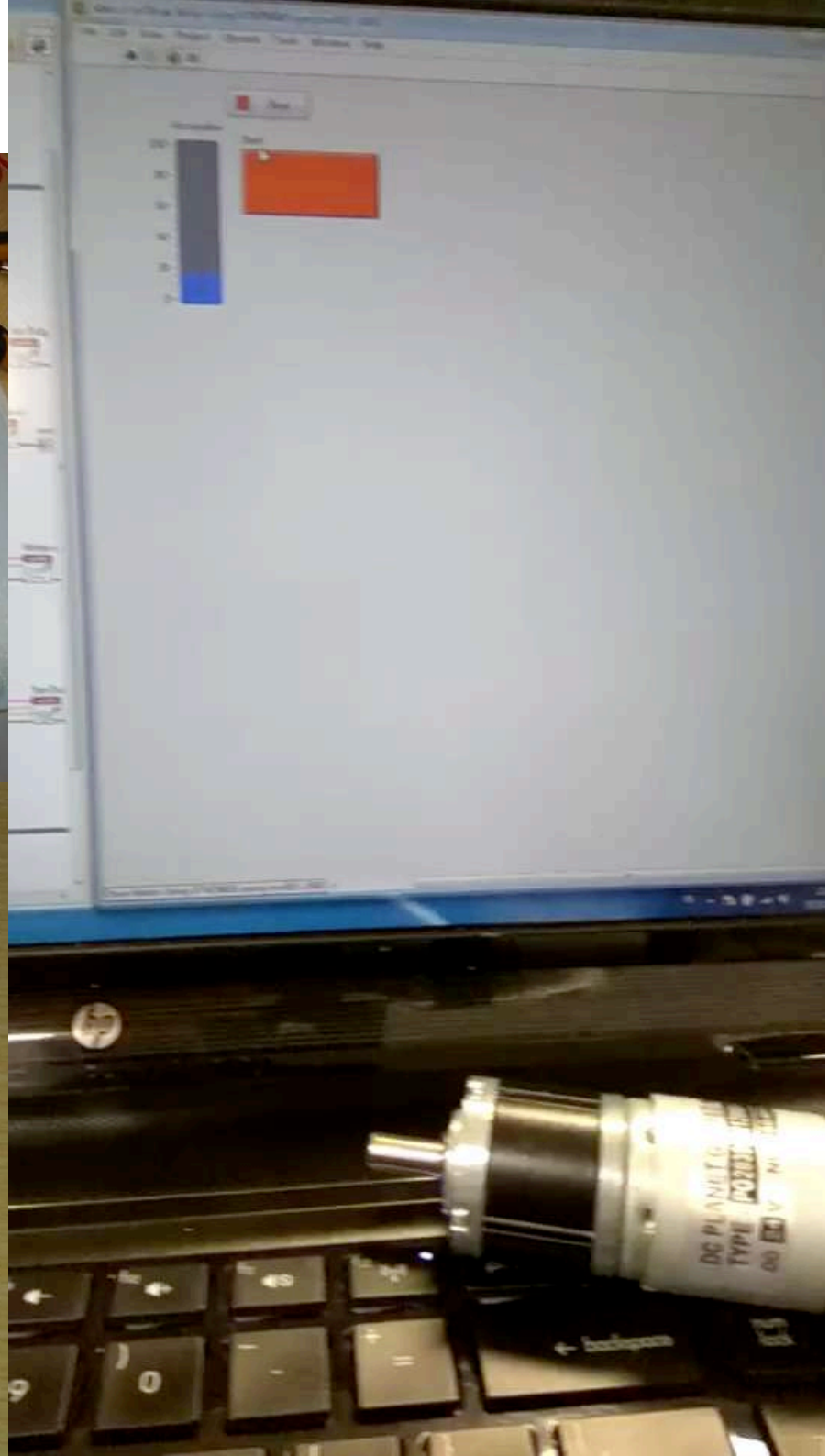
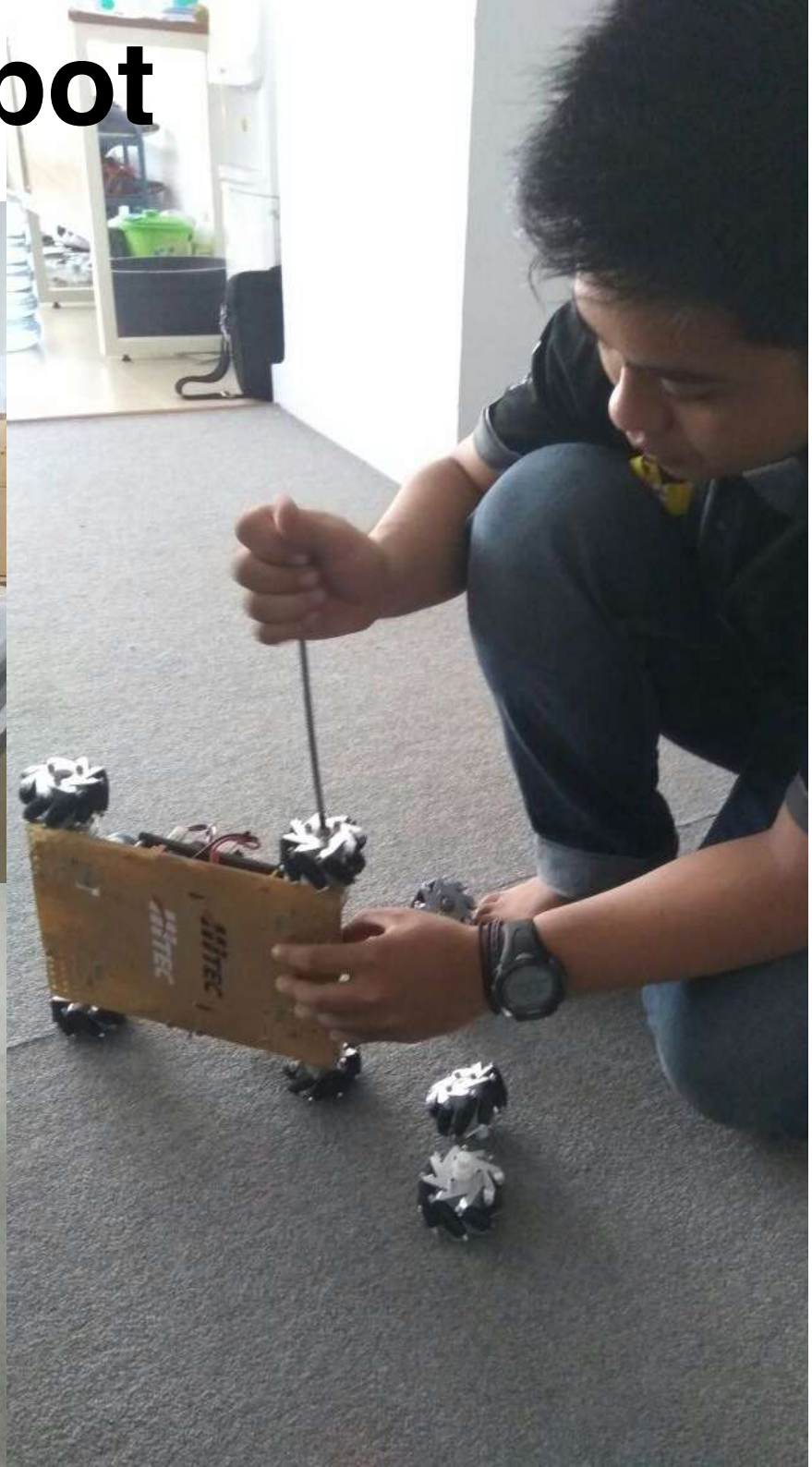
LabView & myRIO Camp

LabView & myRIO Camp

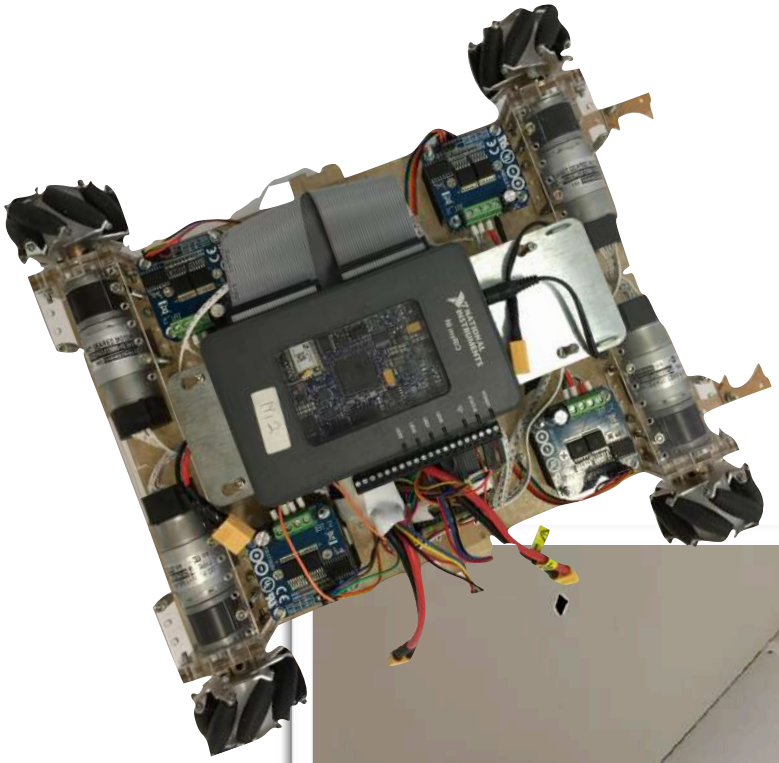


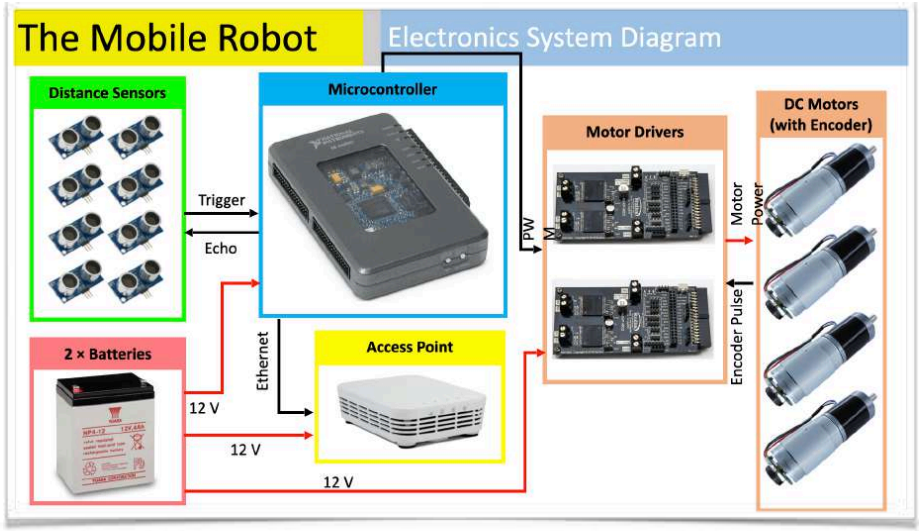
Assembly Robot

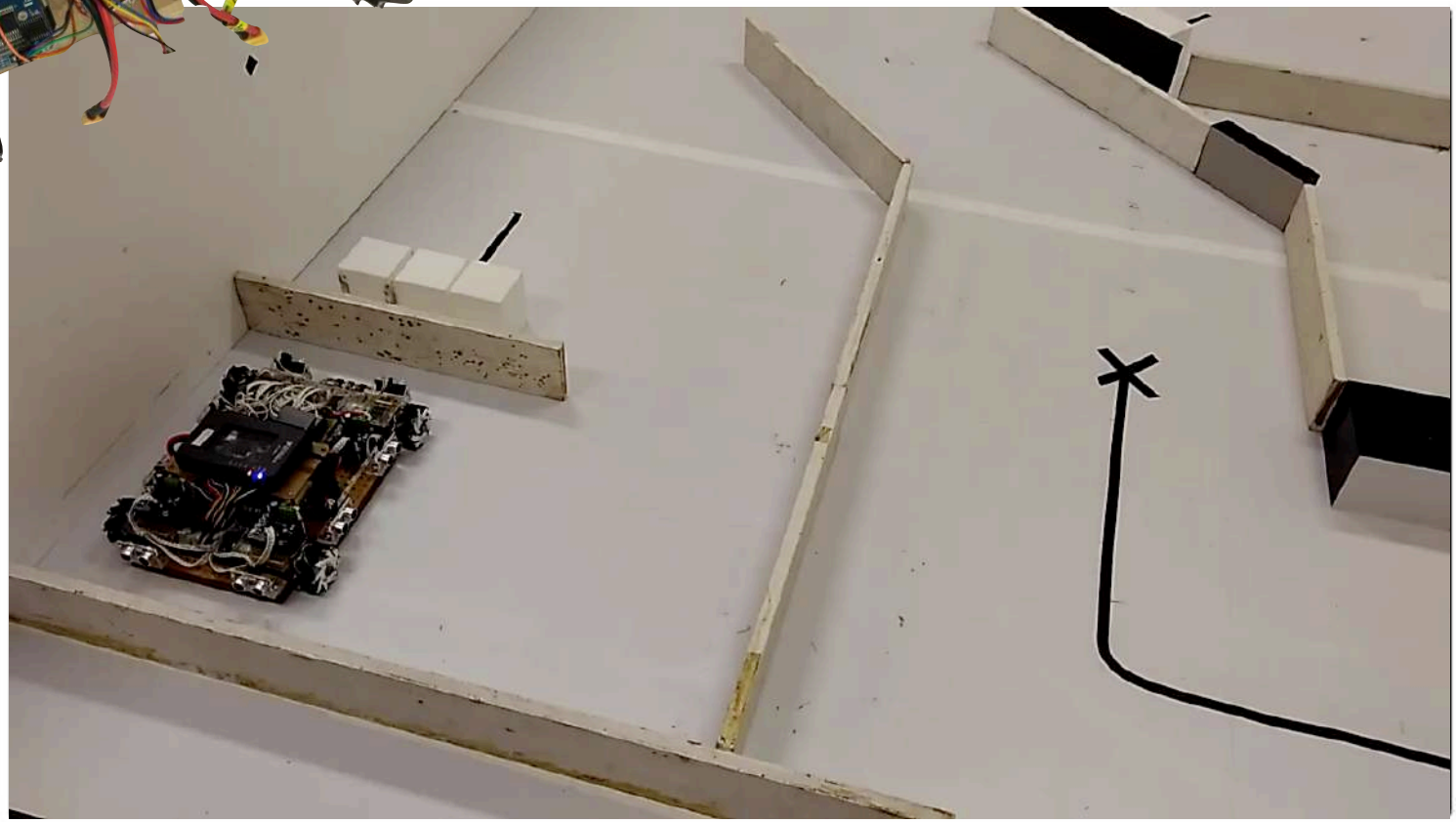


Mobile Robotics

Try Out, Try Out … & Try Out







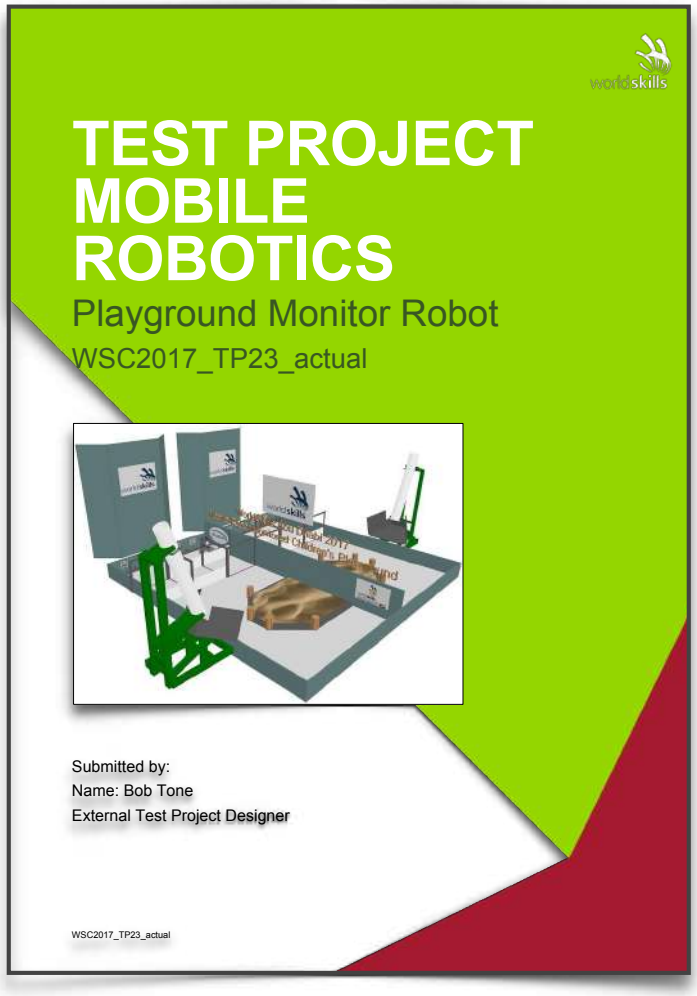
MTP - Materi Test Project

Biasanya dikeluarkan oleh WSSS enam bulan menjelang kompetisi

CIS Marking

	Skill name	
	Mobile Robotics	
	Criteria	Mark
A	Work Organization & Management	10,00
B	Communication and Interpersonal skills	10,00
C	Design	25,00
D	Fabrication & Assembly	5,00
E	Core Programming, Testing & Adjustment	20,00
F	Performance Review and Commission	30,00

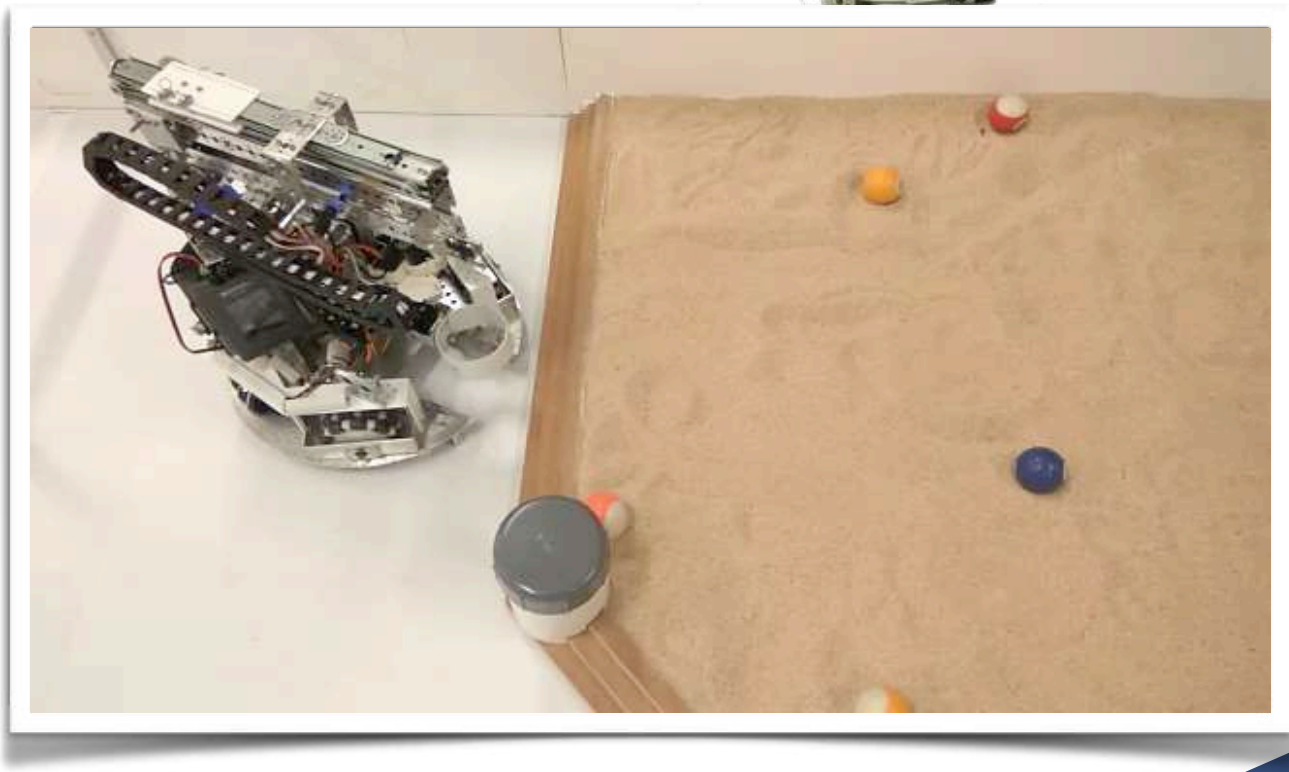
Test Project



Video

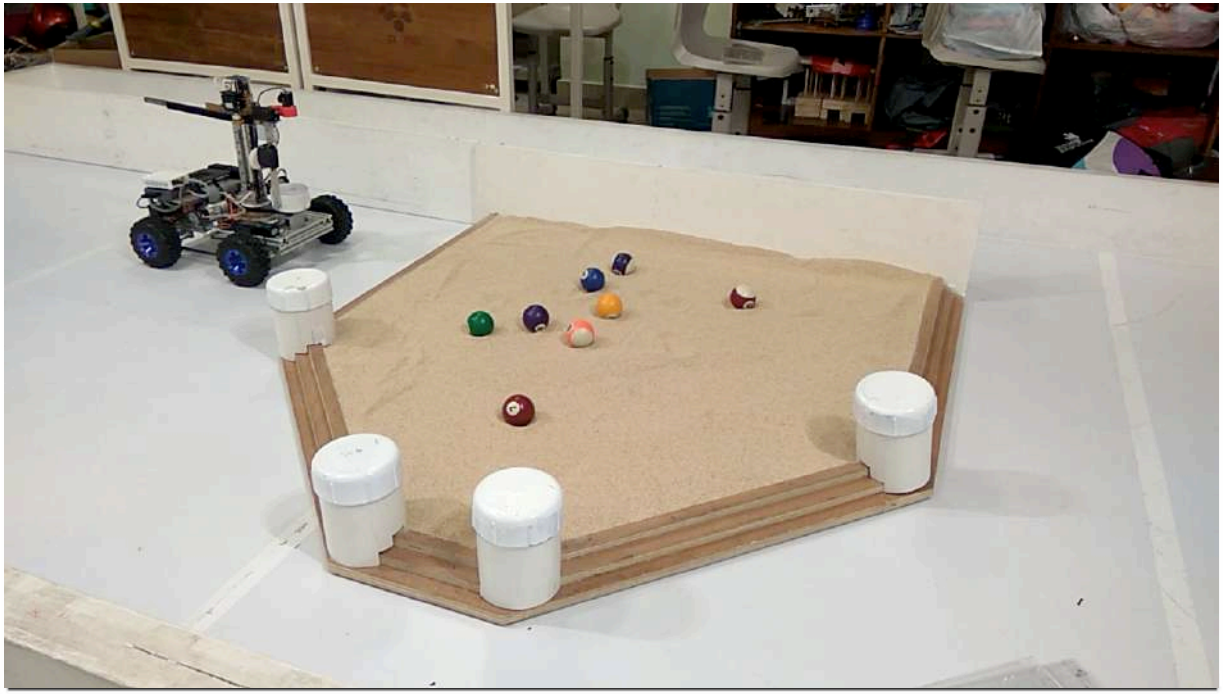
Output Product Training Center

Journal (Report)
dan Robot

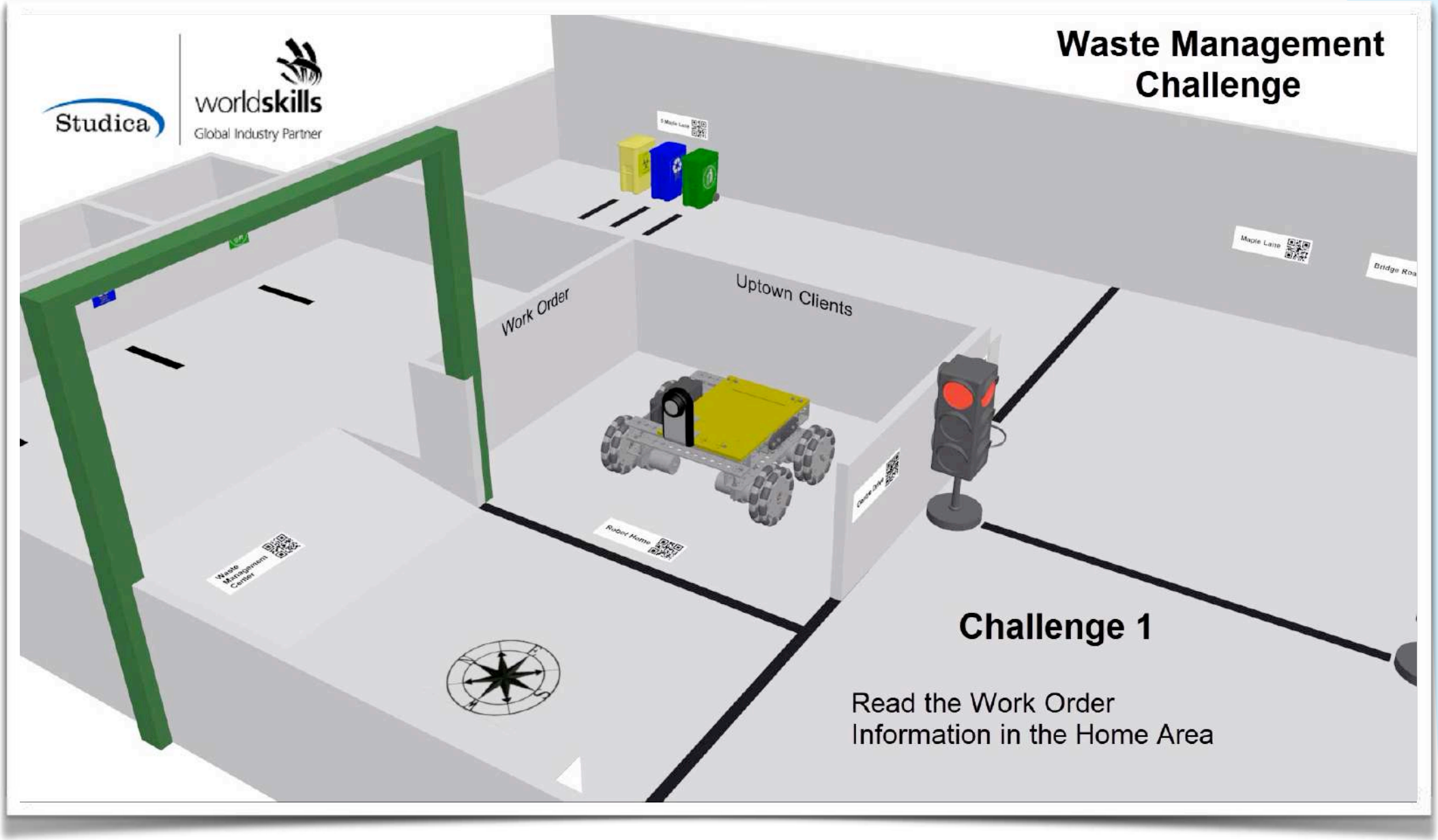


- Frame/Structural
- Mobility Management
- Object Management
- Wiring
- Computer Programming
- Additional Cost

Output Product Training Center



Next Challenge ASC-WSA



AWARDS

Penghargaan Dalam 5 Tahun Terakhir (dari pemerintah, asosiasi, atau institusi lainnya)

No.	Judul Penghargaan	Institusi Pemberi Penghargaan	Tahun
1.	Finalis Indonesian ICT Awards 2013 (Peran: Dosen Pembimbing)	Kemenkominfo Jakarta, Indonesia	2013
2.	Finalis PIMNAS 2013 (Peran: Dosen Pendamping)	Dikti, Kemendiknas Mataram, Indonesia	2013
3.	Tanda Kehormatan "SATYALANCANA KARYA SATYA XX TAHUN"	Presiden Republik Indonesia	2013
4.	Semifinalis Microsoft IMAGINE CUP (Peran: Dosen Pembimbing)	Microsoft Indonesia, Jakarta	2014
5.	Gold Medal untuk Bidang Kejuruan Mobile Robotics (Peran: Expert dan Dosen Pembimbing)	ASEAN Skills Competition 2014 Hanoi, Vietnam	2014
6.	Medal for Excellence Bidang Kejuruan Mobile Robotics (Peran: Expert dan Dosen Pembimbing)	WorldSkills Competition 2015 Sao Paulo, Brazil	2015
7.	Best of Nation Bidang Kejuruan Mobile Robotics (Peran: Expert dan Dosen Pembimbing)	WorldSkills Competition 2015 Sao Paulo, Brazil	2015
8.	Medali Perunggu Presentasi Kategori PKM-KC3 PIMNAS 2015 (Peran: Dosen Pendamping)	Belmawa, Kemristekdikti Kendari, Indonesia	2015
9.	Juara 1 Seleksi Nasional untuk Bidang Kejuruan Mobile Robotics (Peran: Expert dan Dosen Pembimbing)	Dirjen Bina Latas, Kemnaker Bekasi, Indonesia	2015
10.	Finalis PIMNAS 2016 (Peran: Dosen Pendamping)	Belmawa, Kemristekdikti Bogor, Indonesia	2016
11.	Best Paper Award pada the 2nd International Conference on Soft Computing and Data Mining	Bandung, Indonesia	2016
12.	Gold Medal untuk Bidang Kejuruan Mobile Robotics (Peran: Expert dan Dosen Pembimbing)	ASEAN Skills Competition 2016 Kuala Lumpur, Malaysia	2016
13.	Finalis PIMNAS 2017 (Peran: Dosen Pendamping)	Belmawa, Kemristekdikti Makassar, Indonesia	2017
14.	Juara 1 Seleksi Nasional untuk Bidang Kejuruan Mobile Robotics (Peran: Expert)	Dirjen Bina Latas, Kemnaker Bekasi, Indonesia	2017
15.	Medallion for Excellence untuk Bidang Kejuruan Mobile Robotics (Peran: Expert)	WorldSkills Competition 2017 Abu Dhabi, Uni Emirat Arab	2017
16.	Dosen Berprestasi Mata Kuliah Berbasis Teori Di Program Studi Teknik Mekatronika Semester Gasal 2017/2018	Politeknik Elektronika Negeri Surabaya (PENS)	2018
17.	Finalis PIMNAS 2018 (Peran: Dosen Pendamping)	Belmawa, Kemristekdikti Yogyakarta, Indonesia	2018
18.	Bronze Medal untuk Bidang Kejuruan Mobile Robotics (Peran: CoExpert dan Dosen Pembimbing)	ASEAN Skills Competition 2018 Kuala Lumpur, Malaysia	2018
19.	Finalis PIMNAS 2019 (Peran: Dosen Pendamping)	Belmawa, Kemristekdikti Denpasar, Indonesia	2019

AWARDS

IEEE Computational Intelligence Society
IEEE Advancing Technology for Humanity
2020 IEEE CIS Online Summer School on
Computational Intelligence for Human and Robot Co-learning
This certificate is proudly presented to :
Nobby Bagus Muliawan
as
Winner
of Othello Robot Contest.
Tokyo Metropolitan University, Tokyo, Japan
August 22, 2020
Wei Hong Chin
Chair
TOKYO METROPOLITAN UNIVERSITY
東京都立大学
RC CcS TMU

IEEE Advancing Technology for Humanity
2020 IEEE CIS Online Summer School on
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Alfin Junaedi
as
Runner-Up
of Othello Robot Contest.
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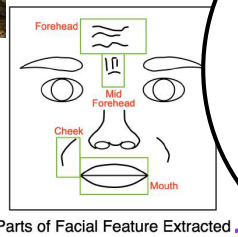
Implementation Robot

Mahasiswa D4: <60
Mahasiswa S2 Terpan: 6
Scopus H-Index: 6
GoogleScholar H-Index: 9
Journal Paper: 12
International Conference: 55+3
National Conference: 29
Pengalaman Pendanaan: 8

Vision Robot

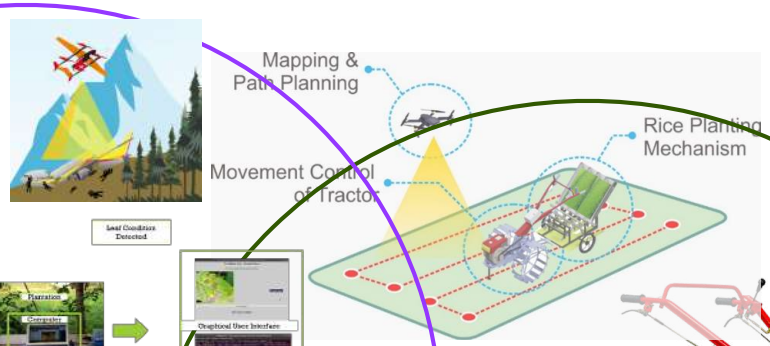
Muhammad Khoirul
Muhammad Ilham P.
Alif Habib H.
M. Nazhat Adiba
Agus Prayudi
…



Parts of Facial Feature Extracted

Agriculture Robot

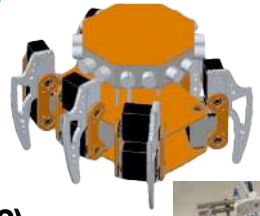
Nobby Bagus M. (S2)
Moch Rifki Ramadhani
Alfan Rahmansyah
Rizqi Amaliatus S
…



HuMeX
Human Mechatronics System
Research Group

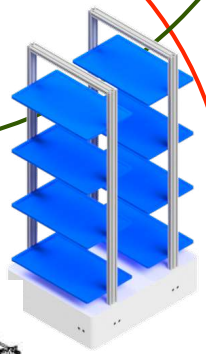
Partner Robot

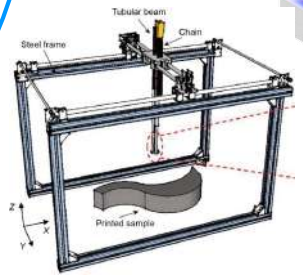
M. Dwijotomo (S2)
Marianus Bayu Aji K. (S2)
Teguh Satrio Wibowo (S2)
Alfin Junaedy (S2)
Rokhmat Febrianto
…



Robot for Hospital, Building

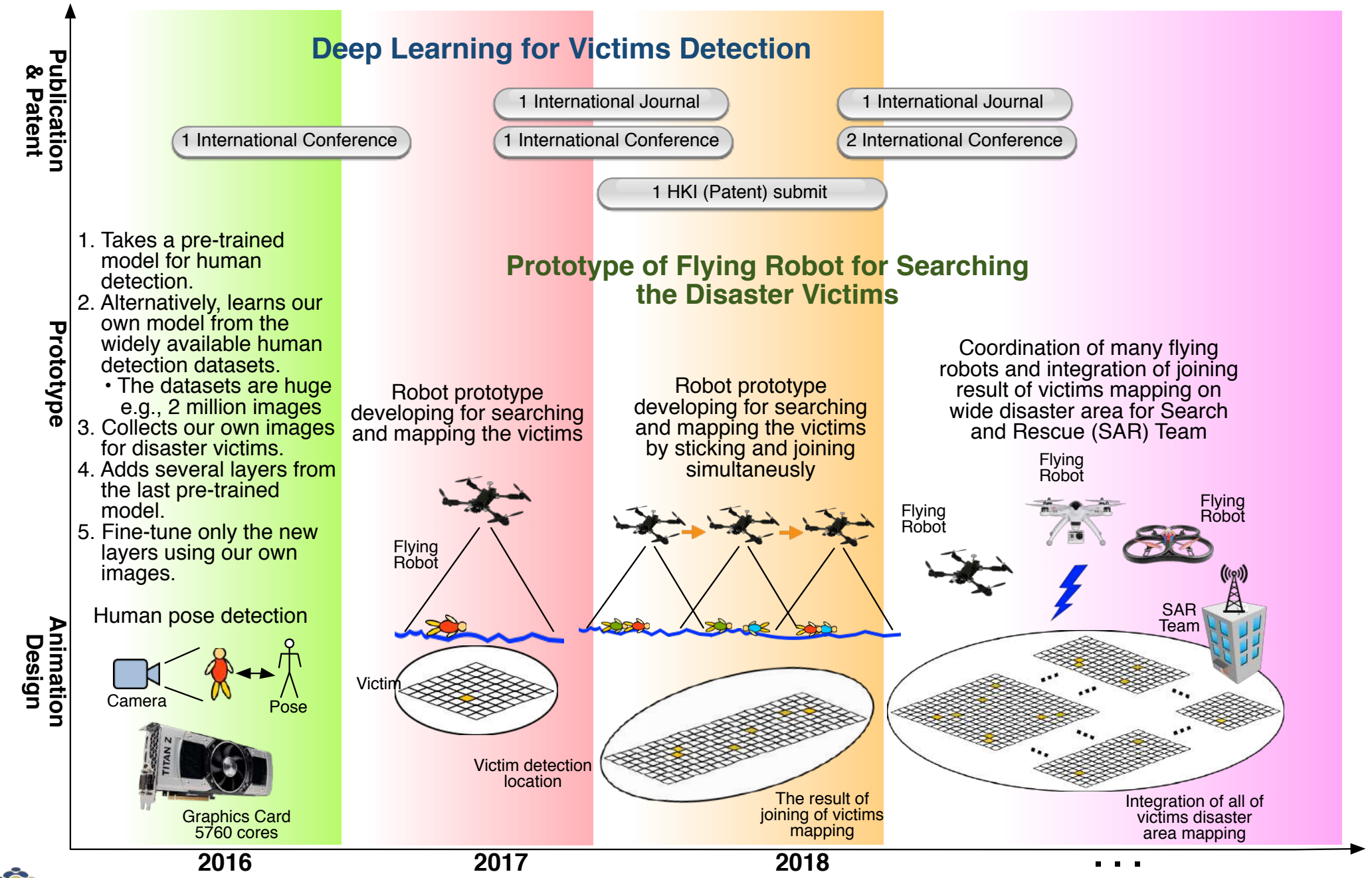
Rodik Wahyu Indrawan (S2)
Andy Yuniawan (S2)
Muhammad Rois
M. Khoirul Abdulloh
…





MOBILE ROBOTICS

Roadmap (Vision Robot) → HuMeX



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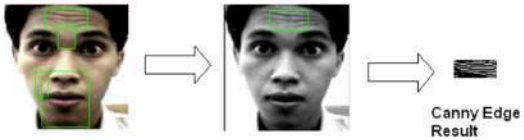
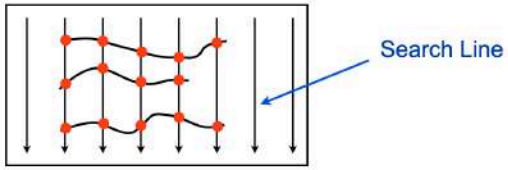
Facial Expression Recognition

Forehead

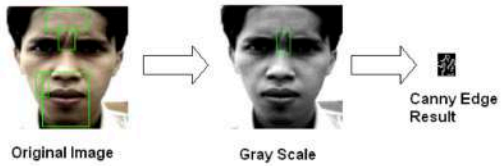


The procedures of counting the Forehead wrinkle are totalled from total RedDot in ForeHead and then the value are scaled between 0-1

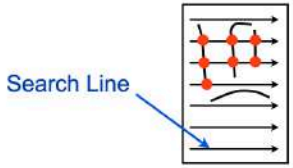


$$FHW = \frac{TotalRedDotInForeHead}{RDmaxInForeHead}$$

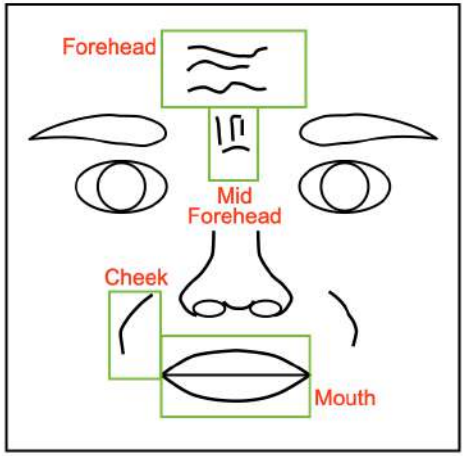
Mid Forehead



The procedures of counting the MidForehead wrinkle are totaled from total RedDot in MidForeHead and then the value are scaled between 0-1

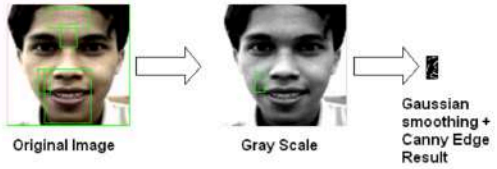


$$MFHW = \frac{TotalRedDotInMidForeHead}{RDmaxInMidForeHead}$$

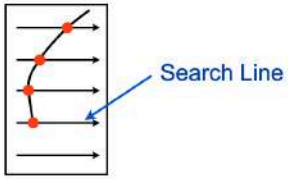


Parts of Facial Feature Extracted

Cheek

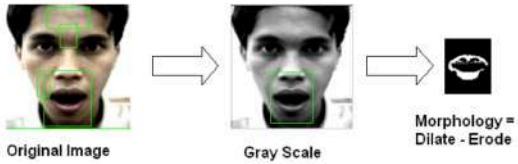


The procedures of counting the Cheek wrinkle are totalled from total RedDot in Cheek and then the value are scaled between 0-1

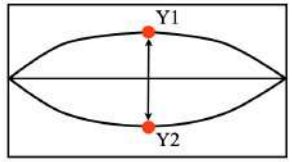


$$CkW = \frac{TotalRedDotInCheek}{RDmaxInCheek}$$

Mouth

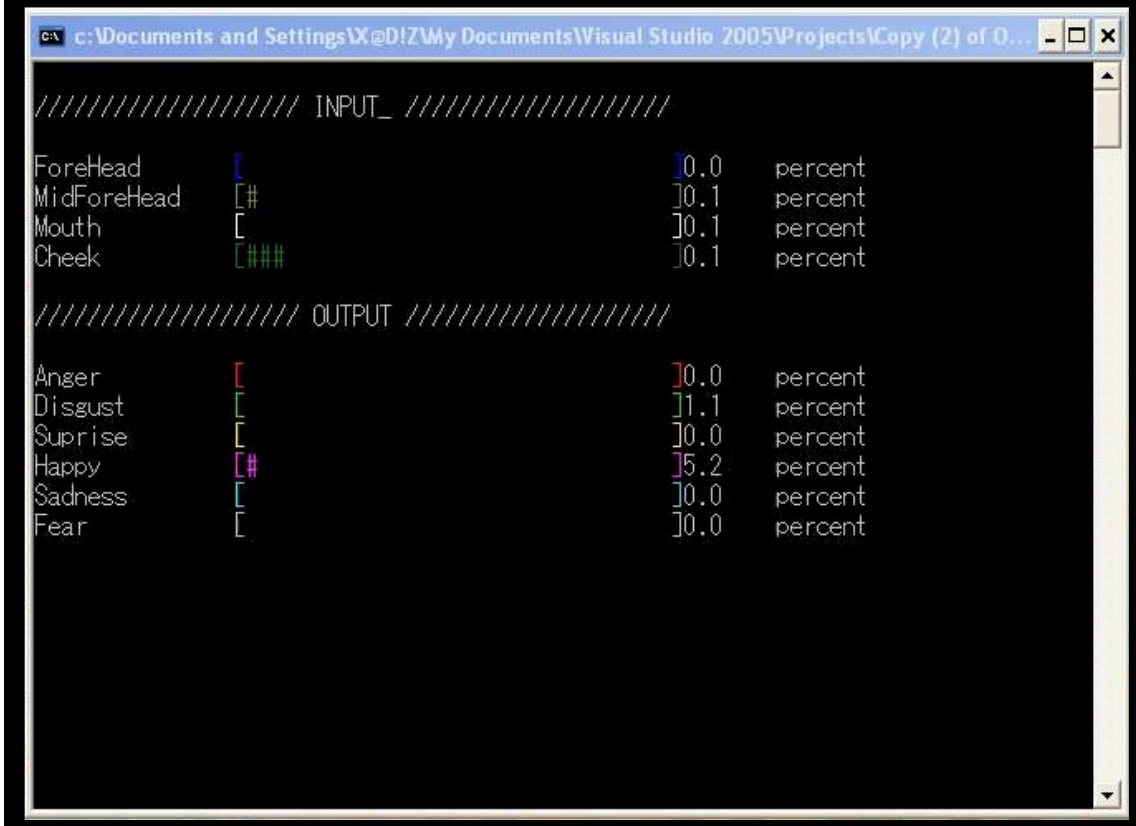


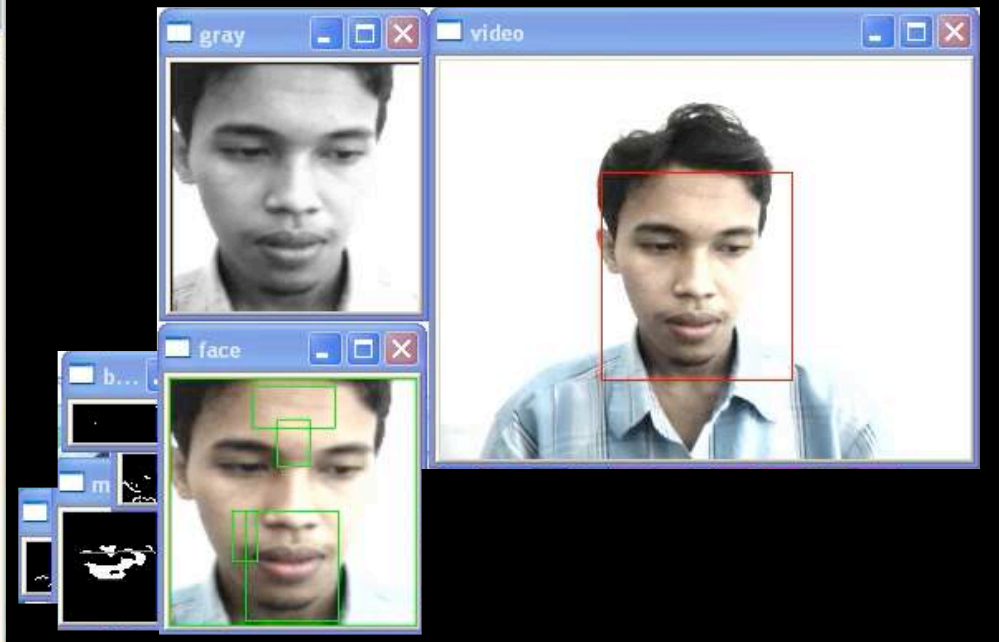
The Mouth value are from mouth height and then the value are scaled 0-1



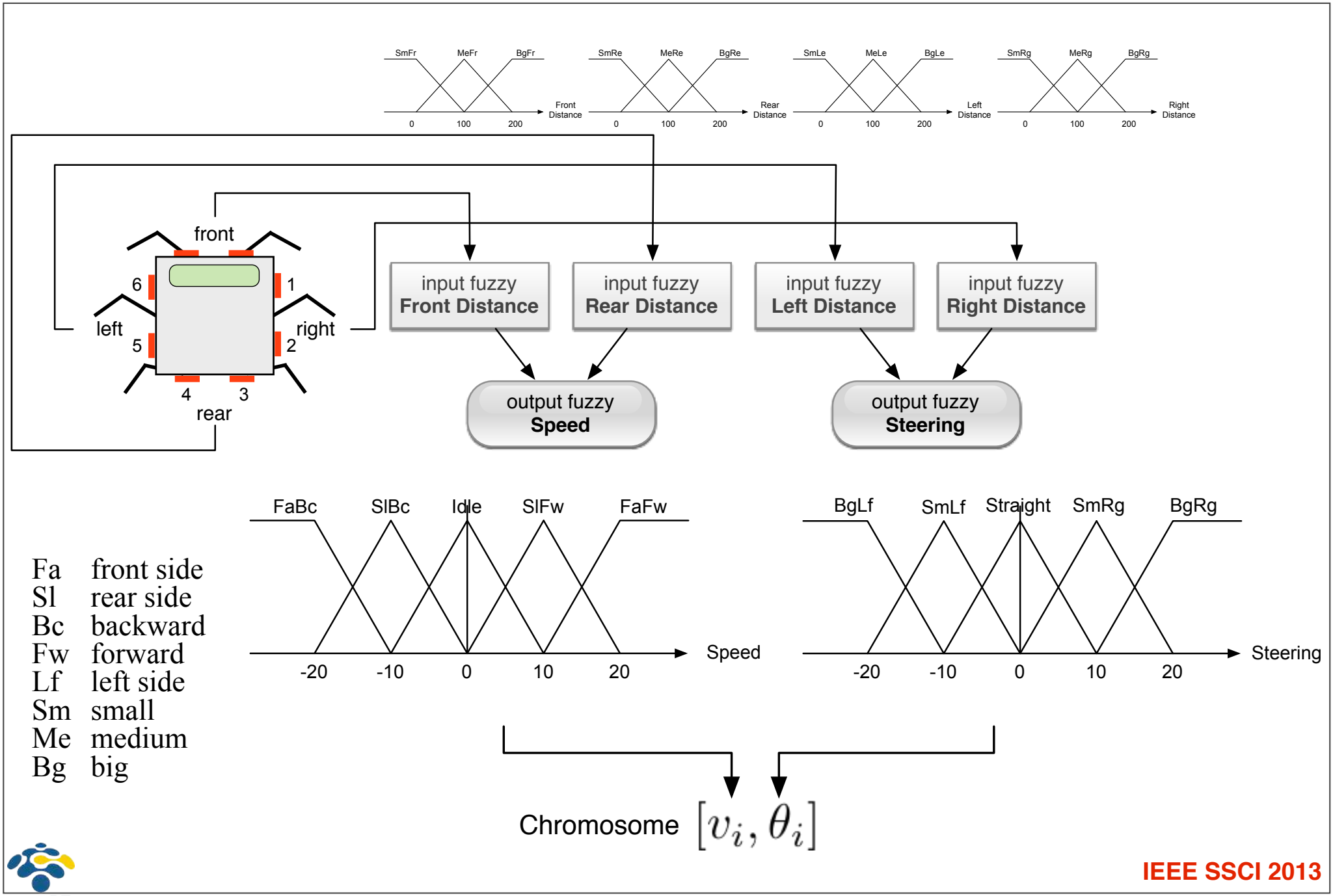
$$VMLg = \frac{(Y2 - Y1)}{VMLg}$$

Experiment Results





A Path Planning Behavior Learning of Six Legged Robot Based on Human Teaching Model



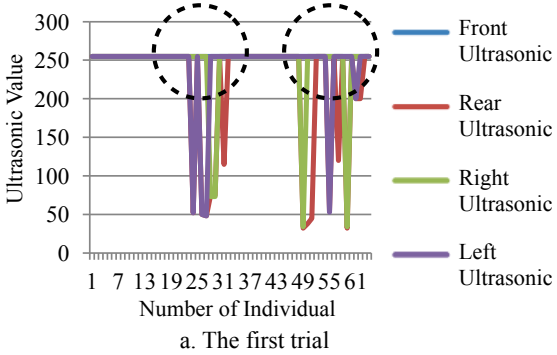
Fa	front side
Sl	rear side
Bc	backward
Fw	forward
Lf	left side
Sm	small
Me	medium
Bg	big

Electronics Engineering Polytechnic Institute of Surabaya (EEPIS), Indonesia

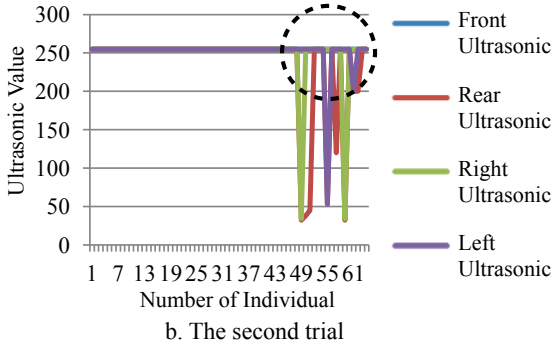
Experimental Results

At first, legged robot path planning was trained by human teaching

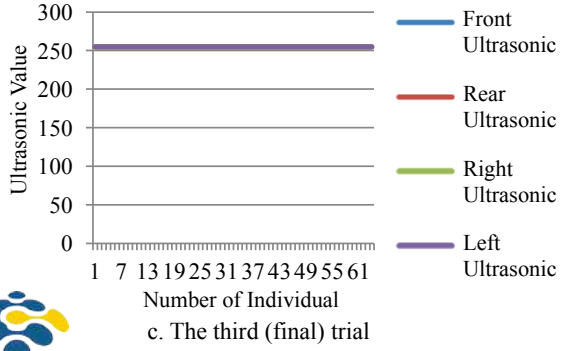
human training



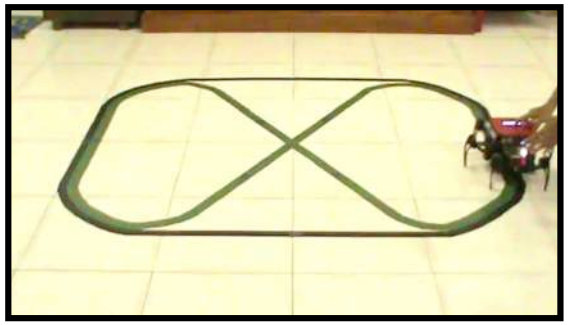
a. The first trial

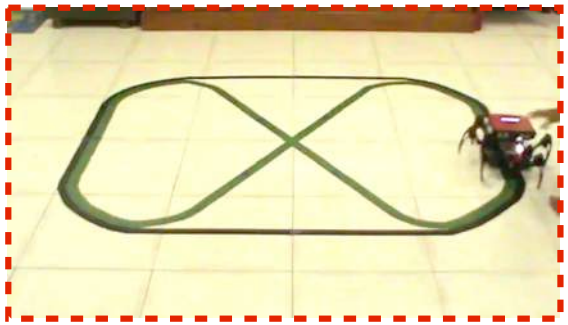


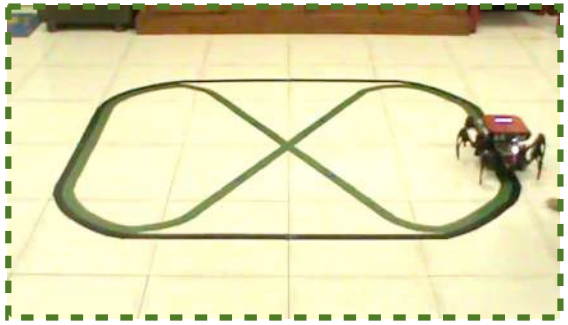
b. The second trial

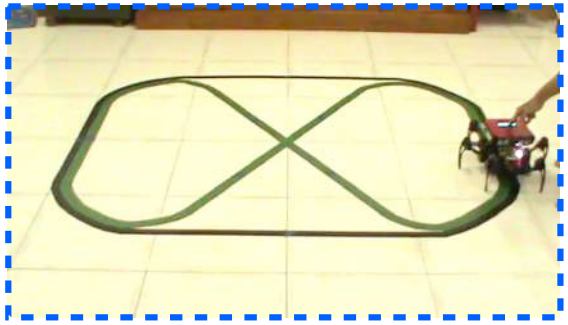


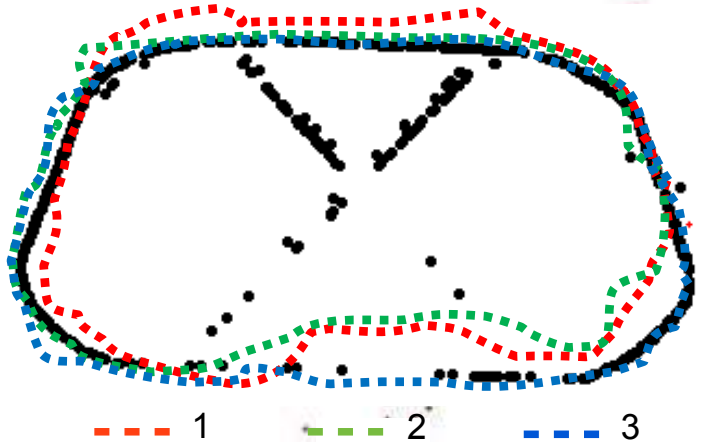
c. The third (final) trial









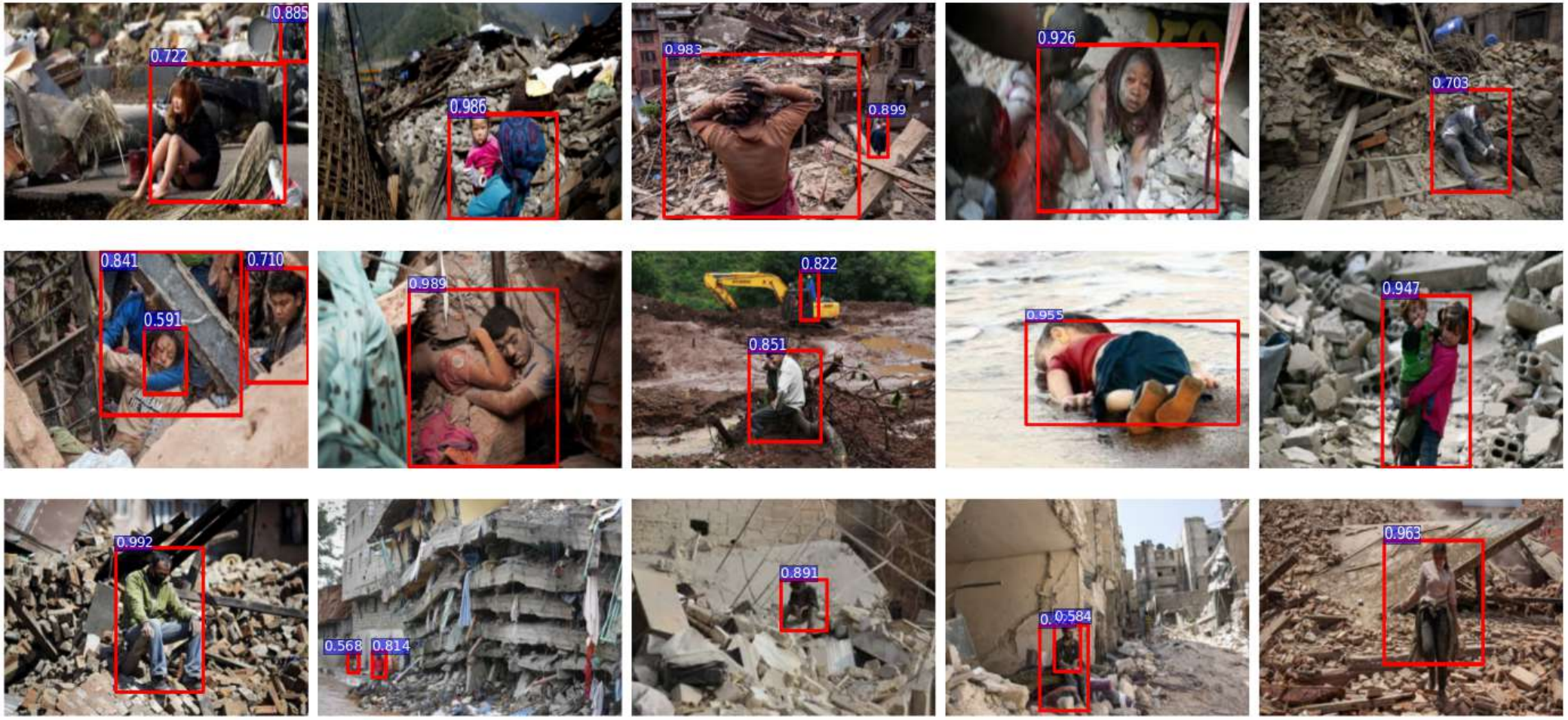


In the first trial, the robot will evaluate its error by using reinforcement learning method led by punishment and reward. In this iteration, the robot will not create a new pattern combination. It means that the Speed and the Steering values are still the same as in the previous iteration. This iteration will then revise the error made by the previous iteration by using reward and punishment value.

The second trial, human teaching for repairing is less required

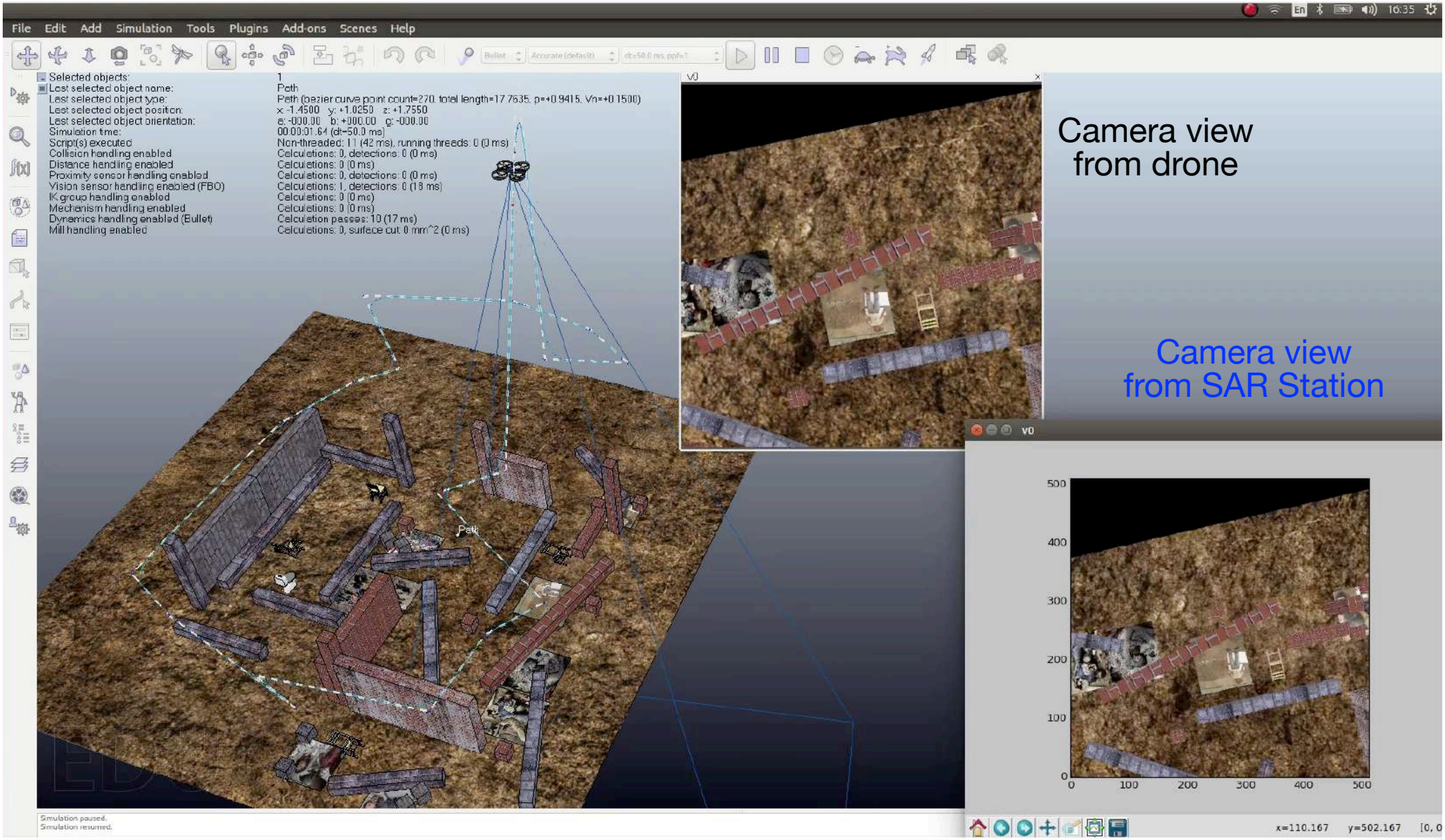
The third (final) trial doesn't need human training again

Deep Learning Untuk Mendeteksi Korban Bencana



We release this **Indonesian Disaster Victims (IDV-50)** datasheet.
The system can work well.

Simulasi Teknologi Robot Vision



Simulasi teknologi robot vision untuk mendeteksi korban bencana (VREP)

The Mobile Robot Overview

Tray

Carriying the stuff like food, medicine, etc.

Ultrasonic

Distance sensor to detect ob

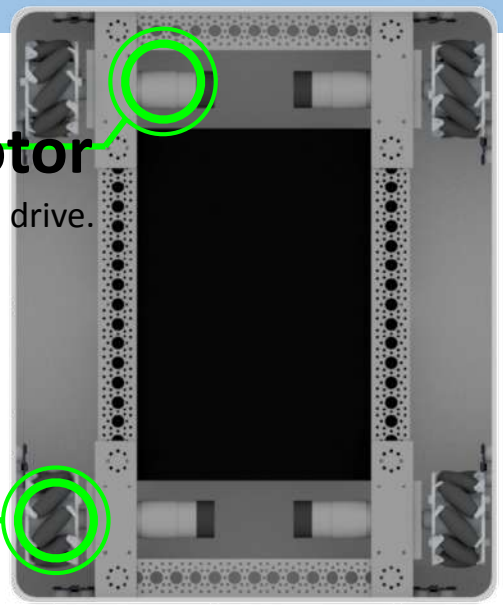
Isometric View

High Torque DC Motor

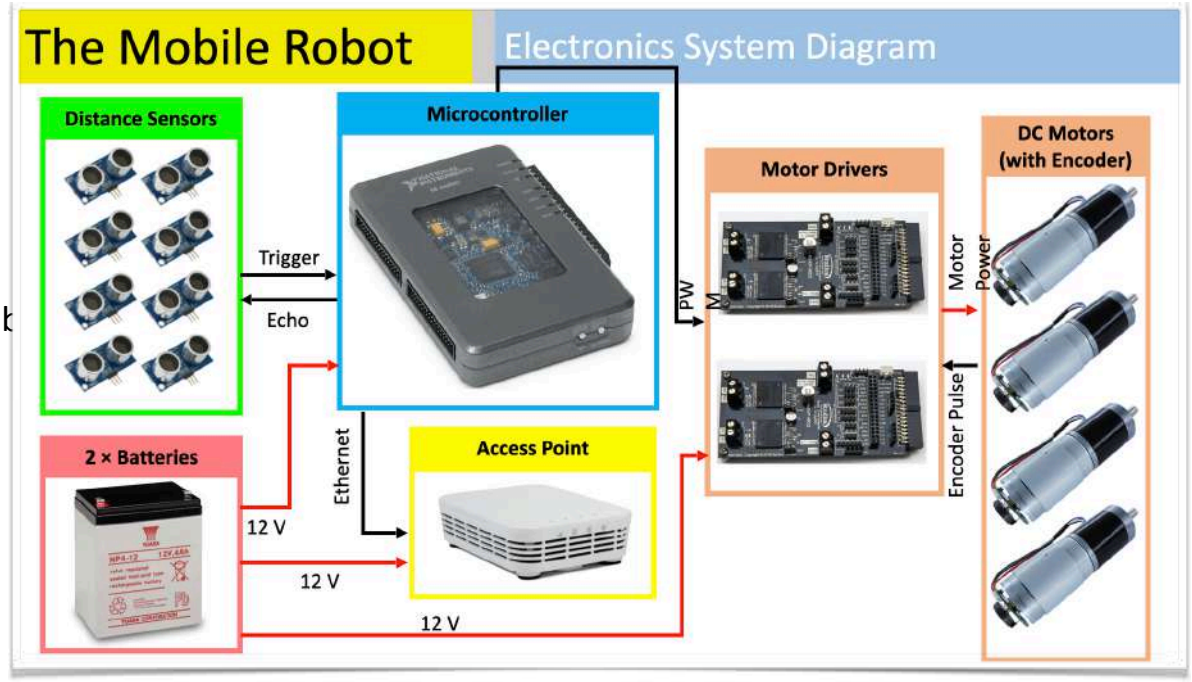
Providing powerful drive.

Mecanum Wheels

Providing holonomic movement and strong hold.



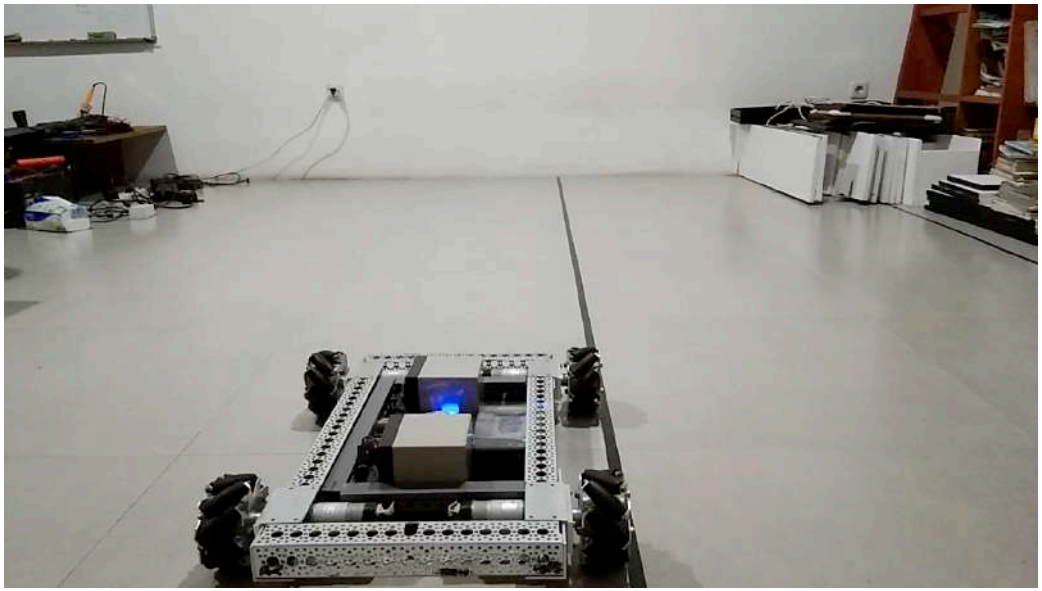
Bottom View

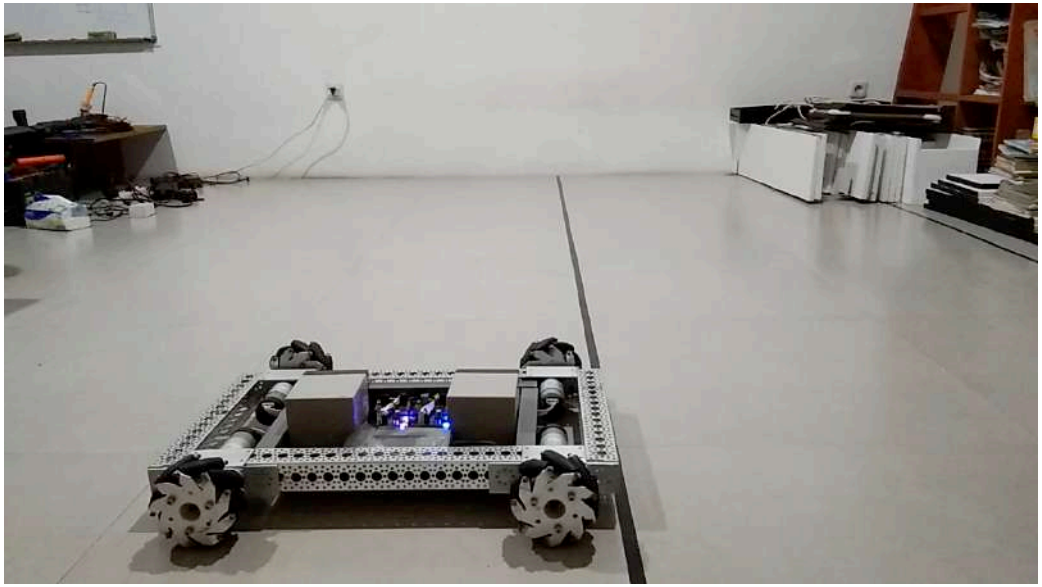


Progress

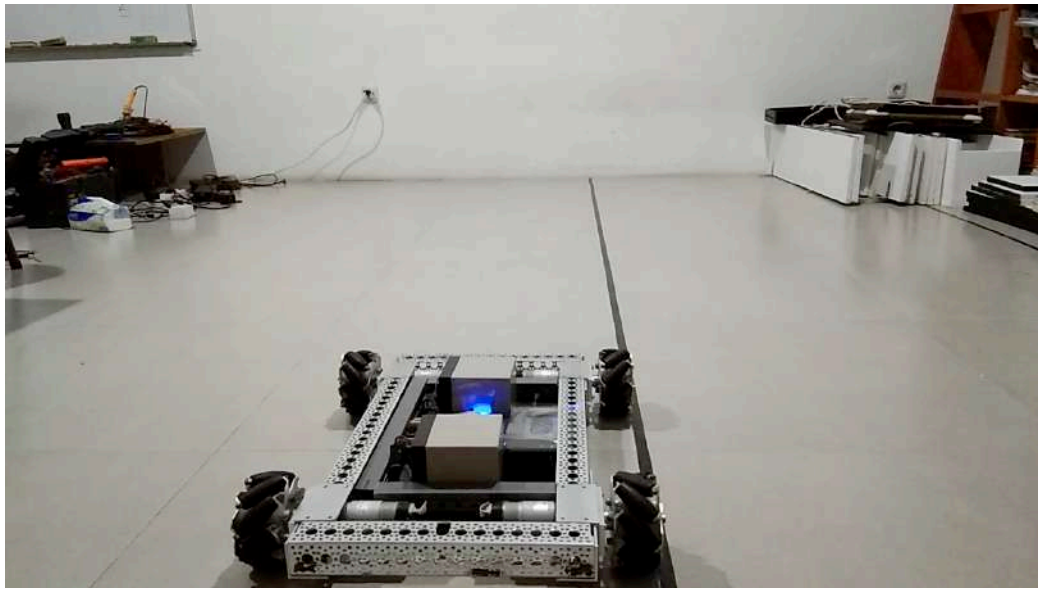
Velocity Control

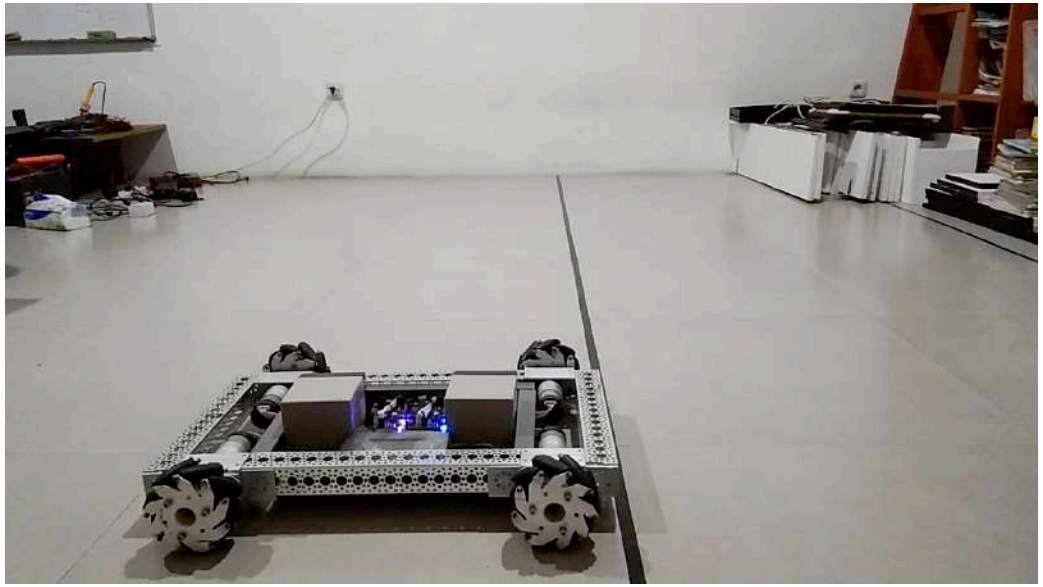
Open-Loop Motor Velocity Control



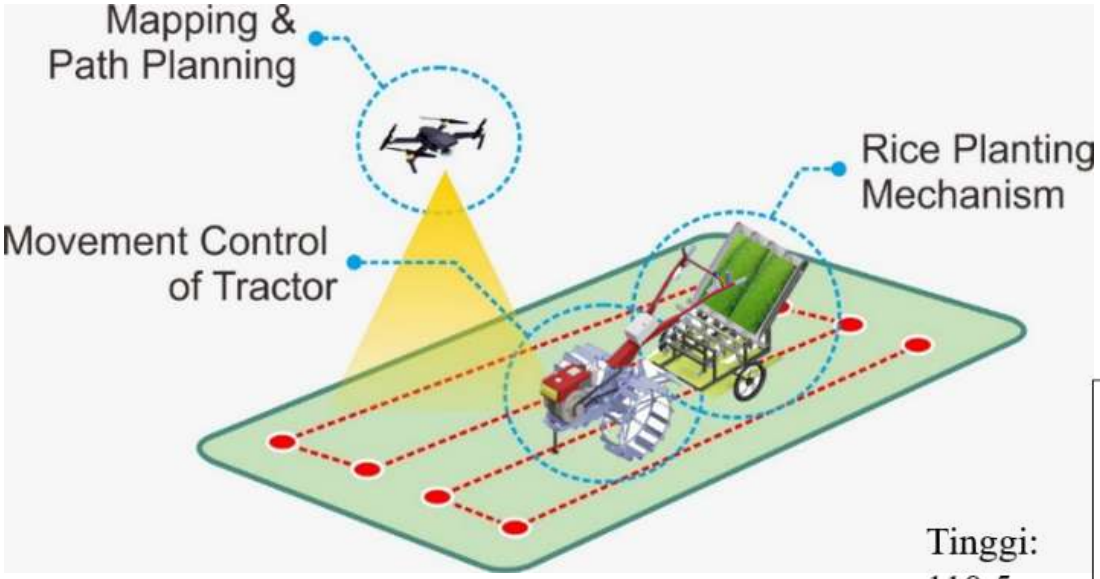


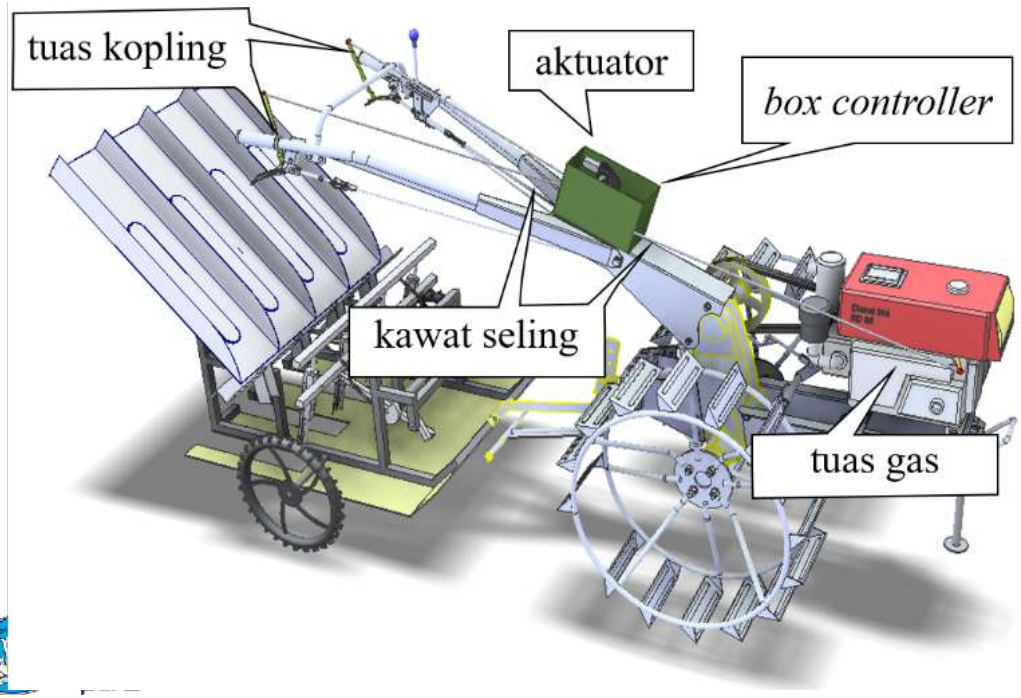
PID Close-Loop Motor Velocity Control





RoboTani: Agriculture Robot





Tinggi:
110.5 cm

Panjang: 209,3
cm

Lebar: 110.8 cm

RoboTani: Agriculture Robot

Simulasi Algoritma Trilaterasi

Simulasi Kendali Mobile Robot

Pengujian Kendali Robot

Pengujian Kecepatan Traktor

Pengujian Kendali Traktor

Pengujian Posisi Sensor

Pengujian Software

Pengujian Kendali Low Level

Pengujian Kendali Arah Hadap

8 Keterampilan Paling Dicari Setelah Pandemi

1. Adaptability and Flexibility

Someone that is going to succeed in a post-coronavirus-world will need to be able to adapt to ever-evolving workplaces and have the ability to continuously update and refresh their skills.

2. Tech Savviness

Technologies such as artificial intelligence, big data, the Internet of Things, virtual and augmented reality, and robotics will make businesses more resilient to future pandemics, and anyone that can help companies exploit these technologies will be in a great position.

3. Creativity and Innovation

We will need human ingenuity to invent, dream up new products and ways of working. Human creativity is going to be essential.

4. Data Literacy

With the right data, companies are able to better predict the impact of future business disruptions and are better able to serve customers with the right products and services during or after any pandemic. Companies that understand business trends and shifting customer needs are better able to respond in the right way.

5. Critical Thinking

Able to thing critically.
Which ones suitable or not.
Which ones fact and hoaxes.

6. Digital And Coding Skills

People who can keep the digital business running—and thriving—during economic downturns or pandemics that make in-person business impossible or less efficient are going to be on the must-hire list.

7. Leadership

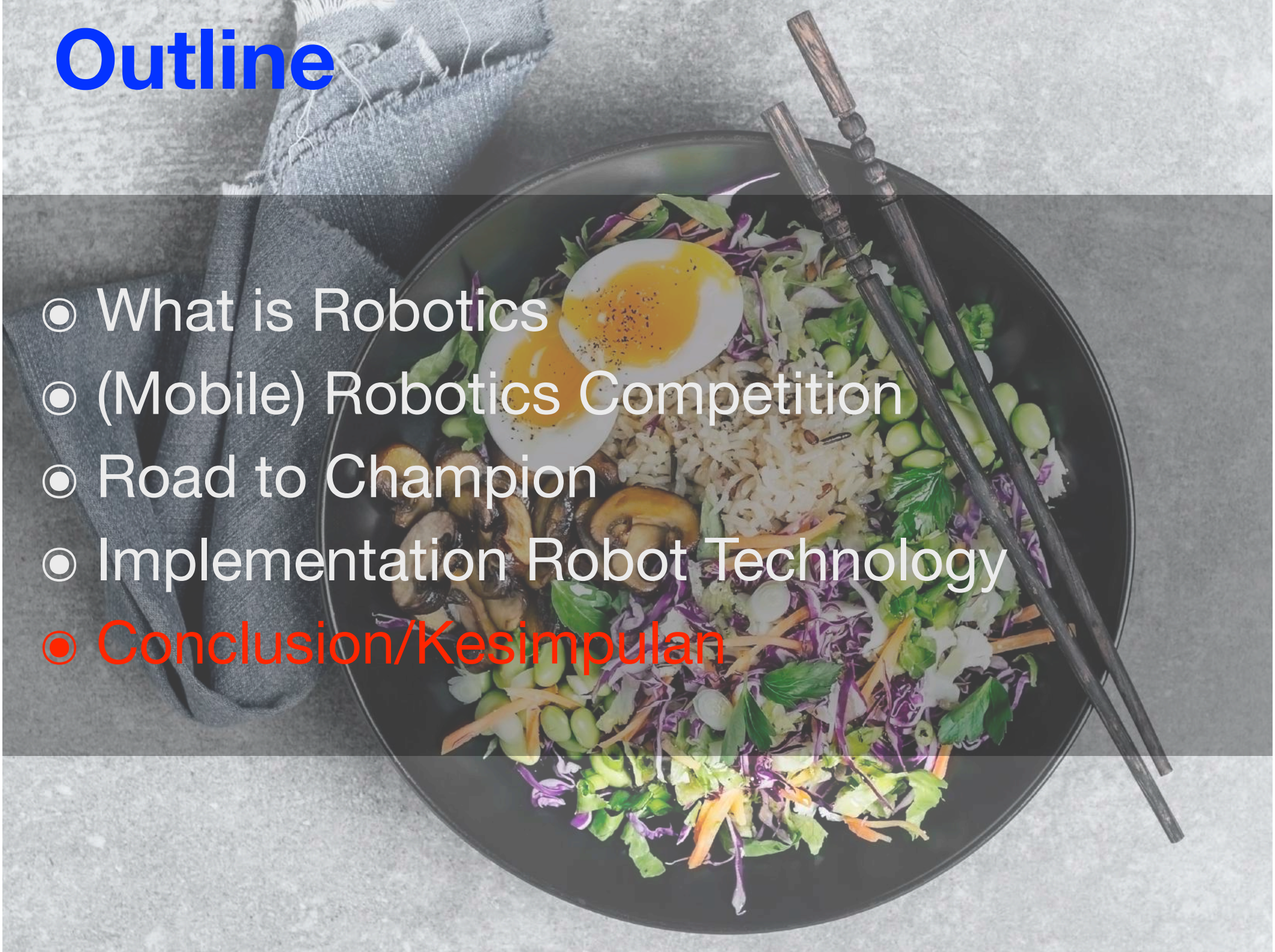
Professionals with strong skills in leadership, including how to bring out the best and inspire teams as well as encourage collaboration, will be in demand.

8. Emotional Intelligence

The ability to be aware of, express, and control our emotions and be aware of others' emotions is what emotional intelligence is all about.

The Forbes
https://www.forbes.com/sites/bernardmarr/2020/04/17/8-job-skills-to-succeed-in-a-post-coronavirus-world/#7a31af902096

Outline



- What is Robotics
- (Mobile) Robotics Competition
- Road to Champion
- Implementation Robot Technology
- Conclusion/Kesimpulan

Kesimpulan

- Pemusatan latihan atau Training Center (TC) bertujuan salah satunya membangun mobile robotics dan melakukan penelitian untuk mencari metode yang paling efektif dan efisien dalam menyelesaikan tujuan serta menyiapkan lingkungan yang kondusif sesuai dengan kriteria kompetisi internasional.
- Robotics merupakan multidisiplin ilmu dari beberapa cabang ilmu, antara lain mekanik, elektronik, embedded system, logic programming dan control.
- Untuk menjadi juara, selain pendanaan diperlukan kerja keras, kerja yang kompak, suasana yang menunjang, dan mental yang kuat.
- Untuk dapat mewujudkan robot yang dapat diimplementasikan dalam dunia riil, TKT (tingkat kesiapan teknologi) dapat dicapai melalui jam kerja dan pengalaman.

Silakan Bergabung

Sehat, Sukses dan Barokah selalu

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Tel: +62 31 594 7280; Fax: +62 31 594 6114
Websites: www.pens.ac.id

Sabda dari Nabi Muhammad SAW

Khoirunnas anfa'uhum linnas

Sebaik-baik manusia adalah yang paling banyak memberikan manfaat kepada sesama manusia.