



**UTM**  
UNIVERSITI TEKNOLOGI MALAYSIA

# TECHNOLOGY SEEDS 2020

MALAYSIA  
JAPAN  
INTERNATIONAL  
INSTITUTE OF  
TECHNOLOGY



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## IKOHZA LIST FOR LISTED SEEDS

<b>ALGAL</b>	Algal Biomass iKohza
<b>CAIRO</b>	Center for Artificial Intelligence and Robotics iKohza
<b>ChECA</b>	Chemical Energy Conversion and Applications iKohza
<b>CSN</b>	Communication Systems and Networks iKohza
<b>EMBEDDED</b>	Embedded System iKohza
<b>IDS</b>	Intelligent Dynamics and System iKohza
<b>MEMO-Bio</b>	Metabolic Engineering and Molecular Biology iKohza
<b>eMAST</b>	Engineering Materials & Structure iKohza
<b>SHIZEN</b>	Shizen Conversion and Separation Technology iKohza
<b>TTES</b>	Takasago Thermal Environment System iKohza
<b>TriPreM</b>	Tribology and Precision Machining iKohza
<b>AVS</b>	Advanced Vehicle System Engineering iKohza
<b>WEE</b>	Wind Engineering for [Urban, Artificial, Man-made] Environment iKohza



ENVIRONMENT





# AN ADVANCED WASTEWATER TREATMENT SYSTEM

Novel Microalgae-Bacteria Granular Sludge System

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## PROBLEM ANALYSIS

### Industry Needs

Integration of microalgae in aerobic granular sludge system is becoming the new alternative in wastewater treatment industries as it has the potential to be applied in treating various types of wastewater, including domestic, municipal and industrial wastewater. The microalgae-bacteria granular sludge exhibited superior characteristics as compared to the conventional activated sludge system and can be used to produce valuable metabolites from the microalgae.

### Problems

Conventional activated sludge system requires high energy consumption and large areas. Aerobic granular sludge as the alternatives of conventional activated sludge requires long start-up period, especially in treating low-strength domestic wastewater due to low availability of readily biodegradable organic content.

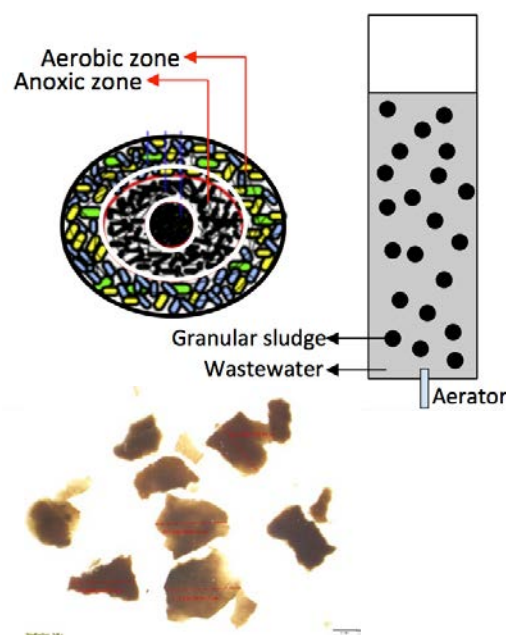
## OUR SOLUTIONS

### Technical seeds

- Integration of microalgae in aerobic granular sludge enhanced the wastewater treatment efficiencies, including in very low-strength wastewater. This is because of the ability of microalgae to directly assimilate organic contents in wastewater.
- Development of microalgae-bacteria granular sludge requires shorter start-up period; therefore the technology is possible to applied in industrial scale wastewater treatment plant.

### Merit of the technology

- Fast settling features of microalgae-bacteria granular sludge (18X faster than conventional activated sludge).
- Shorter start-up period and reach stable state faster.
- Microalgae can be harvested from the granular sludge to extract valuable metabolites.



## MJIT ADVANTAGE

- iKohza algal biomass has been conducting numerous research in microalgae and has strong collaboration with Japanese institutes and universities.
- MJIT has been collaborating with local wastewater treatment sectors in conducting various research in improving the wastewater treatment system.
- MJIT is equipped with wide range of facilities and latest technology.

## PATENT STATUS

Potential to be patented

## CONTACT

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# QUICK AND SIMPLE BIOLOGICAL NITROGEN REMOVAL TECHNOLOGY

Anammox Microgranular Sludge For Domestic Wastewater Treatment

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## PROBLEM ANALYSIS

### Industry Needs

- Many industrial effluents, agricultural wastes, or other human activities generate high and low strength ammonium wastewater. Water pollution leads to the most serious environmental problems due to the discharge of nutrients into receiving waters. Therefore, the industry sector is focusing on minimizing the plant operating costs while effluent standards are still maintained

### Problems

- The extensive energy needed to supply oxygen and the large amount of organic matter required
- Production of N<sub>2</sub>O (a greenhouse gas) as a by product in the process

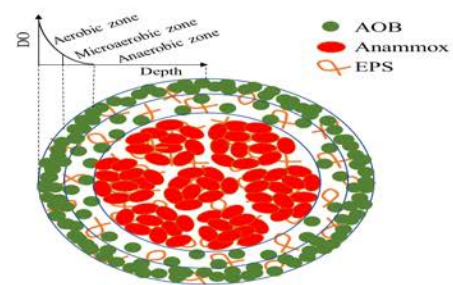
## OUR SOLUTIONS

### Technical seeds

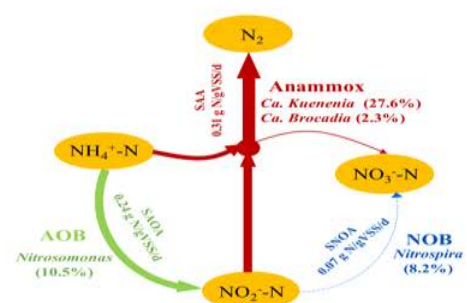
- Cultivation of anammox bacteria from domestic wastewater and continued with cultivation of nitrification-anammox bacteria.
- The cultivated bacteria will be used as seedling sludge for treating the domestic wastewater.
- Microbial composition and the configuration of the granular forming integrated with anammox and nitrification-anammox will be determined..

### Merit of the technology

- Study the benefits of anammox consortium for domestic wastewater treatment while simultaneously yield good quality effluent.
- No organic carbon is required seems it fully autotrophic nitrogen removal process.
- Reduces the aeration energy up to 60%.
- Requires lower operational cost & small space requirements.



(a) Three layer structure



(b) Microbial community and activity

## MJIT ADVANTAGE

- MJIT is a research organization which has innovative research laboratory system in a particular research area headed by a senior academic.
- MJIT has a strong collaboration work with local wastewater treatment plant (IWK Bunus).

## PATENT STATUS

Potential to be applied for patent.

## CONTACT

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Mr. Takano, JICA Expert  
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# HIGH QUALITY LIQUID ORGANIC FERTILIZER

Supplements for vegetables and main-dish for microbes from chicken feather waste

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## PROBLEM ANALYSIS

### Industry Needs

- Agricultural industry (farmers) needs effective fertilizers.
- Poultry and slaughterhouse concerns the disposal/ treatment of high amount of chicken feather waste.
- Fermentation industry is seeking a carbon source for microbes in low cost.

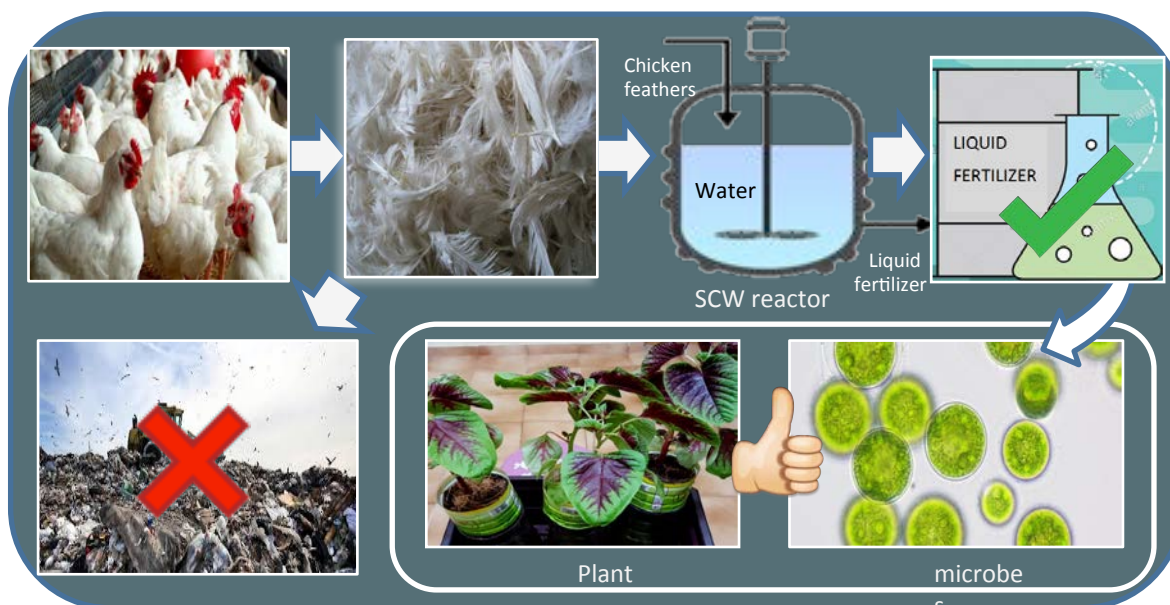
## OUR SOLUTIONS

### Technical seeds

- Liquify the chicken feather waste by Subcritical Water (SCW) technology
- Liquified feather solution contains high amount of amino acids
- Tune the liquified feather solution by the addition of other nutrients according to the usage for producing the effective fertilizer for farming/ cultivation of microbes

### Merit of the technology

- High quality organic fertilizer containing high amount of amino acids is produced
- Waste from slaughterhouse is reduced



## MJIT ADVANTAGE

- MJIT own two unit of two cubic meter (2 m<sup>3</sup>) scale of SCW reactor
- MJIT is able to produce the liquid fertilizer in commercial scale



## PATENT STATUS

Patent in preparation

## CONTACT

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# ECO-FRIENDLY GOLD ADSORBENT/ HEAVY METAL ABSORBER

Low cost Galdieria culture technology

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## PROBLEM ANALYSIS

### Industry Needs

- Mining and plating industry seeking for a low-cost and eco-friendly gold adsorbent.
- Water management needs effective methods to remove heavy metals from water.
- Residences near abandoned mine site are suffering from heavy metal pollution of river.

### Problems

- Conventional methods of gold recovery are expensive and not eco-friendly.
- Conventional methods of heavy metal decontamination are expensive.

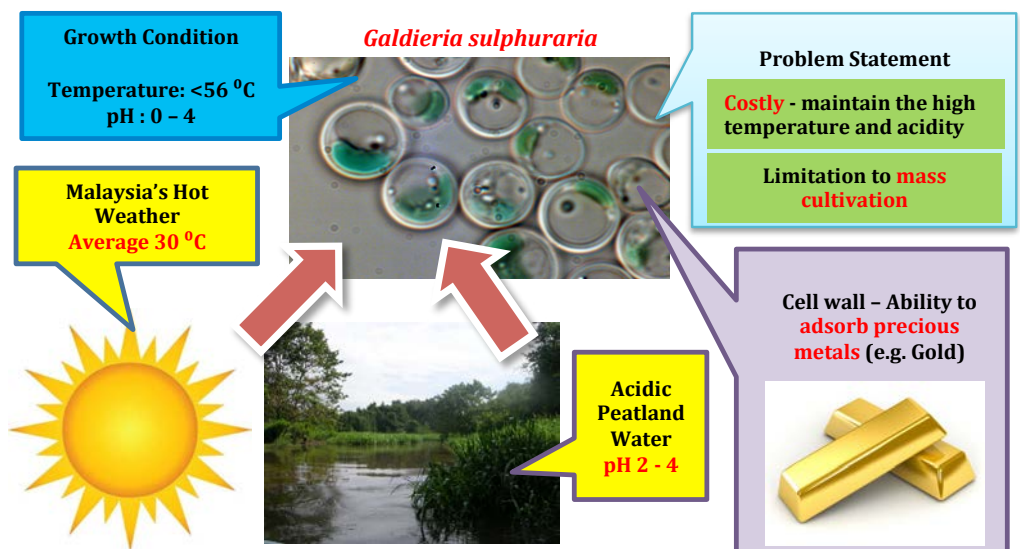
## OUR SOLUTIONS

### Technical seeds

- The unicellular red alga *Galdieria sulfurlaria* has an ability to absorb heavy metals.
- The cell wall of the alga is known to adsorb gold ions in a solution effectively.
- Low cost culture technology has developed to culture the *Galdieria* cells, which require to maintain high temperature and low pH.

### Merit of the technology

- Low cost obtention of *Galdieria* cell that can absorb heavy metals from acidic solution.
- Low cost obtention of *Galdieria* cell-wall that can adsorb gold ions.
- Low level of heavy metals can be decontaminated with low-cost.



## MJIT ADVANTAGE

- MJIT has expert of algal research
- MJIT has special facility for algal research and the mass culture system (July, 2020)

## PATENT STATUS

Patent in preparation

## CONTACT

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# BIOCOKE; ALTERNATIVE COAL COKE FOR SDGS

Biocoke production from various biomass waste in Malaysia

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## PROBLEM ANALYSIS

### Industry Needs

- For the reduction of GHG emission from Industries, utilization of fossil fuel such as coal coke can be altered into alternative solid fuel.

### Problems

- Wood pellet and other solid biomass fuel reach the maximum temperature around 600 degree C, which may not be enough to utilize their industries.
- Handling alternative energy such as hydrogen gas is not easy to transport because of their characterizes.

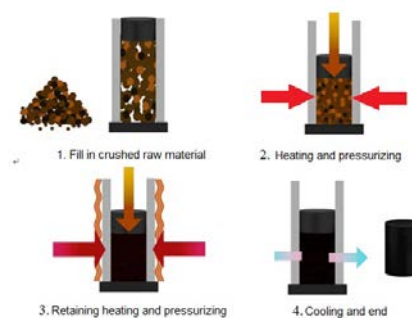
## OUR SOLUTIONS

### Technical seeds

- Any kind of biomass waste in Malaysia can be converted into Biocoke.
- Energy consumption for the production of Biocoke is not higher than wood pellet production.

### Merit of the technology

- Product as Biocoke can be sold as alternative heat energy instead of coal coke.
- It can be involved in the reduction of green house gas (GHG) emission, because materials of Biocoke is abundant biomass waste in Malaysia.



Raw materials	Formation Temperature [°C]			
	130	150	170	190
EFB (Empty Fruit Bunch)				Forming temperature not suitable
Oil Palm Trunk				
Oil Palm Freen				Forming temperature not suitable
Bagasse				Forming temperature not suitable

## MJIIT ADVANTAGE

- Our research group in MJIIT is only research organization to work on Biocoke production in Malaysia because of patented technology.
- MJIIT has strong research collaboration with several research institutes in Malaysia.

## PATENT STATUS

Registered as a Japanese granted patent (Kindai University)

## CONTACT

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# FINE CHEMICAL PRODUCTION FROM BIOMASS WASTE

Enzymes for lignocellulose degradation by tropical microbes

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## PROBLEM ANALYSIS

### Industry Needs

- Organic chemical conversion from biomass waste is now important area for pharmaceutical and energy industries. Generally, chemical conversion produces several kind of by-products, which are difficult to separate and costly. Specific enzymes from Tropical climate can accommodate high reaction temperature and less by-product reaction.

### Problems

- No specific enzyme for lignin depolymerization from Eukaryote has been commercialized in the market.
- Control for the reaction by microbes is difficult under Temperate countries because of fluctuation of outside temperature.

## OUR SOLUTIONS

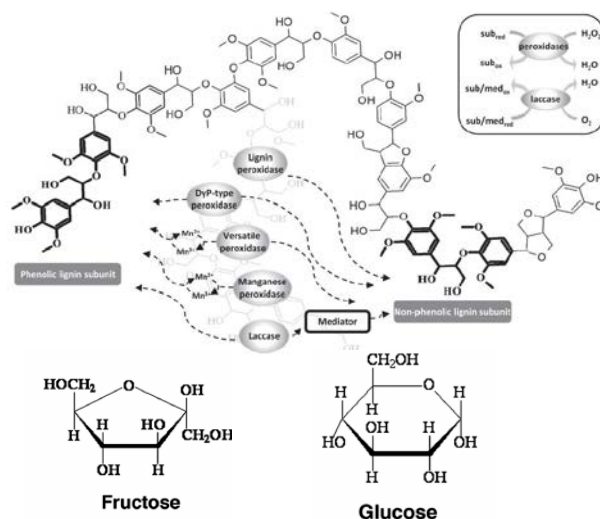
### Technical seeds

- Identified specific enzymes for depolymerization of lignin structure from Tropical microbes.
- No by-product yields using specific enzyme for the decomposition of lignocellulose.



### Merit of the technology

- No need to separate by-product, directly convert into specific organic compounds from lignocellulose from waste biomass in Tropical area.
- Mass production of specific enzymes for the conversion of lignocellulose into market.
- Production of precursors of pharmaceutical materials from lignin, and cellulose and hemicellulose to be converted at same time.



## MJIIT ADVANTAGE

- Our research group in MJIIT obtained first evidence of lignin depolymerization by Eukaryote, and characterized these enzymes.
- MJIIT has strong research collaboration with several research institutes related in oil palm research in Malaysia.

## PATENT STATUS

Patent in preparation

## CONTACT

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# TEMPERATE CROPS CULTIVATION IN THE TROPICS

Soil cooling system to maintain temperate crops cultivation

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## PROBLEM ANALYSIS

### Industry Needs

- Temperate crop cultivation in tropical area is usually operated only in highland area, which average temperature is around 20 degree C. Temperate crops cultivation in temperate area is always one time because of seasonal cultivation. Thus, our idea can accommodate the growth of temperate crops under tropical are throughout of year.

### Problems

- Climate change at temperate contires will be effected for the crop cultivation in the future.
- Cultivation of temperate crops in temperate and tropical countries always faced natural disaster, such as land slide. Moreover, crop cultivation in temperate countries always one time per year.

## OUR SOLUTIONS

### Technical seeds

- Soil cooling system can accommodate temperate crops cultivation under Tropical climate.
- Not only for leaf crop cultivation, but also root crop cultivation are available in the Tropics.

### Merit of the technology

- No need to build expensive green house to maintain atmosphere temperature to support growth of temperate crops.
- Leaf crops are easily grow on this soli cooling system, but root crops and several fruits such as strawberry can also grow by soil cooling system under tropical climate.
- No need to consider seasonal issue in Malaysia,
- Because it is always hot and humid to be suitable for the growth of plant.



## MJIT ADVANTAGE

- Our research group in MJIT obtained first evidence of soil cooling temperate crop cultivation, and nutrient condition and diversity of microbes has been identified.
- MJIT has strong research collaboration with several research institutes in Malaysia.

## PATENT STATUS

Patent in preparation

## CONTACT

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# WASTE TO FUEL

## Sludge Palm Oil Utilization System (SPOUS)

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### PROBLEM ANALYSIS

#### Industry Needs

- Palm Oil Mill Effluent (POME) is a by product of palm oil mill processes. POME has high Biodegradable Oxygen Demand (BOD) which must be treated to below 20 ppm before it can be release to a rivers. One of the most important treatment stage for POME is to remove Sludge Palm Oil (SPO). SPO is considered as waste, cheap in price and having heating value suitable to be used as fuel.

#### Problems

- No systematic system for SPO collection. Usually it is scoop away from the surface of POME pond.
- Abandoned amount of SPO.

### OUR SOLUTIONS

#### Technical seeds

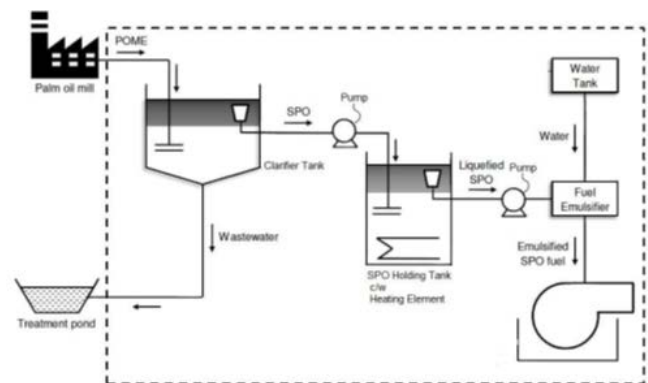
- The system suggest the method for SPO separation and method to utilize the SPO after it's recovery.

#### Merit of the technology

- Ease of further process on POME treatment.
- Utilization of SPO into useful energy.
- Simple method of SPO separation.
- Utility Innovation utilizing proven existing technologies.
- Potential to preserve the environment.



Ponding system of POME



### MJIT ADVANTAGE

- Having a close collaboration with local industries that have wide experience in supplying waste oil from palm oil mill or palm oil refinery to other countries.

### PATENT STATUS

Patent Filed: UI2015701995

### CONTACT

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# BIODIESEL EMULSION FUEL –SOLAR HYBRID SYSTEM

Real-Time Emulsion Fuel Supply System Integrated with Solar-Hybrid (RTES-PV)  
for Diesel Electric Generator

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## PROBLEM ANALYSIS

### Industry Needs

- The critical fossil fuel reserve and climate change are two global issues that will become disastrous to our future generation if these problems not being handled effectively. One of the alternative fuel that has promising effect towards to energy saving as well as reducing harmful exhaust emission is water-in-biodiesel emulsion fuel (W/D). W/D has proven scientifically able to reduce fuel consumption up to 10% and reduce exhaust emission especially Nitrogen oxides (NOx) and particulate matter (PM) up to 50%.

### Problems

- Emulsification process of water and oil is strongly dependent of surfactant. However, dependency of surfactant drastically increased the fuel price. Thus it restrict the commercialization of the fuel.

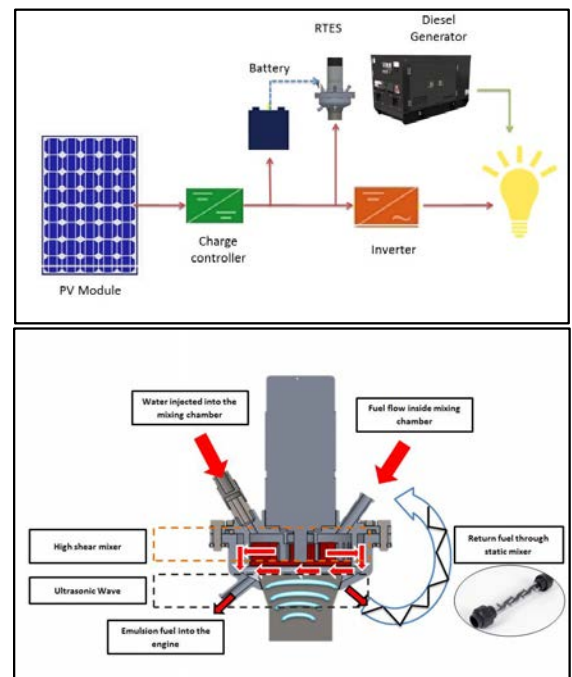
## OUR SOLUTIONS

### Technical seeds

- Real-time Emulsion Fuel Supply System (RTES) is novel in-line mixing device that work by mixing water and oil in real-time and directly supply into the engine
- RTES consist of two in-liner mixers; high shear and static mixer
- RTES has eliminated the dependency of the surfactant
- RTES is connected with Photovoltaic (PV) to power up the system (RTES-PV)

### Merit of the technology

- RTES-PV utilize energy from PV, thus eliminate the extra load to engine
- Extra energy generated from PV will transfer to diesel generator to reduce the electrical load
- RTES-PV will reduce more than 15 % fuel consumption and more than 60% reduction of NOx and PM



## MJIT ADVANTAGE

- The first non-surfactant emulsion with solar hybrid technology in the market
- RTES-PV utilized all the sustainable sources of energy including biodiesel and solar
- RTES-PV was designed a modular type, where it can integrate to existing diesel generator without engine modification

## PATENT STATUS

Patent Filling: PI2014702681

## CONTACT

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# EASY TO INSTALL LOW-COST ROOF INSULATION

Affordable roof shading technique

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## PROBLEM ANALYSIS

### Industry Needs

- Landed low-cost houses with metal roof finish and surrounded with hot-humid climate.
- A low-cost, low-maintenance passive cooling method required.

### Problems

- Most houses in Malaysia face the thermal discomfort in the house, especially landed low-cost houses.
- Installation of heat insulation at the roof is expensive and not affordable by low-income group.
- Aluminium sisalation, the most common material which normally installed under the roof tiles for heat insulation purpose. The installation of aluminium sisalation required massive work and take more than one day and expose the interior of the house to risk of raining.

## OUR SOLUTIONS

### Technical seeds

- Provide shading to roof by using high-density polyethylene sunshade net as roof cover on an existing pitch roof to achieve required thermal comfort in the space under the roof.

### Merit of the technology

- Reduced convective heat flux approximately 70~80% in attic and 88% in the room.
- The mean surface temperature on top of roof tiles and in the attic during day time was reduced approximately 4.4 oC and 1.6 oC, respectively.
- Meanwhile, the daytime mean air temperature in the room was reduced approximately 1 oC.
- Installation work is easy and can be completed in one day.

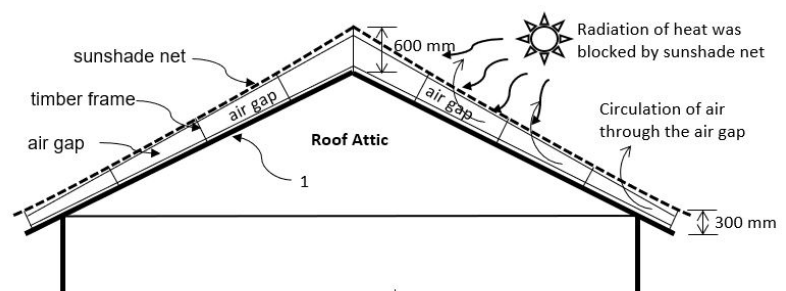
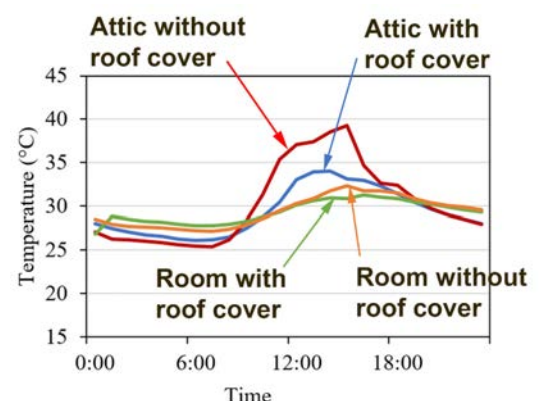


FIGURE 1|



## MJIT ADVANTAGE

- MJIT has outstanding researcher and equipment in the research of thermal comfort.
- MJIT has a strong collaboration with researcher, research centers and universities from Japan.

## PATENT STATUS

Pattern applied: PI 2018704320

## CONTACT

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MATERIAL



# NANOCOATING FOR ANTI-CORROSION OF CARBON STEEL (WONDER PAINT)

Nanocoating Technology

Dr. Norhasnidawani Johari, Senior Lecturer

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Engineering Materials & Structure iKohza (eMAST), MJIT

## PROBLEM ANALYSIS

### Industry Needs

- To meet the ever-growing demands on modern coatings, the paint industry continuously strives to improve their products especially to meet requirement in petrochemical industries. Therefore, over the past years nanotechnology has become more and more important in the development of coatings.



### Problem

- Commercial problem having high toxicity and low performance. The cost for commercial is high and thickness layer is more than 1milimetre.

## OUR SOLUTIONS

### Technical seeds

- New Invention in Paint Industry that offers;
  - ✓ Excellent chemical stability
  - ✓ Oxidation control
  - ✓ Enhanced corrosion resistance for commercial use
  - ✓ Compatibility between (A+B) and carbon steel

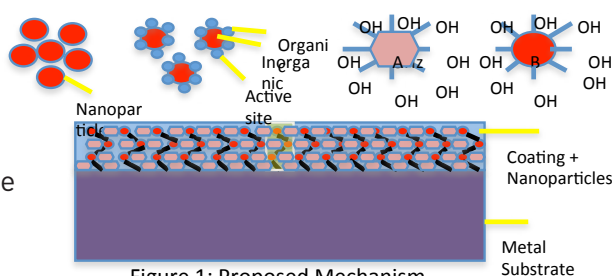


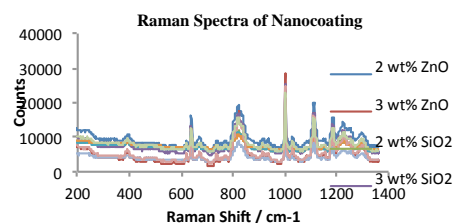
Figure 1: Proposed Mechanism



Figure 2: Different area coating

### Merit of the technology

Properties	Commercial Product	Our Product
Unit Cost (8cmx8cmx0.5cm)	RM0.04	RM0.01
Cost (Per litre)	Rm40	~Rm19
Maintenance	2-3 years	5-7 years
Production batch	10 units	40 units
Area	Limit	Wider
Toxicity	Yes	No
Performances	Average	High
Health concern	No	Yes
Thickness layer	> 1mm	~10micrometer



## MJIT ADVANTAGE

- MJIT is only a research organization in the world which develops this very unique technology.
- MJIT has a strong collaboration work with nanotechnology of The National Institute of Advanced Industrial Science and Technology, Japan

## PATENT STATUS

- MyIPO (PI2017703467)

## CONTACT

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# 100% ORGANIC FERTILIZER AS PLANT GROWTH BOOSTER

Sub-critical Water Technology

Dr. Pramila Tamunaidu, Senior Lecturer  
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SHIZEN Conversion & Separation Technology iKohza (SHIZEN), MJIT

## PROBLEM ANALYSIS

### Industry Needs

- Organic fertilizer that boosts both nutrient efficiency and organic matter content in the soil.
- Retains moisture in soil to make crops to be more resilient and drought-resistant.
- Reduces dependency on chemical fertilizer that may cause waterway pollution, chemical burn to crops, increased air pollution, acidification of the soil and mineral depletion of the soil

### Problem

- Due to the growing population, it is estimated that the demand for food will increase by 50 % by 2030 compared to current needs and by 80-100 % in 2050. (JRC Science & Policy Reports)
- The available technologies are taking several weeks to a few months to produce organic fertilizer.

## OUR SOLUTIONS

### Technical seeds

- High quality and effective organic fertilizer.
- Low production cost and sustainable feedstock.
- Short production time
- Safe and environment friendly.
- Fast conversion of waste to highly effective organic fertilizer.

### Merit of the technology

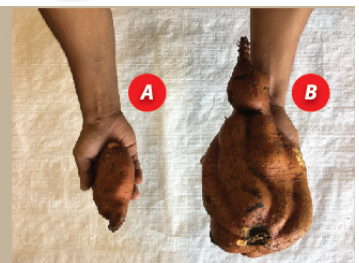
- Subcritical Water Technology. (Green technology)
- Disinfects bad bacteria and viruses in the green waste by sterilization, deodorization, detoxification & decomposition.
- Organic materials are decomposed into smaller molecules.
- Strengthen shelf life and increase nutrition value.



Japanese Yam  
*Dioscorea japonica*

Sample A  
Other Organic Fertilizer  
Weight : 200 gram

Sample B  
**SUGONIX**  
Weight : 2000 gram



## MJIT ADVANTAGE

- MJIT is the only research organization in Malaysia which has the first commercially running subcritical water pilot plant in Southeast Asia
- MJIT has strong collaboration with Malaysian agro-based government units and local farmers.

## PATENT STATUS

Registered as UTM granted patent  
(IP/PT/2018/1035)

## CONTACT

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# HIGH QUALITY AGRO-BASED RUMINANT FEED

Sub-critical Water Technology

Dr. Pramila Tamunaidu, Senior Lecturer

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## PROBLEM ANALYSIS

### Industry Needs

- Ruminant feed that provides natural nutrients to improve animal health and produce high yields of quality meat
- Small Medium Industries in ASEAN cannot afford commercial feed as the cost is very high.
- Feed must be free of bovine spongiform encephalopathy (BSE or mad cow disease)

### Problem

- Due to the growing population, it is estimated that the demand for food will increase by 50 % by 2030 compared to current needs and by 80-100 % in 2050. (JRC Science & Policy Reports)
- Cost- dependent on raw feedstock price which makes it extremely expensive for the smallholders to purchase.

## OUR SOLUTIONS

### Technical seeds

- High quality and effective ruminant feed.
- Low production cost and sustainable feedstock.
- Short production time – 1 hour per cycle.
- Safe and environment friendly.
- Fast conversion of waste to highly effective ruminant feed.
- Free from RAM (Restricted Animal Material)

### Merit of the technology

- Subcritical Water Technology. (Green technology)
- Disinfects bad bacteria and viruses in the green waste by sterilization, deodorization, detoxification & decomposition.
- Organic materials are decomposed into smaller molecules.
- Strengthen shelf life and increase nutrition value.



Nutrient Content	SUGORUMA	Commercial product
Crude protein	13.8 %	17.4 %
Crude fat	2.6 %	1.6 %
Crude fiber	20.8 %	16.6 %
Ash	7.5 %	11 %
Energy	1.5 MJ	1.24 MJ

## MJIT ADVANTAGE

- MJIT is the only research organization in Malaysia which has the first commercially running subcritical water pilot plant in Southeast Asia.
- MJIT has strong collaboration with Malaysian agro-based government unit and local farmers.

## PATENT STATUS

Registered as UTM granted patent (in progress)

## CONTACT

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# HALEA NATURAL SKIN CARE

Wild ginger extract: water-based extraction process

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## PROBLEM ANALYSIS

### Industry Needs

- Industrial extraction process normally takes a lot of processing time, use harmful solvent and high energy consumption.
- Our process improves in shortening the time, water based extraction, use less energy. Therefore it is more profitable and environmental friendly. Besides that, higher quality of extracted product achieved



### Problem

- There are a lot of unsafe products using harmful ingredients such as parabens, hydroquinone & mercury in the market used as ingredients in skin care products. Our product solves the problem by introducing plant based ingredient, non-hazardous chemicals used, applied safe and hygienic process (HALAL & TOYYIBAN) in the production.

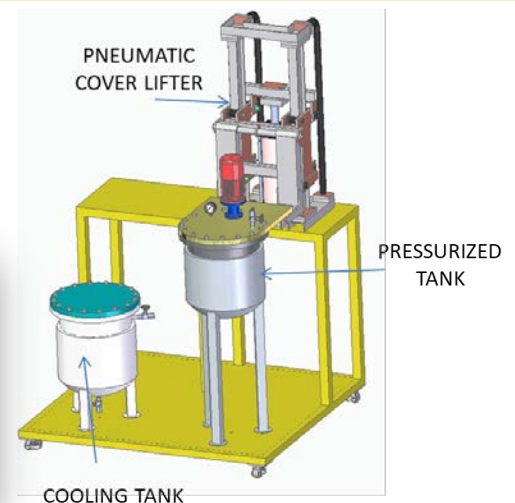
## OUR SOLUTIONS

### Technical seeds

- Our process improves in shortening the time, water based extraction, use less energy therefore it is more profitable and environmental friendly. Besides that higher quality of extracted product achieved

### Merit of the technology

- Shortening process time
- Use water instead of acid & alkaline solvent
- Less energy usage in the process
- Environmentally friendly because it is water based extraction process
- Higher quality extract and yield
- More profitable



## MJIT ADVANTAGE

- MJIT introduced local herbs extract using designated water-based extraction process in skincare product. The nano-technology introduced in the products formulation able to increase penetration of active ingredients to the targeted cell on our skin
- MJIT in the process of conducting an efficacy study to analyze the effect of HALEA products on topical application for different gender and types of skin.



## PATENT STATUS

Trademarks; Reg. No.: 2018010567  
Date of Filing: 14/08/2018 (Approved)  
Trade Secret; Ref. No.: IP/TS/2018/0449  
Year applied: 2018 (Approved)  
Trade Secret; Ref. No.: IP/TS/2019/0208  
Year applied: 2019 (Approved)

## CONTACT

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# AFFORDABLE AND EFFECTIVENESS OF NANOTECHNOLOGY AS ANTIBACTERIAL AGENT

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## PROBLEM ANALYSIS

### Industry Needs

- Despite of finding only a low cost antibacterial agent, in parallel, an effective antibacterial agent also is quiet important for several industries nowadays such as in medical and pharmaceutical industries, agriculture industries and food packaging industries.
- Nanotechnology can be an alternative in solving the rising problems faced by the industries in term of economical and effectiveness.

### Problem

- Antibiotic resistance is an emerging problem nowadays as it can be spread easily through human and animals.
- A failure to mitigate the problem of antibiotic resistance could lead to the high cost of treatments and the worst case is increasing the number of death.

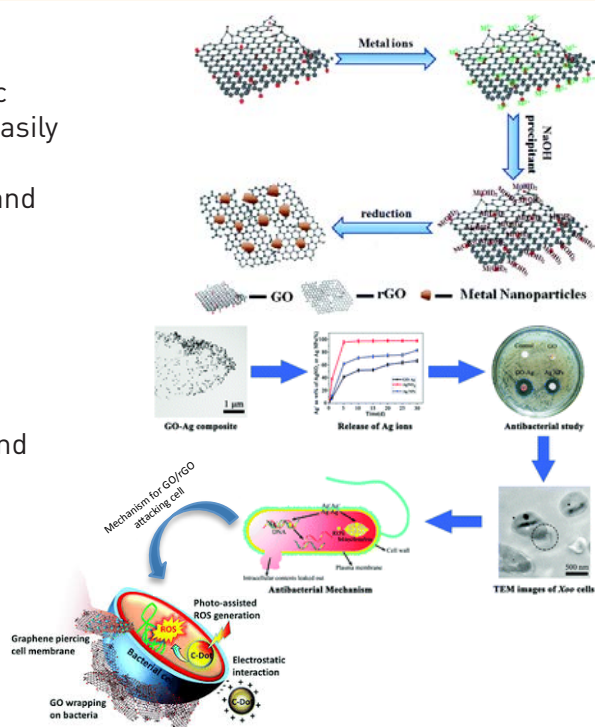
## OUR SOLUTIONS

### Technical seeds

- By combining graphene based nanomaterial and metallic nanoparticles (nanocomposites) which can be obtained easily through chemical reduction process.
- By applying the nanocomposites towards Gram positive and Gram negative bacteria.

### Merit of the technology

- Simple and easy to prepare with short time preparation of the antibacterial agent is needed.
- Combination of the nanotechnology is much more stable and have synergistic effect towards both Gram positive and Gram negative bacteria.
- Can be applied in multiple industries such as electronic industries, medical industries, agriculture and food packaging industries.



## MJIT ADVANTAGE

- MJIT has an advance facilities and also has accessibility to sophisticated equipment in foreign partner university for the nanotechnology analysis.
- MJIT has a strong Japanese-based industrial-linkage that gives opportunities for industrial experience and allows students to use their work experience as part of their research.

## PATENT STATUS

Under preparation

## CONTACT

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# PURIFYING WATER WITH COMBINING NANOTECHNOLOGY AND LIGHT

Dr. Kamyar Shameli, Senior Lecturer

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## PROBLEM ANALYSIS

### Industry Needs

- Alternative wastewater treatment process that is more efficient and cost effective compared to what is being offered now.
- Implementation of wastewater treatment at the industrial level before releasing the wastewater to commercialize wastewater treatment plant
- Multipurpose water treatment that can be use across various applications

### Problem

- Water pollution has been a major problem face by mankind around the world
- Current water treatment is effective but high cost in production and maintenance

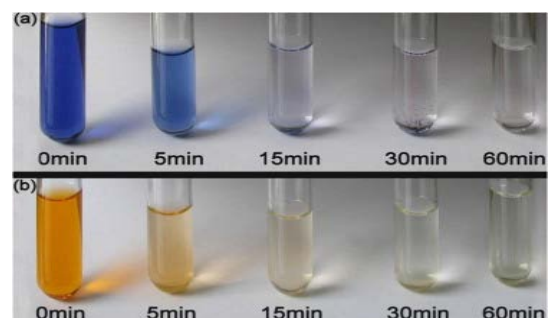
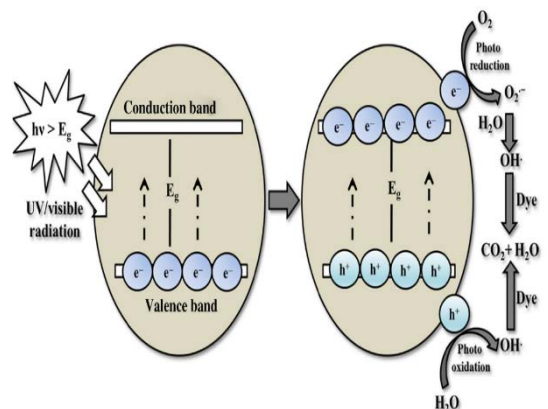
## OUR SOLUTIONS

### Technical seeds

- Utilization of nanotechnology for wastewater treatment through advanced oxidation processes (AOPs).
- Employment of metal oxide nanoparticles together with light irradiation, radical species will be generated and it will degrade the waste in water into safer compound such as water and carbon dioxide

### Merit of the technology

- Simple and effective process in production of metal oxide nanoparticles.
- The treatment process only requires metal oxide nanoparticles and light irradiation to treat the wastewater.
- Applicable across wide range of wastewater.



## MJIT ADVANTAGE

- MJIT is a research institute that utilize Japanese style education which has different iKohza and interaction between iKohza will provide exposure in various type of research
- MJIT has state-of-the-art instruments that are required for analysis thus ease the research process

## PATENT STATUS

Under preparation

## CONTACT

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# SUSTAINABLE PLANT-MEDIATED NANOPARTICLES FOR TARGETED CANCER THERAPY

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## PROBLEM ANALYSIS

### Industry Needs

- Conventional cancer drugs extensively used to treat cancer are double-edged swords that can treat the disease but at the same time give rise to various negative side effects that reduce patients' quality of life. There is a need to develop new anticancer drug that has excellent tumor cells targeting and killing but with minimum negative side effects.

### Problem

- Common negative side effects of current cancer therapy include lowered immune system, fatigue, anemia, appetite loss, swelling and others. With targeted cancer treatment using nanoparticles, less healthy cells are affected and only tumor cells will be eradicated.

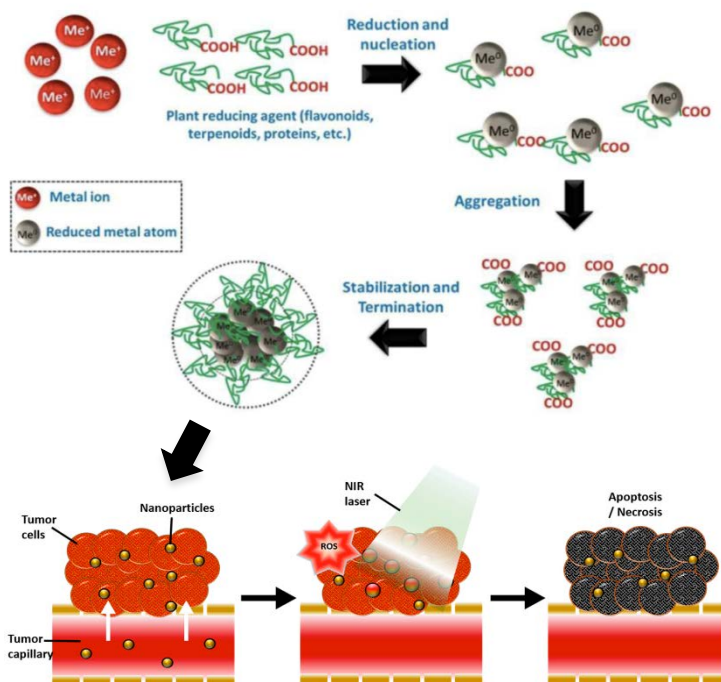
## OUR SOLUTIONS

### Technical seeds

- Synthesizing metal-metal oxide nanoparticles via simple green route from plant's phytochemical compound.
- Injection of nanoparticles to tumor cells site and activating them using light for reduced negative side effects.

### Merit of the technology

- Green synthesis method is sustainable, cost-effective and release minimum toxic materials to the environment.
- Use of nanoparticles as anticancer drugs will increase the drug efficacy.
- Easy functionalization of nanoparticles will generate multi-purpose anticancer drug.



## MJIT ADVANTAGE

- MJIT has cutting-edge instruments and technologies for advanced nanomaterials synthesis and analysis.
- MJIT has strong collaborations with Japanese universities and industry partners for students to share and expand their research findings.

## PATENT STATUS

Patent under preparation

## CONTACT

Mr. Afiq, SRC Coordinator  
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# 21ST CENTURY WATER TREATMENT

Tin(IV) Oxide, Photocatalytic Dye Degradation

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Chemical Energy Conversion And Application iKohza (ChECA), MJIT

## PROBLEM ANALYSIS

### Industry Needs

- This research focusing the needs of treating polluted water with photocatalytic activity using Tin(IV) Oxide nanoparticles (SnO<sub>2</sub>-NPs) synthesized from Pandanus amaryllifolius leaves (PAL). It is very suitable for mass-production as the synthesized method is consider to be 'Green' without the use of any chemicals and the reaction occur by only introducing sunlight.

### Problem

- Water pollution is jeopardizing human health. Unsafe water kills more people each year than war and all other forms of violence combined. However, less than 1% of the earth's freshwater is actually accessible to human. Facts of water pollution, 142L of water will be polluted in order to produce 1 piece of clothing and 20% of industrial water pollution is owed to fabric dyes.

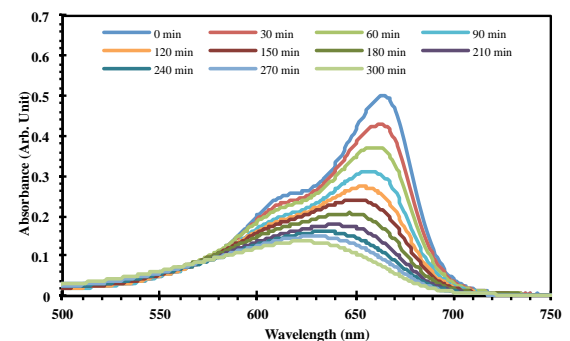
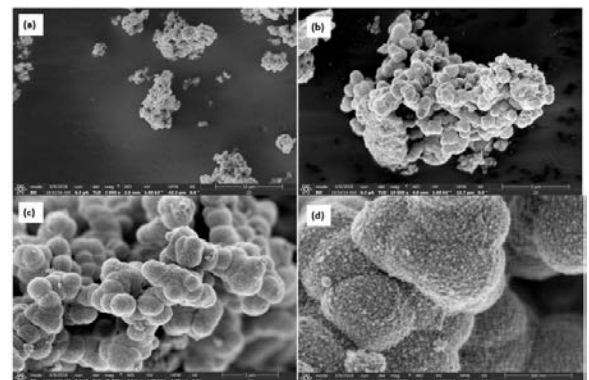
## OUR SOLUTIONS

### Technical seeds

- The extraction of PAL need to be done accordingly to obtain the maximum extraction. SnCl<sub>2</sub>·2H<sub>2</sub>O will be dissolved in the water then mix with the plant extract. The solid particles undergo calcination at 450 °C.
- 3 ppm of methylene blue dye was prepared and 0.2g of SnO<sub>2</sub>-NPs was added. The sample was irradiated with UV light ray. The degradation of dye will start immediately when UV wavelength is introduced.

### Merit of the technology

- The synthesis of SnO<sub>2</sub>-NPs was simple with low cost and toxicity. Having high physical and chemical stability. Nanoparticles can be reactivated and be reused.
- Ultraviolet (UV) from sunlight act as the energy source to promote photocatalytic dye degradation



## MJIT ADVANTAGE

- MJIT is a research organization with lots of connection and collaboration from industries. This will provide firsthand information regarding the current status and needs for industries.
- MJIT is also a world ranking university with Japanese oriented education. It provided the state-of-the-art technology with multiple different iKhoza.

## PATENT STATUS

Under preparation

## CONTACT

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# FRUIT PEELS AND CROP-WASTE FOR PHARMACEUTICAL INDUSTRY

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Chemical Energy Conversion And Application iKohza (ChECA), MJIIT

## PROBLEM ANALYSIS

### Industry Needs

- Decreasing the environmental issues of the agro-waste by using the waste with high biodegradability for nano-technology in the modern-societies can be attractive in waste management and agriculture industries.
- Pharmaceutical industries require low cost of materials and organic medicine with high efficiency bio-competability.

### Problem

- Not used agro-waste effects on the organic matter with huge nutrient losses.
- Chemical drugs can lead to health issues, similar to cancer chemotherapy treatment with side effect.

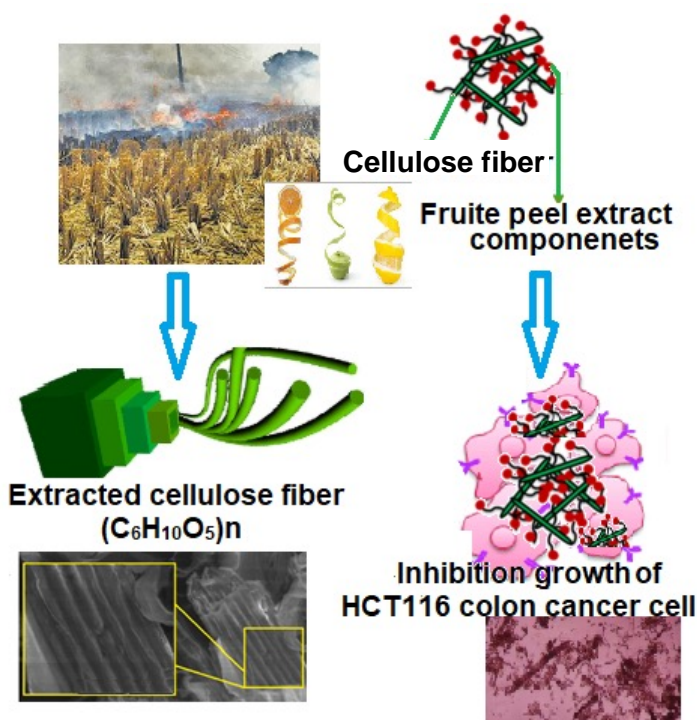
## OUR SOLUTIONS

### Technical seeds

- Anti bacterial and phenolic compounds extraction from different fruit peels waste
- Crystal nanocellulose isolation from fruit peels and crop-waste.

### Merit of the technology

- Decreasing the agro-waste issues by using bio resource materials with high biodegradability.
- Using high percentage of the anti-bacterial components of the fruit which is presented in the peels mostly.
- Using crystal nanocellulose as a solid support for the anti-bacterial components of the peel extract .



## MJIIT ADVANTAGE

- The optimum functions of preparation and characterization of the material have carried out in MJIIT with collaboration with other related universities.
- There has been no report similar this pattern.
- In MJIIT, this material can be fabricated with facile process with high biodegradability from diverse natural-resources for different applications including anti-bacterial and cancer treatments.

## PATENT STATUS

Patent in preparation

## CONTACT

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# SMART PACKAGING FOR MUSCLE-BASED FOODS

Active, Nanoparticles and Antimicrobial Technologies

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## PROBLEM ANALYSIS

### Industry Needs

- Active packaging can be used to extend the shelf life of muscle-based food products. The smart packaging produced by embedding the silver nanoparticles onto biofilm. Silver nanoparticles was produced via novel and green techniques with the aid of biopolymers as a stabilizer. Incorporation of antimicrobial agent into the packaging is to reduce, inhibit or retard the growth of microorganism that may be present on food surfaces.

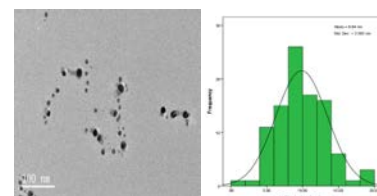
### Problem

- Packaging plays an important role in preserving the processed muscle-based food due to highly perishable food product. Typical packaging materials only provides the good containment for muscle-based food (MBF) product with limited shelf life and storage capability. The expansion of markets for MBF led to longer delivery times thus the demands for longer shelf life is crucial. In solving the problem the novel nanoparticles concepts have been employed in synthesizing the smart packaging. The development of smart packaging materials have demonstrated promising solution in extending the shelf life of MBF product.

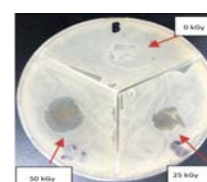
## OUR SOLUTIONS

### Technical seeds

- A novel approach to synthesize biopolymer/Silver (Ag) nanocomposite hybrid material which is based on the seeded growth of Ag nanoparticles within biopolymer matrix.
- Silver salt within the biopolymer matrix forming the metallopolymers films with well- defined structures in which metal centers are embedded directly in the polymer backbone.
- Using  $\gamma$  -irradiation, the preorganized seed points is utilized, led to the growth of Ag nanoparticles (AgNPs) directly on the biopolymer backbone.
- The smart packaging was prepared by embedding the AgNPs onto polymer creating the film.



Spherical shape, finer and good distribution of silver nanoparticles-  
Antimicrobial characteristic



Photograph of antimicrobial test results against *Bacillus Subtilis*-  
after exposed to microbe

### Merit of the technology

- The best approach to solve the toxicity issue in AgNPs is by leaving out the chemicals all together.
- This can be achieved by using radiation-induced method.
- Simple process without adding any chemical reducing agent
- The process is inert without producing any byproduct

## MJIT ADVANTAGE

- MJIT is a research organization with lots of connection and collaboration from industries. This will provide firsthand information regarding the current status and needs for industries.
- MJIT is also a world ranking university with Japanese oriented education. It provided the state-of-the-art technology with multiple different iKhoza.

## PATENT STATUS

Under preparation

## CONTACT

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# CHEMICAL ENGINEERING





# DESIGN OF APPARATUS FOR PHASE EQUILIBRIUM MEASUREMENT

From Low boiling point compounds to polymer

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## PROBLEM ANALYSIS

### Industry Needs

- Precise experimental data of Phase equilibria are essential for design, operation and maintenance of many separation processes (Distillation, Gas absorption, Extraction, Christianization) in chemical industries.

### Problem

- Many types of process simulators are commercialized however it is very expensive. The installed data is sometimes in so called black box. Sometimes there is no data of physical properties like vapor-liquid, liquid-liquid, and solid liquid equilibria.
- To obtain the data, a specificities apparatus will be necessary and required many experience and skillful technique for design, construction and operation.

## OUR SOLUTIONS

### Technical seeds

- From the target system and the component, a suitable method (static, circulating, flow and synthetic) will be provided.
- From the experimental range of temperature and pressure, a suitable cell material will be selected.
- From the cost and the requested precision of the measurement, the apparatus will be constructed by our own technology.

### Merit of the technology

- Saving cost for own measurement
- Providing the data with high precision, rapidly
- Obtaining a suitable thermodynamic model and their parameters for process simulators

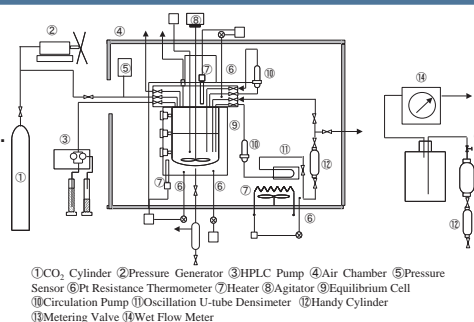
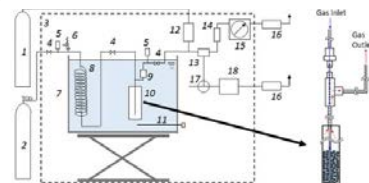


Fig.1 A Circulating type apparatus for measurement of high pressure Gas solubility in lubricant and Liquid density (collaboration with Petroleum Company, Fluid Phase Equilibria, 219, 87-92(2004))



1: Nitrogen cylinder 2: Sample gas cylinder 3: Air chamber 4: Needle valve 5: Pressure gauge 6: Relief valve 7: Constant temperature bath 8: Heat exchanger 9: In-line filter 10: Equilibrium cell 11: Built-in Pt resistance thermometer 12: Mass flow controller 13: Sampling port 14: Rotor meter 15: Wet flow meter 16: Absorber column for Hg 17: three-way valve 18: Mercury survey meter

Fig.2 A Flow type apparatus for measurement of ppm-ppb order mercury vapor pressure and Miscibility into high pressure natural gas (collaboration with Petroleum Company, Fluid Phase Equilibria, (in press))

## MJIT ADVANTAGE

- MJIT is only a research organization in the world which develops this very unique and cutting edge permeation tube technology.
- Prof. Tsuji has strong collaboration works with Japanese companies of chemical & petroleum and national institutes (more than 40 collaboration)
- Prof. Tsuji has many experience on phase equilibrium measurements.

## PATENT STATUS

Registered as a Japanese granted patent (2006-1830)

## CONTACT

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INFORMATION COMMUNICATION  
TECHNOLOGY



# MANAGEMENT OF BACTERIAL PANICLE BLIGHT THROUGH AI CLOUD COMPUTING

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## PROBLEM ANALYSIS

### Industry Needs

- Plant diseases are not only threatened the system on a worldwide scale, but they can also cause catastrophic implications towards Southeast Asia as this continent are heavily rely on agriculture industries especially on paddy crop. With the combination of uprising global penetration of smartphones and the latest advancement in computer vision have made it possible for deep learning to assist in the disease diagnosis process.

### Problem

- The object detection method is used to identify any diseases and pests such as Bacterial Panicle Blight (BPB) and Ostrinia Salentiales Snell that infecting the paddy plants by feeding images into the neural network model.
- Traditional paddy diagnosis can lead to human error which can affect the result of the diagnosis.

## OUR SOLUTIONS

### Technical seeds

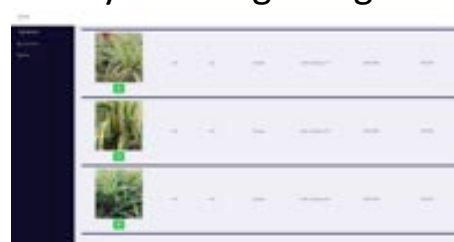
- Using deep learning and computer vision, the AI model can detect and predict whether the paddy images uploaded are infected with diseases and pests.
- All the results are collected and stored in a database and the analysis of the result can be seen in the system portal.

### Merit of the technology

- In image processing, the Faster-RCNN model is used to train and make a prediction on images whether it is infected or not.
- All the diagnosis process will be done automatically which will eliminate human error as well as saving time and energy.
- The result are saved in cloud storage which secure and at the same time make it easier for the owner to make analysis.



System Login Page



Detection on Diseases and Pest Infection

## MJIIT ADVANTAGE

- MJIIT has the great collaboration with NVIDIA company and good environment on researching the AI development.
- MJIIT has great tools and facilities on doing the research.
- MJIIT has a great environment for data collection, data preparation and data analyzation.

## PATENT STATUS

Filling

## CONTACT

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# IOT AND MACHINE LEARNING APPROACH IN FERTIGATION

Smart Agriculture Technology

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## PROBLEM ANALYSIS

### Industry Needs

- Smart farming is important for tackling the challenges of agricultural sector in terms of productivity, environmental impact, food security and sustainability since the global population has been continuously increasing.

### Problem

- Conventional agriculture system do not have precision data on crops environment e.g. soil moisture, soil composition, crop growth, etc in real time
- Resources need to distribute manually or semi-automatic which is need human interference.

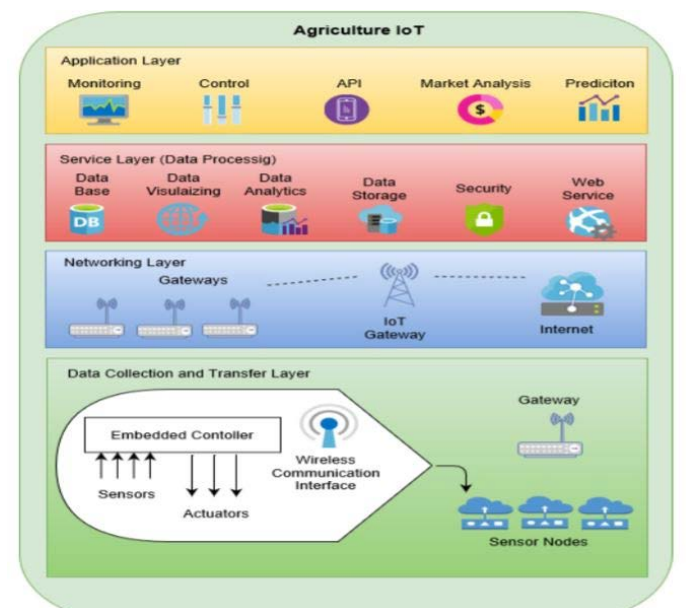
## OUR SOLUTIONS

### Technical seeds

- Using fertigation technique which is distribute fertilizer through irrigation system
- Sensor collect the data on crops environment and store in cloud for monitoring and analyze using IoT
- The data collected will feed into machine learning algorithm to predict the best environment for the crops to grow

### Merit of the technology

- Increase production and quality of the crops
- Supply resources to the crops optimally
- Avoid resource wastage
- Reduce the risk of crop yield failure



## MJIT ADVANTAGE

- Research activities take place in MJIT-CAIRO with a strong reputation for our research work in intelligent systems, artificial intelligence, robotics and mechatronics, and control and automation systems.
- MJIT-CAIRO have established links with industry and other international organisations, both in Malaysia and overseas such as Japan, France and United Kingdom

## PATENT STATUS

Patent in preparation

## CONTACT

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# HEATING, VENTILATION AND AIR-CONDITIONER CONTROL SYSTEM (HVAC)

Internet of Things with Artificial Intelligence

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## PROBLEM ANALYSIS

### Industry Needs

- According to the trend of technology, people want to control all the electrical appliances wirelessly with only one finger. Air-conditioner had become the most important appliance in controlling the humidity and the temperature of certain area.

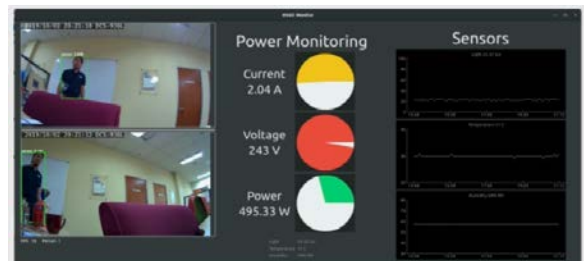
### Problem

- The current HVAC system is based on the environment of US countries which is not compatible to Asia countries' weather.
- People want to have a comfortable environment with suitable humidity and temperature which controlled by air-conditioner automatically.
- Graphical User Interface is required in order to check and observe the power consumption and current surroundings' values such as temperature, humidity and light intensity.

## OUR SOLUTIONS

### Technical seeds

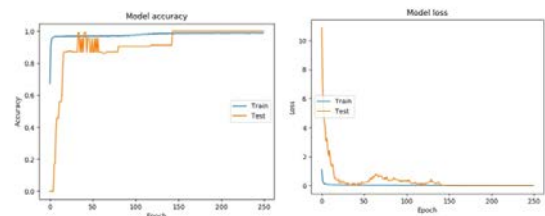
- Using Predicted Mean Value (PMV) index, the predicted temperature is calculated and trained by AI model in order to predict the suitable temperature based on the input values.
- Combination of IoT and AI, all the collected values and images can be shown on the GUI.



GUI Platform

### Merit of the technology

- In image processing, the Faster-RCNN model is used to train and make prediction on people in order to count the number of people.
- The sensors' values are sent to make another prediction on controlling the temperature of air-conditioner wirelessly.
- The air-conditioner controller uses only one IR transmitter and send the related temperature signal by binary form.



Accuracy and Loss of AI model

## MJIT ADVANTAGE

- MJIT has the great collaboration with NVIDIA company and good environment on researching the AI development.
- MJIT has great tools and facilities on doing the research.
- MJIT has a great environment for data collection, data preparation and data analyzation.

## PATENT STATUS

### CONTACT

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# BLOCKCHAIN FOR HOME IOT OF YOUR OWN

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## PROBLEM ANALYSIS

### Industry Needs

- IoT (Internet of Things) is rapidly applied to our homes to provide ease, entertainment and comfort to our daily lives.
- Market for devices/ gadgets/ Software platforms related to IoT are promising business in near future when everything at home is connected via Internet.

### Problem

- Everything personal connected to Internet opens the discussion about security and privacy.
- Current practice of IoT at home or smart home is based on specialized cloud services like Blinq or MQTT. As can be seen in the business model of Google or Amazon, these cloud services have a potential to become the "Big Brother" who monitors and makes money from the data gathered via Internet.

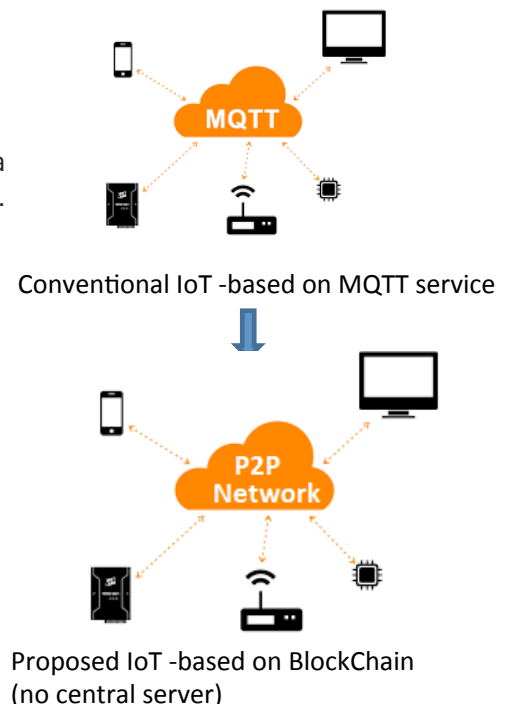
## OUR SOLUTIONS

### Technical seeds

- Blockchain technology is not only for crypt-currencies but also for IoT applications.
- Blockchain-based IoT provide security with tamper-resistant data structure, timestamp, data encryption and distributed consensus.
- Blockchain eliminated servers (Big Brother) and provides (more democratic) decentralized communication between devices directly.
- With novel, easy-to-use platforms, people can build their own Blockchain-based IoT network at home without cloud services.

### Merit of the technology

- Security of IoT at home
- More reliable operation: The network does not rely on a central server thus no downtime.
- User-owned, customizable IoT network at home:  
No threat of censorship by the central servers of cloud services.



## MJIIT ADVANTAGE

- Privacy first – this technology promotes the growing IoT devices in our home but without having third party to store private citizen/user data
- Reduce operation cost of having server – devices can talk with each other directly instead of relying on centralized server to manage devices/communication

## PATENT STATUS

Patent in preparation

## CONTACT

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# DIGITAL FINGERPRINT FOR LOW COST IOT SECURITY

SRAM Physical Unclonable Functions (SRAM PUF) for Security and Authentication

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## PROBLEM ANALYSIS (VENDORS OF DEVICES OR MODULES FOR IOT SYSTEM)

### Industry Needs

- Today, more and more IoT devices are connected to achieve autonomous M2M (machine-to-machine) networking of data, control, or services without the intervention of humans. Therefore, like transactions between humans, device-level identification mechanism among devices is required like fingerprint to provide secure operation of the network.

### Problem

- High cost: Current practices in industry require additional process to program or implement the identification code on the device, that increases the manufacturing cost of IoT devices.
- Too easy access: The programming of the code is done by fuse-blowing or storing identification code in non-volatile memory on the board, that allows easy access to hackers.

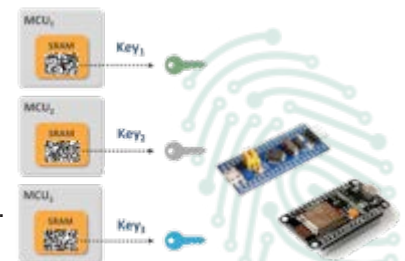
## OUR SOLUTIONS

### Technical seeds

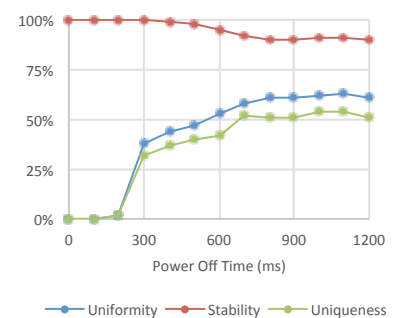
- SRAM as a source of the device identification code or digital fingerprint or physical unclonable functions (PUF):
  - ✓ By utilizing existing SRAM (either commercial chip or SRAM cores embedded in commercial microcontroller chips), this technology requires no additional cost for programming or implementing the PUF.
  - ✓ The PUF information derives from the very subtle device mismatches in the SRAM memory cells and therefore it is intrinsic to each SRAM chips/cores.
- The initial start-up values of SRAM after power-up as a source of PUF:
  - ✓ Since the PUF read-out steps require complicated control, the access to PUF is not easy for outside hackers.

### Merit of the technology

- Strong bit selection algorithm to achieve low error rate without the error correction (ECC):
  - ✓ The strong PUF bits can be decided by testing the SRAM after optimum power off time (300ms in the example).
  - ✓ Using the strong PUF bits, ECC is no more needed.



SRAM PUF Characteristics



## MJIT ADVANTAGE

- Uniqueness and unpredictability of PUF offers the best hardware security with no additional cost to the chip manufacturers
- No other technology will be able to achieve this level of security without using additional hardware or software resources.
- This technology will be very beneficial to any chip manufacturer or vendor which focuses on securer and low-cost devices for IoT Systems.

## PATENT STATUS

Patent in Preparation

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# MACHINE LEARNING SOLUTIONS

High Performance Extreme Learning Machine Accelerator

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## PROBLEM ANALYSIS

### Industry Needs

- Hardware implementation of machine learning is an important research towards fast, accurate for large scale classification and regression problem where there is a vital need for acceleration.
- Computer vision, speech recognition, healthcare, autonomous, etc

### Problem

- Machine learning plays a critical role in extracting meaningful information out of the zetabytes of data collected every day.
- Extreme learning machine (ELM) is one of the popular machine learning techniques as it has similar performance or outperforms the deep-learning.
- However, Machine learning running in PC are suffer from long training time as taking several days to a few months.

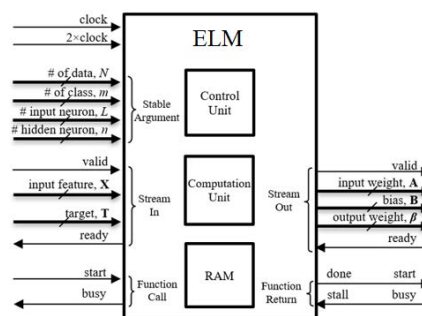
## OUR SOLUTIONS

### Technical seeds

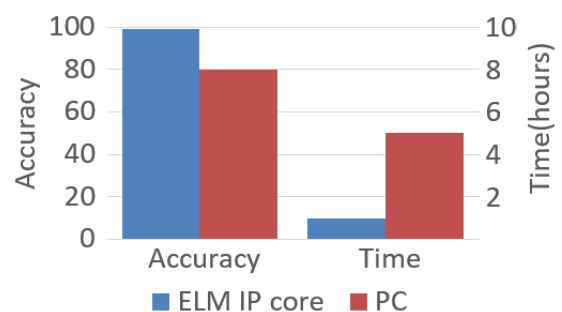
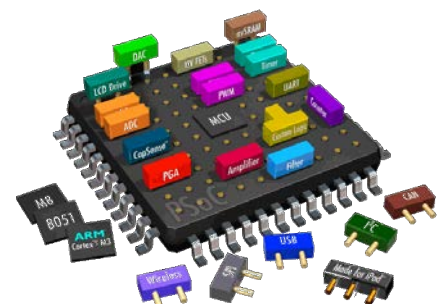
- A novel ELM algorithm that utilize the pipelining and parallelism in FPGA to speed up the training time.

### Merit of the technology

- The proposed ELM IP core can be used for any classification or regressing problems.
- It can be implemented as a standalone unit, or as a part of System-on-Chip (SoC) with embedded microprocessor and other peripherals.
- High accuracy and short training time



ELM IP Core



## MJIT ADVANTAGE

- MJIT is only a research organization in the world which develops this very unique and cutting-edge machine learning technology.
- MJIT has a strong collaboration work in academic and industries between Japan and Malaysia.

## PATENT STATUS

Patent in preparation

## CONTACT

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# HARDWARE TROJAN DETECTION FRAMEWORK

Using Machine-learning Approaches at Multiple Abstraction Levels

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## PROBLEM ANALYSIS

### Industry Needs

- Hardware Trojan refers to the malicious modification of circuitry of an integrated circuits. Modern electronic devices usually have an integrated circuit as the main component. This puts electronic devices around vulnerable to hardware Trojan attack. Hardware Trojan could cause an adverse impact to a system or network, including denial-of-service attack and information leak.

### Problem

- Most existing researches focus on achieving high true positive rate on detecting hardware Trojans. However, the false positive problem is unresolved.
- The diversity of hardware Trojan types leads to the difficulty of detection. Detection methods are designed to tackle specific hardware Trojans. This is inefficient to implement it in practice, as the kind of hardware Trojans facing must be known, that usually is not possible.

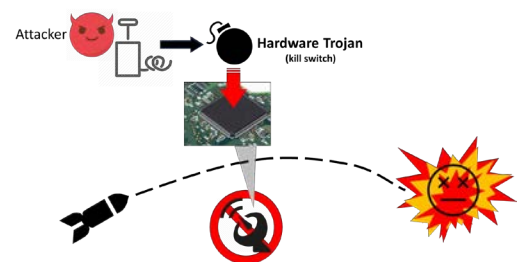
## OUR SOLUTIONS

### Technical seeds

- A framework to detect hardware Trojan inserted at Register-transfer level, using machine learning approaches.
- Improved detection performance by using multiple-abstraction-level features, which are conditional statement features at register-transfer level and net testability features at gate level.

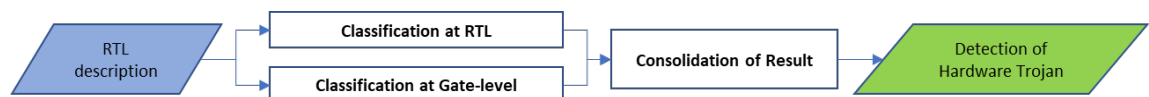
### Merit of the technology

- The framework can tackle any hardware Trojan without considering the type or specification of the hardware Trojan.
- The framework can detect hardware Trojan circuits without false positive detection on normal circuit.



Performance Benchmarking

Benchmark (RS232)	Detection of Hardware Trojan
Trojan-1	✓
Trojan-2	✓
Trojan-3	✓
Trojan-4	✓
Trojan-5	✓
Trojan-6	✓
Trojan-7	✓
Trojan-8	✓
Trojan-9	✓
Clean	



## MJIIT ADVANTAGE

- MJIIT is a research organization involving hardware Trojan research which is very limited in the world, especially in Malaysia.
- MJIIT has a strong collaboration work in academic and industries between Japan and Malaysia.

## PATENT STATUS

Patent in Preparation

## CONTACT

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# BASE STATION ANTENNAS FOR 5G MOBILE

Antenna Application Technology

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## PROBLEM ANALYSIS

### Industry Needs

- In the 5G mobile system, multi beam radiation characteristics at millimeter wave is requested at the base station antennas (Fig. 1).
- Fabrication industries of base station antennas must develop multi beam antennas.

### Problem

- What types of antennas and configurations are possible for 5G multi beam antennas.

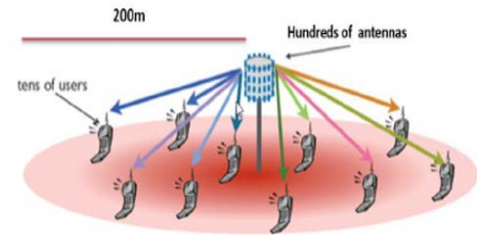


Fig. 1 Multi beam base station antenna for 5G mobile

## OUR SOLUTIONS

### Technical seeds

- At CSN iKohza, possible antenna types such as array, dielectric lens and reflector are designed and multi beam radiation patterns are obtained by electromagnetic (EM) simulations.
- Array antenna has Butler Matrix Feed circuit for multi beam. Good multi beams are ensured through measurements (Fig. 2)
- Excellent multi beam radiation patterns of dielectric lens
- Lens antenna are ensured through EM simulations (Fig.3).
- Good multi beam radiation patterns of dual reflector antenna are ensured through EM simulations (Fig.4).

### Merit of the technology

- ✓ Array antenna
- ✓ Antenna is formed by a single board (most simple).  
Feed loss of board is large at millimeter band.
- ✓ Lens antenna
- ✓ Multi beam radiation patterns are most superior.  
Lens structure may be heavy.
- ✓ Reflector antenna
- ✓ Metallic reflectors are most sustainable for severe weather.  
Moderate multi beams are obtained.

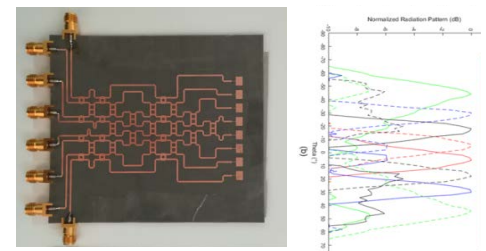


Fig. 2 Array antenna

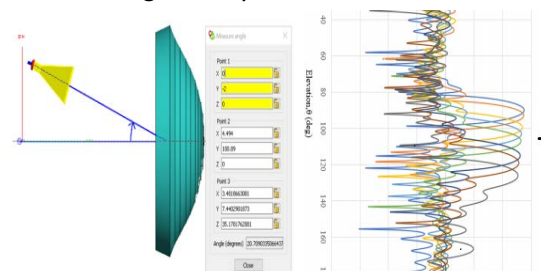


Fig.3 Dielectric Lens antenna

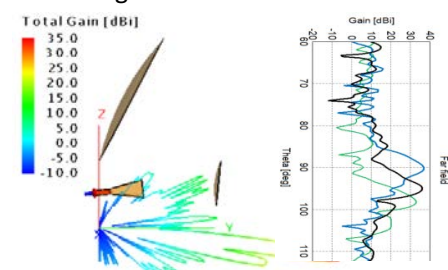


Fig.4 Dual reflector antenna

## MJIT ADVANTAGE

- MJIT developed new antenna technologies.
- MJIT can measure practical radiation patterns.
- MJIT can consult with antenna technologies and research collaboration with industries and universities.

## CONTACT

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# RADIO WAVE MEASUREMENT LABORATORY

Radio Wave Measurement Technology

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## PROBLEM ANALYSIS

### Industry Needs

- Researchers of radio wave products, radio communication companies and radio wave users need to measure performances of radio wave equipment. For the next generation mobile system (5 Generation), millimeter frequency (up to 40 GHz) measurement is requesting.

### Problem

- For measurements, special facility (anechoic chamber (Fig. 1)) and measurement equipment (transmitter and receiver) are necessary. To achieve facility is very expensive.

## OUR SOLUTIONS

### Technical seeds

- This radio labo. offer many measurement such as radiation characteristics and input impedance of antennas, RCS and electric characteristics of materials. (Table 1).
- Frequency range up to 40 GHz is available.
- Antenna fabrication facility is available.
- Human body phantom fabrication labo. is available.
- Dielectric constants measurement.



Fig. 1 Anechoic chamber

### Merit of the technology

- Wideband measurement
  - From 800 MHz to 40GHz, measurement horns are prepared.
- Phantom fabrication
  - Any part of human tissue can be fabricated.
- Millimeter measurement
  - Special low loss cable is used for millimeter measurement.

Table 1 Specifications of labo. measurement

Equipment	Frequency range	Measurement item
Transmitter	9 KHz to 40 GHz	Antenna radiation pattern
Receiver	10 KHz to 44 GHz	Antenna radiation pattern
Vector Network Analyser (VNA)	10 MHz to 43.5 GHz	(1) Impedance and Transmission parameters (2) Radar Cross Section (RCS) (3) Dielectric constants
Anechoic chamber	300 MHz to 50 GHz	Antenna radiation pattern and RCS 5.6m(L) x 2.9m (W) x 2.8m (H)
Dielectric probe kit	200 MHz to 20 GHz	Complex permittivity

## MJIT ADVANTAGE

- MJIT offer the radio labo. for users by very economical price.
- Fees for use are 300RM/day for universities and 500RM/day for industries.
- MJIT technician can support measurements.
- MJIT can consult with measurement results and suggest to improve performances.

## CONTACT

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# HUMAN BODY ANTENNAS

Antenna Application Technology

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## PROBLEM ANALYSIS

### Industry Needs

- For human healthcare, human body antennas are now developing. So, industries and universities developing human healthcare equipment will be interested.

### Problem

- Antenna design method and performances near or inside a human body application are not clarified.
- Practical antenna characteristics should be obtained through electromagnetic (EM) simulations and measurements.

## OUR SOLUTIONS

### Technical seeds

- Design and EM simulation method of small antennas are developed. (Fig. 1).
- Fabrication method of a small antenna is established (Fig.2).
- Fabrication method of a human body phantom is established (Fig.3).
- Measurement method of a small antenna in a human body phantom is established.

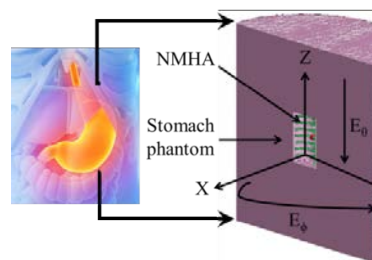


Fig. 1 EM simulation model

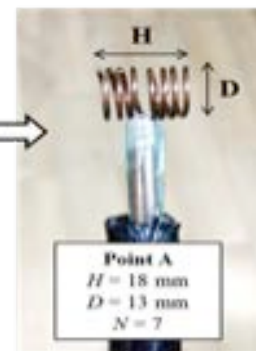


Fig. 2 Fabricated antenna

### Merit of the technology

- Fabrication of a small antenna
  - In designing a small antenna in a human body condition, many antenna parameters should be optimized.
  - Design equations for optimum structure are developed.
- Fabrication of human body phantom
  - Many chemical powders are mixed and formed to a phantom. Mixing ratio for any human tissue is determined.

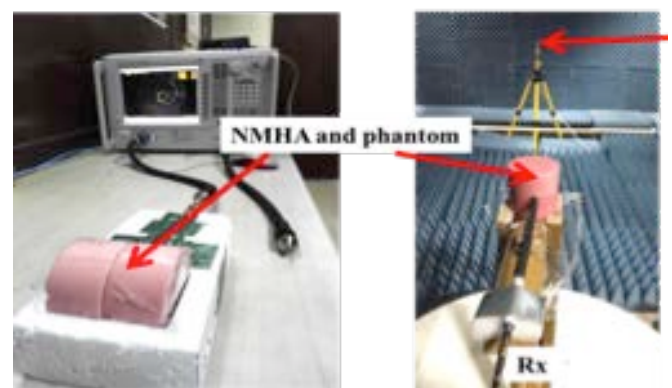


Fig.3 Antenna electrical characteristics measurement

## MJIT ADVANTAGE

- MJIT is one of the active research institute of fabrication of antenna and human body phantom.
- MJIT can consult with small antenna design method and measurement method and make research collaboration with industries and universities.

## CONTACT

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# RADAR CROSS SECTION ESTIMATION

Radio Wave Analysis Technology

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## PROBLEM ANALYSIS

### Industry Needs

- The collision avoidance RADAR is using in car. Here, the Radar Cross Section (RCS) is a measure of RADAR reception strength. So, in the military, for the stealth ability of aircraft and ships, RCS research is strongly interested. In the car industries, for autonomous driving and parking assist system RCS of many objects are very important.

### Problem

- Theoretical researches for typical shape objects are done and theoretical equations for RCS are obtained.
- RCS of practical structures should be obtained by simulations and measurements.
- For simulation, huge memory computer and electromagnetic simulator is needed.
- For measurement, special measurement facility is needed.

## OUR SOLUTIONS

### Technical seeds

- At antenna measurement facility at CSN iKohza, RCS measurement facility is constructed (Fig. 1).
- In RCS measurement, transmit and receive antenna is used to get reflected waves from a target.
- The target is mounted on a turn table.
- By turning the target, RCS of around the target is measured.

### Merit of the technology

- Time domain Measurement
  - When transmitted wave is frequency swept, the Fourier Transform signal becomes pulsed waveform (Fig. 2)
- RCS signal selection
  - By selecting the target signal pulse, very accurate measurement is achieved.



Fig. 1 RCS measurement in the anechoic chamber

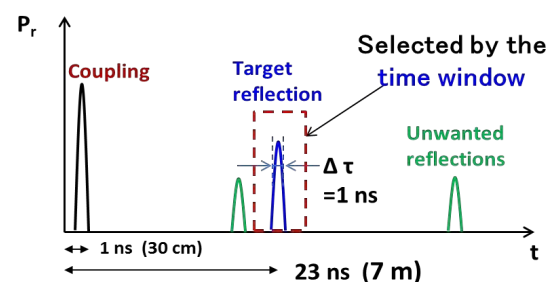


Fig. 2 Time domain signals and RCS signal selection

## MJIT ADVANTAGE

- MJIT is one of the active research institute of RCS.
- MJIT can consult with RCS calculation methods and measurement method and research collaboration with industries and universities.
- Reference papers; N. Michishita, N. Q. Dinh and Y. Yamada, "Simulation and Measurement Methods for RCS Estimations of a Scale Model Airplane", REV Journal on Electronics and Communications, Vol. 5, No. 1-2, Jan-June 2015, pp. 15-21, March 2016

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ELECTRONICS



# LOW-COST 2IN1 FORCE SENSOR

Rapid and tunable force-related control

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Engineering Materials & Structure iKohza (eMAST), MJIT

## PROBLEM ANALYSIS

### Industry Needs

- Force sensor capable of sensing a very fine changes in force by adjusting the material stiffness through magnetic field strength. It is suitable to be used in robotic technology for rehabilitation (orthoses, prosthetics, etc.) and sensory application (tire pressure sensor, force measurement, instrumental machines, etc.)

### Problem

- The development of force sensor through thin film with maximum size 0.5" inch can detect the simple on and off, such as 0 and 1 when the load exerted with force less than 15 N.
- The available technologies are small and thick, the production need a complex fabrication and unreliable as it tear out easily.
- The value inaccurate and the detection for sensing not within the range.

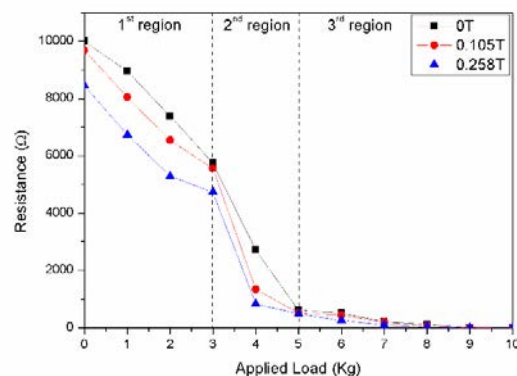
## OUR SOLUTIONS

### Technical seeds

- By a rapid and tunable force-related control with graphite based magnetorheological elastomers (Gr-MREs), the resistivity and magnetic feedback can be detected.
- The material stiffness can be controlled through magnetic field exerted using magnetic particles.

### Merit of the technology

- The force sensor is thin as the material thickness is 1 mm and can detect the force up to 100 N (10kg).
- A unique of Gr-MREs is reversible force sensor as the dual-like properties graphite.
- The fabrication of Gr-MREs is simple, easy and cost-effective.



## MJIT ADVANTAGE

- MJIT is only a research organization which develops a very unique advanced smart materials that can control the stiffness of the force sensor.
- MJIT has a strong collaboration work with Inha University, Korea (expertise in materials), Universitas Sebelas Maret, Indonesia (expertise in design) and Shibaura Institute of Technology (SIT), Japan (expertise in robotic devices)

## PATENT STATUS

Registered as Malaysian patent  
(PI 2019003772)

## CONTACT

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# ION “DIRECT-WRITE” LITHOGRAPHY

Focused Ion-Beam Lithography Technology

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## PROBLEM ANALYSIS

### Industry Needs

- Micro- and nanoscale patterning of the functional material is crucial in semiconductor integrated circuits due to the demand of miniaturization that can realizes its notable performance capability

### Problem

- Combination of optical/electron beam lithography with ion etching are the most prominent techniques for the structures patterning in fabricating micro- and nanoelectronic devices. However, this requires costly high-resolution-masks, and not worthy for a low-volume fabrication of micro- nanodevices or for the fabrication of single test devices

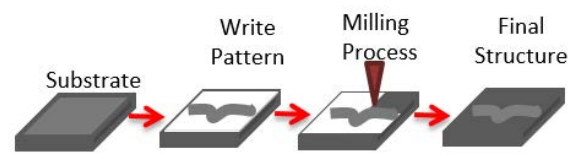
## OUR SOLUTIONS

### Technical seeds

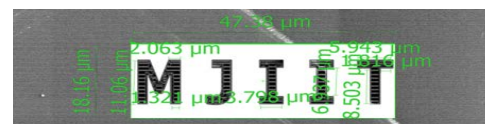
- Ion “Direct-Write” lithography, also called as Focused-Ion Beam (FIB) lithography is the mask-less technique that use a system that enables direct write of shape/pattern, follows by the direct milling of the shape/patterns to fabricate the structures on substrate

### Merit of the technology

- It is a mask-less technique and everything can be done in one equipment
- Smallest milled features in the nanometer range can be realized with a focused  $\text{Ga}^+$  ion beam of less-few-nm diameter
- Suitable for low-volume fabrication of micro-nanodevices or for the fabrication of single test devices



**Everything in one equipment!!** 



(a) Raw Design from Computer



(b) Milled structure on Silicon Substrate

## MJIT ADVANTAGE

- Microscopy Laboratory is one of the advanced laboratories in MJIT equipped with the high-end equipment for the nanocharacterization and nanofabrication
- MJIT has a strong collaboration with The Ultramicroscopy Research Center in Kyushu University (URC-KU). The URC-KU is currently involved in Japan national project of MEXT Nanotechnology Platform.
- Ref: “*Focused Ion Beam Lithography*” by Heinz D Wanzenboeck and Simon Waid Vienna University of Technology – Institute for Solid State Electronics Austria

## PATENT STATUS

NIL

## CONTACT

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# WEARABLE PASSIVE CONTROLLED ANKLE FOOT ORTHOSIS

Assistive Device with IoT Technology

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## PROBLEM ANALYSIS

### Industry Needs

- This gait measurement device is important for the assessment of the patient's disability level (i.e., the post-stroke patient), where the assessment results can be utilized further for suitable treatment or even ankle-foot orthosis (AFO) prescription for the patient.

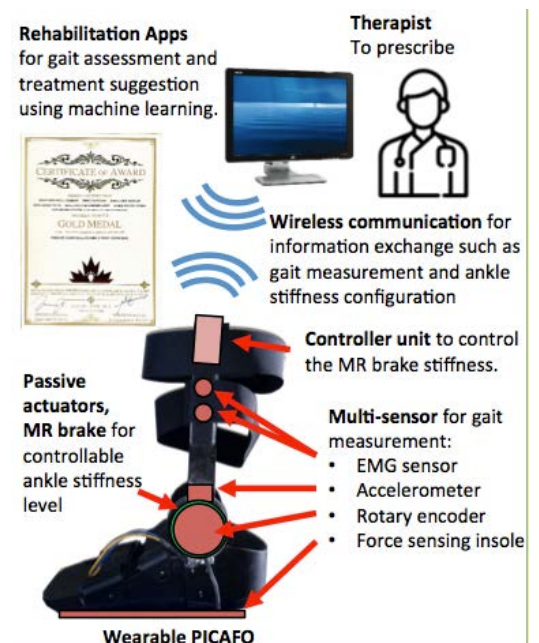
### Problem

- Recent gait assessment methods may involve more than one device, platform, or instrument, which is time-consuming to do the assessment thus increasing work intensity of the therapists.
- Later, results from gait assessments suggest suitable treatment in the form of AFO prescription, it however cannot be directly implemented using the conventional mechanical-link AFO due to long manufacture process.

## OUR SOLUTIONS

### Technical seeds

- Enhanced version from the conventional AFO for clinical trials called Wearable Passive Controlled Ankle Foot Orthosis or PICAFO for short.
- Provides insight into the patient's walking gaits using one platform with several sensors for ankle rotation, leg acceleration, foot force, and electromyography.
- Award-winning articulated ankle joint equipped with a magnetorheological (MR) brake at ankle joint for controllable and adjustable ankle stiffness levels.
- Merit of the technology
- Straightforward walking gaits assessment.
- One-click ankle stiffness configuration.
- Optimized walk training benefits.
- Flexibility between stand alone device and attached device.



## MJIT ADVANTAGE

- MJIT provides state of the art research facilities on gait studies and measurements, for instances, VICON's motion capture & BIOPAC's bio-signal data acquisition systems.
- MJIT has established research collaboration partnerships with Kyushu Institute of Technology (KyuTech), Japan and Surabaya Telkom Institute of Technology (ITTelkom), Indonesia in developing this wearable prototype.

## PATENT STATUS

Filed as a Malaysia Patent  
(PI2017000848)

## CONTACT

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# INTELLIGENT CONTROL DEVICE

Enhancing Vehicle Ride Comfort in Active Suspension System

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## PROBLEM ANALYSIS

### Industry Needs

- Intelligent control such as Fuzzy Logic Control is becoming hot topic in current automobile technology especially in suspension system.
- High potential to be used in automobiles industries as this project expected to be a future trend of automated vehicle suspension in Malaysia by using the intelligent control technologies

### Problem

- The main cause of vehicle body vibration through vibration suspension system and wheel are bump and pot holes
- Comfort of passenger gets affected by overshoot and settling time
- Typical controller available that extensively used in car manufacturing

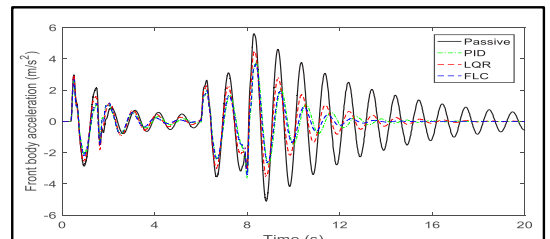
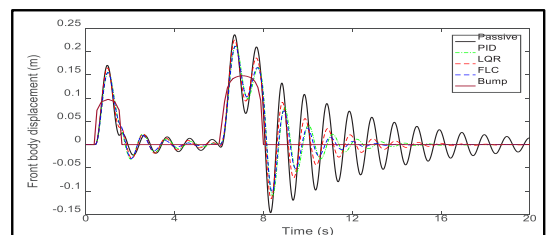
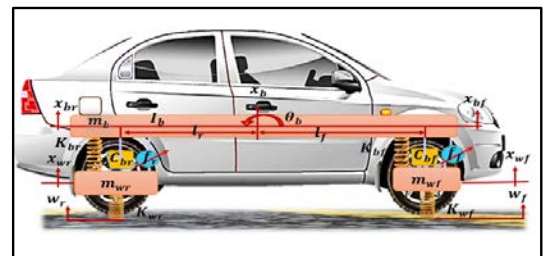
## OUR SOLUTIONS

### Technical seeds

- Proposed intelligent controller can reduce a vibration in a vehicle suspension system
- Perform much better compare to the existing controller
- Improved the ride comfort by considering the effect of disturbances to the system

### Merit of the technology

- Fuzzy Logic Control device for vehicle suspension system give less overshoot and fast settling time
- Fuzzy Logic based control does not require a mathematical model since it is a rule based system
- Uniqueness of using the linguistic variables



## MJIT ADVANTAGE

- MJIT has a strong bond with Japanese Institution in term of cutting edge technology
- MJIT is the top research university that follow the lead of Japanese technology especially artificial intelligent technologies

## PATENT STATUS

Patent in preparation

## CONTACT

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MECHANICAL





# SEMI-ACTIVE AND CONTROLLABLE ENGINE MOUNTING

Magnetorheological Elastomer (MRE)

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## PROBLEM ANALYSIS

### Industry Needs

- In the automobile industry, isolation of vibration from engine compartments into an automobile chassis always become a significant factor in vehicle performance.
- Semi-active engine mount that comprised of magnetorheological elastomers (MREs) is introduced where its stiffness and damping properties can be varied with the influenced of external magnetic field thus the rheological properties can be adaptively tuned to diminish both low and high frequency vibrations.

### Problem

- Vibration induced from engine mount would result in a disturbances if it is not properly reduced before getting into to the inner compartments thus providing inconvenient condition to the passenger
- An active engine mounting system has been known as the most advanced engine mounting system due to its superior performance in improving driver comfort simultaneously with the enhancement of handling stability. However, the system suffered from complexity and limited in durability and expensive.

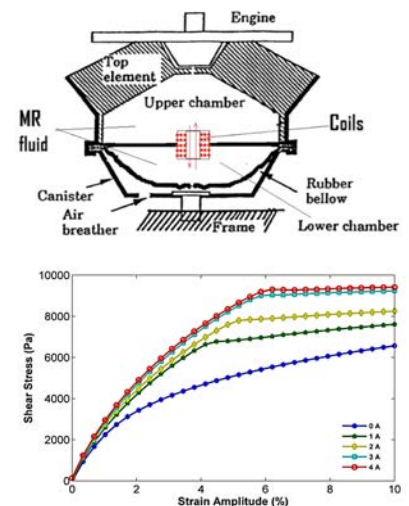
## OUR SOLUTIONS

### Technical seeds

- Embedded of magnetic particles in a solid matrix of natural/synthetic/waste rubber produce magnetic elastomer (MRE) that exhibit variable ranges of dynamic stiffness and damping modulus which correspond to applied currents of magnetic fields.
- This smart material could also avoid unwanted noises and vibrations during initial of working engine (stop start engine), also during handling of the vehicle.
- Improve the unbalanced engine disturbance force at high frequencies.

### Merit of the technology

- MRE-based engine mounting will have a cost reduction by changing to semi-active engine mount that possess similar performance as an active one.
- Has a higher performance than a conventional/passive elastomer engine mount.
- Ability to have variable damping stiffness with embedded electromagnetic coil that is capable to enhance the ride and handling of the vehicle.
- Potential for low to mid-end vehicle.



### MJIT ADVANTAGE

- MJIT is the one of research organizations in which capable in producing an MRE material and fabricating MRE engine mount.
- MJIT has a close collaboration with Research Rubber Institute (RRI) of Malaysia and Kumpulan Jebco (M) Sdn Bhd.

### PATENT STATUS

An MR Isolator (PI2014703882).  
MREs based on Reclaimed Waste Rubber (PI2017001217)

### CONTACT

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# ADJUSTABLE MAGNETIC MR DAMPER

Magnetorheological Damper

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**eMast**  
Engineering  
Materials & Structures

## PROBLEM ANALYSIS

### Industry Needs

- Controllable stiffness and low power consumption in vehicle suspension system to reduce the trade-off between ride and handling
- Suitable to be used in automotive industry and spare part provider, Vibration and automation provider and military industry

### Problem

- Passive suspension system exhibits constant stiffness and complicated design thus limit the valve effective area.
- Cost of active suspension system is too expensive for low to mid-end vehicle.
- Available technologies have a rubber stopper as damper protection from unwanted impact, however the incompatibility between rubber and hydrocarbon oil causes leaking problem.

## OUR SOLUTIONS

### Technical seeds

- Semi-active suspension system namely Magneto-rheological (MR) damper offers variable damping stiffness to the induced magnetic field
- A compatible prototype of a full-scale automotive MR damper that can minimize the use of MR fluid in the damper to reduce the cost is introduced

### Merit of the technology

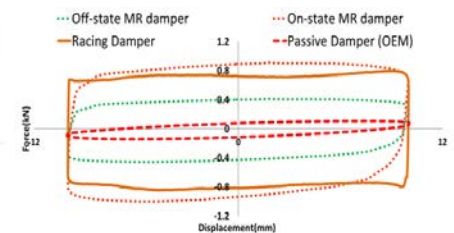
- Controllable stiffness
- Highly Responsive
- Low power consumption
- Easy installation  
(Static placement of throttling valve)
- Less usage of MR fluid
- Enhance long lifecycle of the damper



Prototype  
MR Damper



Full car integration with  
embedded MR Dampers



Damping performance

## MJIT ADVANTAGE

- MJIT is one of the main research organization in the world, which develops various smart materials from the material preparation until the application of MR materials in devices and applications.
- MJIT has a strong collaboration work with few international universities and industries particularly related to rubber fabrication (Malaysian Rubber Board), device and modelling (Universitas Sebelas Maret, Indonesia and Inha University, Korea) and automotive industries (PROTON Holdings Bhd & Kumpulan Jebco (M) Sdn Bhd).

## PATENT STATUS

Registered as Malaysian Patent,  
MY170167A, MY168383A,  
PI2013700998, PI2014700304,  
PI2015700294 & PI2016701529

## CONTACT

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# FLOW INDUCED VIBRATION AS A DISRUPTOR OF MICROALGAE CELL

Renewable Energy Technology

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## PROBLEM ANALYSIS

### Industry Needs

- A fast and abundantly grow of microalgae has attracted many researchers to do a research on it for a specific purpose in cosmetics, food, medicine, biodiesel, edible oil, nutraceuticals, and etc.
- To extract the content of microalgae, firstly the microalgae cell wall needs to be disrupted for further process.

### Problem

- The mechanical methods used to disrupt the microalgae cell wall are generally in high frequency technologies. Those technologies require high energy demand with steep cost.
- Recently the growth of microalgae has moved to the sea surface due to the availability of large space.
- However, it is inconvenient to transport the microalgae from sea surface to land for cell wall disruption and further processing.

## OUR SOLUTIONS

### Technical seeds

- The idea is to use Flow Induced Vibration (FIV) at low frequency from the range of 1-5 Hz to disrupt the microalgae cell.
- To accelerate the process of disruption, a little amount of enzyme will be added'

### Merit of the technology

- Microalgae is a renewable energy source that is environmental friendly and can be cultured in a huge amount in Malaysia because of the temperature condition and a lot of sunlight.
- The purpose of using Flow Induced Vibration as a disruptor of microalgae cell wall because it occurs at low frequency. Therefore, the energy demand is relatively low compare to high frequency technology.
- Besides, FIV is a natural phenomenon that occurs in ocean current. Therefore, the cost involved will be relatively low.
- The microalgae can be pre-treated in the sea before sending to the laboratory for further process.

A bottle filled with microalgae will be shaken vertically.



Fig. 1: The rig design for the experiment

AC motor as the power source. The variables of the test are amplitude and frequency

## MJIT ADVANTAGE

- MJIT is the only research organization which develops this method of microalgae cell wall disruption.
- MJIT has the microalgae laboratory that possesses numbers of microalgae strains.

## PATENT STATUS

None

## CONTACT

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# SUPPRESSION OF VORTEX-INDUCED VIBRATION OF RIGID CYLINDER USING FLEXIBLE SHROUD

Suppression Technology in Offshore Industry

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## PROBLEM ANALYSIS

### Industry Needs

- Suppression devices to reduce the vortex-induced vibration (VIV) have been investigated actively because of its importance in engineering applications such as airplane wings, slender structures, offshore platforms and bridges.

### Problem

- Currently several suppression devices are available, eg. Helical strakes, fairing and splitter plate. However, each of them has their own advantages and disadvantages. Ideal balance between the simplicity of the design, the effectiveness and the cost is hard to achieve.
- An ideal suppression device that match all the requirements of the industries which include the reduction of both VIV and drag, and omni-directional design is still unachieved yet.

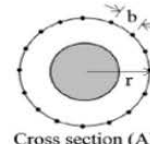
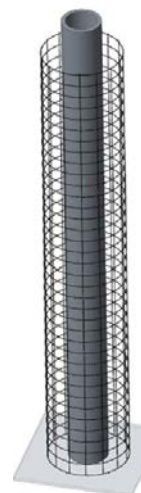
## OUR SOLUTIONS

### Technical seeds

- The proposed suppression device is able to disrupt the incoming flows and wake formed behind the structures and hence reduce the VIV.
- Is able to provide higher suppression performance using optimum configurations.

### Merit of the technology

- The shroud is omnidirectional so it is an attractive option for offshore and other engineering structures.
- Improve the performance of shroud in terms of amplitude and drag reduction.
- Shroud requires nothing to be permanently fixed to the structures and lead to the lower maintenance cost as the time installation can be reduced.



Cross section (A)



Figure 1: the shroud used in the experiment.

$b$  = Mesh size

$r$  = Shrouding radius around the pipe

## MJIT ADVANTAGE

- The shroud is an unique design but is not yet commercially implemented in the offshore industry as it is still under exploitation. However, it has the high potential to be implemented if the outcome is promising.
- MJIT has a water circulating tank that can be used to conduct experiment and to study more on shroud and other suppression device.

## PATENT STATUS

N/A

## CONTACT

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# BEARING FAULT DIAGNOSIS OF SPARCE DATA BASED ON EFFECTIVE AND FLEXIBLE DEEP LEARNING

Artificial Intelligence

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## PROBLEM ANALYSIS

### Industry Needs

- A deep learning(DL) diagnosis approach has caught much attention in the field of machinery diagnosis. This is because, DL model can be implemented without depending on the expertise and experience of the experts, so new technician would easily diagnose machine faults.

### Problem

- The foremost problem in the industry's application of the DL diagnosis method is the accessibility of huge amounts of labelled data.
- It is arduous to implement DL model in real applications, as data is machine-specifics and fault also does not occur frequently, thus leads to divergence between healthy and faulty data.

## OUR SOLUTIONS

### Technical seeds

- By establishing the proposed model, that contain twin precursory model, it determines whether both images input belong to same class or not.
- Pairing technique used to generate paired data from small amount of original labelled data.
- Improved architecture has made the model could generalize well, so it can be implemented in any machine that has bearing faults.

### Merit of the technology

- The developed SNN algorithm can be used in real applications because this model can work with only a few data images (sparse data inputs).
- The model could be utilised to diagnose any type of machine that has bearing faults regarding bearing size and type.
- An effective, less complicated diagnosis method with a good accuracy can save the industry from a damaged bearing which would jeopardize machine, save time and cost on training new engineers/technicians.

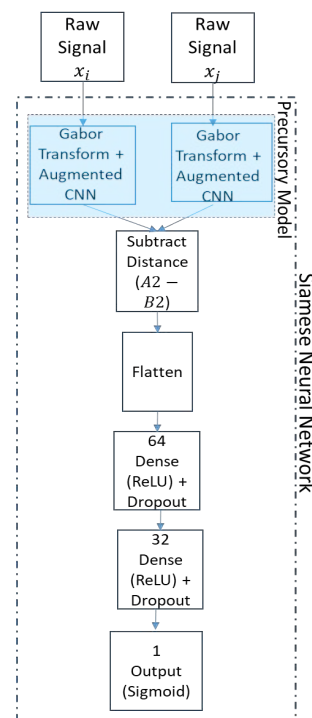


FIGURE 1: ARCHITECTURE OF THE SIAMESE NEURAL NETWORK

TABLE 1: MODEL PREDICTION ACCURACY OF DIFFERENT BEARING

DATA		
Data	Test Accuracy [%]	Test Loss [%]
CWRU (Dataset A)	100	0.59
MFPT	97.76	10.50
Experimental rig	100	0.38
Data from industry	100	0.33

## MJIT ADVANTAGE

- MJIT is one of the few research organizations that implement this improved deep learning method in machinery diagnosis especially bearing.

## CONTACT

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# ADVANCED GREEN-COOLING TECHNOLOGY

A Hybrid Microchannel Heat Sink with Effective Energy Consumption

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## PROBLEM ANALYSIS

### Industry Needs

- Low degree of flow mixing is one of the main factor increases the thermal resistance in cooling system of electronic device. Besides that, it also affects the flow instability due to boiling crisis (This is very important for nuclear fuel element in order to carry heat efficiently from a nuclear reactor to a boiler)

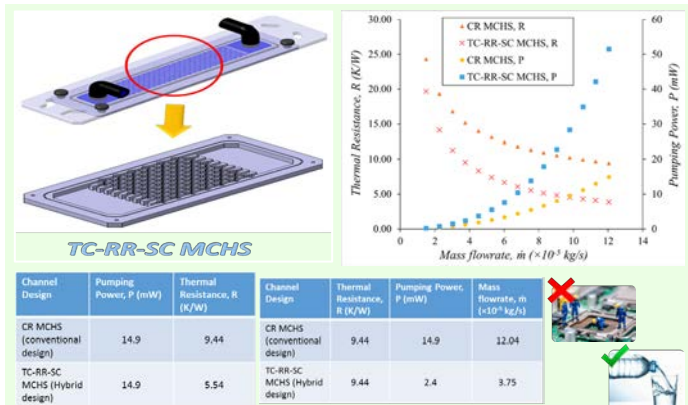
### Problem

- Unpredicted increment of power density in a high dense microchip generates high heat flux
- Conventional design of existing microchannel heat sink (straight channel) inadequate to remove/carry the such heat flux
- Growing demand in reducing weight and volume for a high performance electronic device reduces the cooling compartment area

## OUR SOLUTIONS

### Technical seeds

- Performance:
  - ✓ Energy saving: 83.7%
  - ✓ Coolant consumption saving: 68.9%
  - ✓ Thermal performance enhancement: 41.3%
- System:
  - ✓ Easy to install
  - ✓ Free-maintenance
  - ✓ Green cooling technology



### Merit of the technology

- Combination of secondary channel geometry in rib-groove microchannel heat sink generates high disturbance on flow structure which reduces the thermal resistance and boiling issue that experienced by conventional or existing microchannel heat sink
- Temperature and velocity distribution in TR-RR-SC MCHS is more uniform than existing Microchannel heat sink
- A high degree of flow mixing that obtained at a low Re number contributes to the reduction of pumping power consumption compared to conventional or existing microchannel heat sink

## MJIT ADVANTAGE

- The TC-RR-SC MCHS shows outstanding cooling performance with low electric power consumption. Based on the performance factor, PF, evaluation, this hybrid microchannel heat sink is far advanced from any other competitors and literally no other researchers can catch up
- MJIT has a strong collaboration work with The Takasago Thermal Engineering Group of Takasago Thermal Engineering Co., Ltd., Japan

## PATENT STATUS

Intellectual Property Corporation of Malaysia:  
AR 2019002047

## CONTACT

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# GREEN COMPOSITE MATERIAL FOR BEARING APPLICATION

Treated Oil Palm Empty Fruit Bunch Fibre Reinforced Polyoxymethylene

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## PROBLEM ANALYSIS

### Industry Needs

- Global awareness of environmental issues has resulted in the emergence of sustainable and environmental friendly green materials, which are renewable resource, recyclable, and biodegradable.

### Problem

- Though synthetic fibre such as carbon and glass reinforced polymer are used in bearing application, environmental concern has been a challenge to its feasibility as a sustainable material. This is due to the factors contributed from the production such as fossil fuel depletion, smog, air pollution, carbon dioxide emission and health hazard to human.
- To develop green composite material, natural fibre from plant based source have been used to replace conventional synthetic fibre as it is a renewable resource that are abundant, biodegradable, sustainable and non-toxic.

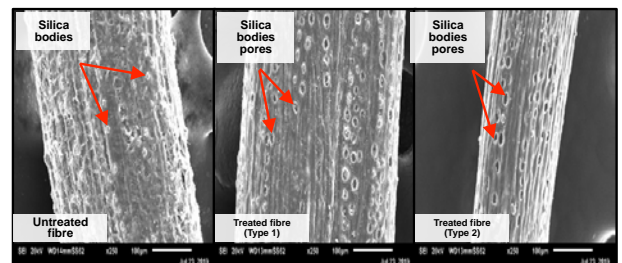
## OUR SOLUTIONS

### Technical seeds

- The use of plant fibre; OPEFB as an effective reinforcement in polyoxymethylene (POM) based composite material for bearing application.

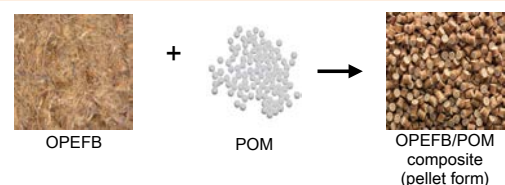
### Merit of the technology

- OPEFB fibres are renewable, non-abrasive to process equipment and low cost and energy to produce.
- OPEFB fibres are abundant, biodegradable, sustainable, light weight and non-corrosive material.
- Unlike synthetic fibres, the production of OPEFB fibres composite material can reduce the environmental pollution.



**Figure 1** Micrograph of OPEFB fibre by using scanning electron microscope

Chemical treatment have been done on OPEFB fibres to improve the interfacial bonding between fibre and matrix, which lead to excellent enhancement in mechanical properties of the composite.



**Figure 2** Treated OPEFB fibres are mix with POM to form composite material

## MJIT ADVANTAGE

- MJIT is the research organisation that allow the development of natural fibre reinforced polymer composite material for bearing application, which is aligned with their mission to produce qualified and competent researchers in sustainable engineering field and management technology with high sensitiveness on the environment, green technology and precision engineering.

## PATENT STATUS

Patent in preparation

## CONTACT

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# QUICK AND AFFORDABLE TRACE-HUMIDITY CONTROLLER

Permeation Tube Humidification Technology

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## PROBLEM ANALYSIS

### Industry Needs

- Humidity control in ppb to ppm level is becoming a hot topic in R&D on powder technology (medicine, advanced materials, etc.), advanced batteries (for mobile tools, EV, etc.), sensing technology (self-driving car, autonomous navigation drone, etc.), environmental technology (meteorological observation, standard gas generation for humidity sensor calibration), etc.

### Problem

- Popular humidification technologies are a frost/dew point generator, diffusion-tube moisture generator and those combined with dilution technique of gas, which are accompanied by precise temperature controllers and gas flow meters.
- Those popular technologies are slow in response as taking several hours to a few days to get the equilibrium of humidification, heavy, huge, and extremely expensive.

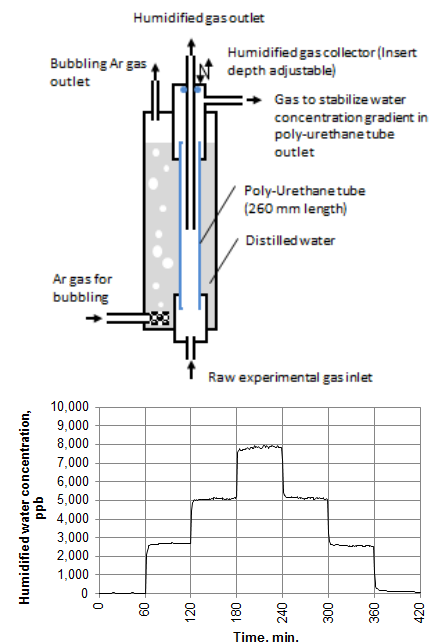
## OUR SOLUTIONS

### Technical seeds

- By permeation tube technology with water located outside, desired humidity can be obtained easily by changing the position of a gas collector in the tube.
- By bubbling of carrier gas in the source water, gaseous contamination is restricted.

### Merit of the technology

- Very unique idea of the humidity collector realizes the change of the humidity value in ppb to ppm range as quick as a few minutes.
- Simple and effective construction of the devised permeation tube humidifier realizes portable applications with a small size and light weight device with cost less than 1/10 of the existing humidifiers.
- The wide dynamic range of humidification from ppb level to ppm level can be realized by high flexibility of the humidifier design.



## MJIT ADVANTAGE

- MJIT is only a research organization in the world which develops this very unique and cutting edge permeation tube technology.
- MJIT has a strong collaboration work with Gas and Humidity Standards Group of The National Institute of Advanced Industrial Science and Technology, Japan

## PATENT STATUS

Registered as a Japanese granted patent (6052661)

## CONTACT

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# VISUAL AND ADVANCED FRICTION/WEAR ANALYSIS

Spatiotemporal mapping analysis of tribology data

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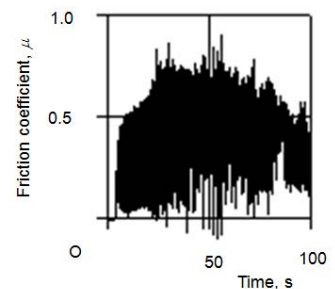
## PROBLEM ANALYSIS

### Industry Needs

- Tribology (science and technology about friction, wear and lubrication) is one of key technologies in the various industrial fields. Tribology has contributed for the realization of many innovative technologies such as hard disk drives, artificial satellites, bullet trains, artificial joints, etc. Tribology also contributes for environmental issues through energy saving and the durability improvement of machines.

### Problem

- In general, tribology phenomenon is difficult to observe because it is 1) interfacial, 2) very small, 3) dynamic, and 4) complicated phenomenon.
- The conventional techniques to display the time-dependent tribo- data can provide temporal (when) information only but no spatial (where) information.



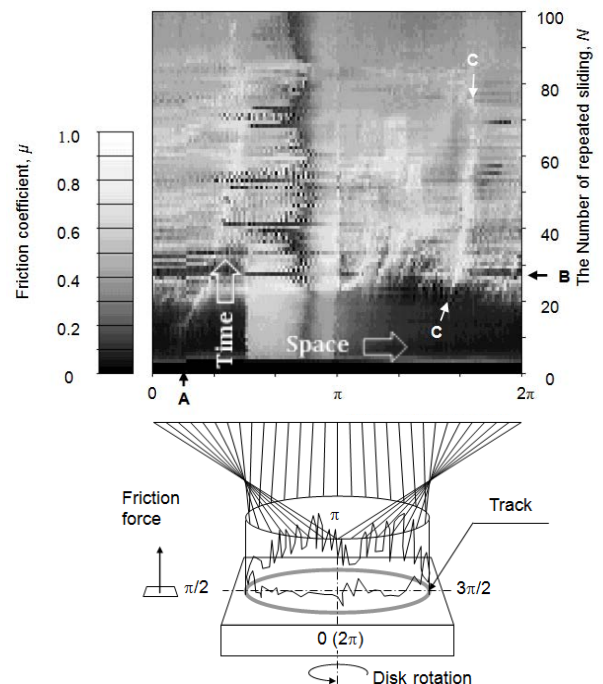
## OUR SOLUTIONS

### Technical seeds

- Originally developed analysis system; Tribo-Master realizes collecting dynamic tribo-data as a function of the time and position of sliding.
- Tribo-Master can display the dynamic tribo-data on the spatiotemporal map.

### Merit of the technology

- Very unique Tribo-Master realizes the easy and precise analysis of the dynamic tribo-data from both spatial and temporal view points by visualizing the data.
- Applicable dynamic tribo-data are friction force, specimen displacement, electrical resistance between specimens, etc.
- Tribo-Master is also possible to provide the combinational analysis of 2 kinds of dynamic data.



## MJIT ADVANTAGE

- The research member in MJIT is one of the originator of the spatiotemporal mapping analysis technology and has further developed the technology in a very unique way.
- TriPreM, MJIT can provide sliding tests services using 3 types of tribo-testers, which are equipped with Tribo-Master analysis system, for dry-sliding, fluid lubricated sliding, and vacuum or special gaseous environment sliding.

## PATENT STATUS

Registered as a Japanese granted patent (2719275)

## CONTACT

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# ULTRASONICALLY EXCITER FOR MACHINING FLUID

Enhancement of Cutting/Grinding Fluid

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## PROBLEM ANALYSIS

### Industry Needs

- This technique is suitable for manufacturing section which using conventional machining such as cutting/grinding with wet condition.

### Problem

- This technique able to solve issues such as chipping of machine tools, grinding wheel, scratch mark on machined surface, massive wear of grinding wheel and loading of grinding wheel

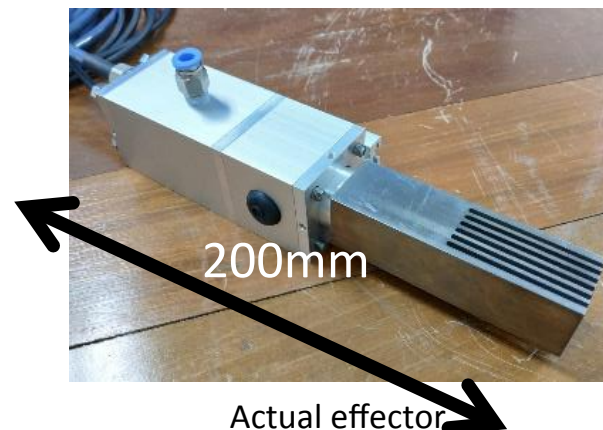
## OUR SOLUTIONS

### Technical seeds

- Ultrasonically exciter[effector]for machining fluid
  - Just insert comb shaped effector into machining fluid flow between nozzle and cutting point.
  - Vibrated exciter change performance of fluid

### Merit of the technology

- Able to reduce machining force between tools and work materials
  - It leads low wear rate of tools
  - It leads less times of truing/dressing process
- Able to reduce thermal escalation at cutting/grinding point
  - It leads to avoid burn mark on surface
  - It leads less chemical reaction on surface



a) Without Excitation



b) With Excitation

Avoiding thermal damage on surface  
Ground t1.0mm SUS304 plate until 0.2mm

## MJIT ADVANTAGE

- Easy to install, no replacement in existing machine Size of effector only 40x40x200mm
- Less power consumption only additional 150~200w

## PATENT STATUS

Patent applied in Japan

## CONTACT

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# MOTORCYCLE CRASH AVOIDANCE SYSTEM

Detection and Warning System for Motorcycle Vehicular Collision Avoidance (DEWAMCA)

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Advanced Vehicle System iKohza (AVS), MJIT

## PROBLEM ANALYSIS

### Industry Needs

- More than 60% of fatal road accident are involving motorcycle in Malaysia accounting more than 4500 young breadwinner lives every year. Almost similar statistical number is shared in Southeast Asia countries such as Vietnam, Indonesia and Thailand. There is no active safety features installed into motorcycle or moped to avoid accident from happen so far.

### Problem

- Price for motorcycle, moped or scooter is so cheap that restrain additional safety features to be installed.
- Complexity of active safety features may incur higher cost of maintenance.

## OUR SOLUTIONS

### Technical seeds

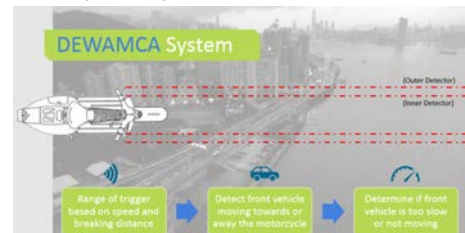
- DEWAMCA is a device that can detect obstacle in front of motorcycle and give audible warning to the motorcyclist and surrounding.
- Milliseconds of earlier treat detection and warning might give motorcyclist some time to react and avoid the obstacle.

### Merit of the technology

- Simple configuration. Simple control algorithm.
- Use existing motorcycle components (horn, speed sensor).
- Easy installation.
- First in the world. Solving regional issue.
- Potential to save many lives.



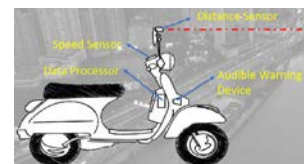
Motorcycle, moped and scooter in Southeast Asia



Algorithm of DEWAMCA



Sensors installation on moped



Configuration and Component of DEWAMCA

## MJIT ADVANTAGE

- Having a very close collaboration with Malaysian Institute of Road Safety Research (MIROS) which is a government agency doing research on road safety and ASEAN NCAP an entity elevate vehicle safety standard in Southeast Asian countries.

## PATENT STATUS

Patent Filed:  
PI2017001216

## CONTACT

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# DIESEL FUEL SAVER

Real-Time Non-Surfactant Emulsion Fuel Supply System (RTES)

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## PROBLEM ANALYSIS

### Industry Needs

- Main operation cost for energy and transportation sectors is fuel. It is undeniable that diesel powered engine and burner are still one of the most reliable and cheap option for the purpose. Few percentages in fuel saving will have a great effect in long-term operation. Some industries are also suffering from exhaust emissions regulation especially Nitrogen Oxides (NOx) and Particulate Matter (PM).

### Problem

- High fueling cost.
- Trade-off relation between combustion performance, NOx and PM.

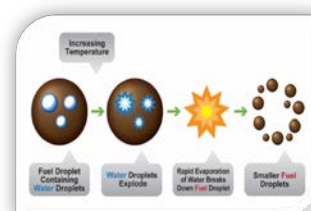
## OUR SOLUTIONS

### Technical seeds

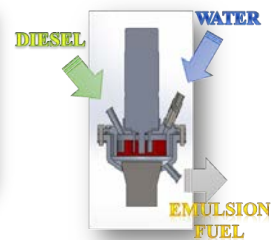
- A device named as RTES can produce an emulsion fuel without additive.
- Emulsion fuel can improve atomization of diesel fuel during combustion hence improve its efficiency.

### Merit of the technology

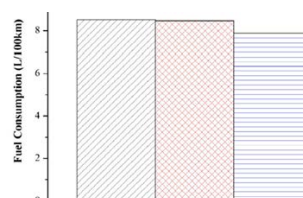
- Reduce fuel consumption in the range of 5% to 10%.
- Efficient combustion which will reduce carbon deposits for long-term operation in engine.
- Simultaneous reduction of NOx and PM.
- No additive required for the operation.
- Plug and play type of installation.



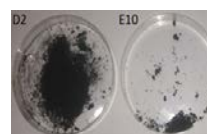
How emulsion fuel breakdown fuel droplets leads to efficient combustion



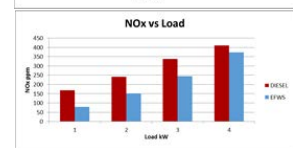
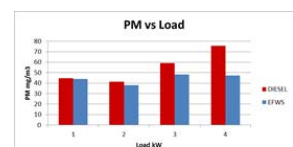
RTES produce emulsion fuel without additive



Reduce Fuel Consumption



Reduce Carbon Deposits



Reduce Emissions

## MJIT ADVANTAGE

- Technology was developed through R&D for more than 8 years. Won many gold awards from various exhibitions including international awards. Produced more than 10 related journal papers Q1 and Q2.
- Continuous R&D and "Kaizen" is a culture. Current focus is on utilization of alternative fuel sources such as waste oils from palm oil mill.

## PATENT STATUS

Patent Filed:  
PI2014702681, PI2018000086,  
PI2018000465

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