An Advanced Wastewater Treatment System ......................................................... 9
Norhayati Abdullah, ALGAL iKohza

Quick and Simple Biological Nitrogen Removal Technology .................................. 10
Norhayati Abdullah, ALGAL iKohza

High Quality Liquid Organic Fertilizer ................................................................. 11
Koji Iwamoto, ALGAL iKohza

Eco-friendly Gold Adsorbent/Heavy Metal Absorber ........................................... 12
Koji Iwamoto, ALGAL iKohza

Bi coke; Alternative Coal Coke for SDGs ............................................................. 13
Hirofumi Hara, MEMO-Bio iKohza

Fine Chemical Production from Biomass Waste .................................................. 14
Hirofumi Hara, MEMO-Bio iKohza

Temperate Crop Cultivation in The Tropics ........................................................ 15
Hirofumi Hara, MEMO-Bio iKohza

Waste to Fuel ........................................................................................................ 16
Wira Jazair bin Yahya, AVS iKohza

Biodiesel Emulsion Fuel Solar Hybrid System .................................................... 17
Ahmad Muhsin Ithnin, AVS iKohza

Easy to Install Low Cost Roof Insulation .............................................................. 18
Sheikh Ahmad Zaki Shaikh Salim, WEE iKohza

Nano Coating for Anti-Corrosion of Carbon Steel (Wonder Paint) ...................... 21
Norhasnidawani Binti Johari, eMast iKohza

100% Organic Fertilizer as Plant Growth Booser ............................................... 22
Pramila Tamunaidu, SHIZEN iKohza

Hight Quality Agrobased Ruminant Feed for Safe Meat Production .................. 23
Pramila Tamunaidu, SHIZEN iKohza

Sub-Critical Water Extraction (SWE) Technology for Natural Skincare Applications ...... 24
Mariam Firdhaus Mad Nordin, SHIZEN iKohza

Affordable and Effectiveness of Nanotechnology as Antibacterial Agent .............. 25
Kamyar Shameli, ChECA iKohza
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purifying Water with Combining Nanotechnology and Light</td>
<td>26</td>
</tr>
<tr>
<td>Sustainable Plan Mediated Nanoparticles for Targeted Cancer Therapy</td>
<td>27</td>
</tr>
<tr>
<td>21st Century Water Treatment</td>
<td>28</td>
</tr>
<tr>
<td>Fruit Peels and Crop Waste for Pharmaceutical Industry</td>
<td>29</td>
</tr>
<tr>
<td>Smart Packaging for Muscle Based Foods</td>
<td>30</td>
</tr>
<tr>
<td>Design of Apparatus for Phase Equilibrium Measurement</td>
<td>33</td>
</tr>
<tr>
<td>Management of Bacterial Panicle Blight Through AI Cloud Computing</td>
<td>37</td>
</tr>
<tr>
<td>IoT and Machine Learning Approach in Fertigation</td>
<td>38</td>
</tr>
<tr>
<td>Heating, Ventilation and Air-Conditioner Control System [HVAC]</td>
<td>39</td>
</tr>
<tr>
<td>Blockchain for Home IoT of Your Own</td>
<td>40</td>
</tr>
<tr>
<td>Digital Fingerprint for Low Cost IoT Security</td>
<td>41</td>
</tr>
<tr>
<td>Machine Learning Solutions</td>
<td>42</td>
</tr>
<tr>
<td>Hardware Trojan Detection Framework</td>
<td>43</td>
</tr>
<tr>
<td>Base Station Antenna for 5G Mobile System</td>
<td>44</td>
</tr>
<tr>
<td>Radio Wave Measurement Facility</td>
<td>45</td>
</tr>
<tr>
<td>Human Body Antenna</td>
<td>46</td>
</tr>
<tr>
<td>Radar Cross Section Estimation</td>
<td>47</td>
</tr>
<tr>
<td>Low-cost 2in1 Force Sensor</td>
<td>51</td>
</tr>
<tr>
<td>Ion “Direct-Write” Lithography</td>
<td>52</td>
</tr>
<tr>
<td>Wearable Passive Controlled Ankle Foot Orthosis</td>
<td>53</td>
</tr>
<tr>
<td>Intelligent Control Device</td>
<td>54</td>
</tr>
</tbody>
</table>
MECHANICAL

Semi-active and Controllable Engine Mounting ................................................................. 57
Nur Azmah Nordin, eMAST iKohza

Adjustable Magnetic Mr Damper ....................................................................................... 58
Saiful Amri Mazlan, eMAST iKohza

Flow Induced Vibration as a Disruptor of Microalgae Cell ............................................. 59
Lee Kee Quen, IDS iKohza

Suppression of Vortex Induced Vibration of Rigid Cylinder Using Flexible Shroud ....... 60
Lee Kee Quen, IDS iKohza

Bearing Fault Diagnosis of Sparse Data Based on Effective and Flexible Deep Learning .... 61
Aminudin Abu, IDS iKohza

Advanced Green Cooling Technology ................................................................................ 62
Nor Azwadi Che Sidik, TTES iKohza

Green Composite Material for Bearing Application ....................................................... 63
Shahira Liza Kamis, TriPrem iKohza

Quick and Affordable Trace Humidity Controller ............................................................. 64
Kanao Fukuda, TriPrem iKohza

Visual and Advanced Friction/Wear Analysis ................................................................. 65
Kanao Fukuda, TriPrem iKohza

Ultrasonically Exciter for Machining Fluid ....................................................................... 66
Jun Ishimatsu, TriPrem iKohza

Motorcycle Crash Avoidance System .............................................................................. 67
Wira Jazair bin Yahya, AVS iKohza

Diesel Fuel Saver ................................................................................................................ 68
Wira Jazair bin Yahya, AVS iKohza

IKOHZA LIST FOR LISTED SEEDS

ALGAL Algal Biomass iKohza
CAIRO Center for Artificial Intelligence and Robotics iKohza
ChECA Chemical Energy Conversion and Applications iKohza
CSN Communication Systems and Networks iKohza
EMBEDDED Embedded System iKohza
IDS Intelligent Dynamics and System iKohza
MEMO-Bio Metabolic Engineering and Molecular Biology iKohza
eMAST Engineering Materials & Structure iKohza
SHIZEN Shizen Conversion and Separation Technology iKohza
TTES Takasago Thermal Environment System iKohza
TriPreM Tribology and Precision Machining iKohza
AVS Advanced Vehicle System Engineering iKohza
WEE Wind Engineering for [Urban, Artificial, Man-made] Environment iKohza
AN ADVANCED WASTEWATER TREATMENT SYSTEM
Novel Microalgae-Bacteria Granular Sludge System
Dr. Norhayati Abdullah, Associate Professor
norhayati@utm.my
Algal Biomass iKohza (ALGAL), MJIIT

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 be 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.

MJIIT ADVANTAGE

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

PATENT STATUS

Potential to be patented

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my

Mr. Takano, JICA Expert
rtakano38@utm.my
QUICK AND SIMPLE BIOLOGICAL NITROGEN REMOVAL TECHNOLOGY
Anammox Microgranular Sludge For Domestic Wastewater Treatment
Dr. Norhayati Abdullah, Associate Professor
norhayati@utm.my
Algal Biomass iKohza (ALGAL), MJIIT

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 N2O (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.

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

PATENT STATUS
Potential to be applied for patent.

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
HIGH QUALITY LIQUID ORGANIC FERTILIZER
Supplements for vegetables and main-dish for microbes from chicken feather waste

Dr. Koji Iwamoto, Associate Professor
k.iwamoto@utm.my
Algal Biomass iKohza (ALGAL), MJIIIT

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

MJIIT ADVANTAGE
• MJIIT own two unit of two cubic meter (2 m2) scale of SCW reactor
MJIIT is able to produce the liquid fertilizer in commercial scale

PATENT STATUS
Patent in preparation

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
ECO-FRIENDLY GOLD ADSORBENT/ HEAVY METAL ABSORBER
Low cost Galdieria culture technology
Dr. Koji Iwamoto, Associate Professor
k.iwamoto@utm.my
AAAlgal Biomass iKohza (ALGAL), MJIIT

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.
• Residents 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 sulfularia has an ability to absorb heavy metals.
• The cell wall of the alga is know 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.

MJIIT ADVANTAGE
• MJIIT has expert of algal research
• MJIIT has special facility for algal research and the mass culture system (July, 2020)

PATENT STATUS
Patent in preparation

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
BIOCOKE: ALTERNATIVE COAL COKE FOR SDGS
Biocoke production from various biomass waste in Malaysia
Dr. Hirofumi Hara, Associate Professor
hhara@utm.my
Metabolic Engineering and Molecular Biology iKohza (MEMO-Bio), MJIIT

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.

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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
FINE CHEMICAL PRODUCTION FROM BIOMASS WASTE
Enzymes for lignocellulose degradation by tropical microbes
Dr. Hirofumi Hara, Associate Professor
hhara@utm.my
Metabolic Engineering and Molecular Biology iKohza (MEMO-Bio), MJIIT

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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
TEMPERATE CROPS CULTIVATION IN THE TROPICS
Soil cooling system to maintain temperate crops cultivation

Dr. Hirofumi Hara, Associate Professor
hhara@utm.my
Metabolic Engineering and Molecular Biology iKohza (MEMO-Bio), MJIIT

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.

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

PATENT STATUS
Patent in preparation

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my

Mr. Takano, JICA Expert
rtakano38@utm.my
# WASTE TO FUEL
## Sludge Palm Oil Utilization System (SPOUS)

**Dr. Wira Jazair Yahya, Associate Professor**
wira@utm.my  
Advanced Vehicle System iKohza (AVS), MJIIT

## PROBLEM ANALYSIS

### Industry Needs
- Palm Oil Mill Effluent (POME) is a byproduct of palm oil mill processes. POME has high Biodegradable Oxygen Demand (BOD) which must be treated to below 20 ppm before it can be released to rivers. One of the most important treatment stages 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 suggests the method for SPO separation and method to utilize the SPO after its 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.

## 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
- Mr. Afiq, SRC Coordinator
  afiqmurad@utm.my
- Mr. Takano, JICA Expert
  rtakano38@utm.my
BIODIESEL EMULSION FUEL – SOLAR HYBRID SYSTEM
Real-Time Emulsion Fuel Supply System Integrated with Solar-Hybrid (RTES-PV) for Diesel Electric Generator
Dr. Ahmad Muhsin Ithnin, Senior Lecturer
ahmadmuhsin@utm.my
Advanced Vehicle System iKohza (AVS), MJIIT

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 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

MJIIT 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 Filing: PI2014702681

CONTACT
- Mr. Afiq, SRC Coordinator
  afiqmurad@utm.my
- Mr. Takano, JICA Expert
  rtakano38@utm.my
EASY TO INSTALL LOW-COST ROOF INSULATION
Affordable roof shading technique
Dr. Sheikh Ahmad Zaki bin Shaikh Salim, Associate Professor
sheikh.kl@utm.my
Wind Engineering for [Urban, Artificial, Man-made] Environment iKohza (WEE), MJIIT

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.
• Meanwhiles, the daytime mean air temperature in the room was reduced approximately 1 oC.
• Installation work is easy and can be completed in one day.

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

PATENT STATUS
Pattern applied: PI 2018704320

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
NANOCOATING FOR ANTI-CORROSION OF CARBON STEEL (WONDER PAINT)

Nanocoating Technology
Dr. Norhasnidawani Johari, Senior Lecturer
norhasnidawani@utm.my
Engineering Materials & Structure iKohza (eMAST), MJIIT

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

Merit of the technology

<table>
<thead>
<tr>
<th>Properties</th>
<th>Commercial Product</th>
<th>Our Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Cost</td>
<td>RM0.04</td>
<td>RM0.01</td>
</tr>
<tr>
<td>Cost (Per litre)</td>
<td>Rm40</td>
<td>~Rm19</td>
</tr>
<tr>
<td>Maintenance</td>
<td>2-3 years</td>
<td>5-7 years</td>
</tr>
<tr>
<td>Production batch</td>
<td>10 units</td>
<td>40 units</td>
</tr>
<tr>
<td>Area</td>
<td>Limit</td>
<td>Wider</td>
</tr>
<tr>
<td>Toxicity</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Performances</td>
<td>Average</td>
<td>High</td>
</tr>
<tr>
<td>Health concern</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Thickness layer</td>
<td>&gt; 1mm</td>
<td>~10micrometer</td>
</tr>
</tbody>
</table>

MJIIT ADVANTAGE

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

PATENT STATUS

- MyIPO (PI2017703467)

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my

Mr. Takano, JICA Expert
rtakano38@utm.my
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.

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

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

CONTACT
- Mr. Afiq, SRC Coordinator
  afiqmurad@utm.my
- Mr. Takano, JICA Expert
  rtakano38@utm.my
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

<table>
<thead>
<tr>
<th>Nutrient Content</th>
<th>SUGORUMA</th>
<th>Commercial product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td>13.8 %</td>
<td>17.4 %</td>
</tr>
<tr>
<td>Crude fat</td>
<td>2.6 %</td>
<td>1.6 %</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>20.8 %</td>
<td>16.6 %</td>
</tr>
<tr>
<td>Ash</td>
<td>7.5 %</td>
<td>11 %</td>
</tr>
<tr>
<td>Energy</td>
<td>1.5 MJ</td>
<td>1.24 MJ</td>
</tr>
</tbody>
</table>

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

PATENT STATUS
Registered as UTM granted patent (in progress)

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
HALEA NATURAL SKIN CARE
Wild ginger extract: water-based extraction process
Dr. Mariam Firdhaus Mad Nordin, Senior Lecturer
mariamfirdhaus@utm.my
SHIZEN Conversion & Separation Technology iKohza (SHIZEN), MJIIT

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

MJII ADVANTAGE

• MJII 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
• MJII 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 Filling: 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
AFFORDABLE AND EFFECTIVENESS OF NANOTECHNOLOGY AS ANTIBACTERIAL AGENT

Dr. Kamyar Shameli, Senior Lecturer
kamyar@utm.my
Chemical Energy Conversion And Application iKohza (ChECA), MJIIT

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.

MJIIT ADVANTAGE

• MJIIT has an advance facilities and also has accessibility to sophisticated equipment in foreign partner university for the nanotechnology analysis.
• MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
PURIFYING WATER WITH COMBINING NANOTECHNOLOGY AND LIGHT

Dr. Kamyar Shameli, Senior Lecturer
kamyar@utm.my
Chemical Energy Conversion And Application iKohza (ChECA), MJIIT

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.

MJIIT ADVANTAGE

• MJIIT 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
• MJIIT has state-of-the-art instruments that are required for analysis thus ease the research process

PATENT STATUS

Under preparation

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
SUSTAINABLE PLANT-MEDIATED NANOPEARLICLES
FOR TARGETED CANCER THERAPY

Dr. Kamyar Shameli, Senior Lecturer
kamyar@utm.my
Chemical Energy Conversion And Application iKohza (ChECA), MJIIT

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.

MJIIT ADVANTAGE
• MJIIT has cutting-edge instruments and technologies for advanced nanomaterials synthesis and analysis.
• MJIIT 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
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
21ST CENTURY WATER TREATMENT
Tin(IV) Oxide, Photocatalytic Dye Degradation

Dr. Kamyar Shameli, Senior Lecturer
kamyar@utm.my
Chemical Energy Conversion And Application iKohza (ChECA), MJIIT

PROBLEM ANALYSIS

Industry Needs
• This research focusing the needs of treating polluted water with photocatalytic activity using Tin(IV) Oxide nanoparticles (SnO2-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. SnCl2.2H2O will be dissolved in the water then mix with the plant extract. The solid particles undergo calcination at 450 ℃.
• 3 ppm of methylene blue dye was prepared and 0.2g of SnO2-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 SnO2-NPs was simple with low cost and toxicity. Having high physical and chemical stability. Nanoparticles and be reactivated and be reused.
• Ultraviolet (UV) from sunlight act as the energy source to promote photocatalytic dye degradation

MJIIT ADVANTAGE

• MJIIT 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.
• MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
FRUIT PEELS AND CROP-WASTE FOR PHARMACEUTICAL INDUSTRY

Dr. Kamyar Shameli, Senior Lecturer
kamyar@utm.my
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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
SMART PACKAGING FOR MUSCLE-BASED FOODS
Active, Nanoparticles and Antimicrobial Technologies
Dr. Roshafima Rasit Ali, Senior Lecturer
roshafima@utm.my
Chemical Energy Conversion and Application iKohza (ChECA), MJIIT

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 γ -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.

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

MJIIT ADVANTAGE
• MJIIT 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.
• MJIIT 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
DESIGN OF APPARATUS FOR PHASE EQUILIBRIUM MEASUREMENT
From Low boiling point compounds to polymer
Dr. Tomoya Tsuji, Professor
t.tsuji@utm.my
Shizen Conversion & Separation Technology iKohza [SHIZEN], MJII

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

MJII ADVANTAGE
• MJII 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
MANAGEMENT OF BACTERIAL PANICLE BLIGHT THROUGH AI CLOUD COMPUTING

Dr. Zool Hilmi Bin Ismail, Senior Lecturer
zool@utm.my
Center for Artificial Intelligence and Robotics iKohza (CAIRO), MJIIT

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 (PBP) 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.

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 analysis.

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
IOT AND MACHINE LEARNING APPROACH IN FERTIGATION

Smart Agriculture Technology
Dr. Mohd Ibrahim Shapiai, Senior Lecturer
md_ibrahim83@utm.my
Center for Artificial Intelligence and Robotics iKohza (CAIRO), MJIIT

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

MJIIT ADVANTAGE

• Research activities take place in MJIIT-CAIRO with a strong reputation for our research work in intelligent systems, artificial intelligence, robotics and mechatronics, and control and automation systems.
• MJIIT-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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
HEATING, VENTILATION AND AIR-CONDITIONER CONTROL SYSTEM (HVAC)

Internet of Things with Artificial Intelligence

Dr. Mohd Ibrahim bin Shapiai, Senior Lecturer
md_ibrahim83@utm.my
Center for Artificial Intelligence and Robotics iKohza (CAIRO), MJIIT

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.

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.

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

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
BLOCKCHAIN FOR HOME IOT OF YOUR OWN

Dr. Koichiro Mashiko, Professor
k.mashiko@utm.my
Embedded System iKohza (EMBEDDED), MJIIT

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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
DIGITAL FINGERPRINT FOR LOW COST IOT SECURITY
SRAM Physical Unclonable Functions (SRAM PUF) for Security and Authentication

Dr. Koichiro Mashiko, Professor
k.mashiko@utm.my,
Embedded System iKohza (EMBEDDED), MJIIT

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.

MJIIT 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

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
MACHINE LEARNING SOLUTIONS
High Performance Extreme Learning Machine Accelerator

Dr. Ooi Chia Yee, Associate Professor
ooichiayee@utm.my
Embedded System iKohza (EMBEDDED), MJIIT

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

MJIIT ADVANTAGE

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

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my

Mr. Takano, JICA Expert
rtakano38@utm.my

Patent in preparation
HARDWARE TROJAN DETECTION FRAMEWORK
Using Machine-learning Approaches at Multiple Abstraction Levels

Dr. Ooi Chia Yee, Associate Professor
ooichiayee@utm.my
Embedded System iKohza (EMBEDDED), MJIIT

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 venerable 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.

<table>
<thead>
<tr>
<th>Performance Benchmarking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (RS232)</td>
</tr>
<tr>
<td>Trojan-1 ✔</td>
</tr>
<tr>
<td>Trojan-2 ✔</td>
</tr>
<tr>
<td>Trojan-3 ✔</td>
</tr>
<tr>
<td>Trojan-4 ✔</td>
</tr>
<tr>
<td>Trojan-5 ✔</td>
</tr>
<tr>
<td>Trojan-6 ✔</td>
</tr>
<tr>
<td>Trojan-7 ✔</td>
</tr>
<tr>
<td>Trojan-8 ✔</td>
</tr>
<tr>
<td>Trojan-9 ✔</td>
</tr>
<tr>
<td>Clean ✔</td>
</tr>
</tbody>
</table>

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.

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my

MJIIT ADVANTAGE PATENT STATUS

Patent in Preparation
BASE STATION ANTENNAS FOR 5G MOBILE
Antenna Application Technology
Dr. Yoshihide Yamada, Professor
yoshihide@utm.my
Communication Systems and Networks iKohza (CSN), MJIIT

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.

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 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.

MJIIT ADVANTAGE
• MJIIT developed new antenna technologies.
• MJIIT can measure practical radiation patterns.
• MJIIT can consult with antenna technologies and research collaboration with industries and universities.

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
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.

Merit of the technology
• Wideband measurement
  - From 800 MHz to 40 GHz, 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

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

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

CONTACT
• Mr. Afiq, SRC Coordinator
  afiqmurad1@utm.my
• Mr. Takano, JICA Expert
  rtakano38@utm.my
HUMAN BODY ANTENNAS
Antenna Application Technology
Dr. Yoshihide Yamada, Professor
yoshihide@utm.my
Communication Systems and Networks iKohza (CSN), MJIIT

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.

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

MJIIT ADVANTAGE

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

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
RADAR CROSS SECTION ESTIMATION
Radio Wave Analysis Technology
Dr. Yoshihide Yamada, Professor
yoshihide@utm.my
Communication Systems and Networks iKohza (CSN), MJIIT

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.

MJIIT ADVANTAGE
• MJIIT is one of the active research institutes of RCS.
• MJIIT can consult with RCS calculation methods and measurement method and research collaboration with industries and universities.

CONTACT
• Mr. Afiq, SRC Coordinator
  afiqmurad@utm.my
• Mr. Takano, JICA Expert
  rtakano38@utm.my
LOW-COST 2IN1 FORCE SENSOR
Rapid and tunable force-related control

Dr. Nurhazimah Nazmi, Senior Lecturer
nurhazimah@utm.my
Engineering Materials & Structure iKohza (eMAST), MJIIT

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.

MJIIT ADVANTAGE
• MJIIT is only a research organization which develops a very unique advanced smart materials that can control the stiffness of the force sensor.
• MJIIT 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
ION “DIRECT-WRITE” LITHOGRAPHY
Focused Ion-Beam Lithography Technology
Dr. Siti Rahmah Aid, Senior Lecturer
sitirahmah.aid@utm.my
Takasago Thermal Environment System iKohza (TTES), MJIIT

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 Ga⁺ ion beam of less-few-nm diameter
• Suitable for low-volume fabrication of micro-nanodevices or for the fabrication of single test devices

MJIIT ADVANTAGE

• Microscopy Laboratory is one of the advanced laboratories in MJIIT equipped with the high-end equipment for the nanocharacterization and nanofabrication
• MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
WEARABLE PASSIVE CONTROLLED ANKLE FOOT ORTHOSIS
Assistive Device with IoT Technology
Dr. Mohd Azizi Abdul Rahman, Senior Lecturer
azizi.kl@utm.my
Advanced Vehicle System iKohza (AVS), MJIIT

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.

MJIIT ADVANTAGE

• MJIIT 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.
• MJIIT 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

Mr. Afiq, SRC Coordinator afiqmurad@utm.my
Mr. Takano, JICA Expert rtakano38@utm.my
INTELLIGENT CONTROL DEVICE
Enhancing Vehicle Ride Comfort in Active Suspension System
Dr. Mohd Fitri Bin Mohd Yakub, Senior Lecturer
mfitri.kl@utm
Wind Engineering for [Urban, Artificial, Man-made] Environment iKohza (WEE), MJII

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

MJII ADVANTAGE

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

PATENT STATUS

Patent in preparation

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
SEMI-ACTIVE AND CONTROLLABLE ENGINE MOUNTING
Magnetorheological Elastomer (MRE)
Dr. Nur Azmah Nordin, Senior Lecturer
nurazmah.nordin@utm.my
Engineering Materials and Structures iKohza (eMast), MJIIT

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.

MJIIT ADVANTAGE

• MJIIT is the one of research organizations in which capable in producing an MRE material and fabricating MRE engine mount.
• MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
ADJUSTABLE MAGNETIC MR DAMPER
Magnetorheological Damper
Dr. Saiful Amri Mazlan, Associate Professor
amri.kl@utm.my
Engineering Materials and Structures iKohza (eMast), MJIIT

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 Magnetorheological (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

MJIIT ADVANTAGE

• MJIIT is one of the main research organization in the world, which develops varies smart materials from the material preparation until the application of MR materials in devices and applications.
• MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
FLOW INDUCED VIBRATION AS A DISRUPTOR OF MICROALGAE CELL
Renewable Energy Technology
Dr. Lee Kee Quen, Senior Lecturer
lkquen@utm.my
Intelligent Dynamic System iKohza (IDS), MJIIT

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.

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

PATENT STATUS
None

CONTACT
Mr. Afiq, SRC Coordinator
afiqmuradi@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
SUPPRESSION OF VORTEX-INDUCED VIBRATION OF RIGID CYLINDER USING FLEXIBLE SHROUD

Suppression Technology in Offshore Industry

Dr. Lee Kee Quen, Senior Lecturer
lkquen@utm.my
Intelligent Dynamic System iKohza (IDS), MJIIT

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.

MJIIT 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.
• MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my

Mr. Takano, JICA Expert
rtakano38@utm.my
BEARING FAULT DIAGNOSIS OF SPARSE DATA BASED ON EFFECTIVE AND FLEXIBLE DEEP LEARNING
Artificial Intelligence
Dr. Aminudin Abu, Associate Professor
aminudin.kl@utm.my
Intelligent Dynamic System iKohza (IDS), MJIIT

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.

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

CONTACT
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my

<table>
<thead>
<tr>
<th>Data</th>
<th>Test Accuracy [%]</th>
<th>Test Loss [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWRU (Dataset A)</td>
<td>100</td>
<td>0.59</td>
</tr>
<tr>
<td>MFPT</td>
<td>97.76</td>
<td>10.50</td>
</tr>
<tr>
<td>Experimental rig</td>
<td>100</td>
<td>0.38</td>
</tr>
<tr>
<td>Data from industry</td>
<td>100</td>
<td>0.33</td>
</tr>
</tbody>
</table>

TABLE 1: MODEL PREDICTION ACCURACY OF DIFFERENT BEARING DATA

FIGURE 1: ARCHITECTURE OF THE SIAMESE NEURAL NETWORK
ADVANCED GREEN-COOLING TECHNOLOGY
A Hybrid Microchannel Heat Sink with Effective Energy Consumption

Dr. Nor Azwadi Che Sidik, Associate Professor
azwadi@utm.my
Takasago Thermal Environment System iKohza (TTES), MJIT

PROBLEM ANALYSIS

Industry Needs
• Low degree of flow mixing is one of the main factors 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
GREEN COMPOSITE MATERIAL FOR BEARING APPLICATION
Treated Oil Palm Empty Fruit Bunch Fibre Reinforced Polyoxymethylene
Dr. Shahira Liza Kamis, Senior Lecturer
shahiraliza@utm.my
Tribology and Precision Machining iKohza (TriPrem), MJIT

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.

MJIIT ADVANTAGE

• MJIIT 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
QUICK AND AFFORDABLE TRACE-HUMIDITY CONTROLLER
Permeation Tube Humidification Technology
Dr. Kanao Fukuda, Professor
fukuda.kl@utm.my
Tribology and Precision Machining iKohza (TriPreM), MJIIT

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 rage of humidification from ppb level to ppm level can be realized by high flexibility of the humidifier design.

MJIIT ADVANTAGE
- MJIIT is only a research organization in the world which develops this very unique and cutting edge permeation tube technology.
- MJIIT 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
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 viewpoints 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.

MJIIT ADVANTAGE

- The research member in MJIIT is one of the originator of the spatiotemporal mapping analysis technology and has further developed the technology in a very unique way.
- TriPreM, MJIIT 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

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my

Mr. Takano, JICA Expert
rtakano38@utm.my
ULTRASONICALLY EXCITER FOR MACHINING FLUID
Enhancement of Cutting/Grinding Fluid
Dr. Jun Ishimatsu, Senior lecturer
junishimatsu@utm.my
Tribology and Precision Machining iKohza (TriPrem), MJIIT

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

MJIIT 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
MOTORCYCLE CRASH AVOIDANCE SYSTEM
Detection and Warning System for Motorcycle Vehicular Collision Avoidance (DEWAMCA)

Dr. Wira Jazair Yahya, Associate Professor
wira@utm.my
Advanced Vehicle System iKohza (AVS), MJIIT

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.

MJIIT 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
Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
DIESEL FUEL SAVER
Real-Time Non-Surfactant Emulsion Fuel Supply System (RTES)
Dr. Wira Jazair Yahya, Associate Professor
wira@utm.my
Advanced Vehicle System iKohza (AVS), MJIIT

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.

MJIIT 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

CONTACT

Mr. Afiq, SRC Coordinator
afiqmurad@utm.my
Mr. Takano, JICA Expert
rtakano38@utm.my
CONTACT

Mr. Mohd ‘Afiq Bin Murad
SRC Coordinator
afiqmurad@utm.my

Mr. Ryotaro Takano
JICA Expert
rtakano38@utm.my

MJIIT SANGAKU RENKEI CENTER (SRC)
Malaysia- Japan International Institute of Technology
UTM Kuala Lumpur
Jalan Sultan Yahya Petra
54100 Kuala Lumpur.
03-2203 1517
03-2203 1266