Sustainable activity of engineering education and research of association for advanced education in Asia

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Abstract. In this paper we describe activities of members in the association for advanced education in Asia (AAEA). It is a specified non-profit organization in Japan. The members are in activity at National University of Laos, Laos, King Mongkut’s Institute of Technology Ladkrabang, Thailand and universities in Vietnam, Malaysia and others. They have collaborated with their counterparts such us professors and students on specialized education and research. A lot of activities are useful and effective for our sustainable fields.

1. Introduction
In 2006, an association for advanced education in Asia (AAEA) was established as a specified non-profit organization in Kanagawa, Japan. The mission is to build the creative and sustainable society through collaborative activities concerning education and research. We set up (1) to do collaboration with research and events, (2) to do human resources development by educational collaboration, (3) to support international exchange between Japan and Asian countries etc. In this paper our activities are summarized in each area. In section 2, the robot contest which has been done in Laos and in section 3, the collaborative researches and activities in Laos and Thailand are described. In section 4, the research activities which have been performed in Vietnam and Malaysia are mentioned. Their outputs and problems are discussed in detail. They are useful and effective activities for collaborations. The effort is continued in order to realize a sustainable institute in the countries.

2. Robot contest in Laos
2.1. Purpose of the robot contest in Laos A subsection
The first robot contest in Lao was held in Vientiane by organizing by the Faculty of Engineering of National University Laos (NUOL) in 2002. The international robot contest was held on 2003, 2004, 2005 and 2006 respectively, together with Japan and Thailand teams. The 14th robot contest 2018 was held in the Sokpaluang campus of NUOL in Vientiane. The Laos robot contests provide three purposes as the International interchange of students, the Human resources of creative specialists, and the acquisition of robot technology.

The international robot contest provide in student interchange with the university student of Laos, the vocational school student and the Laos neighbourhood students in Asian countries. The students will be able to study for high knowledge and technology by making a robot under the rule of the robot
contest. The education by using robot technology not only provides in conventional technical knowledge but also grows the creative thinking technology. In addition, a mainly microcomputer, electronics, machine, electricity, and information technology are indispensable for teaching robot technology. The students have been challenging the programming of microcomputer with interesting in engineering, science and technology. This is considered as an education of PBL with integrating the skill of computer engineering, solving problem, and team working.

2.2. Purpose of the robot contest workshop
The robot committee, the Faculty of Engineering of NUOL organized a robot contest workshop on applied microcomputer to robot design for students from technical college in Lao including the Faculty of Engineering and the Faculty of Sciences of NUOL in collaboration with the NPO/AAEA. During the workshop, the participants learned about fundamental knowledge of electrical circuits, transistor circuits and motor control circuits with driving microcomputer for robot design from Japanese robot expert at the NPO/AAEA. The Japanese robot expert presents the embedded technology with combined the software engineering and hardware engineering by using practical robot. They have learned various techniques fact that they faced to use microcomputer equipment in producing their robots at the workshop.

2.3. Achievement and the expected results
It is one of achievement that the students have obtained various abilities and ingenious robot technology in the robot contest match [1]. The robot contest workshop in collaboration with NPO/AAEA is expected as an education of PBL with integrating the skill of computer engineering, problem solving, and team working for students of technical college in Lao including the Faculty of Engineering and the Faculty of Sciences of NUOL in Laos.

2.4. Robot contest 2018 in Lao
The contest is a game that an autonomous robot carries one colour box to the target position with cooperating manual robot, and to compete for a score according to the rule of the robot contest 2018. In the contest, the students of participated team prepared a manual robot and an autonomous robot to participate the robot contest. The student is operating the manual robot to carrying a cube box with colour to an autonomous robot. The autonomous robot should be automatic carrying to target colour box stand by tracing the black line, and the robot should be setting the target box stand by detecting a colour. The student team will get a score if the autonomous robot will be carrying to target colour box stand successfully. In the contest, two fields are set up as shown in figure 1 and 13 teams in each field participated.

Figure 1. Robot contest at NUOL in 2018 - (a) field and (b) robot contest tournament.
3. Collaborative research and activity in Laos and Thailand

3.1. Development of a renewable energy source and eco car in Laos

It is important to develop a renewable energy source and a new type of car in order to build a sustainable society. Especially, in Laos petroleum is not produced and its price very expensive compared with other economic price. Research on production of biomass gas from tree branch and corn core has been done as a challenge topic and succeeded to make small experimental plant. This result will be represented in near future.

Research on design and manufacture of electric vehicle is taken notice by government because Laos has much electric energy resource by hydro many power stations and petroleum is not produced in Laos as mention above. It is very important to bringing up human resources in university to develop electric vehicle in own country. Four departments, namely mechanical, electric, electronic and information ones cooperated, and first electric vehicle was designed and manufactured in Laos as shown in figure 2 [2]. On the other hand research on development and simulation of electric tricycle was performed in KMITL because exhaust gas from the tricycle (TukTuk) is one of the air pollution causes in Bangkok and big cities in Thailand [3].

Research on application of microbubble to purification of waste water is recently interested one in the world [4]. Fortunately manufacturing the experimental apparatus and nozzle which is important part for generation microbubble are not difficult in workshop of the university. NUOL started the application research of the microbubble to purification of waste water in 2016, and KMITL did application of it to washing fruit surface in 2017. They are shown in figure 3. Associate professor and lecturer of NUOL will present obtained result in this conference.

![Figure 2](image1.png)  
**Figure 2.** Manufacturing electric vehicle in NUOL

![Figure 3](image2.png)  
(a)  
(b)  

**Figure 3.** Experimental apparatus of microbubble – (a) NUOL and (b) KMITL.
3.2. Research on microwave propagation
In Laos and Thailand, humidity is very high and temperature also very high. Therefore, the water vapor of the air increases. The radio waves of a microwave band decrease in proportion to water vapour content. The relation between the satellite TV receiving by a small aperture antenna and the water vapour content has been discussed experimentally and theoretically since 2002 [5],[6]. The figure 4 shows the scene of research discussion. Research on modelling and measurement of airplane flutter phenomenon on television signal has been done in Thailand. The airplane flutter phenomenon was considered theoretically and experimentally [7]. As research on propagation needs the human power, research funding and measuring devices in order to do, such research is not done actively in Laos and Thailand.

3.3. Lecture and research on M2M/IoT
Special lecture on Introduction to M2M/IoT was done by Dr. H. Tsuji at NUOL on Nov. 1, 2016. Many students and the faculty members attended and there were many questions and answers. Also, he had the special lecture on M2M/IoT at KMITL on Nov. 9, 2016. The faculty members and students attended the lecture (figure 5 for content) and many questions answers were made. Many attendees were interesting in research on M2M/IoT at both faculties of engineering. After the lecture research discussions were done and some have been continued through the internet. In near future, some papers will be submitted at the conference.

4. Research activity in Vietnam and Malaysia
4.1. Research on low power wireless monitoring system
Shrimps are very sensitive with water condition changing. Shrimps can get disease if changing is not processed, even though the changing is small in a short time. VASEP (Vietnam Association of Seafood Exporters and Producers) reports that the successful harvest probability is only 66%. Therefore, a system replacing human always monitors water quality can reduce risks for farmers. The objective of the research is to design a wireless monitoring system that monitors 24/7 shrimp water quality and warns farmer abnormal conditions. The overall architecture of the system is shown in figure 6. The experiment in the sites is shown in figure 7.
It has been performed to develop an integrated environment including data management, web server, web client application, smart phone application to connect farmers, technical engineers, companies, government together. Farmers can share their water condition and learn from others. Engineers and companies can access monitoring data, give farmer advice or recommend. Base on statistical analysis
of monitoring data, the government has an overview, can make a plan and has some directional guidelines. The research will be able to sustain itself in future by conducting research and deployment for companies with different places and multiple shrimp ponds in the south of Vietnam due to the ability to increase their shrimp production.

4.2. Collaborative research at universities in Malaysia

Research on the material science and joining science has been done at the universities such as Universiti Malaya(UM), Universiti Malaya Perlis( UMP), Universiti Kebangsaan Malaysia(UKM), and Universiti Sains Malaysia(USM). Main research themes are as follows;

- Joining technology of various ceramics (Al2O3, AlN)
  Ceramics (aluminum oxide, aluminum nitride) and copper alloy are joined using special filler metal (porous Cu,+Ag+Cu+ Ti). Then, the joining interface is analyzed to evaluate the joining property.
- New type of semiconductor cooling device
  Combining copper plate and porous metal (Cu,Ni) to produce a new type of semiconductor cooling device
- Joining of aluminum alloy by laser heat source
  Aluminum alloy is joined (brazed) using the fiber laser.
- Addition of special metal (porous metal) to solder joint
  Construct a new joining interface for joining strength and heat resistance of soldered joints
- Diamond particle joining technology
  The diamond particles are fixed on the stainless steel plate by using a special joining material.
Joining of copper alloy using microwave

Joining performance was examined using a microwave as a heating method. Those research results are reported in the papers. Some papers are shown in the references [8], [9].

4.3. Collaborative research and lectures in MJIIT

MJIIT was established by Malaysia and Japanese governments in Kuala Lumpur in 2011 and was a faculty of Universiti Technologi Malasia (UTM). Vision is leading in cutting edge technology education and research. Also missions are (1) providing Japanese style engineering education blended with Malaysia distinctiveness for sustainable industry and society and (2) leading in academic and research excellence in Electronics, Precision, Environmental & Green Engineering and Management of Technology. Most noteworthy is education and research based on both Malaysia and Japanese styles and international development of human resources in ASEAN.

MJIIT is constituted of 12 programs of PG and UG in niche areas. Departments are (1) Electronics System Engineering (UG, PG), (2) Mechanical Precision Engineering (UG, PG), (3) Chemical Process Engineering (UG), (4) Environmental Engineering and Green Technology (PG) and (5) Management of Technology (PG). Table 1 is numbers of students, and graduates in 2018. T. Wakabayashi was a professor from 2011 to 2014.

MJIIT had collaborative research with KMITL and the title is a study on planar antennas elder care systems and communication networks in sustainable society. The outputs were four papers and five symposium papers [10], [11], [12]. The central frequency of the band notch characteristic is obtained by changing the slit position, length and width. The figure 9 shows the return loss characteristics of the UWB planar antenna (L_1=21, L_2=24, W=21, L_1=16, L_2=12.8, F_1=0.4, h_s=0.035, h_c=1 mm, ε_r=4.2, ε=0.6). Other results of the collaborative research are subscribed in the paper [13].

Table 1. Numbers of students and graduation

|       | students | graduates |
|-------|----------|-----------|
| UG    | 783      | 365       |
| PG    | 455      | 167       |
| total | 1238     | 532       |

Figure 9. Return loss of UWB planar antennas
5. Conclusion

Association for Advanced Education in Asia (AAEA) is a small specialized non-profit organization with 12 members. Prof. Dr. T. IIJIMA is the president of NPO/AAEA. The members have been independently collaborated with their counterparts with their own policy to realize sustainable society since 2006. Those collaborative research and activities will be continued in order to achieve the missions of the association.

Finally, N. Komine, T. Iijima, Y. Moriya, H. Tsuji, S. Tomiyama, T. Ariga and T. Wakabayashi describe the parts of 2, 3A, 3B, 3C, 4A, 4b and 4c, respectively. This is summarized by T. Wakabayashi.

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