附件三

出國報告書封面（出國類別：國際會議）

2016 系統應用創新國際研討會
2016 International Conference on Applied System Innovation (ICASI 2016)

服務機關：國立虎尾科技大學車輛工程系

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派赴國家：日本(沖繩)

出國期間：105.05.27~105.05.31

報告日期：105.07.26

摘要

本年度系統應用創新國際研討會由 IEEE 和臺灣知識創新學會(TIKI)與台灣及日本多所知名大學，於 2016 年 5 月 28 日至 6 月 1 日，在日本沖繩國際會展中心，舉辦 IEEE 2016 International Conference on Applied System Innovation (ICASI 2016)國際研討會。此次會議有來自許多其他國家之各類不同領域研究者發表近期創作，此次參與本研討會發表論文為車用風力發電系統之評估(An investigation of vehicle wind turbine system)，目前節能議題普遍受到國際重視，論文研究主要將風力發電設備裝置於汽車前保險桿進行發電效益評估，本研究車用再生能源技術可提升能源效益達 15%，除了發表論文之外，藉由研討會與其他領域研究者交流新知，並進行沖繩地區景點參訪，接觸並了解當地文化；研討會接受之論文，將會刊登於 IEEE Xplore® (indexed by EI)，並且將獲推薦轉投其他 EI 或 SCI 期刊。

目次

本文

（一）目的:

原定參加研討會計畫目標主要進行論文發表交流與參訪，論文主題在節能科技與新能源技術發方面，期望參與能源科技技術方面交流，並引發新的技術方向。

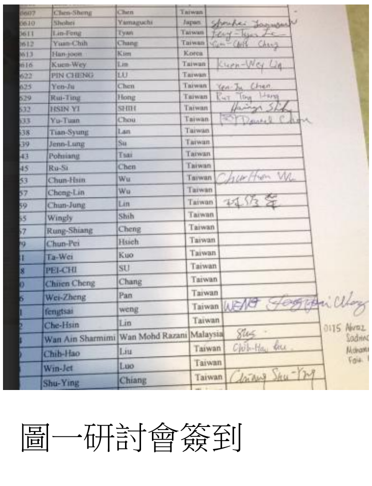
緣起：節能及新能源科技已是本世紀各國共同追求及發展的目標，特別在日本核災之後，再度成為焦點，車用風力發電的研究已有許多實際發明案例探討，但均僅在創意完成，並無實際效益評估，此為本研究參與國際研討會動機。

預期效益：本研究車用風力發電系統，主要將風力發電機構架設於汽車前保險桿位置，進行實車性能測試，在冬天天候下，可減少油耗，節能效益達 15%，參與研討會除發表論文技術成果之外，也能吸收新知，論文可獲推薦國際期刊之機會。

（二）過程:

研討會經過情形如下:五月二十七日晚班機桃園出發，到達目的沖繩地稍作休息，隔日搭車前往會場沖繩國際會議中心熟悉環境。五月二十九日早上前往會場報到(圖一)並參加研討會第一會議室議程(圖二)，發表科技設計與創新創意，以及科技與人文方向的結合，此項主題引起與會者討論與爭議，科技與人文的結合是創意，但呈現方式似乎不太容易被有些科技人所接受。下午繼續研討會行程參訪美國村並參加晚宴，二戰之後，美軍在沖繩設置基地協防，駐地因素逐漸形成美國村，成為觀光特色景點。五月三十日參與論文發表主題”車用風力發電系統之評估”(圖三)，將一具水平軸式風力發電機設置於車頭位置，再將充電線路與車輛電瓶作接合，特別設計一組可切換車輛發電機與風力發電機兩種模式的電磁離合機構，將原車輛冷氣壓縮機以車輛發電機取代，並使用連結套筒將電磁離合器與車輛發電機結合，此機構可離合車輛發電機使其不運轉發電，並使用風力發電機作接替充電。

油耗測試方法以固定距離、固定油量，固定時速作試驗，比較使用車輛發電機與風力發電機油耗結果，實驗結果顯示: 30km 距離定速測試實驗中平均可節省 15%以上的燃油消耗量。當日並參訪首里城公園與琉球王宮(圖四 a~e)，琉球國的都城為首里城，小國向中國及日本進貢在今沖繩縣那霸市的東郊。歷代琉球國王及王族居住和處理政務的首里城和其他琉球文化遺蹟在 2000 年被聯合國教育科學文化組織定為世界文化遺產，琉球雖歸屬日本，感覺上其文化與日本本土差異，反因與中國往來頻繁，受中國影響甚大。五月三十一日早班機回程。



圖一研討會簽到

圖二　第一會議室議程

(圖三) 論文發表

(圖四 a) 參訪首里城公園

(圖四 b) 首里城公園表演秀

(圖四 c)參訪首里城公園

(圖四 d)參訪首里城公園琉球王宮

(圖四 e)參訪首里城公園琉球王宮

（三） 心得及建議事項：

本次五天研討會行程中，除發表論文之外，也聽取其他國外研究者的研究狀況及相關主題，並討論研究相關內容及先進技術，從而獲益良多，對於沖繩當地文化，也有了些粗淺層面認識，期望能多藉由國際研討會場合的交流與學習，增廣見聞與教學新知，擴充知識文化視野，增進教學之能。

(附錄)

研討會議程

IEEE ICASI 2016 International Conference on Applied System Innovation
Okinawa, Japan, May 28-Jun 1, 2016

Conference Agenda

Venue: Okinawa Convention Center, 4-3-1 Mashiki, Ginowan City Okinawa 901-2224, Japan

Language: English

Pre-Conference Schedule		
Saturday, May 28, 2016		
2:00pm	6:00pm	Sponsor Showcase (Grand Ballroom)
4:00pm	8:00pm	Early Conference Registration and Conference Information Collection (Reception Hall)

Main-Conference Schedule		
Sunday, May 29, 2016		
8:00am	9:00am	Conference Registration and Conference Information Collection (International Conference Room, Building A1)
9:00am	10:00am	Opening Ceremony (International Conference Room, Building A1)
10:00am	10:50am	Keynote Speech 1 (International Conference Room, Building A1)
10:50am	11:10am	Coffee Break
11:10am	12:00am	Keynote Speech 2 (International Conference Room, Building A1)
12:10am	1:30pm	Lunch (Ballroom)
1:30pm	5:30pm	Poster session of ICASI 2016, P1, P2, P3, P4
1:30pm	2:20pm	Keynote Speech 3 (International Conference Room, Building A1)
2:30pm	3:20pm	Keynote Speech 4 (International Conference Room, Building A1)
1:30pm	2:30pm	Breakout Sessions of ICASI 2016, Oral 1, Oral 2 (International Conference Room, Building A2 and A3)
2:30pm	3:30pm	Breakout Sessions of ICASI 2016, Oral 3, Oral 4 (International Conference Room, Building A2 and A3)
3:30pm	4:30pm	Breakout Sessions of ICASI 2016, Oral 5, Oral 6, Oral 7 (International Conference Room, Building A1, A2 and A3)
4:30pm	5:30pm	Breakout Sessions of ICASI 2016, Oral 8, Oral 9, Oral 10 (International Conference Room, Building A1, A2 and A3)
6:00pm	8:00pm	Conference Dinner (Ballroom)
		Breakout Sessions of ICASI 2016, Oral 11, Oral 12,

IEEE ICASI 2016 International Conference on Applied System Innovation
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3:30pm	4:30pm	Breakout Sessions of ICASI 2016, Oral 39, Oral 40 (International Conference Room, Building A2 and A3)
4:30pm	5:30pm	Breakout Sessions of ICASI 2016, Oral 41, Oral 42 (International Conference Room, Building A2 and A3)

Main-Conference Schedule		
Wednesday, June 1, 2015		
8:00am	9:00am	Conference Registration and Conference Information Collection (International Conference Room, Building A, A2)
9:00am	12:00am	Sponsor Showcase (Ballroom)

IEEE ICASI 2016 International Conference on Applied System Innovation
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Main-Conference Schedule		
Monday, May 30, 2016		
8:00am	9:00am	Conference Registration and Conference Information Collection (International Conference Room, Building A2)
9:00am	10:00am	Breakout Sessions of ICASI 2016, Oral 13, Oral 14, (International Conference Room, Building A2 and A3)
10:00am	11:00am	Breakout Sessions of ICASI 2016, Oral 15, Oral 16, (International Conference Room, Building A2 and A3)
9:00am	4:30pm	Poster session of ICASI 2016, P5, P6, P7, P8
10:40am	11:00am	Coffee Break
11:00am	12:00am	Breakout Sessions of ICASI 2016, Oral 17, Oral 18 (International Conference Room, Building A2 and A3)
12:10pm	1:30pm	Lunch (Ballroom)
1:30pm	2:30pm	Breakout Sessions of ICASI 2016, Oral 19, Oral 20 (International Conference Room, Building A2 and A3)
2:30pm	3:30pm	Breakout Sessions of ICASI 2016, Oral 21, Oral 22 (International Conference Room, Building A2 and A3)
3:30pm	4:30pm	Breakout Sessions of ICASI 2016, Oral 23, Oral 24 (International Conference Room, Building A2 and A3)
4:30pm	5:30pm	Breakout Sessions of ICASI 2016, Oral 25, Oral 26 (International Conference Room, Building A2 and A3)
6:00pm	8:30pm	Conference Dinner (Ballroom)
7:00pm	8:30pm	Breakout Sessions of ICASI 2016, Oral 27, Oral 28 (International Conference Room, Building A2 and A3)

Main-Conference Schedule		
Tuesday, May 31, 2016		
8:00am	9:00am	Conference Registration and Conference Information Collection (International Conference Room, Building A2)
9:00am	10:00am	Breakout Sessions of ICASI 2016, Oral 29, Oral 30, (International Conference Room, Building A2 and A3)
10:00am	11:00am	Breakout Sessions of ICASI 2016, Oral 31, Oral 32, (International Conference Room, Building A2 and A3)
9:00am	11:50am	Poster session of ICASI 2016, P9, P10,
10:40am	11:00am	Coffee Break
11:00am	12:00am	Breakout Sessions of ICASI 2016, Oral 33, Oral 34 (International Conference Room, Building A2 and A3)
12:10pm	1:30pm	Lunch (Ballroom)
1:30pm	2:30pm	Breakout Sessions of ICASI 2016, Oral 35, Oral 36 (International Conference Room, Building A2 and A3)
2:30pm	3:30pm	Breakout Sessions of ICASI 2016, Oral 37, Oral 38 (International Conference Room, Building A2 and A3)

2

發表倫文

An investigation of vehicle wind turbine system

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Abstract

Wine turbine applications such as battery charging for auxiliary|power for boats or to power traffic warning signs. Wind turbines are becoming an increasingly important source. A wind turbine is a device that converts kinetic energy from the wind into electrical power. The Generator supplies the electricity by connecting to the pulley system of engine of vehicle generally. In order to investigate energy-saving efficiency, a wind turbine of 400w was mounted to the front bumper of vehicle. In the experiment, there are two choices of charge types for vehicle. An electromagnetic clutch was designed for cutting charge system by wind turbine with a button in the car. Fuel consumption can be reduced using wind turbine. Generator is driven by engine pulley system when vehicle starts, it will be occupied about 30% fuel consumption by this type generally. The generator can be switched driven by wind turbine while the vehicle moves at a stable speed on road, fuel consumption can be reduced about 15% by the wind turbine. The charge type can be set to wind turbine system when car speed is higher than 50kilometers, and the higher, the more efficiency. While wine turbine system will self-stop when wind speed is too high at car speed more than 120 kilometers for safety. The road experiment results revealed that proposed vehicle wind turbine system saved about 15% fuel consumption when car speed is higher than 80 kilometers.

Key words: Wind Turbine, Generator, Clutch.

Introduction

Wind power electricity is not a mass production which is constrained by seasons, weather and the wind much. No wind, no electricity. Owing to the gas crisis, green energy is noticed in recently years. A wind turbine is a device which converts energy of wind into electrical power. There are two kinds of wind turbine systems, which are manufactured in a wide range of vertical and horizontal axis types [1]. The smallest turbines are used for applications such as battery charging for auxiliary power for boats or caravans or to power traffic warning signs. Slightly larger turbines can be used for making contribution "Fig.1". Some applications of wind turbines of cars are accomplished in "Fig.1". But examples the efficient was low and it's constrained by the reasons of seasons and the weather. Wind turbine in car? Most People concern about how can the wind residence be overcame [2].

Arrays of large turbines "Fig.2", known as wind farms, are becoming an increasingly important green source of renewable energy can be connected to the power grid system[3][4][5]. As of 2015, Denmark generates 40% of its electricity from wind. Same applications were adapted widely in many countries.

Modern vehicles are composed by a four-stroke engine in which the piston completes four separate strokes which constitute a thermodynamic cycle. The four separate strokes are termed: Intake, Compression, Power, and Exhaust. Engine drives the power train system, alternator, power steering, and air conditioner through pulleys by strokes.

Experimental Results and Discussion

In this study, a described Horizontal-axis wind turbine (HAWT) Air X – 400W (made in Germany) was used as an auxiliary vehicle power electrical charging system. The wind turbine is set on the bumper in front of vehicle as "Fig. 3". When the automobile running in a steady velocity, wind turbine can convert wind energy to electricity, and charge electricity to power saving system. An electromagnetic clutch mechanism was set up for switching the charge mode between car alternator and wind turbine. In experiments, charge efficiency of wind turbine was compared, and fuel consumption was also investigated when different length of wind turbine blades. Charge voltage and charge current were larger with increasing vehicle speed.

Charge controller was used for stable charge in the system. An anemometer and a voltmeter were set for observation and dada record in "Fig.4". The experiment schematic electrical circuit diagram was shown in "Fig.5". An extra auxiliary battery is connected for wind turbine charge system in experiment. An independent fuel tank is also set up for the investigation of gasoline consumption in road test. The fuel consumption can be evaluated precision. Battery 1 was charged by car alternator which is driven by engine when automobile started. Auxiliary battery (Battery 2) can be charged independent or together with Battery 1 by wind turbine when vehicle is operated at stable speed, or at a higher speed in highway.

A horizontal axis type wind turbine is adapted for possible energy saving test in vehicle electrical system for this paper. The length of turbine blade was cut into 32cm and 40cm from a PVC pipe "Fig.6". Charge effect of the two wind turbine blade was evaluated firstly, as original blade length is too long to mount on front bumper of the car. Specification of wind turbine is in "Fig.7". Original length of turbine blade is of 115cm in diameter. Table I shown data of charge effect of the turbine blade length 32cm with no electricity load. Table II shown data of charge effect of the turbine blade length 40cm with no electricity load. Table III shown data of charge effect of the turbine blade length 32cm with no electricity load. Table IV shown data of charge effect of the turbine blade length 40cm with no electricity load. Table V shown data of charge effect of a parallel-connected 2 batteries of blade length 40cm. Table VI shown data of charge effect of a parallel-connected 2 batteries of blade length 40cm. In experiments, Air conditioner is set turned off. "Fig.8" shows the charging effect at different car speed of 40km, 60km, 80km, and 100km in a 30 km distance when using wind turbine charging for single battery. Column 1 shows charge voltage of blade length 32cm, Column 2 shows charge voltage of blade length 40cm, Column 3 shows charge current of blade length 32cm. Column 4 shows charge current of blade length 40cm. Charge voltage was bigger than 12v when car speed is higher than 60km. while the charge current is too high when car speed goes up to100km. This may course reduced battery life.

Three car speed (60 km/hr, 80 km/hr, and 100 km/hr) was continuing tested (charge effect of 40 km/hr was too low). An auxiliary battery was connected parallel with the car battery, and was charged together by wind turbine. The results show that blade length 40 cm have better charging efficiency, but a high charging current may damage the battery, therefore another battery was connected parallel to increase battery's capacity and disperse the charging current.

Column 1 shows charge voltage of blade length 32cm, Column 2 shows charge voltage of blade length 40cm, Column 3 shows charge current of blade length 32cm. Column 4 shows charge current of blade length 40cm"Fig.9". To avoid the battery over charge, a charge controller is needed. The charging voltage is insufficient for electrical system when car speed is lower than 60km. Wind turbine system can't charge to extra battery when car speed is lower than 60kilometers.

With better effect, blade length 40cm was selected for follow-up test of fuel consumption in different car speed by using engine charging (red), not using engine charging which alternator was turned off (blue), and using wind turbine charging (green) "Fig.10". It is visible that fuel consumption of wind turbine is better than car alternator in a 30 km distance. The wind turbine could charge more effectively for batteries if blade shape was well designed [6].

The experiments were accomplished in the night. A metal net surround the wind turbine blade is needed for safety. The wind turbine can have higher efficient if the weight could be decreased.

Conclusions

(1) An electromagnetic clutch mechanism was developed for switching vehicle charging system, and the wind turbine system.
(2) Experimental results revealed that proposed wind turbine system reduced the fuel consumption about15% in a 30 km-distance.
(3) Position of wind turbine mounted on front bumper of vehicle revealed high efficient.
(4) Wind turbine has speed limit.
(5) Car alternator is possible to be substituted by wind turbine at highway to reduce the fuel consumption.

Future Study

A small array wind turbine system as an auxiliary power supply for vehicle electricity system may be a possible idea.

References

[1] Grogg, Kira. "Harvesting the Wind: The Physics of Wind Turbines." Thesis. Carleton College, 2005.
[2] Using Wind Turbines on Your Electric Vehicle", http://www.gavinshoebridge.com/electric-car-conversion/using-wind-turbines-on-your-electric-vehicle/2009.
[3] Zbigniew Lubosny, "Wind Turbine Operation in Electric Power systems" Springer, 2003.
[4]. Matevosyan, J., Ackerman, T., Bolik S., Lennart, S. Comparison of international regulations for connection of wind turbines to the network. Nordic wind power conference, 1-2 march, 2004.
[5] A. Sudria, M. Chindris, A. Sumper, G. Gross, and F. Ferrer. "Wind Turbine Operation in Power Systems and Grid Connection Requirements".
[6] Wang Xudong, Wen Zhong Shen, Wei Jun Zhu, Jens Norkær Sorensen, and Chen Jin. "Shape optimization of wind turbine blades", Issue online: 16 November 2009.

Fig.1 Applications of wind turbines (website http://www.gavinshoebridge.com/electric-car-conversion/using-wind-turbines-on-your-electric-vehicle/)

Fig.2 Arrays of large turbines as wind farms (pasted from website)

Fig.3 schematic and real structure of vehicle wind turbine system

Fig.4 An anemometer and a voltmeter

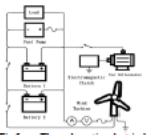

Fig.5 The schematic electrical circuit diagram of experiment.

Fig.6 a self-made blade of wind turbine.

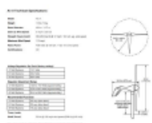

Fig.7 The specification of wind turbine.

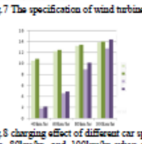

Fig.8 charging effect of different car speed in 40km/hr, 60 km/hr, 80km/hr, and 100km/hr when using wind turbine charging for single battery.

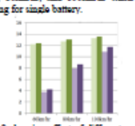

Fig.9 charging effect of different car speed in 60 km/hr, 80km/hr, and 100km/hr when using wind turbine charging for a parallel connected two batteries.

TABLE I
CHARGING EFFECT OF BLADE LENGTH 32cm WITH NO LOADING

Car speed km/hr	wind m/s	charging voltage (v)	charging current (A)
40	10.7~12.8	12.7~12.95	2.8~4.5
60	14.5~16.5	13.5~13.9	7.8~10.5
80	23.5~26.5	14.3~15.1	14.7~18.3
100	27.8~29.8	15.5~17.1	16.8~19.5

TABLE II
CHARGING EFFECT OF BLADE LENGTH 40cm WITH LOADING

Car speed km/hr	wind m/s	charging voltage (v)	charging current (A)
40	10.7~12.8	12.7~12.95	2.8~4.5
60	14.5~16.5	13.5~13.9	7.8~10.5
80	23.5~26.5	14.3~15.1	14.7~18.3
100	27.8~29.8	15.5~17.1	16.8~19.5

TABLE III
CHARGING EFFECT OF BLADE LENGTH 32cm WITH NO LOADING

Car speed km/hr	Charging voltage (v)	Charging Current (A)	Battery Voltage (v) Generator OFF	Battery voltage(v) Generator ON
40	10.2~10.8	1.2~2.4	9.8~10.2	10.1~10.5
60	12.1~12.4	3.9~5.2	9.8~10.2	12.1~12.2
80	13~13.4	7.9~10.8	9.8~10.2	12.2~12.4
100	13.7~14.1	11.2~14.3	9.8~10.2	12.2~12.4

TABLE IV
CHARGING EFFECT OF BLADE LENGTH 40cm WITH LOADING

Car speed km/hr	Charging voltage (v)	Charging Current (A)	Battery Voltage (v) Generator OFF	Battery voltage(v) Generator ON
40	10.5~11.1	1.5~2.8	9.8~10.2	10.1~10.5
60	12.3~12.6	4.2~5.6	9.8~10.2	12.1~12.3
80	13.2~13.6	8.8~11.5	9.8~10.2	12.2~12.4
100	13.8~14.2	13.5~15.2	9.8~10.2	12.2~12.4

TABLE V
CHARGING EFFECT OF WIND TURBINE FOR PARALLEL 2 BATTERIES OF BLADE LENGTH 40cm

Car speed km/hr	Charging voltage (v)	Charging Current (A)	Battery Voltage(v) Generator OFF	Battery voltage(v) Generator ON
60	12.1~12.3	3.2~4.4	10.3~10.5	12.1~12.3
80	12.6~12.9	7.1~8.8	10.3~10.5	12.2~12.3
100	13.1~13.5	9.7~12.1	10.3~10.5	12.2~12.4

TABLE V
CHARGING EFFECT OF WIND TURBINE FOR PARALLEL 2 BATTERIES OF BLADE LENGTH 40cm

Car speed km/hr	Charging voltage (v)	Charging Current (A)	Battery Voltage(v) Generator OFF	Battery voltage(v) Generator ON
60	12.3~12.5	3.7~4.8	10.3~10.5	12.2~12.3
80	12.9~13.2	7.9~9.5	10.3~10.5	12.2~12.3
100	13.3~13.8	10.6~12.9	10.3~10.5	12.2~12.4

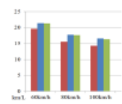

Fig.10 The comparison of fuel consumption at different car speed by using engine charge mode (red), not using engine charge mode (blue), and using wind turbine mode (green).