GREEN POWER VEHICLE RESEARCH CENTER

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1. Motivation

Research activities on vehicle development have been continued for decades. The standard transportation vehicle has become a daily tool in human society. In the beginning of vehicle history, electric vehicles existed for a short period and were replaced by the combustion engine vehicle due to their poor performance. However, due to massive use of combustion engine vehicles, critically low oil reserve levels and, most importantly, the global environment continuously worsening due to vehicle emissions, the deployment of clean energy vehicles to resolve these problems has become an important solution to the global society. Because electric vehicles can achieve promising performance due to the improvement in battery performance over the past few decades many governments are taking on aggressive projects to develop and deploy electric vehicles.

For Taiwan industry this new wave of electric vehicle development is a good chance to have a role in the auto industry. This is because Taiwan has a globally recognized ICT industry and a solid mechtronic industry. Taiwan also has an integrated battery industry. The potential for4 these industries may lead us to play an important role in electric vehicle development.

The Vehicle Engineering department has launched this Green Power Vehicle Research Center. The goal is to develop clean energy vehicle related technologies to help Tawian industry tbe globally competitive.

2. Objectives

This center uses Product Oriented research as a guiding principle for activity planning. The target vehicle platform can be indentified through collaborating with industry. By developing different clean vehicle platforms, key technologies can be developed and integrated. The objectives of this center are to become an electric vehicle innovation center, a talent pool of the clean vehicle industry and one of the Think Banks for the Taiwan Central and local governments.

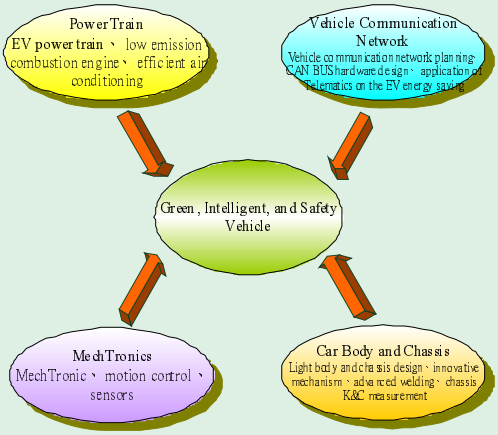

Fig. 1 Organization and activities

3. Strategies

Research development strategy

The research development strategy of this center focuses on two aspects. First, this center collaborates with other research units at the school, other global research centers and, most importantly, the industrial companies around the island to develop industrial technologies. By following the smiling curve theory, the value chain of the research activities can be completed, the target market for the developed product identified by industrial companies along with the key technologies. To evaluate the competency of the center, members of this center actively attend clean vehicle related seminars and exhibitions to collect global research activities and updated technologies.

Technologies promotion strategy

To promote the developed technologies, this center impels its members to publish research results in domestic and global research publications. This center also actively participates in different exhibitions to show the developed platforms. Finally, this center participates in different research unions to raise our visibility.

4. Organization and members

This center has four groups; mechtron-

ics, power train, body and chassis, and communication network. The power train group focuses on the development of green power trains, low emission engines and efficient air conditioning. The mechtronics group focuses on mechtronics, motion control and sensors. The body and chassis group focuses on the development of light body and chassis, innovative mechanisms, advanced welding and chassis K&C measurement. The communication network group focuses on communication network planning, CAN BUS hardware design and Telematics on EV energy saving applications.

Current members of the center include the faculties from the school's engineering college, the Metal Industry Research and Development Center (MIRDC), Institute for Information Industry (III), and several leading companies in the motorcycle, bus, power train and Telematics industries.

5. Core technologies

The developed core technologies of this center are as follows;

Green power system:design and performance analysis of green power train, low emission engine control, and design of efficient air conditioning.

Body and chassis: light body and chassis structure design and analysis, innovative mechanism development, advanced welding technology, and chassis K&C measurement technology.

Mechtronics: mechtronics technology, motion control technology, and sensor development.

Communication network: vehicle communication network planning, CAN BUS hardware design technology, and algorithm development for the application of Telematics on EV energy saving.

6. Recent projects

Development of a Multi-Purpose Intelligent Electric Utility Vehicle(supported by NSC and MEAO)

This is a joint project between this center, KYMCO, and MIRDC. The goal is to develop a next generation utility vehicle. For which, several innovative modules are developed;

A light body and chassis; total net weight is under 550Kg.

A power package; integrated motor, automatic manual transmission (AMT), and efficient CVT.

An electrical air conditioner; an efficient air conditioner with power less than 1 kW and weight less than 25 kg.

An interior heat dissipation system; use a solar system to detect the interior temperature and to actuate an electrical fan to dissipate the interior hot air to maintain the interior temperature to release the loading of AC at the starting.

A range extender; a replaceable HCCI gasoline engine to drive a 10kW generator to extend the vehicle cruising range when needed.

An energy recharging active suspension system to receive the vibration energy and transfer that energy to the battery.

A parking assistance mechanism; to automatically park the vehicle in the urban area.

The development of a light weight, high strength bus body structure (supported by MOEA)

This is a joint project between this center, bus manufactures, and MIRDC. The goals are the following;

To develop a common use body for ECE R66 regulation, to improve the safety of the bus body.

To develop a SOP for the design, analysis, and manufacturing process, to strengthen the competency of bus manufactures.

7. Research Roadmap

Between 2005 and 2009, the focuses are the development of a hybrid motorcycle, an inverse differential type hybrid system and an energy management algorithm for a hybrid sedan. Among which, the hybrid motorcycle is a joint project with KYMCO. The inverse differential type hybrid system project is supported by MOEA. The energy management algorithm is supported by ITRI. Substantial results were obtained from these projects.

Since 2008 the focuses has been on the development of two electric vehicles including the previously mentioned multi-purpose intelligent electric vehicle. The second vehicle is a tricycle with two front in-wheel motors and an engine driven rear wheel. Its power is about the size of a 500 c.c. engine vehicle. However, its fuel consumption can be 30% better than the gasoline engine vehicle. A driver assistance system is also installed on the vehicle to detect the front obstacles and roadway such that warning can be activated with a risk like lane departure is likely.

In the future, a multi-purpose agricultural green vehicle and it sustainable energy system will be the research topic. This multi-purpose agricultural green vehicle has a tractor with green power train and a trailer module for the agricultural use. A solar system will be developed to reduce the battery pack on the vehicle such that the energy and environmental impact will be sustainable. ◆