



Build the better future of Mobility



WOOSU **T**M M overview

2020 Company Profile



Content

Through Passion ,Innovation, Creativity WOOSU TMM corporation is becoming very important company in Ulsan Korea especially in business field concerned with Micro size EV and 1ton truck EV. To become a leader of micro sized EV, TMM continues to pioneer a broader world.

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CERTIFICATION



GROUP OVERVIEW

INNOVA-TIVE

Clean & Healthy

Trust

Core values

CEO	Noh Jong Sang
HQ	(44428) Jongga-ro 362-11, Green car Technology Center 903 Jung-gu, Ulsan, Korea
EV R&D CENTER	(44428) Jongga-ro 362-11, Green car Technology Center 906 Jung-gu, Ulsan, Korea
Total sales('18)	60billion
Core Technique	<ul style="list-style-type: none"> ·EV System Technology ·Lay-out Technology ·EV Manufacturing Technology ·Traction Module, Driving Module Design

DIFFERENTIAL CASE

HPD

가공

고객사 주요 적용 차종

Volvo Cars

400,000 대 / 년

CARRIER PLATE

MT82

가공

고객사 주요 적용 차종

FORD TRANSIT

4,000 대 / 년

ADAPTOR-WATER OUTLET

B-DOMC GEN1, GEN2

가공 + 조립

고객사 주요 적용 차종

SPARK AVEO

53,000 대 / 년 400,000 대 / 년

CAP-CAM SHAFT

T300

가공

고객사 주요 적용 차종

SPARK AVEO

150,000 대 / 년

BRACKET

EV Car System Design

주요 부품 선정 및 모델링

EPT PDU OBC LDC E-Comp

레이아웃 및 차체 설계

주요 부품 배치 차체 설계

Manufacture & Sales

BUSINESS DIVISION

Company Profile

▶ Main business

Automobile components

- Differential Case
- Carrier Plate
- Air Compressor

▶ Main business

Automobile components

- Control Shaft Ass'y
- Rail-Sub Ass'y Shift
- Bracket etc.,

WOOSU
AMS

WOOSU
TMM
주식회사 우수티엠엠

WOOSU
정기

Business Introduction

Through Passion ,Innovation, Creativity TMM corporation is becoming very important company in Ulsan Korea especially in business field concerned with Micro size EV and 1ton truck EV. To become a leader of micro sized EV, TMM continues to pioneer a broader world.

▶ Main business

Electric Vehicle

- Electric Vehicle development
- Micro-size Electric Vehicle
- Electric Truck
- Power train module

Milestone

2010.11

Modify EV

2012.12

Develop 1ton EV

2013.08

2018.03

Established TMM

2018.05

Micro EV kick off

2018.06

Established EV R&D Center

2018.07

Certified EV producer

2019

Proto EV Develop

2020.05

TMM is Incorporated as a subsidiary of WOOSU AMS

BUSINESS DIVISION

Planning



Experts Recruitment :

VCU Design Engineers
EV System Layout Engineers
Motor/Inverter Design Engineers

Performed In National Research Project :
Development of Micro Electric Mobility



▶ DO ▶

•Motorcycle (Under 100cc)
Development and Sales

▶ DO ▶

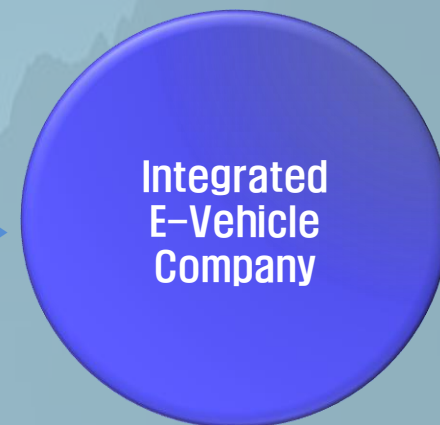
•Micro Electric Mobility Development,
Sales, and Export
▪ Micro Electric Cargo Development
and Sales

▶ DO ▶

EV module
Industry
[traction
module]

•110kW Motor/ Inverter
Development/ Sales
▪ 10kW Motor/ Inverter
Development/Sales

▶ Check ▶



ELECTRIC VEHICLE DEVELOPMENT

Micro EV on developing

- Max speed: 80km/h
- Travel Distance: 100Km
- Grade ability: 25%
- Size: 2725*1486*1557

• Joint development with Ulsan city, Ulsan Techno park



1ton Electric Truck

- Max speed: 110km/h
- Travel Distance: 120Km
- Grade ability: 25%

- Developed 1ton electric truck in 2017
- Supplied to Ulsan Techno Park
- Equipped in-house-developed motor
- produce 1ton electric truck in 2018



Avante EV

- Max speed: 120km/h
- Travel Distance: 120Km
- Grade ability: 25%

- Modify - Developed EV Avante in 2011
- Supplied to Ulsan Techno Park

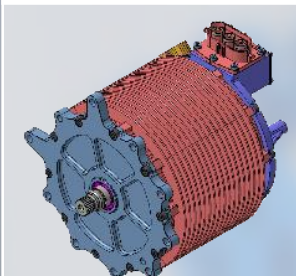


Morning EV

- Max speed: 120km/h
- Travel Distance: 120Km
- Grade ability: 25%

- Developed remodeled EV Morning in 2010
- Supplied to Jeju island
- Supplied to Ulsan Techno Park

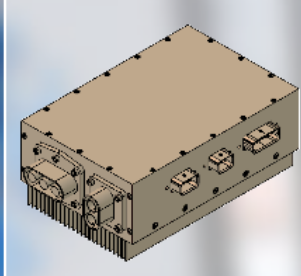




Micro EV Motor

- Capa & efficiency : 15KW, 95%
- RPM : 6000rpm
- PM motor
- Natural air-cooled

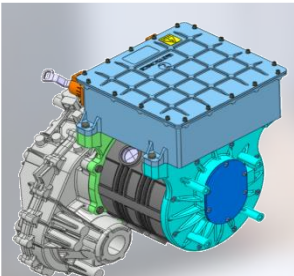
- Rotor patent application registered
- Housing patent application registered



Micro EV Inverter

- Capa & efficiency 20KW, 95%
- Operating Voltage : 60V ~ 200V
- Operating temp : -40°C ~ 125°C
- Natural air-cooled

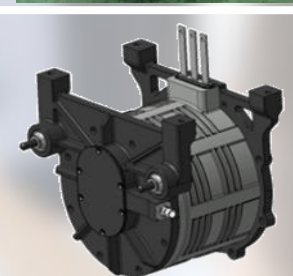
- Independent radiant heat patent application registered



EV Power train module

- Embedded motor platform
- Durability Evaluation: 500hr
- System Capacity: 110kw

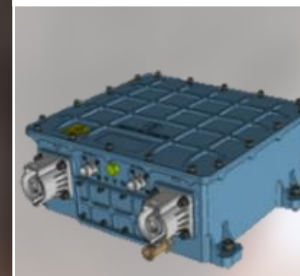
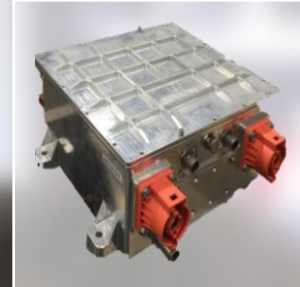
- Joint Development project
With UlsanTechnoPark
- Developed the first PM-type traction motor(100kW) in Korea



Traction Motor

- Max Output: 110kW
- Motor Efficiency: 95%
- Max rpm: 11,500rpm

- RE-EV Government Task
- Joint Development project
With UlsanTechnoPark



Inverter

- Output: 120kW
- Motor Efficiency: 96%
- Network: CAN 2.0

- RE-EV Government Task
- Joint Development project
With UlsanTechnoPark

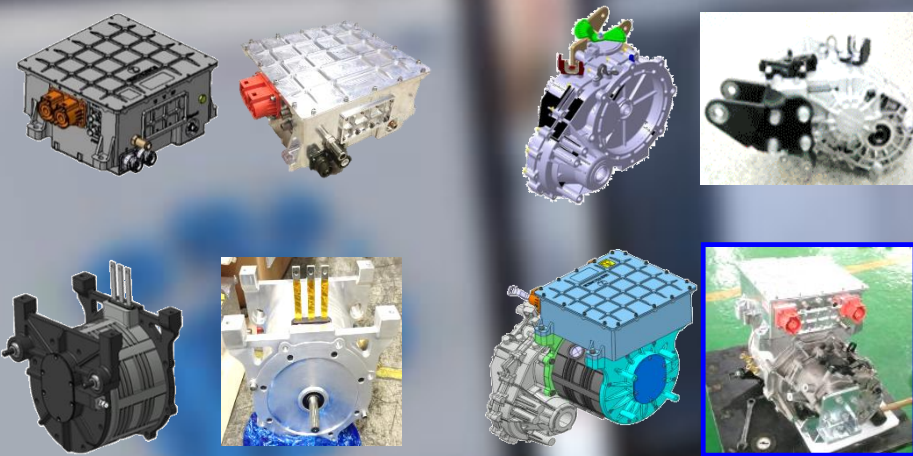


Compressor

- Output: 10kW
- Motor Efficiency: 95%
- Max rpm: 100,000/45,000rpm

- Variable Pressure, PEMFC R&D
- Joint Development project
with HMC

Watercooling 110kW Integral drive module

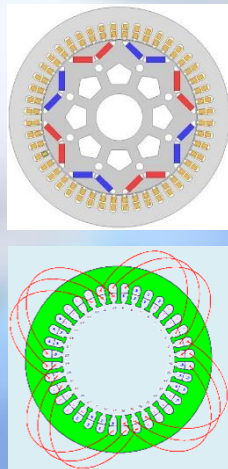


Specifications

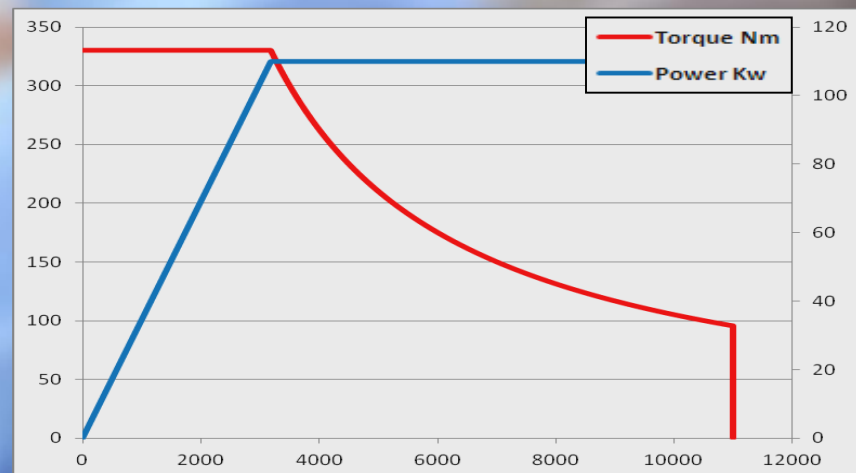
Max power capacity	110kW
Max efficiency, Torque	95%, 330Nm
Max RPM	11,000rpm
Gear ratio	9.486
Cooling Method	Watercooling
Assemble Structure	Hollow spline

Electromagnetic field analysis

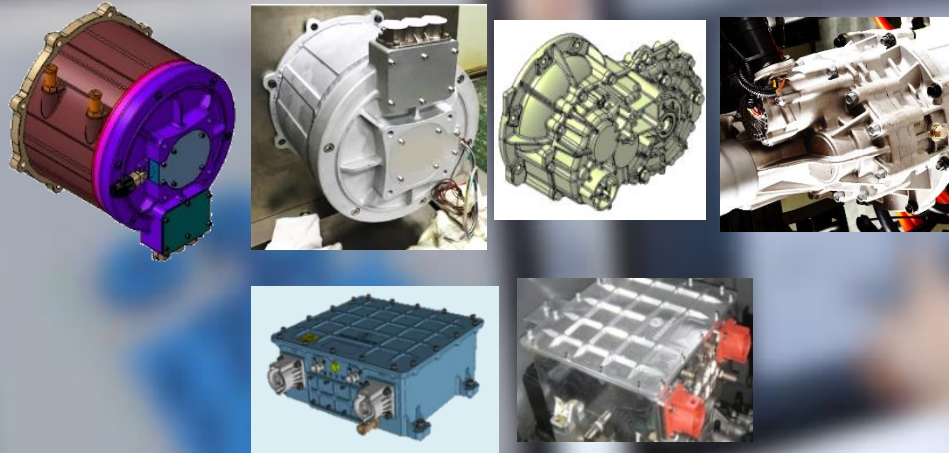
Parameter	Figure	Unit
Max. Power	110	kW
Max. Torque	330	Nm
Speed (Base / Max.)	3,180/11,000	rpm
residual voltage (Constant torque / Constant power)	270/300	V _{dc}
Current density (Max)	21.11	A/mm ²
Pole / Slot	8/48	-



T-N Curve



Watercooling 110kW Separated drive module

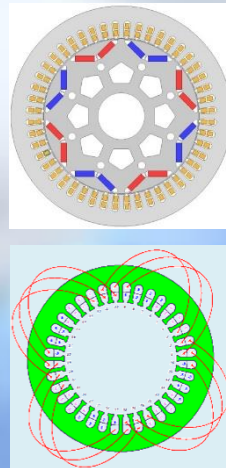


Specifications

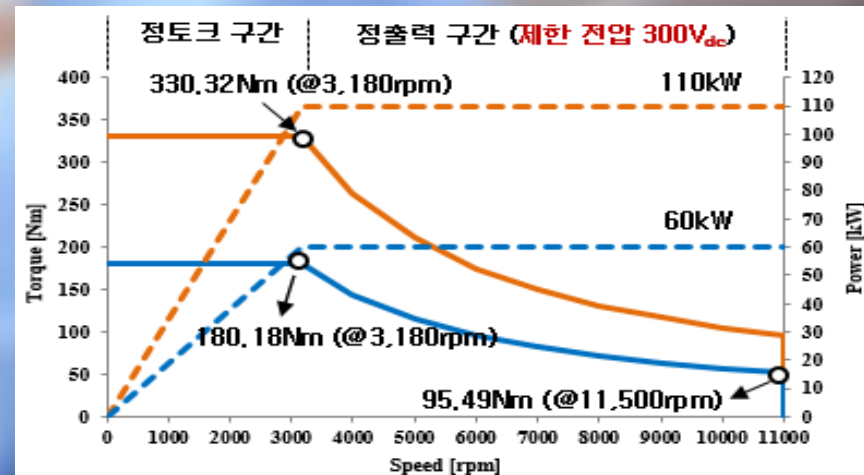
Max power capacity	110kW
Max efficiency, Torque	95%, 330Nm
Max RPM	11,500rpm
Gear ratio	9.719
Cooling Method	Watercooling
Assemble Structure	Hollow spline

Electromagnetic field analysis

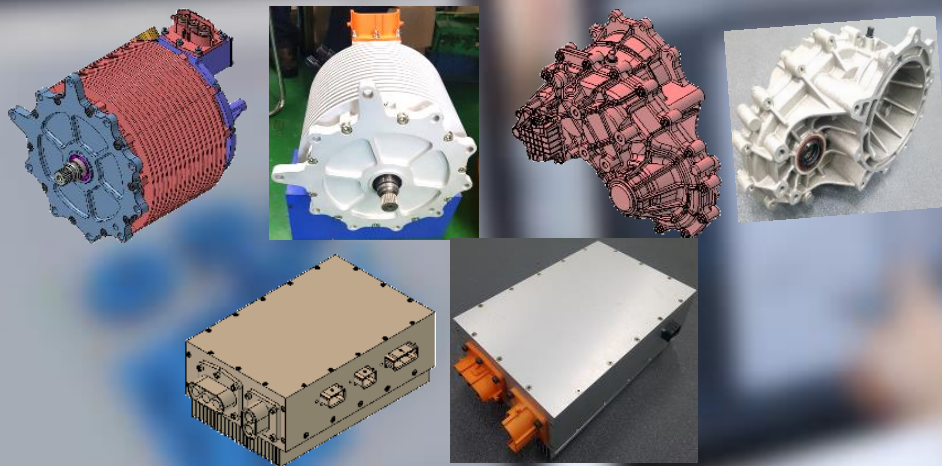
Parameter	Figure	Unit
Max. Power	110	kW
Max. Torque	330	Nm
Speed (Base / Max.)	3,180/11,500	rpm
residual voltage (Constant torque / Constant power)	270/300	V _{dc}
Current density (Max)	21.9	A/mm ²
Pole / Slot	8/48	-



T-N Curve



Aircooling 15kW Separated driving module

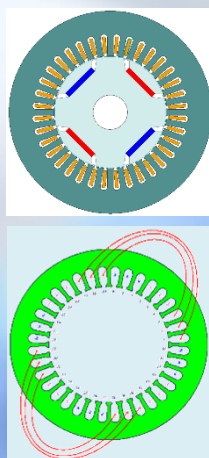


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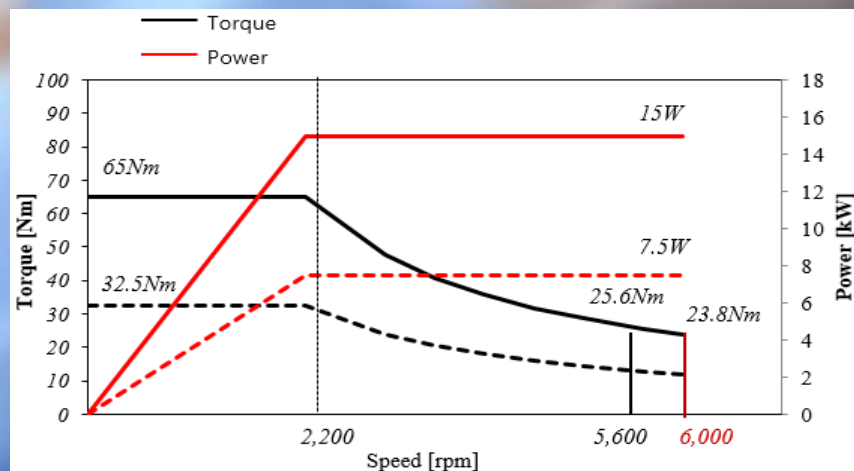
Max power capacity	15kW
Max efficiency, Torque	95%, 65Nm
Max RPM	6,000rpm
Gear ratio	8.61
Cooling Method	Air natural cooling
Assemble Structure	Spline

Electromagnetic field analysis

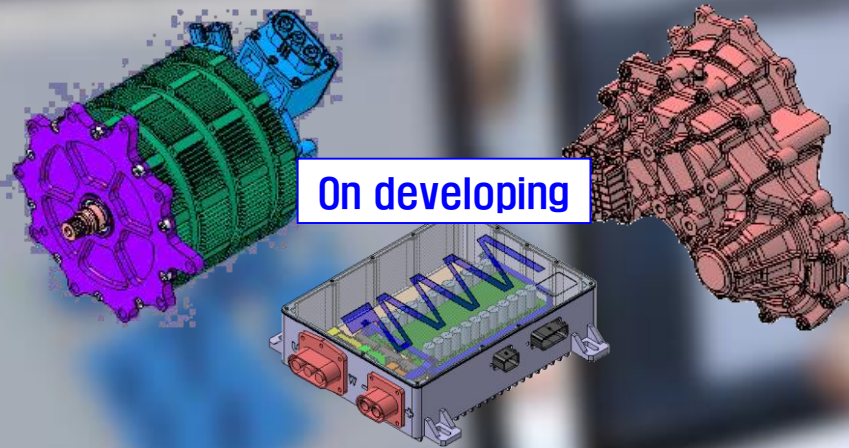
Parameter	Figure	Unit
Max. Power	15	kW
Max. Torque	65	Nm
Speed (Base / Max.)	2,200/6,000	rpm
residual voltage (Constant torque / Constant power)	60/65	V _{dc}
Current density (Max)	7.875	A/mm ²
Pole / Slot	4/36	-



T-N Curve



Aircooling 15kW Separated driving module

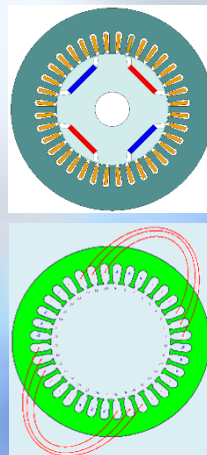


Specifications

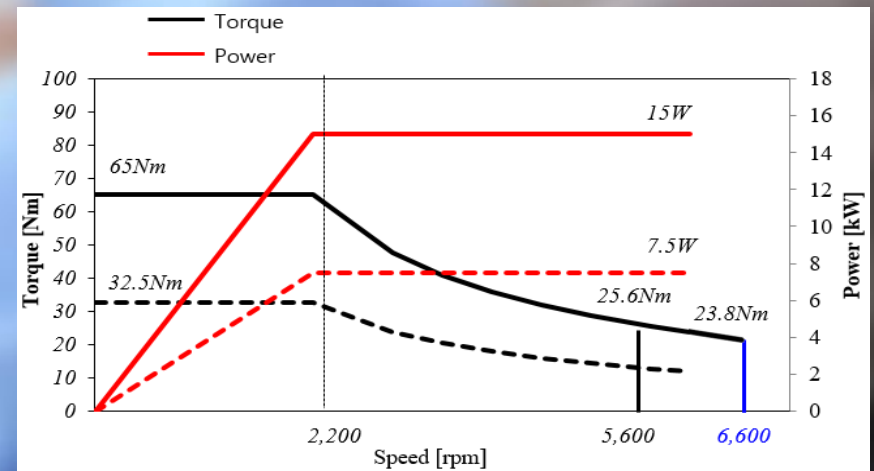
Max power capacity	15kW
Max efficiency, Torque	95%, 65Nm
Max RPM	6,600rpm
Gear ratio	9.61
Cooling Method	Air natural cooling
Assemble Structure	Spline

Electromagnetic field analysis

Parameter	Figure	Unit
Max. Power	15	kW
Max. Torque	65	Nm
Speed (Base / Max.)	2,200/6,600	rpm
residual voltage (Constant torque / Constant power)	60/65	V _{dc}
Current density (Max)	7.875	A/mm ²
Pole / Slot	4/36	-

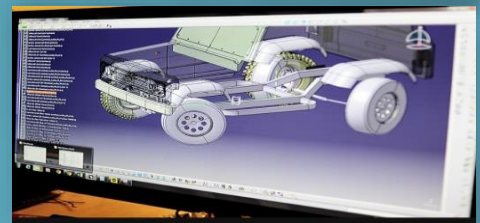
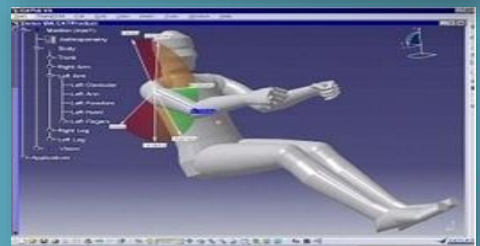
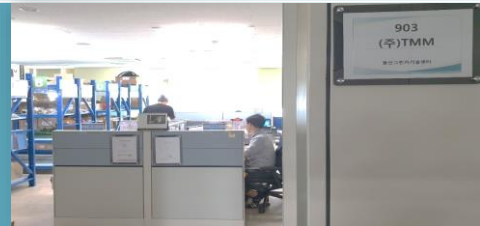


T-N Curve



Development field

TMM



Motor production line



Inverter production line



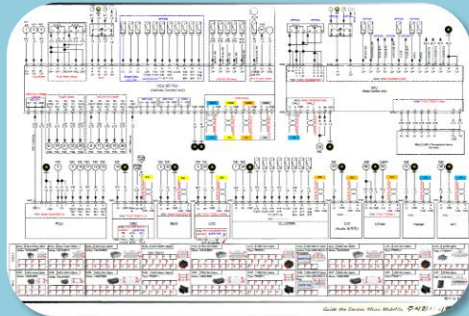
Car assembly line

Preparing

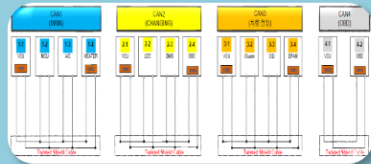


KEY TECHNOLOGY

- EV performance-design technology
- EV Wiring Harness Assembly
- CAN system

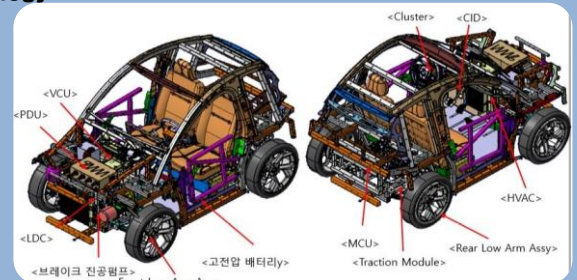


<Micro EV electrical system >



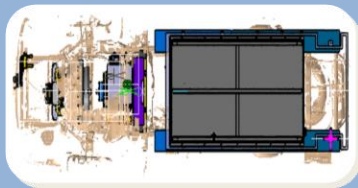
EV system design

- Center of gravity design technology
- Driving module Lay-out design
- Hardness design



<Micro EV Lay-out Design>

- Small quantity production
- Mass production
- Remodeled vehicle production



<Remodel 1Ton EV>



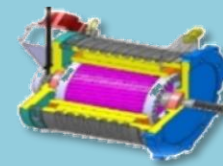
<Micro EV Rendering>



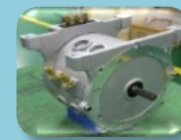
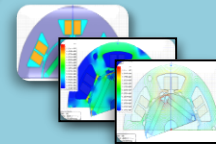
<Produce Micro EV>

EV PRODUCTION

Power train module
design&analysis



- Electromagnetic field analysis
- motor design, inverter design



<110KW Traction Module>



<9KW hydrogen car compressor>



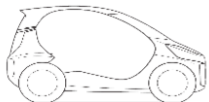
MINISTRY OF LAND

Permission to make micro size, small size Two-wheeled Vehicle



MINISTRY OF SCIENCE AND ICT(MSIT)

R&D Center CERTIFICATION



MINISTRY OF LAND

Permission to make micro size, small size, mid size Sedan, Commercial Vehicle, Truck



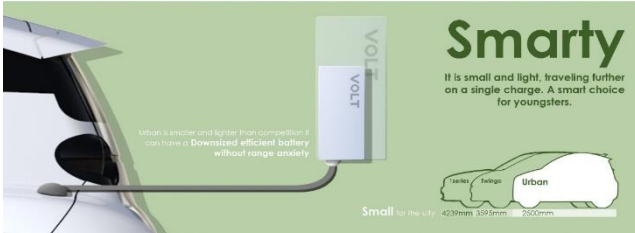
Certification and Awards

2019.09 IDEA Design award winner

Use Scene



Concept Smarty Dynamic yet Elegant



Dynamic

Urban's front graphic resembles that of a hero's mask. The driver becomes a hero behind the wheel.



Elegant

Youngsters desire that poetic elegance, like the fluttering wings of a butterfly.



Innovative Features

1. Openness

Even though the car is small, users can get openness through whole transparent door, and the opening way. Also, the door get higher space efficiency when user parks.



2. Space Efficiency

'Butterfly door' get higher space efficiency than existing door. Also, user can store suitcase and bags under the seat.



3. Easy to 3D Print

This mobility is optimized to 3D print by designing plastic foam mono-body seat and sectional exterior. User can easily customize their seat!

4. Simple and Smart

All users need to drive is just their smart phone. Through smartphone mirroring, the mobility navigates, calls and connects all the things.



Why Urban?

'Urban' is a compact size 3D printed 2 seater EV for 2020, targeting urban youngsters. It gives smart & innovative driving experience. Costing only \$8800, it is an affordable price. The 'Urban' is environmentally clean and reduces traffic problems through its compact size. The adjustable dashboard & plastic foam monobody seat greatly simplifies the structure. Also, use of polycarbonate & 3D printed materials without steel makes it very light.



WOOSU **T**M M

CLEAN & HEALTHY
Innovative leader of future automotive