E-Power Train for Personal e-Mobility Devices

Smart Vehicle Control based on
Advanced Motor Control Technology
and CAN Communication

INNOBILE

Company Introduction 01
Technology Summary 02
Products Specification 03
Products Applications 04
Cooperation plan 05

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INNOBILE CO., LTD

INNOBILE OVERVIEW

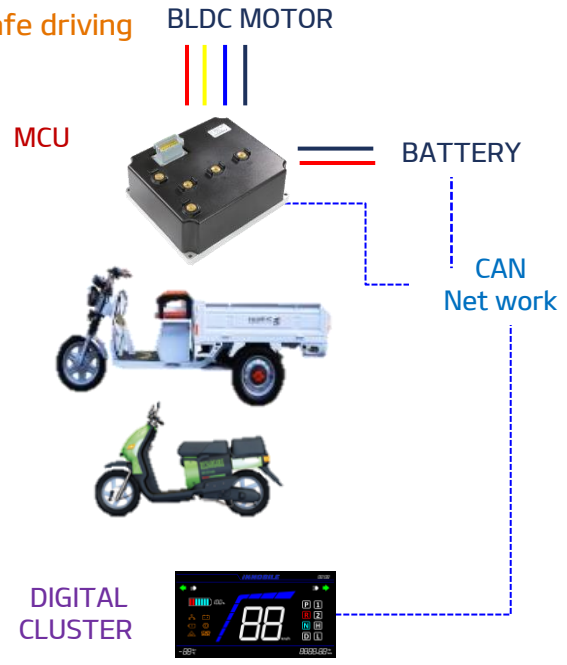
❖ Company Name	INNOBILE CO., LTD
❖ CEO	KIM TAE YONG
❖ Founded	April, 2014
❖ Address	Head Office : Room 635, 62, Seongseogongdan-ro 11-gile, Dalseo-gu, Daegu, Korea China Office : Room 612, No. 36, South Yutian Road, Jiading District, Shanghai, China
❖ Business Areas	▪ Automotive electric parts manufacture and sale ▪ General machinery electric components manufacture and sale ▪ General machinery motor parts manufacture and sale
❖ Core Technology	▪ Motor control ▪ Electronic circuit design and software development such as ECU for vehicles. ▪ Automotive communication(CAN, LIN, etc.) and Wireless communication ▪ Machinery components design
❖ Development Capabilities	▪ Electric Water Pump(EWP), Motor Controller of Automotive ▪ Electronic Parts(Cooling Fan, Electric Vacuum Pump) ▪ Personal e-Mobility e-Power Train(Motor Controller, Cluster)

Core Technology : Safe driving platform through real-time driving situation monitoring based on CAN communication.

❖ Real-time driving status cognitive solution.

- Real-time monitoring of a series of driving situations such as below
  : Power on -> Driver, speed up/down.-> stop -> power off
- Support safe driving as a countermeasure in the event of a vehicle abnormality.
  -> Protecting the vehicle system by protecting against overvoltage and overcurrent.
  -> Prevent accidents by sharing driver information on abnormal conditions.
  -> Support safe driving (speed limit, etc.) by engaging in actual driving.
  - Easy defect identification. - A/S response glass.

- Identifying driving information such as system power, acceleration and deceleration, and stopping.
- Check motor and battery information.
- Countermeasures for safe driving



- Display of vehicle driving-related information.
- Check for abnormalities in various input/output channels.
- Show a warning about abnormal conditions.

Products Summary

Item	Product Picture	Product Features	Specification	Remark
Motor Control Unit (MCU) (IBMC6040-SDTZ)		▪ Rated power 4kW(Maximum 8kW) BLDC motor controller ▪ Trapezoidal control ▪ Self-diagnosis and display - Overvoltage, overcurrent, overload ▪ Non-slip at heavy gradient	▪ Input voltage range : 42 ~ 86V ▪ Rated / Maximum current : 80A / 150A(30sec) ▪ Rated / Maximum power : 4kW / 8kW ▪ Communication : CAN2.0A), UART ▪ Operating temperature : -20 ~ 85℃ **(Based on IBMC6040-SDTZ)**	▪ Internal structure CPU Inverter Power **- Inverter and power module: Common according to output** **- CPU Module: Change according to SW Controller Act**
Digital Cluster		▪ Customizing User-Interface ▪ Battery remaining capacity with 10 columns ▪ Various information -> Vehicle system error, voltage, current -> Mileage, driving time and vehicle identification number	▪ Input voltage range : 9 ~ 18V(12V) ▪ PCB 4layers ▪ Power consumption : 50W ▪ Communication : CAN2.0A (500kbps) ▪ EX_IO : 8bit Input / 16bit Output	▪ Active view area (mm) : 108 x 61
Vehicle Control Unit (VCU)		▪ Vehicle system control based on CAN communication with cluster, MCU and BMS ▪ Regenerative braking, charging control ▪ Vehicle driving status measurement based on IMU	▪ Input voltage range : 9 ~ 18V(12V) ▪ Standby current : 100mA ▪ DI/O : Input 16ch / Output 16ch ▪ Analogue input : 8ch ▪ PWM output : 4ch ▪ Communication : CAN2.0A, SPI, I2C	▪ High-tier vehicle controller for micro-EV
Body Control Unit (BCU)		▪ Vehicle input and output signal processing -> Left and right indication -> Forward and backward -> Speed regulation and braking ▪ CAN Communication -> Easy to identify the causes of I/O errors	▪ Input voltage range : 9 ~ 18V(12V) ▪ Power consumption : 50W ▪ Process time : 10ms ▪ Communication : CAN2.0A (500kbps) ▪ DI/O : Input 12ch / Output 12ch ▪ AI/O : ADC 12bits / 6ch	▪ Basic body controller for two-wheel electric bikes, three and four-wheel electric vehicles
Network Driver (NWD)		▪ Customizing according to customer specifications.	▪ BLE 4.2 OR 5.0, LTE-CAT/MI, GPS ▪ CPU : Cortex-M3 (120MHz) ▪ CAN : 2ch (2.0A, 2.0B)	▪ Customer's vehicle installation test.
DC-DC Converter		▪ 150W grade high frequency transformer ▪ Converter circuit PUSH-PULL topology ▪ Protection functions	▪ Voltage range : 40~96V ▪ Rated / Maximum current : 10A / 15A ▪ Control : Half-Bridge PWM ▪ Protection : Over-Voltage, Over-Current, Over-heat	▪ Release sample on 21 Q4.

Motor Control Unit (MCU) Specification

❖ Highlights

Performance	Description
Applications	▪ Driving motor control for e-mobility and micro-mobility vehicles
Features	▪ Hardware design following automotive electronic parts standard(main electronic components by automotive grade) ▪ High-efficiency motor control : 90% ↑ (Sinusoidal), 85% ↑ (Trapezoidal) ▪ Vector control for sinusoidal motor control : FOC (Field Oriented Control) - Self-developed encoder based torque control, speed control, position control
Functions	▪ System fault diagnosis and display (connection with cluster) : A/S convenience ▪ Self-inspection and countermeasure : overvoltage, overcurrent, overload ▪ Safe driving : non-slip at heavy gradient, speed control for downhill ▪ Regenerative braking, charging

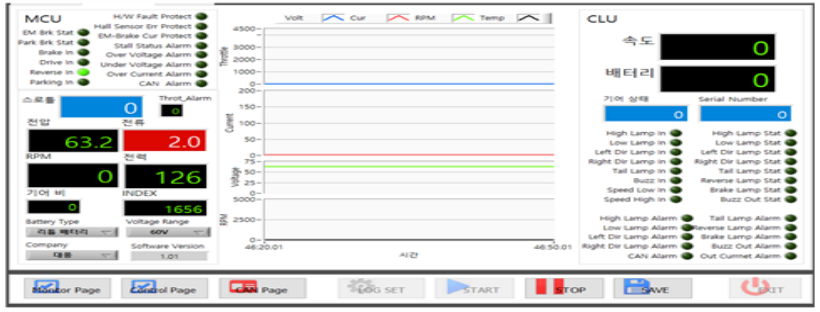
❖ Specification

Product Name	IBMC2402-ENSS	IBMC6040-SDTZ IBMC6040-ENSS	IBMC7240-SDTZ IBMC7240-ENSS	IBMC7275-SDTZ IBMC7275-ENSS	IBMC4415-ENSS
Rated Power	200W	2.5kW	4kW	7.5kW	15kW
Rated Voltage	24V	48V / 60V	48V / 60V	60V / 72V	144V
Input Voltage Range	18V~29V	42V~86V	42V~86V	60V / 84V	120V / 180V
Rated Current	15A	50A / 42A	80A / 65A	130A / 100A	120A / 100A
Maximum Current	30A	100A / 85A	150A / 130A	250A / 200A	250A / 200A
Operating Temperature	-20℃~85℃	←	←	←	←
Storage Temperature	-40℃~120℃	←	←	←	←
Motor Control	Trapezoidal	Trapezoidal Sinusoidal	Trapezoidal Sinusoidal	Trapezoidal Sinusoidal	Sinusoidal
Communication	CAN 2.0A	←	←	←	←

Vehicle Driving Safety and Optimization System

❖ Vehicle Monitoring Program

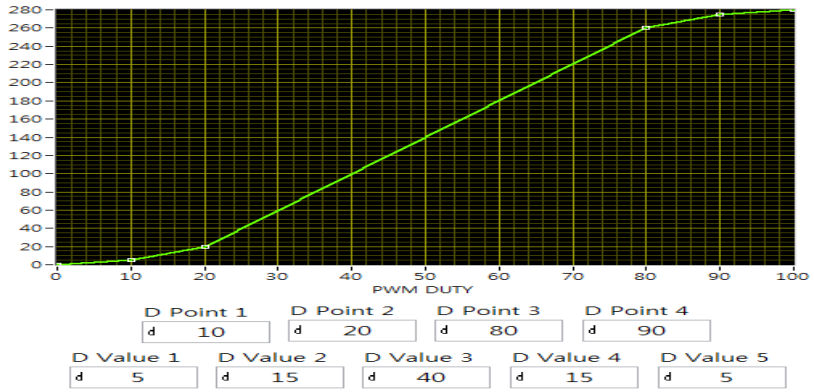
- **Based on vehicle inside communication, monitoring real-time status**
  - **Monitoring Driving information**
  - **Checking Digital cluster operation**
  - **Battery remaining capacity**
  - **Motor and Inverter status such as voltage, current**
  - **Alarm vehicle error and take safety action**
  - **Easy to find out the error at A/S service**



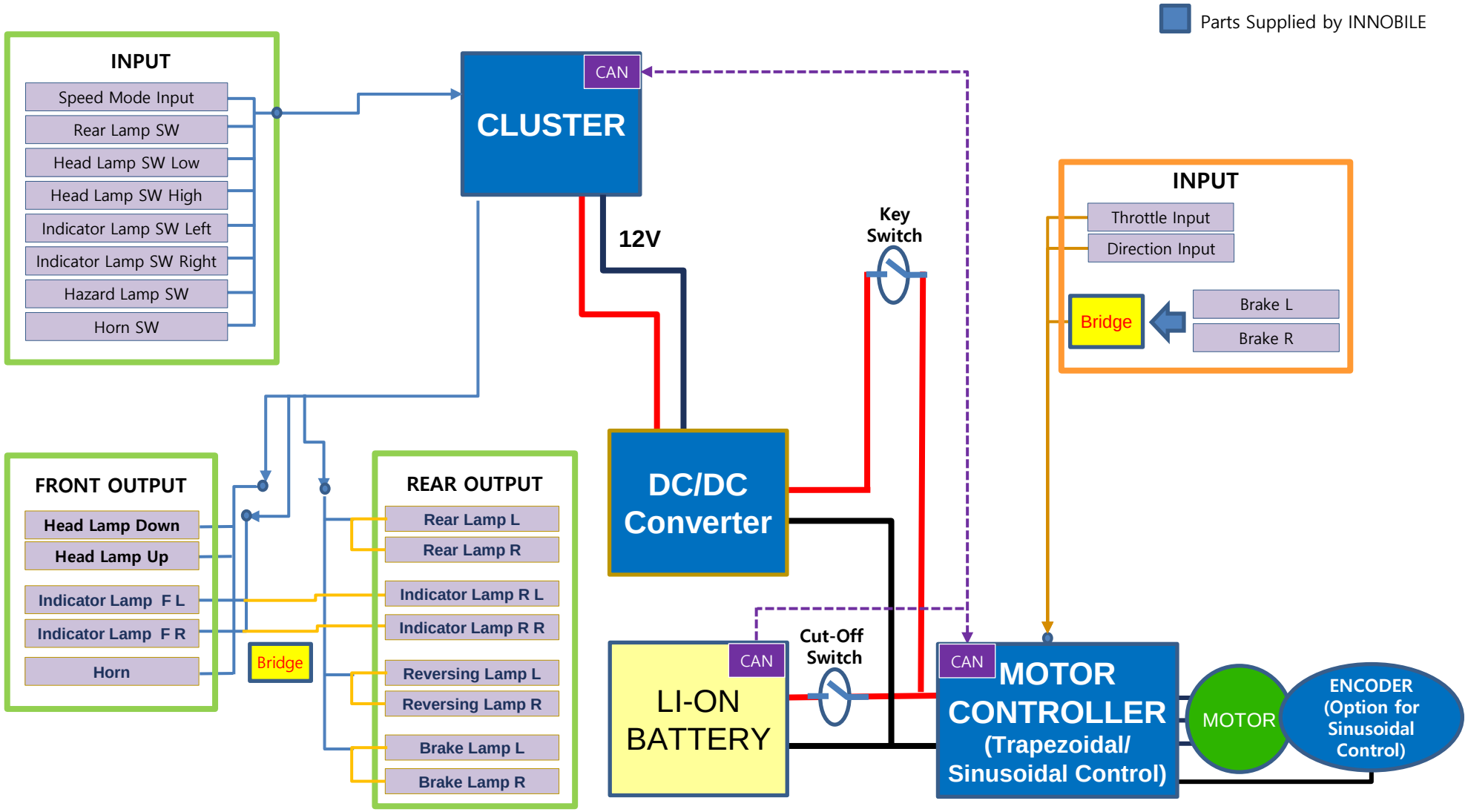
	Division	Requirements	Description
구동 제어	Status	Motor RPM	모터 RPM 상태
	Status	Battery Voltage	배터리 전압 상태
	Status	Load Current	부하 전류 상태
	Analog Input	Throttle Input	가속 스로틀 입력 신호 스로틀 입력 : ADC 0 ~ 5V / 0 ~ 1024
	Input	Parking Brake Input Switch Signal	주차 브레이크 입력
	Input	Drive Mode Input Switch Signal	신호 0 -> D 스위치 입력 상태
	Input	Reverse Mode Input Switch Signal	신호 1 -> R 스위치 입력 상태
	Output	EM_Brake Status Signal	EM 브레이크 출력 상태
		Parking Brake Status Signal	주차 브레이크 출력 상태
		Gear Ratio	감속기 기어비
		Motor Index Count Value	모터 반바퀴 돌때마다 Count 하여 출력

❖ Vehicle Option Tool

- **Driving mode set-up**
  - **Change and set up start, accelerating pattern**
  - **Upon vehicle system, optimization driving condition**
    -> Motor, Battery and Inverter
  - **Various kinds of driving option**

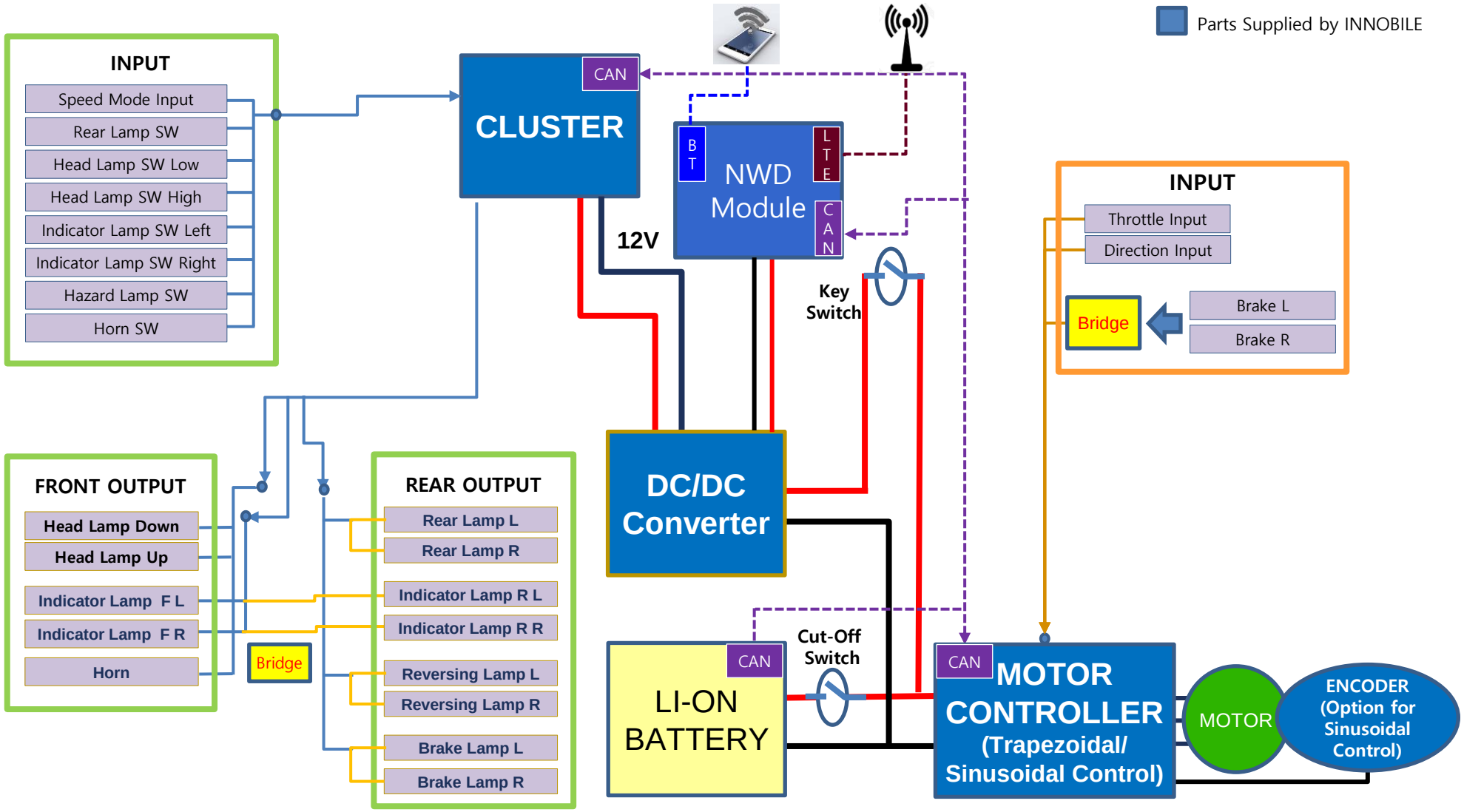


CAN-based Cluster System: 2 and 3~4 Wheel Electric Vehicles (Standalone)



**. Illustration : Above system is based on Lithium-ion Battery.
CAN Communication is not applied for Lead Acid Battery system.

CAN-based Cluster System: 2 and 3~4 Wheel Electric Vehicles (Connected)



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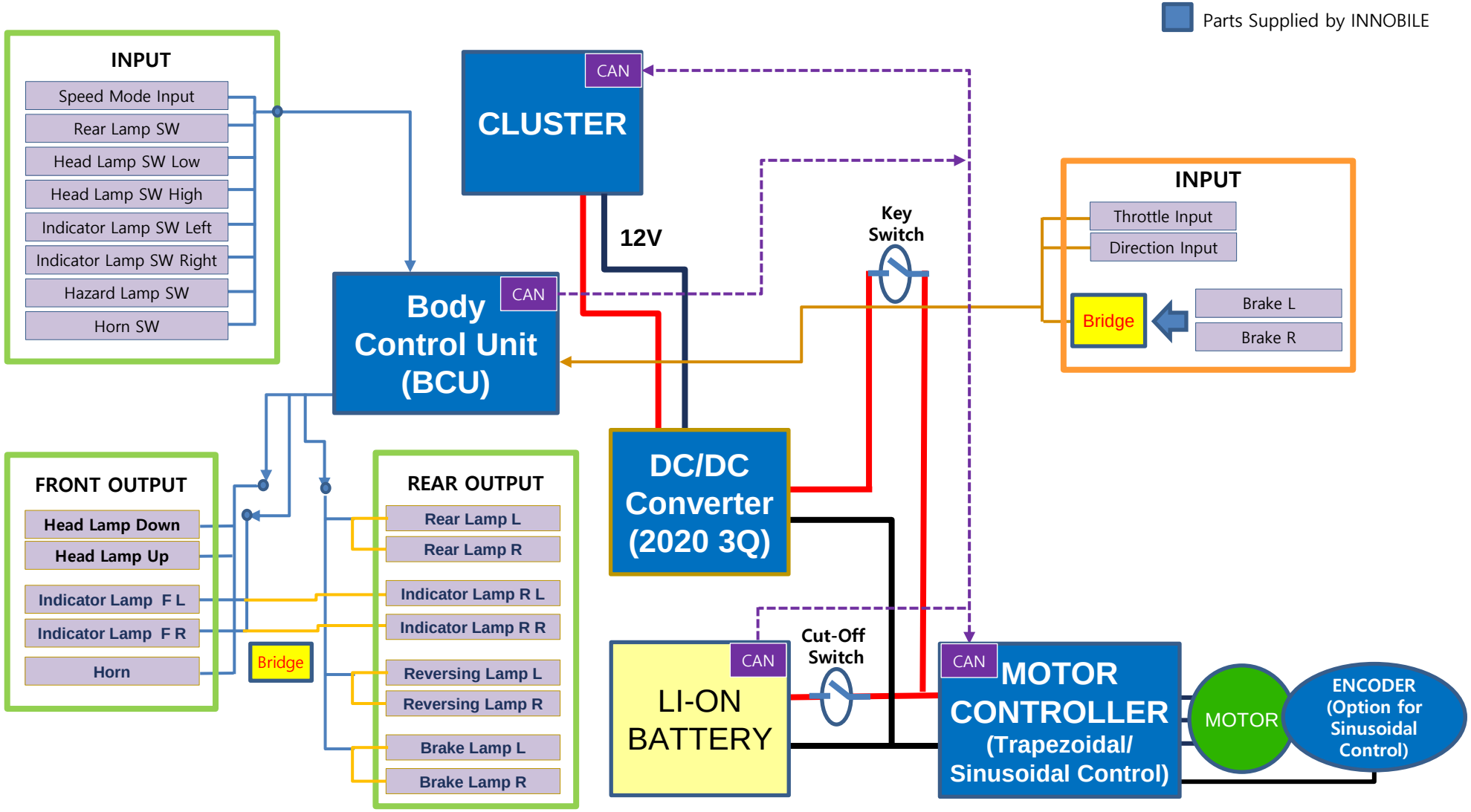
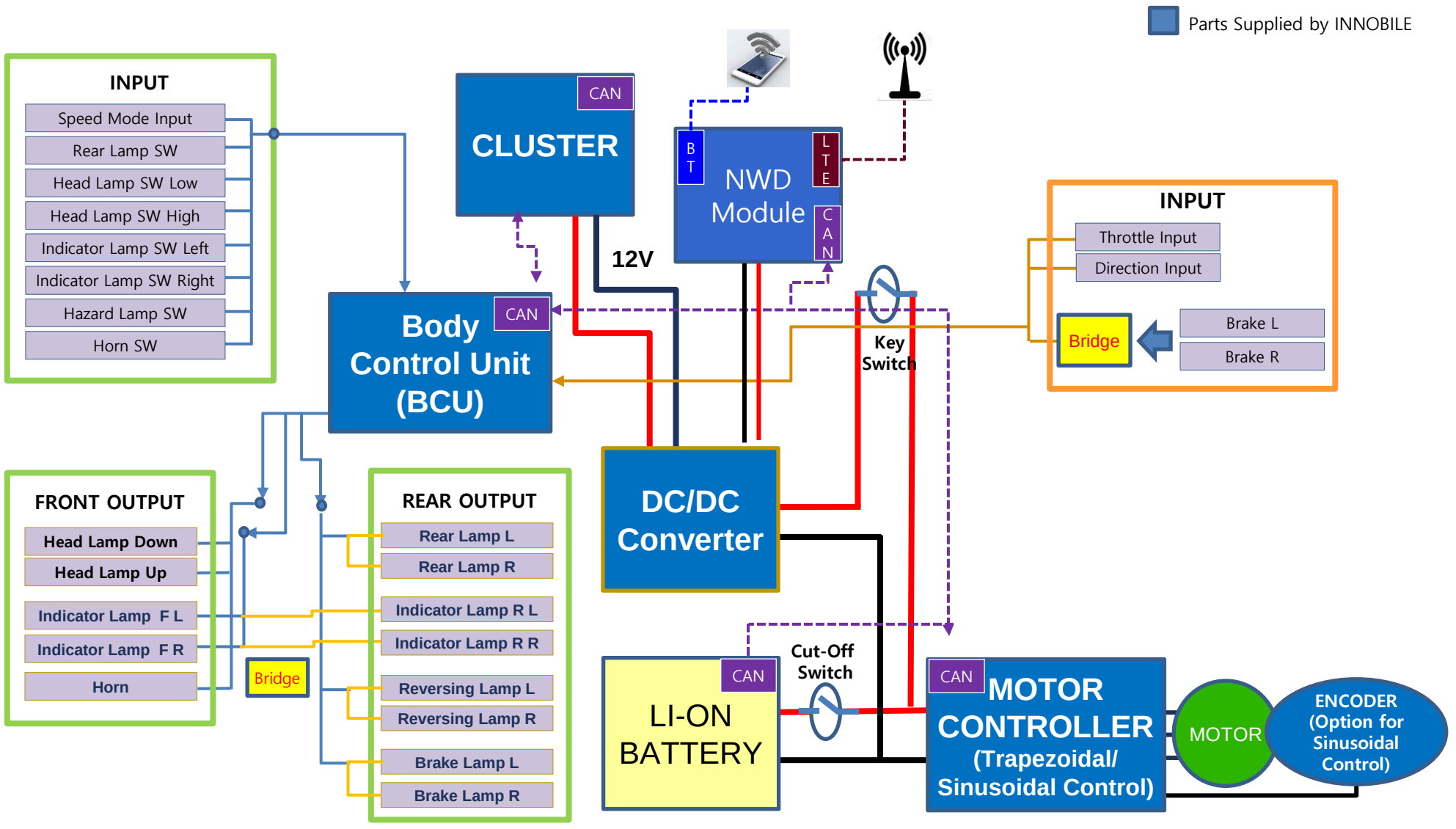
CAN-based Body Control System : 2 and 3~4 Wheel Electric Vehicles (Standalone)



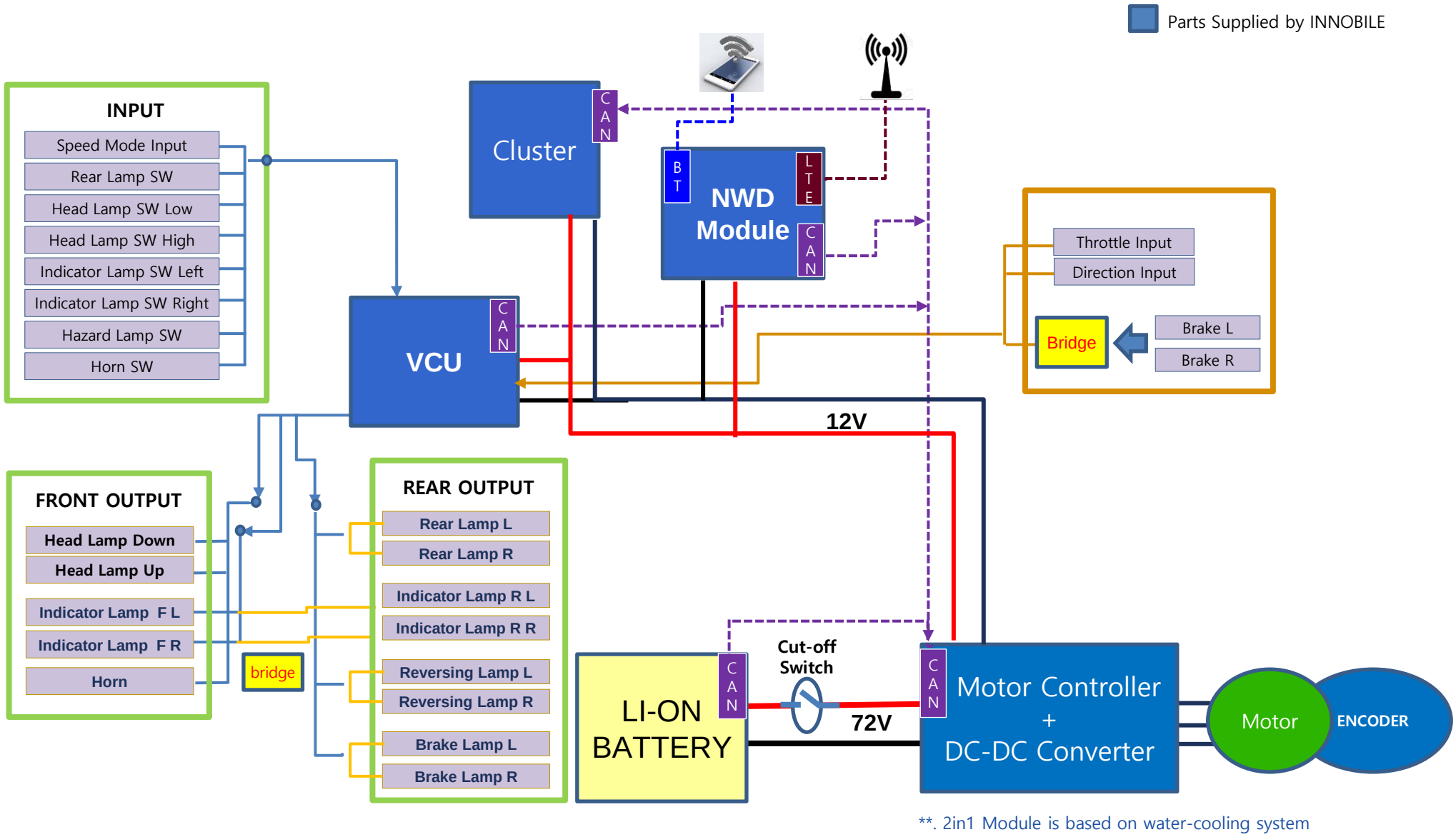
**. Illustration : Above system is based on Lithium-ion Battery.
CAN Communication is not applied for battery and motor controller in Lead Acid Battery system.

CAN-based Body Control System : 2 and 3~4 Wheel Electric Vehicles (Connected)



**. Illustration : Above system is based on Lithium-ion Battery.
CAN Communication is not applied for battery and motor controller in Lead Acid Battery system.

CAN-based 2 in 1 System : Micro EV (Standalone or Connected)



**. 2in1 Module is based on water-cooling system

Customized development system.

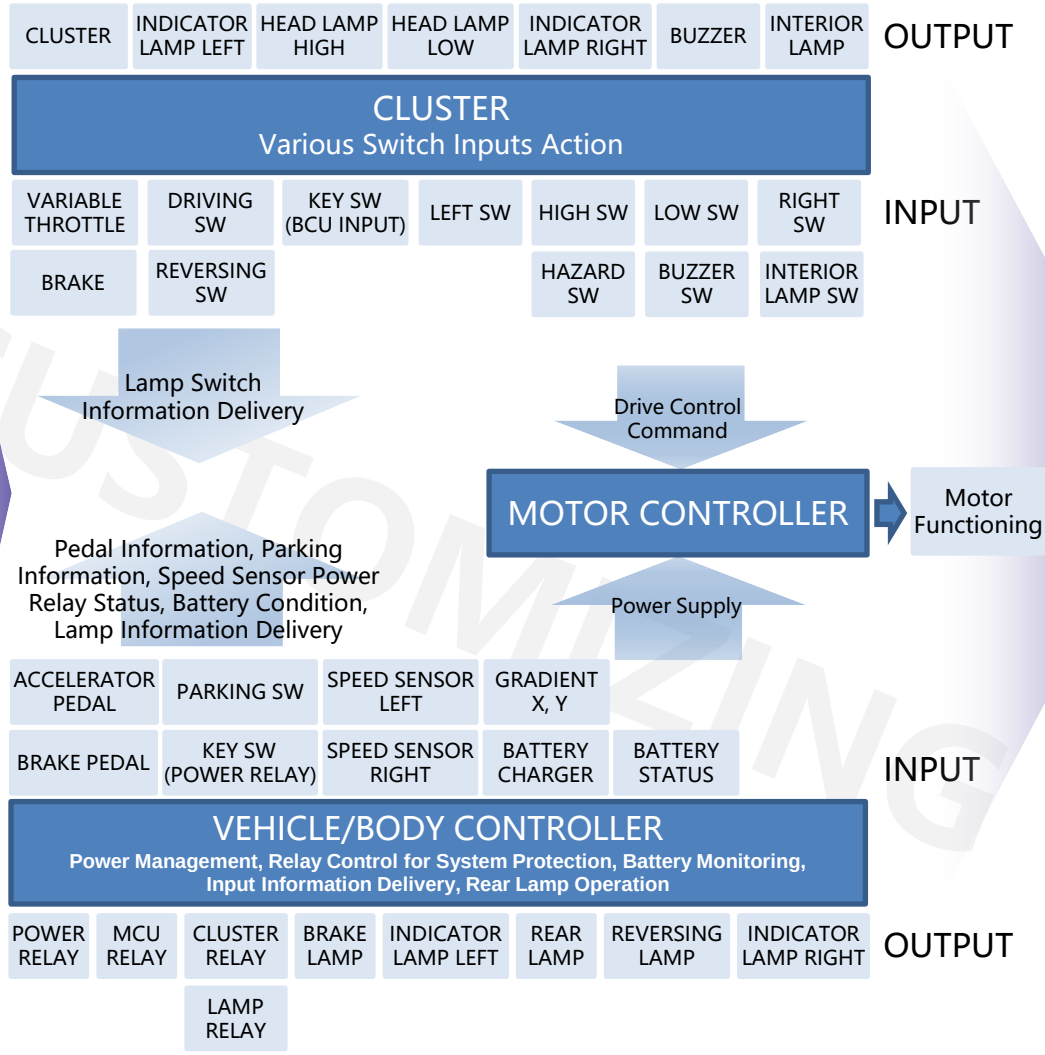
Vehicle Types
Electric Two-Wheel Vehicle
Micro-EV

Motor Classification
Motor Power
Motor Types

Battery
Lead Acid Battery
Lithium-ion Battery

Communication System
CAN
Others

Other Functions
Multimedia
Cluster
Communication module



CUSTOMIZING

THANK YOU