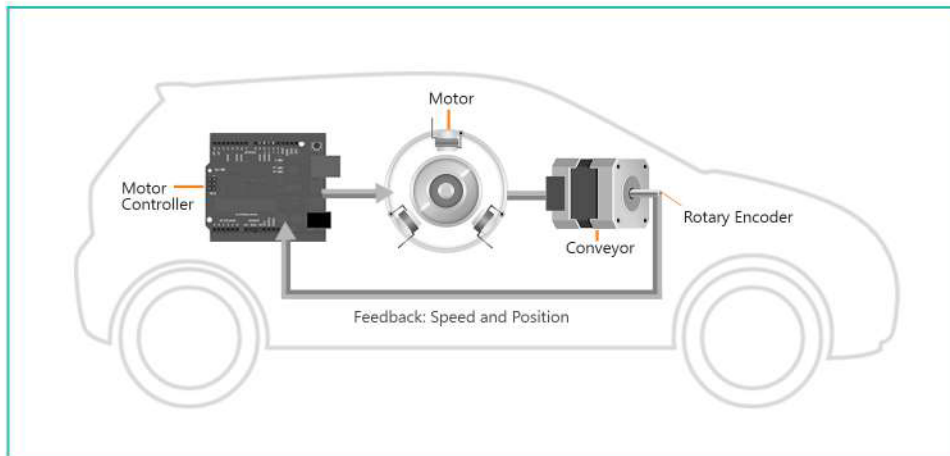




Leverage our Reference Design Solution for Motor Controller Development

Speed-to-market with our Reference Design Solution. Partner with our domain experts and engineering team to custom-build Brushless DC Motor Controller and PMSM Motor Control solutions for your Automotive Production Programs.

We can also partner for the development of motor control design solutions for other motors like AC Induction motor, Stepper motors etc.

Here is an indicative list of Automotive Applications, for which we have delivered Motor Control solutions:

- HVAC System
- Seating Control
- Electronic Power Steering

Motor Control System Use Cases and Applications

Automobiles are also called 'motor' vehicles for a reason! Automobiles have evolved and so have the motors.

Electric Motors , along with the Motor Control System, find application in numerous automotive systems.

The most crucial ones are:

- Electric Vehicle Drivetrain
- Anti-lock braking system
- Electronic Power Steering
- Modern HVAC systems
- Body Control Modules
- Smart Actuators in Turbo Chargers and more..

We have the domain and tool expertise, to develop motor control solutions for all of these automotive systems.

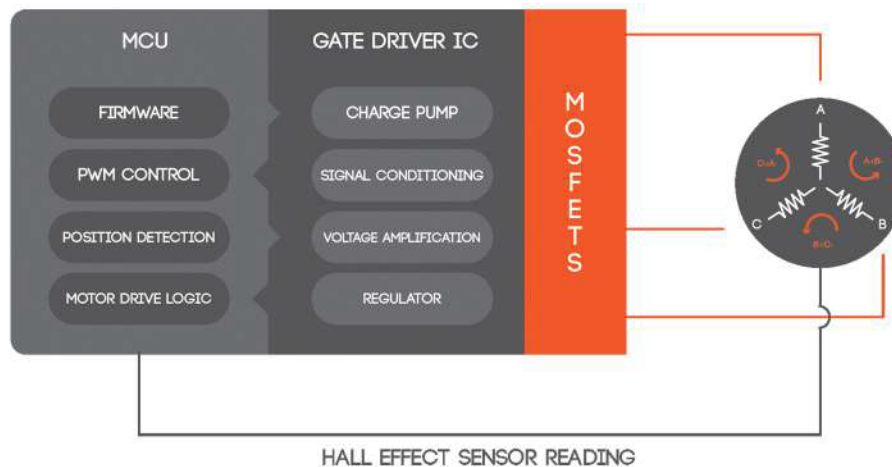
Salient Features

Our reference design of the Motor Control System has some built-in hardware, software and diagnostics features. However, there is always scope for addition of project-specific features.

A few Salient Features of our Motor Control System:

- Developed using Model Based Development Approach
- ISO 26262 Mandated Functional Safety Compliant
- Both Sensor-less and HALL effect sensor equipped
- AUTOSAR, Non-AUTOSAR and Partial AUTOSAR Compliant options available
- Equipped with algorithms- FOC, PWM, Speed Regulation, Soft Start/Stop and more

Motor Controller Solution Architecture



A Typical Motor Controller Comprises:

- **Hardware Modules:**
 - Microcontroller Unit
 - Gate Driver IC
 - MOSFETS
- **Software Modules:**
 - Motor Drive Logic
 - Field Oriented Control (FOC)
 - Diagnostics algorithms like over/under current protection and more

Software and Hardware Services for Motor Control System

1 Hardware Design and Consulting Services

Our hardware team will provide Consulting Services in order to evaluate hardware components such as:

- Microcontroller
- Torque & Angle Sensors

- HALL Effect sensors
- Gate Driver IC
- Temperature Sensors
- Pre-driver Components
- H-Bridge (MOSFETs)

We also provide end-to-end support for **automotive grade hardware development** as well as **EM and Thermal Analysis** of the hardware.

2 MCAL and Base Software (BSW) Layer Development

Microcontroller Abstraction Layer accesses the peripheral modules and the external devices mapped to the microcontroller. Its primary responsibility is to make the upper application layer independent of the MCU.

BSW is the collection of software that helps define a particular s/w functionality of the control unit.

Services include:

- Development of Low level drivers such as ADC,MCU,SPI,I2C,PWM,ICU,and NVM
- CAN and LIN Driver development
- Off Board Diagnostics (UDS, J1939 etc.)
- AUTOSAR compliant BSW development
- Fault Code Memory mapping
- Integration of Safety Mechanisms as per ISO 26262
- Hardware Abstraction Layer development

3 Application Software & Motor Control Algorithm Development

These algorithms are responsible to drive the motor as required by the automotive application. For example, **direction control algorithm** helps alter the direction of motor's driving force.

We have expertise in the following motor drive algorithms:

- Speed Regulation
- Pulse Width Modulator (PWM)
- Current Regulation
- Field-oriented Control (FOC)
- Proportional Integral Derivative Controller
- Direction control
- Soft Start/Stop
- Software Start/Stop

Ready-to-deploy & re-usable software stacks and Bootloader solutions for **in-vehicle communication** and diagnostics (CAN, LIN, UDS, KWP2000, Serial, BT)

4 ISO 26262, AUTOSAR and MISRA Compliant Motor Control Development

- AUTOSAR, ISO 26262, MATLAB and MISRA based application software development
- Safety Lifecycle as per the ISO 26262 Guidelines in parallel with the regular SDLC
- Support for required ASIL compliance
- Validation and Test report for ASIL compliance

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