



Company Information

Company Name	<i>GKN Automotive</i>	Date Submitted	<i>04/12/2021</i>
Project Title	<i>Design of a Modular Mechanical Data Acquisition System for Assembly Stations (GKN_DATA)</i>	Planned Starting Semester	<i>Fall 2021</i>

Senior Design Project Description

Personnel

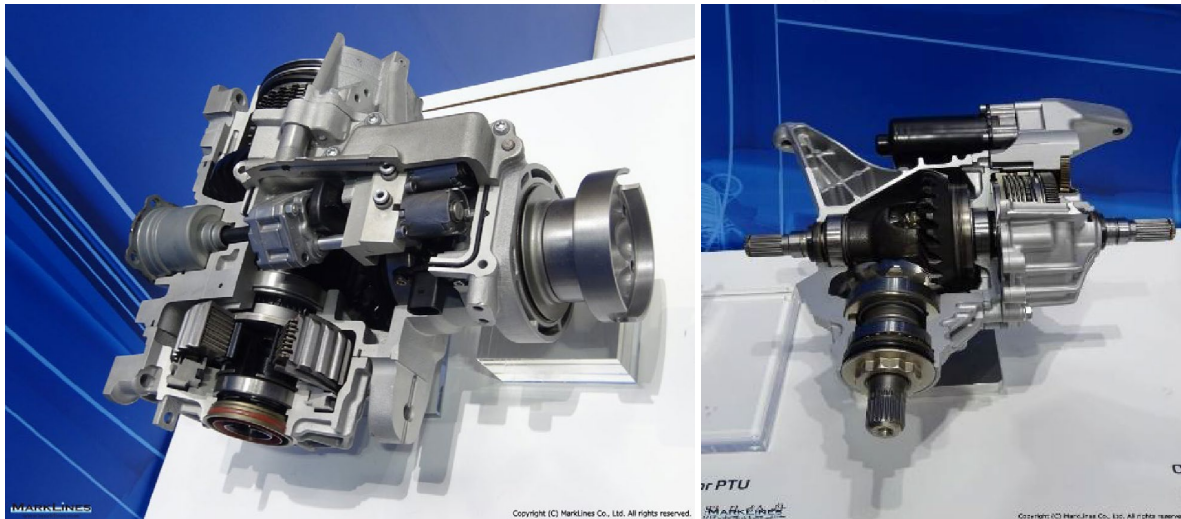
Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	1	Electrical	2
Computer	2	Systems	1
Other ()			

Company and Project Overview:

GKN ePowertrain, Newton NC is a leader in Tier 1 automotive differential assembly and component manufacturing. There are 2 plants on the Newton site. Plant 1 is the machining facility where differential ring and pinions are generated and manufactured. Plant 2 is the assembly plant. With 13 assembly lines and 4 major products it is a lean and diverse facility. The four main products that are manufactured are RDM (Rear Drive Module), FDU (Front Drive Unit), PTU (Power Transmission Unit), and Hydraulic disconnect clutches. With each of these units there are variants of clutch engagement and differential gear ratio, up to 18 variants per product, per customer. Some product examples:



GKN is an industry leader in differential product development and engineering. In order to continue this leadership, GKN is moving into IoT and advance machine analytics. This project will be to develop a modular, micro-computer based machine data acquisition system for validation on one station on the C1-PTU line.

Project Requirements:

The system for machine data acquisition (MDA) will be used for determination of station failures in assembly process, machine failures or process irregularities on Station 190 on C1 PTU line. (see Figure 1.)

Left

Front

Right



Figure 1 – Station 190

This station presses a clip and seal onto a shaft and it is typical of the type of assembly stations in Plant 2. Station 190 will be used to do validation testing for the project prototype, but the design must be modular, so that it can be implemented for any of the assembly stations in the factory. The MDA system will be designed so that it can collect, communicate and display information about the work cell conditions. These conditions will be used to correlate to machine output results for trend and effect analysis to improve product yield and quality. It will be easily to fit into any of the cells, have the option for battery power and have a user screen interface to display data collected in various formats.

Measurement requirements:

Measurements that are required to be collected are humidity, ambient temperature and vibration and sound.

Analysis requirements:

Data should be organized into graphical plots for quick and easy analysis by line Engineer when required.

Data access:

Micro computer will be accessible via Wi-Fi or Bluetooth for quick access without interference with assembly line. Data logging provision for required data and long term storage.

Mounting requirements:

This project will use a micro-computer to collect data based on a series of sensors. Students will have to develop a modular system to easily install with minimal interference to assembly line. Downtime requirement should be held to a minimum, therefore system will to be modular in terms mounting sensors and main computer.

Sensor requirements:

Wiring/quick change:

Installation of sensors into system should be quick and easy with minimal interference to system if a sensor fails in the “field”. The sensors are to be quick change wiring based on DIN standard for connections.

Mounting:

Sensor should be as close to process point of action without interference with assembly process or line operator. Mounting system for sensor will be modular to allow for versatile integration into the stations.

Unit Requirements:

Power: Must be able to run on electrical power in the cell or battery power if its not available.

Service: Must be quick and easy to replace any failed parts

Must be designed to withstand industrial environment

Expected Deliverables/Results:

- 1 complete assembled unit ready for station integration and validation testing.

To include supporting documentation:

- BOM
 - Micro-computer requirements
 - HMI requirements
 - Modular mounting case micro-computer
 - Prints for mounting case
 - Sensor specifications
 - Modular mounting system for sensors
 - Print for mounting system sensors
 - Sensor connections
- Wiring diagram for micro-computer to sensors.
- Sensor wiring diagram prints
- Programming for Graphical User Interface and data analysis with detailed pictorial (screen grabs) instructions

Disposition of Deliverables at the End of the Project:

GKN will plan to pick up complete unit to include hardware and software after Expo

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- 3d modeling
- 3d printing
- Print development
- Electrical controls
- Electrical wiring
- Electrical schematics
- Design for manufacturing
- C++ programming language
- Python programming language
- System Engineering - Data Analytics
- Data statistics
- Travel to GKN facility in Newton will be required to canvas assembly stations to be able to gather design requirement data and understand the modular requirements. Travel for validation testing will be required as well.