**DESIGN AND IMPLEMENTATION OF A TELEMETRY AND DISPLAY SYSTEM FOR MOTORSPORT APPLICATIONS USING CONTROLLER AREA NETWORK COMMUNICATION**

*An Undergraduate Project Report submitted to Manipal University*

*Submitted by*

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**INTRODUCTION**

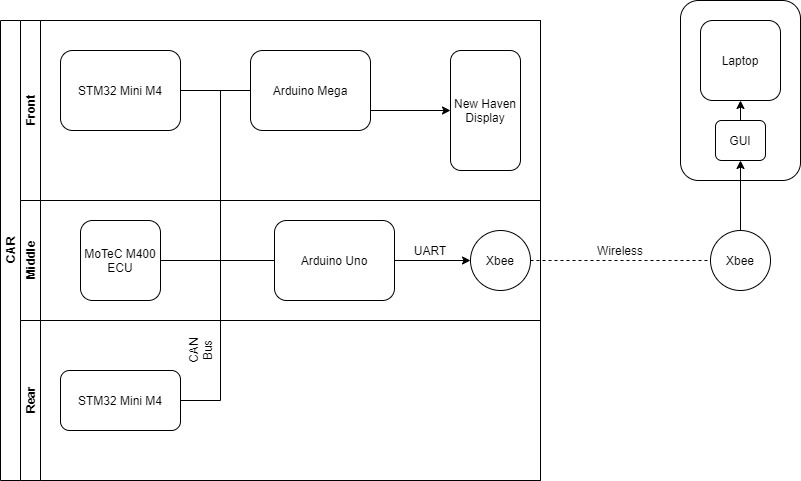
This project report describes the design and working of a Motorsport Data Acquisition System,Live Telemetry System and Display system developed using the Controller Area Network (CAN) communication protocol as the backbone of the system. A Formula One car hosts over a hundred sensors during each of its races. The Data Acquisition System, although does not directly affect the car’s performance, is an indispensable system when it comes to improving and testing designs. Designers can validate their assumptions and calculations, real-time data during testing can be a safety indicator and it provides insight to the driver about the performance of the vehicle.

**OBJECTIVES**

The proposed work is to design and implement a Data Acquisition and Telemetry System to be on-board a race car. The major objectives include

* Establish a modular Controller Area Network bus which runs throughout the vehicle.
* Interfacing multiple nodes to the said CAN bus, each with their own functionalities.
* Transmitting the data of multiple sensors onboard the vehicle.
* Display valid data to the driver while operating the car.
* Wireless data transmission back to host across a long range.

**SYSTEM OUTLINE**



**COMPONENTS**

1. **MoTeC M400 ECU**

The MotecM400 engine control unit is a part of the Hundred Series of the Motec ECU's. It is specifically designed for a four-cylinder engine. It provides multiple features for engine tuning and management and also supports CAN protocol. It is connected to various sensors in the car and transmits their data to the CAN bud=s

1. **STM32 Mini M4**

The STM32 Mini M4 is a development Board fitted with STM32f415RG microcontroller powered by ARM cortex. The board comes fitted with 15 Analog Input Pins and an inbuilt CAN Controller. The system Utilises 2 such boards, one positioned in the front and one in the rear of the vehicle, to collect data from all the non-engine sensors (ECU sensors), format them into appropriate CAN messages and transmit them onto the CAN bus.

1. **Arduino Uno**

Arduino Uno is a microcontroller board based on the Atmega328P microcontroller. The board has 14 digital I/O pins and 6 Analog input pins. A can controller (MCP2515) is connected to this board via SPI which enables it to communicate through the CAN bus. Its role in the system is to collect data from the CAN bus and transfer it to the XBEE module via UART.

1. **Arduino Mega**

Arduino Mega is a microcontroller board based on the Atmega2560 microcontroller. The board has 54 digital I/O pins and 16 Analog input pins. A can controller (MCP2515) is connected to this board via SPI which enables it to communicate through the CAN bus. Its role in the system is to control the display. It receives data from the CAN bus and transfers it to the display using an 8 bit data bus.

1. **Xbee Pro 900 Hp**

The Xbee modules are used to transfer data wirelessly from the car to the laptop for live telemetry. They have a frequency band of 902 to 928 MHz and RF data transfer rate of 10Kbps for up to 610m indoor or 15.5km outdoor and 200Kbps for up to 305m indoor and 6.5km outdoor.

1. **New Haven Display**
2. The display is a 240 x 128 LCD module which is controlled by and receives data from the Arduino Mega.