SAE Formula 1 Multifunction Display Project: System Block Diagram

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Hardware Block Diagram

Microprocessor

The core of the multifunction display system will be a Motorola 68HC11 microcontroller. The microcontroller's function is to modify and redirect input and output data to the various subsystems. Note that the 68HC11 has a built-in 8-channel analog-to-digital converter for reading in analog sensor voltages.

LCD

The LCD subsystem consists of the actual display screen as well as the accompanying driver and address decoding logic. From preliminary research, a 4.80 by 3.62 inch (320 by 240 pixels) LCD screen was found that meets the current dimensions and resolution requested by the mechanical engineering team. Data from the microprocessor is sent to the LCD through the display driver. There are no output lines from the LCD to other subsystems.

Helmet LEDs

Control logic will be used with some of the I/O ports on the microprocessor to drive the helmet-mounted LEDs. As with the LCD, the LED drivers do not output signals to the other subsystems.

Keypad

A ten-digit keypad will provide the input to the microprocessor to select the desired display mode, reset the system, and scroll through data sent from the Data Acquisition System. The keypad will also add flexibility for future system improvements, such as entering numerical data or entering a driver code that customizes the LCD screen layout.

Sensors

Four sensors will be the main inputs to the system: an Engine Speed Sensor, an Oil Temperature Sensor, an Oil Pressure Sensor, and a Transmission Gear Sensor. All the sensor inputs will provide analog signals to the microprocessor. None of the sensors receive input signals from the other subsystems.

Data Interface

If implemented, the data interface will allow the system to interface with the microcontroller of other vehicle systems (essentially, the LCD and keypad will be a "dumb terminal"). The interface consists of address decoding logic and data lines from the processor.

System Reset

This switch will simply reset the microprocessor.

Software Block Diagram

Initialization Routine

The initialization routine of the software will configure the processor and execute a loop that will wait for the first mode selection from the user keypad and then select the appropriate subroutine.

Racing Mode Subroutines

This subroutine will receive a signal from each of the sensors and perform the necessary computations and conversions to prepare the data to be displayed in the proper Racing Screen format (large tachometer with warning indicators). The data will then be sent to the LCD driver chip as well as the LED driver logic to present the appropriate information to the vehicle driver.

Practice Mode Subroutines

This subroutine will receive a signal from each of the sensors and perform the necessary computations and conversions to prepare the data to be displayed in the proper Practice Screen format (all gauges displayed graphically instead of warning indicators). The data will then be sent to the LCD driver chip as well as the LED driver logic to present the appropriate information to the vehicle driver.

Demo Mode Subroutines

For the Demo mode of the system, sample screens for the Racing, Practice, and Test modes will be displayed on the LCD for 10 seconds each. The sample output data will also be sent to the LED driver logic.

Test Mode Subroutines

If implemented, the test screen will access other systems, such as the Data Acquisition System, through the Data Interface. The LCD and keypad will function in a dumb terminal mode in order to interface with the other vehicle systems' microcontrollers.