Introduction

The American Solar Challenge (ASC) is a competition for engineering students from colleges and universities across the country to explore renewable energy and develop unique ideas. Our team's objective is to design and integrate a dependable electric safety system that is capable of isolating the battery bay to protect components and the driver.

Our Approach to Safety

Sensors
- Temperature Sensor
- Voltage Sensor
- Speed Sensor

CPU
- Outputs PWM signal to run the DC electric motor
- Reads data from sensors and switches
- Reacts autonomously to input from sensors
- Takes input from the driver to control speed and direction

User Speed Control
- Gas Pedal is a 5K Ohm potentiometer that provides an analog signal to the Arduino to control PWM output.

Contactor Switch
- Low voltage controlled switches to connect and disconnect power to the motor.

Drive Train
- Series-wound DC motor powering the rear differential of the car

Battery Bay
- Eight 12V batteries power the DC electric motor and high-voltage components

Driver Notification System
- Graphical User Interface that will display relevant information to the driver

Safety Features
- Temperature Sensors
  - Mounted on main battery bank, isolated battery cell, DC motor, and EMC fly-back diode.
- Voltage Sensors
  - This ensures calibration between the user’s input of speed (pedal position) and supplied voltage to the motor.
- Speed Sensor
  - A sensor mounted at the front right tire to measure speed and display it to the driver.
- Kill Switch
  - The user can physically isolate the batteries in case of safety system failure.
- High Voltage/Low Voltage System Isolation
  - All low voltage system components have physical isolation from the high voltage system to prevent damage and to keep the safety system on even in the event of an error.
- Contactor Switch
  - Prevent electrical damage to components by isolating the batteries based on implemented software.
- Graphical User Interface
  - The graphical user interface is used to display typical dashboard information to the driver as well as system monitoring information to aid in extending drive times and component life.

Electric Motor Controller
- Receives PWM signal from Arduino to control the switching transistor and provide power to the motor

Forward/Reverse Selector
- A mechanical H-bridge used to control the directional rotation of the motor

Graphical User Interface

Components
- Parameters
  - Temperature Cutoff
    - Battery Bank: 55°C/131°F
    - EMC: 88°C/190°F
    - DC Electric Motor: 100°C/212°F
  - Voltage Cutoff
    - If the potentiometer expected output is +/- 20% different from the voltage at the EMC

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American Solar Challenge: Team E2.05 - Safety and Integration