Team Smart Tow

The Trailer Monitor

In this project we seek to design and construct an intelligent trailer monitoring system that will provide the operator with useful safety related information about the trailer and its surroundings. The system will monitor the trailer's blindspots, brake lights, blinkers, inside temperature and main door and will provide backup ranging when in reverse.

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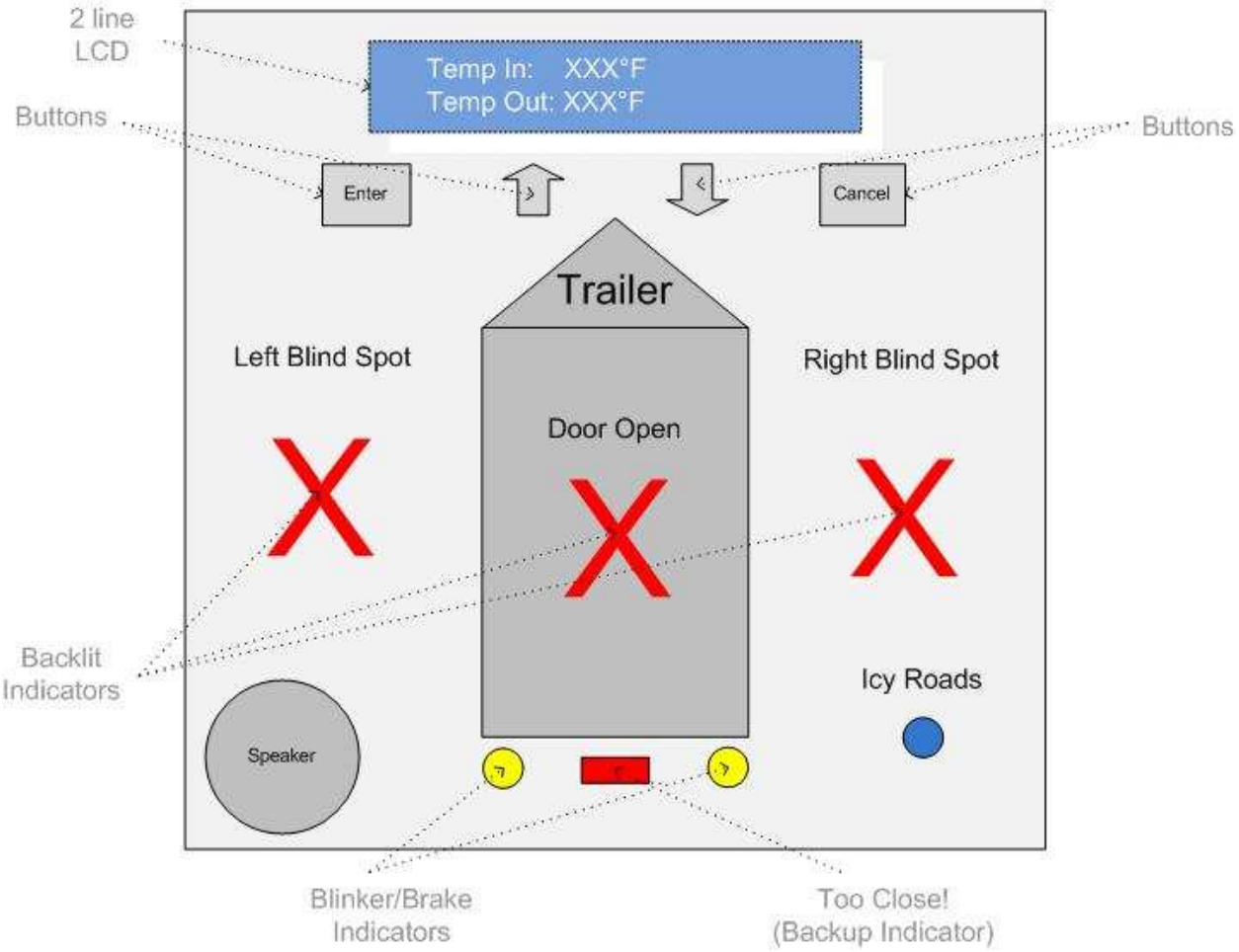
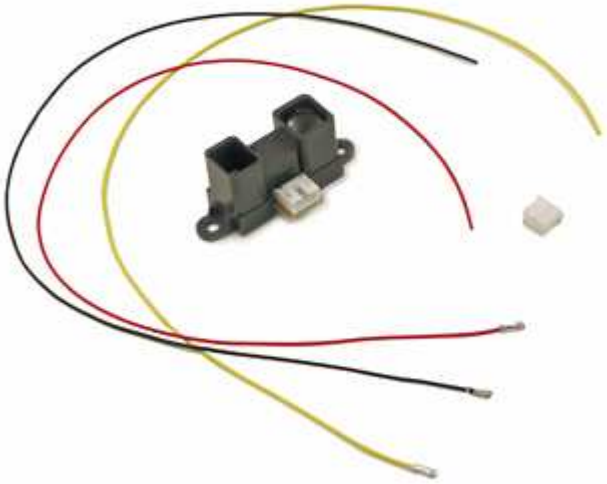
In-Cab Display



Blind Spot Detection

Ultrasonic sensors are used to check the blindspots of the trailer for the presence of other vehicles. The sensors are placed above the wheel wells on either side of the trailer and return a distance measurement, in inches, to the trailer board. If the returned distance is less than our specified threshold of 12 feet, the red blindspot light on the display is illuminated.

Back-up Ranging



Infrared sensors are used to provide the driver with a distance measurement to the nearest obstacle behind the trailer. The system automatically returns a distance measurement to the display when the truck is put into reverse. Two sensors are used, one located on either side of the trailer and the shorter distance is returned. Infrared sensors were chosen as they are less expensive than ultrasonic sensors.

Door Monitoring

A magnetic switch was used to monitor the main door of the trailer. A magnet is affixed to the trailer door and positioned to align next to the sensor when the door is closed. When the door is open, the magnetic switch will pull its signal line low and the display will sound an audible alarm, illuminate the door light and print “Door Open” on the LCD. Pressing any button will clear the LCD and stop the audible alarm.

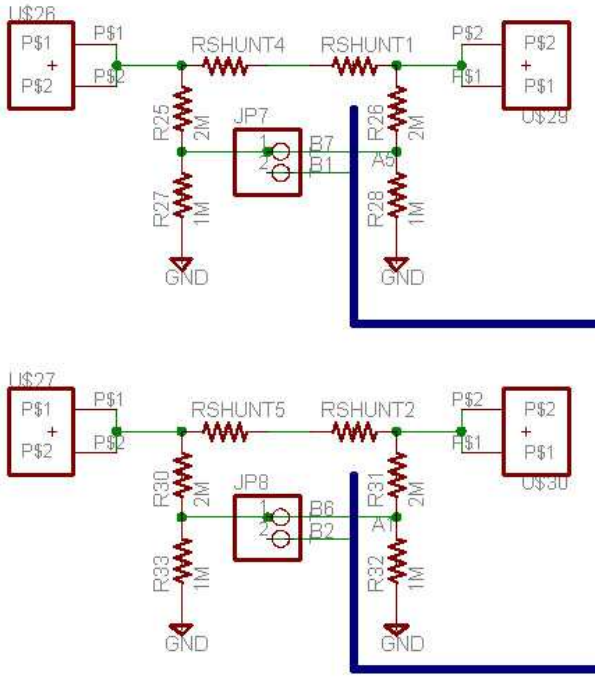
Wireless Communication

We chose to use the Zigbee wireless communication protocol for our project as it is robust, reliable and cost-effective. The wireless protocol used for our communication is:

Unique 'Beginning of Message'	Identifier	Data
0x7E	Lights: 0b00000000	Explained below
	Backup: 0b00000001	Backup range in inches
	Temp In: 0b00000010	Temp in degrees F
	Temp Out: 0b00000011	Temp in degrees F

Lights Data							
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
reserved	R Blink	L Blink	reserved	L Blind	R Blind	Icy	Door

Blinker/Brake Burnout Monitoring



The blinker/brake lights on the in-cab display show what is actually happening on the back of the trailer. If a light is burned out on the trailer, it will not illuminate on the display board. To accomplish this, the current for each light is fed through a shunt resistor. The trailer board ensures the voltage drop across the shunt resistor is sufficiently large when the light is turned on. If the voltage drop is too low, the light is burned out!