



REAR DISTANCE DETECTION SYSTEM WITH ULTRASONIC SENSORS

PROGRESS REPORT 1

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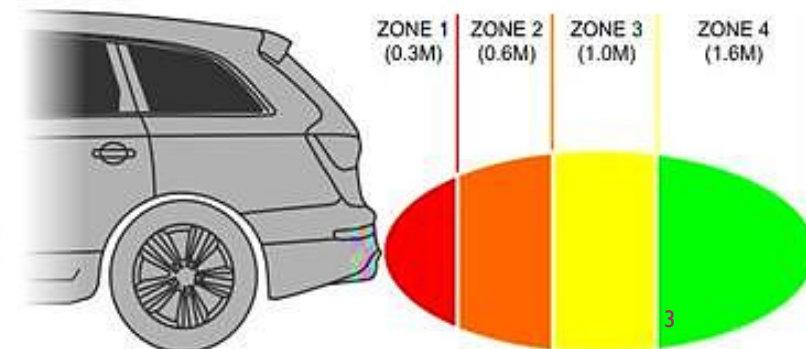
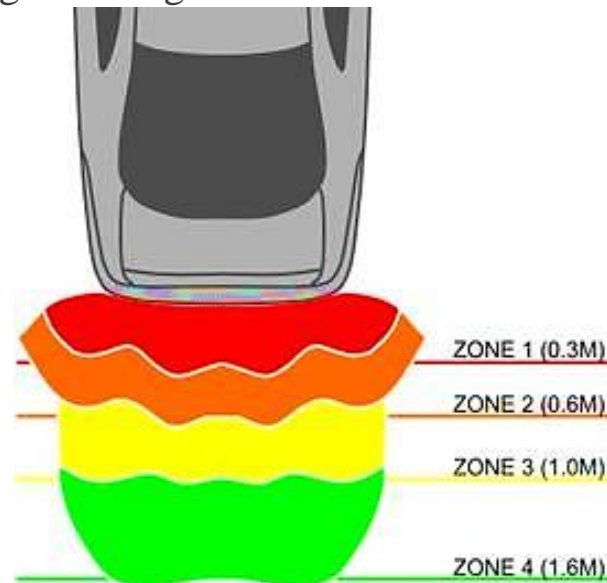
OVERVIEW

- National Highway Traffic Safety Administration (NHTSA) reported close to 30,000 backing crashes in 2007 [1]
 - Approximately 302 of these crashes resulted in fatalities
 - 35% of fatalities involved children under the age of 5
- Causes of these crashes include
 - Poor environmental lighting
 - Congested parking lots
 - Backing out of parking spaces
- Need better technology to prevent these accidents



OVERVIEW

- Problem can be solved with backup sensor technology
- Features include
 - Ability to Detect the Distance in Three Sides, Simultaneously!
 - Using LCD to Show Distances
 - Using LEDs (Green, Yellow, Red) for Illustrating the Range of Distance
 - Using Buzzer for Alarm



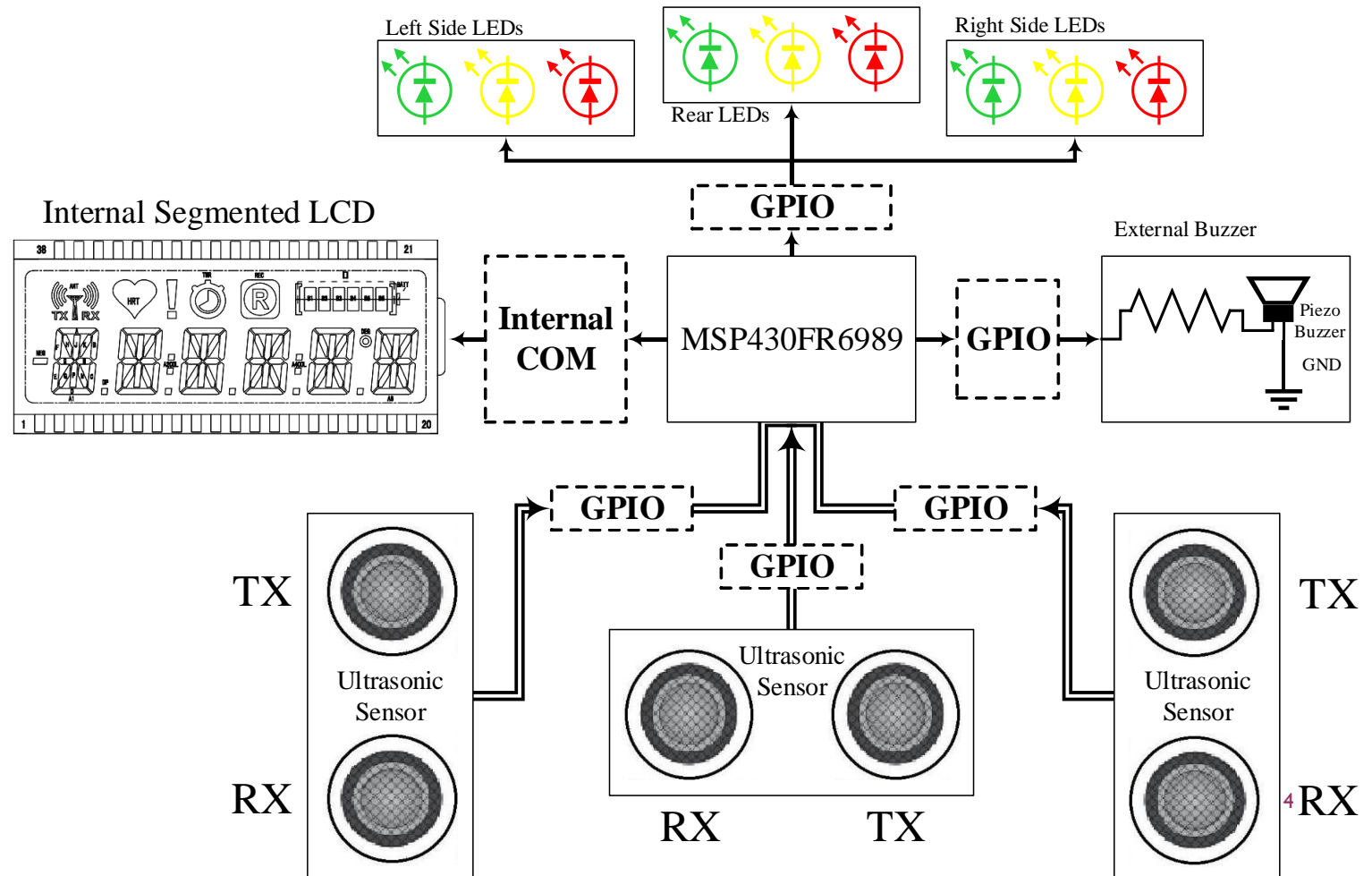
BLOCK DIAGRAM

- Hardware

- MSP430FR6989 Launchpad
- Ultrasonic Sensors
- Piezo-Speaker
- Integrated MSP430's Segmented LCD
- External RGB LEDs

- Software

- Code Composer Studio 7.3.0



MAJOR COMPONENTS

■ Ultrasonic Sensor (HC-SR04)

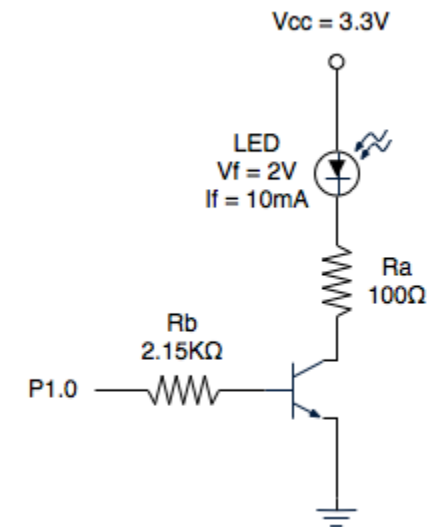
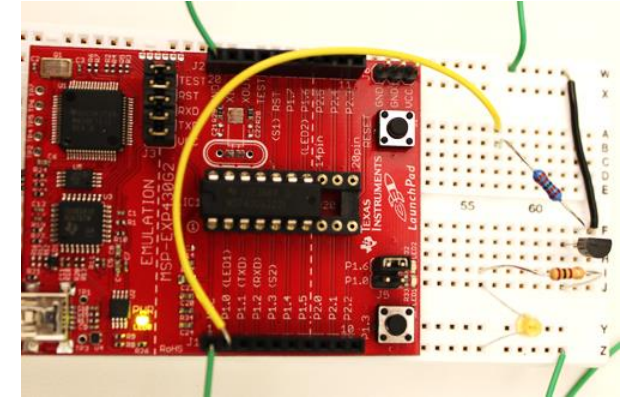
- Component Type: Sensor Hardware
- Hardware Interface
 - Four pins to interface with device (VCC, Trig, Echo, GND)
 - Applying voltage to trigger pin generates sonic burst
 - Echo pulse resulting from burst is timed to determine distance
- Software Addressing
 - Echo pulse can trigger interrupt service routine (ISR) to enable timer
 - Falling edge of pulse can trigger interrupt service routine to disable timer
- Progress With Component
 - Component has been ordered and is currently being configured using MSP's A1 timer
- Challenges
 - Problems may arise when configuring the software to accurately monitor echo pulse
 - Problems may be faced when dealing with timer overflow



MAJOR COMPONENTS

■ 5mm RGB LEDs

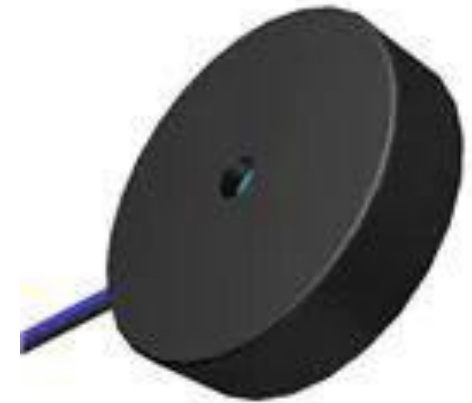
- Component Type: Visual Feedback Hardware
- Hardware Interface
 - Offers three distinct pins for addressing the color outputs
 - Each pin corresponds to a colored diode inside of the device
 - Fourth pin acts as ground (common-anode setup)
- Software Addressing
 - Digital voltage values can be written to each pin of the LED using the port output vectors (e.g., P1OUT)
- Progress with component (tested)
 - Component has been ordered and various color configurations are being tested.
- Challenges
 - Determining the approximate analog values to produced desired color outputs.



MAJOR COMPONENTS

■ Piezo-speaker (Buzzer)

- Component Type: Audio Feedback Hardware
- Hardware Interface
 - Offers one pin for writing an alternating voltage signal to produce audio
 - The second pin acts as ground
- Software Addressing
 - Timer output modes (e.g., Set/Reset) can be used to produce an output desired frequency
 - Capture and compare registers (e.g., TA1CCR0) can be used to modify the frequency
- Progress with component (i.e. ordered, acquired, tested, done)
 - Component is currently being interfaced with the MSP's timer A1 to produce sample sounds
- Challenges
 - Adjusting the frequency at which the beeps occur to match the proximity of an approaching object



PROJECT DIVISION

■ Farnaz

- Main Programmer
- Buzzer Interfacing + Setting up the Tone

■ Osaze

- Ultrasonic Sensor Interfacing

■ Kimia

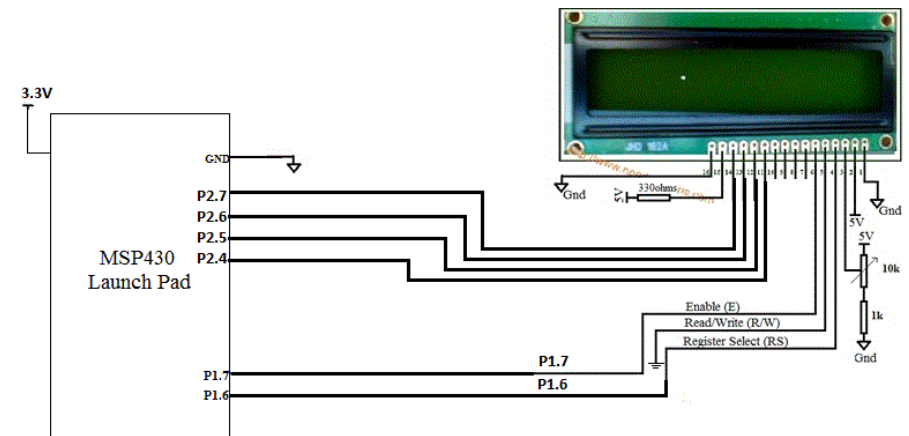
- LCD and LED Interfacing

OVERALL PROGRESS

- Parts have been acquired
- Prototyping and component testing in progress
 - Researching ways to receive feedback from ultrasonic sensor
 - Demoing piezo-speaker sounds using timer components
 - Determining RGB addressing modes for the LED
 - Testing LCD addressing methods using Code Compiler Studio

PLAN B

- Alternative options for this project include
 - Reducing the number of ultrasonic sensors involved to one (1)
 - Reducing the number of LEDs involved to one (1)
 - Displaying only important commands ("Ok", "SLOW" or "STOP") on the LCD
 - Using External LCD
 - Using a different Piezo Speaker



REFERENCES

- [1] Austin, R. (2008). Fatalities and Injuries in Motor Vehicle Backing Crashes: Report to Congress (No. DOT HS 811 144). *Washington, DC: National Highway Traffic Safety Administration, US Department of Transportation.*