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| Sensor Fusion: Ultrasonic Sensor PGA460 and Murata MA58MF14-7N |  |
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## Abstract

The increasing prevalence of autonomous vehicles progresses along with increasing complexity in sensor capabilities and fusion for real-time decision-making. As such, the vehicle is equipped with a combination of sensors relaying different and unique information about the surrounding environment, in which ultrasonic sensors play an important role in surveilling the vehicle’s immediate proximity. Ultrasonic sensors operate on the principle of time-of-flight for the purpose of distance measurement. The time-of-flight principle refers to a measurement of time taken by a particle to travel through a medium. The duration is then used to calculate the distance between the ultrasonic sensor and the barrier by taking d = v\*t/2, for which v is the speed of sound (a constant) and t is the duration the signal takes to travel to the barrier and back to the emitter. The division by 2 in the calculation ensures that the result is the distance between the sensor and barrier, and not the total distance traveled by the signal.

## Vision Statement

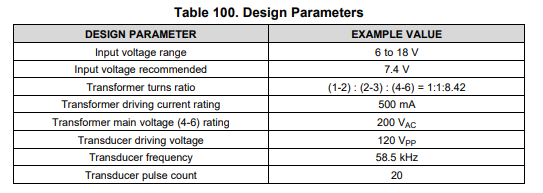
The purpose of this project entails establishing communication between microcontroller, ultrasonic transducer, and ultrasonic sensor and ensuring accurate and consistent distance measurement of up to five meters at more than ten frames per second. Eventual simultaneous command of multiple ultrasonic sensors will follow successful distance extraction of one ultrasonic sensor.

## Materials and Specifications

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| Main components |  |
| Microcontroller | Arduino Mega 2560 |
| Ultrasonic transducer | PGA460 |
| Ultrasonic sensor | Murata MA58MF14-7n |

## \*Signal amplifier and filter circuitry dependent on direct-driven or transformer-driven mode

###### [PGA460](http://www.ti.com/lit/ds/symlink/pga460.pdf)



###### [Murata MA59MF14-7N](https://www.murata.com/en-sg/api/pdfdownloadapi?cate=cgsubUltrasonicSensors&partno=MA58MF14-7N)

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| **DESIGN PARAMETER** | **EXAMPLE VALUE** |
| Center Frequency | 58kHz |
| Capacitance | 1400pF |
| Max Input Voltage | 120Vpp, 20 pulses |

## Summary of Procedure

#### Stage one

* Establish reliable communication between PGA460 and microcontroller
* Initialize settings for PGA460

#### Stage two

### Successful bursting and listening of ultrasonic sensor

### Enable and refine

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