

# KPIT

Summer 2019

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



Presenter: My Uyen Nguyen, MIT

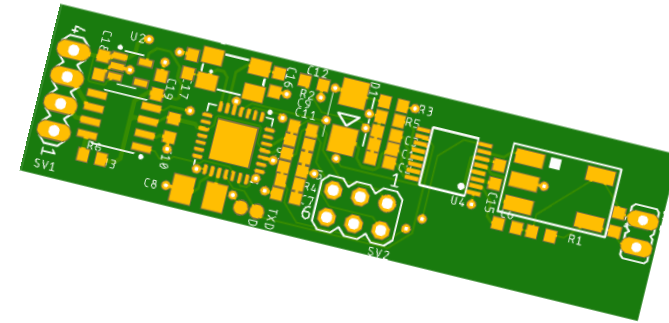
Mentor: Ankur Deo

# Related Works

## On Vehicle



## Developed Embedded Platform



## Product specs

- 4 ultrasonic sensors
- Up to 2 meters
- 4 frames per second

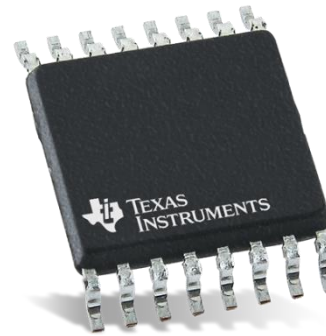
- 1 ultrasonic sensor
- Unknown distance range
- Unknown feed rate

# Project Objectives

- Accurate and consistent distance measurement of up to 2 meters
- Feed rate of  $\geq 10$  frames per second
- Multiple sensors configuration using 1 microcontroller



Microcontroller



Ultrasonic  
Driver



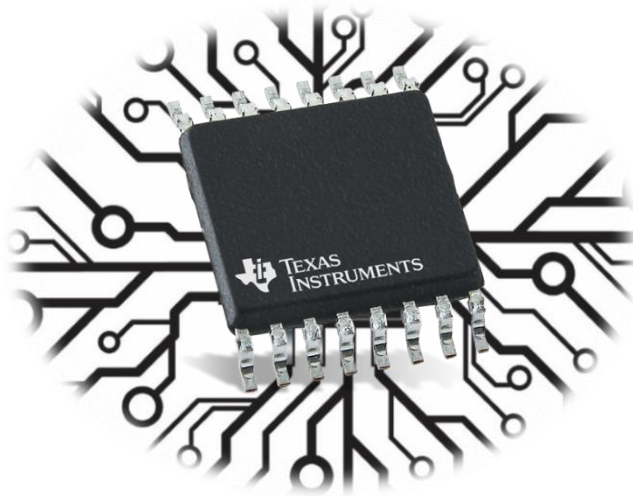
Ultrasonic  
sensor

# Challenges and Troubleshooting

- Unreliable hardware and software
- Failed serial communication and burst+listen
  - Constant distance measurement regardless of object detection
  - Invalid data transmission
- Incomplete understanding of ultrasonic driver's method of operation



Microcontroller



Ultrasonic  
Driver



Ultrasonic  
sensor

# Method of Operation



INITIALIZATION – EEPROM, Threshold, AFEGAIN + TVG



BURST + LISTEN



PULL + FILTER DATA

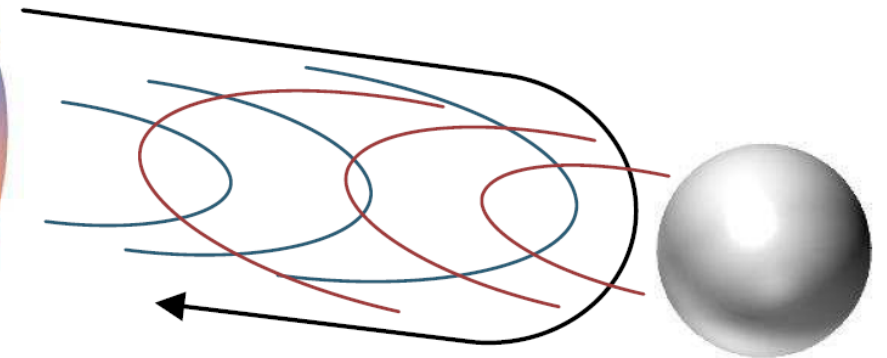


COMPUTE DISTANCE

Loop



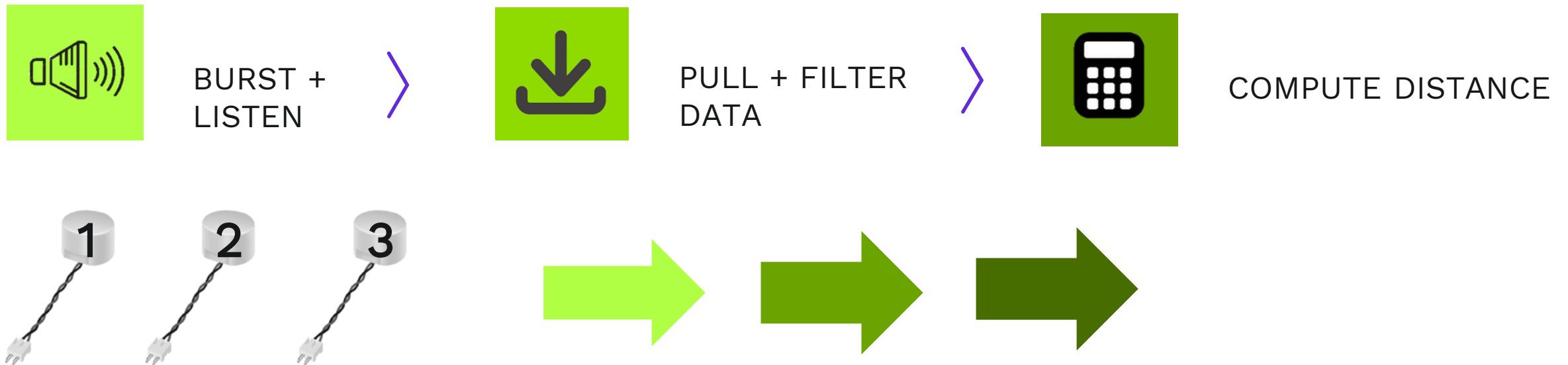
XDCR TX+RX



Mono-Static Configuration

# Modified Method of Operation

- Additional Methods of Data Communication
  - USB Communication for PC
  - CAN Bus for ECUs



# Results

## Performance Comparison

	Third-Party Device	Inherited Device	Developed Embedded System		
Number of sensors	4	1	1	2	3
Min distance (m)	N/A	N/A	0.25	0.25	0.25
Max distance (m)	2.0	N/A	3.5	3.5	3.5
Frames per second	4	N/A	45-50	44	43
Accuracy	N/A	N/A	+/- .02	+/- .02	+/- .02



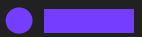


- Manufacture PCB for multiple-sensors setup (IN PROGRESS)
- Test PCB outside of lab and confirm maximum distance range
- Install sensors onto vehicle for real-time testing
- Increase number of ultrasonic sensors driven by one microcontroller using SoftwareSerial



# KPIT

**Thank you for a wonderful  
time at KPIT and in India**



Special thanks to Ankur Deo and Sant Ranjan