

# BSAC's Impact on Startups: From Device Engineering to Entrepreneurial Excellence, Illustrated by UltraSense Systems

[Hao-Yen Tang](#)

Co-Founder/CTO, UltraSense Systems

# BSAC Alumni from Prof. Boser & Horsley's Group

Prof. Bernhard E. Boser



(PDMS skeleton) (Ultrasonic image on phantom)

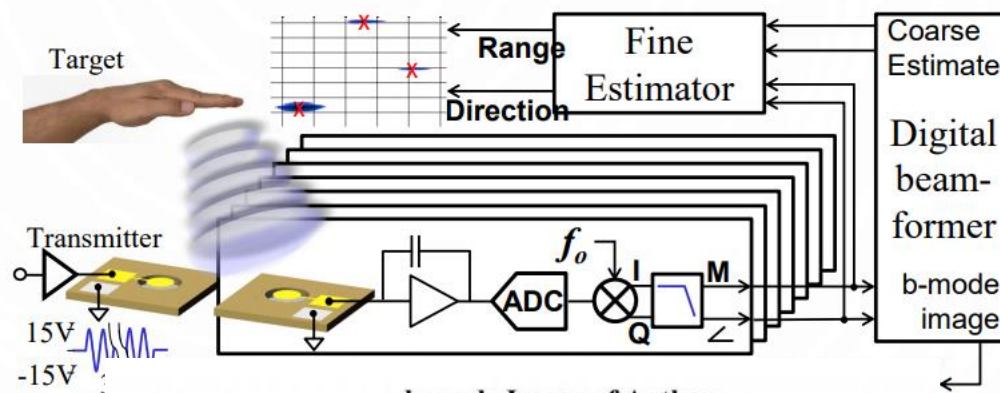
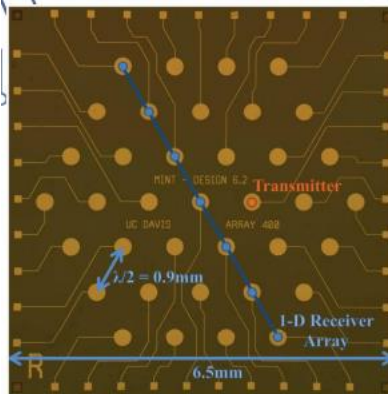
Prof. David A. Horsley



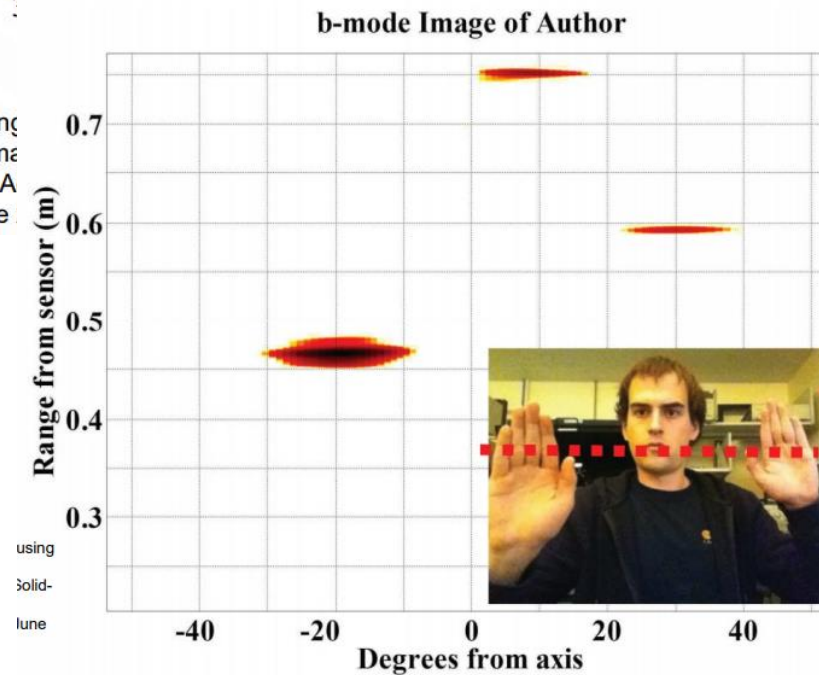
(PDMS skeleton) (Ultrasonic image on phantom)

Prof. Bernhard Boser		Prof. David Horsley	
Burak	Neuralink	Qi Wang	Apple
Joshua	Iota	Joy	UltraSense
Efthymios	Qualcomm	Parsa	Prof (UCSF)
Hao-Yen	UltraSense	Soner	Prof (Northeasten)
Behnam	SiLC	Jason	Qualcomm
Pramod	Apple	Ofer	Intel
Igor	Intuitive	Vashwar	InvenSense
Mitchell	Chirp	Yipeng	Prof (Peking)
Richard	Chirp	Mo Li	UltraSense
Oleg	Chirp	Stefon	Chirp

# Chirp MicroSystems – Role Model!



R. Przybyla, et al., "In-air Ultrasonic Range Estimation using an Array of AIN Micromachined Transducers", Proc. Hilton Head Solid-State Sensors, Actuators and Microsystems Workshop 2012, 3-7 June.



TDK to acquire Chirp Microsystems, aiming for leadership in ultrasonic sensing solutions

- TDK to acquire Chirp Microsystems, Inc., a developer of high-performance ultrasonic 3D-sensing solutions
- Acquisition to enhance TDK's existing technology in fingerprint sensors, MEMS sensors, and Piezoelectric transducer product lines.
- TDK aims to be the leader in the ultrasonic MEMS sensors and solutions market

# And More..

- Prof Liwei Lin



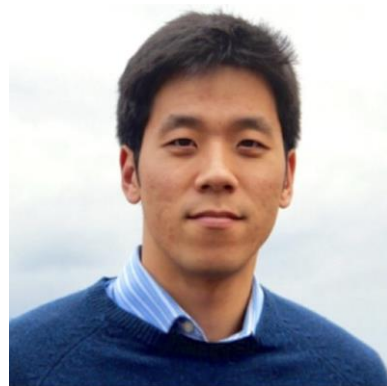
- Prof Michel Maharbiz (Iota Bioscience)



- Sina (UltraSense)



- DJ Seo (Neuralink)



## Astellas Completes Acquisition of Iota Biosciences

Oct 30, 2020

**TOKYO October 30, 2020** - Astellas Pharma Inc. (TSE: 4503, President and CEO: Kenji Yasukawa, Ph.D., "Astellas") announced today that it has completed the acquisition of Iota Biosciences, Inc. ("iota"), a start-up company focused on the bioelectronics field, located in Berkeley, California, and iota has become a wholly owned subsidiary of Astellas as of U.S. Pacific Time October 29, 2020.

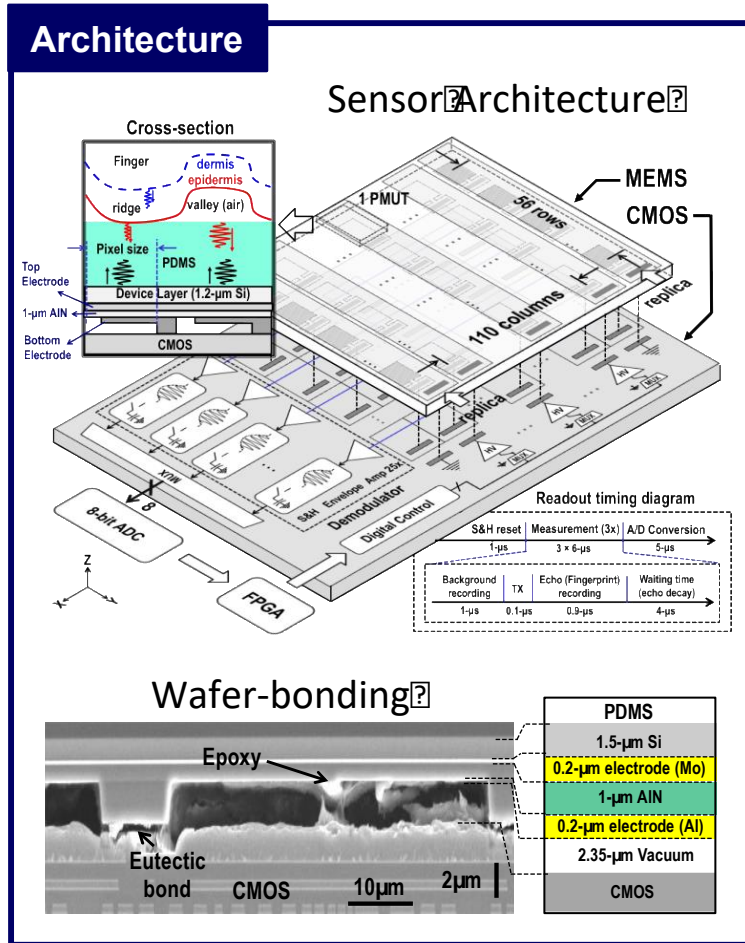
Under the Merger Agreement executed between Astellas and iota shareholders, Astellas paid approximately US\$127.5 million to acquire all of the outstanding equity in iota that was not previously held by Astellas (Astellas through a U.S. subsidiary, was an investor in iota through its previous Series A Preferred Stock offering). In addition, iota's former shareholders (other than Astellas) will be eligible to receive additional payments of up to a total of approximately US\$176.5 million upon achievement of predetermined milestones by iota within certain timeframes after completion of the transaction.







# What Did We Do in BSAC?



### Verification

**Capacitive Fingerprint Sensor**

**Proposed Ultrasonic Fingerprint Sensor**

**Robust**

**Secure**

**3D Imaging**

**Finger with sweat**

**Fake Finger on our Sensor**

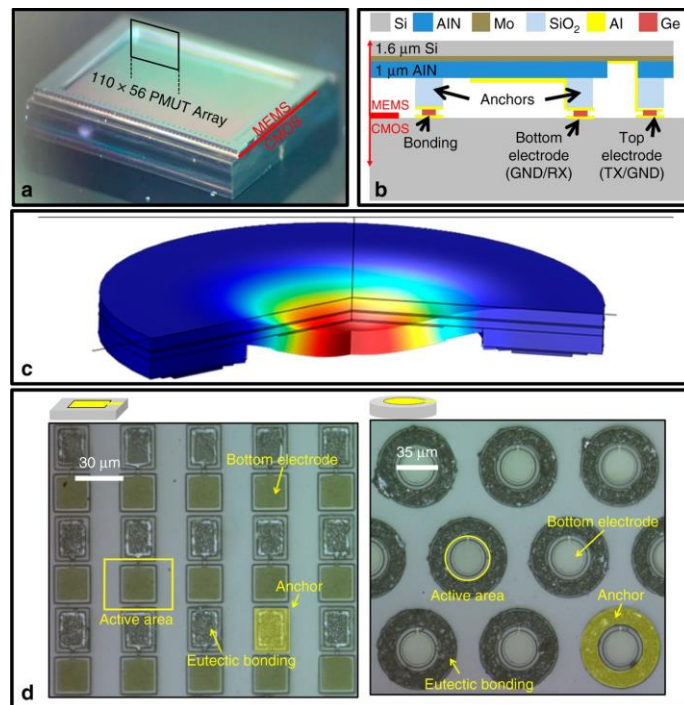
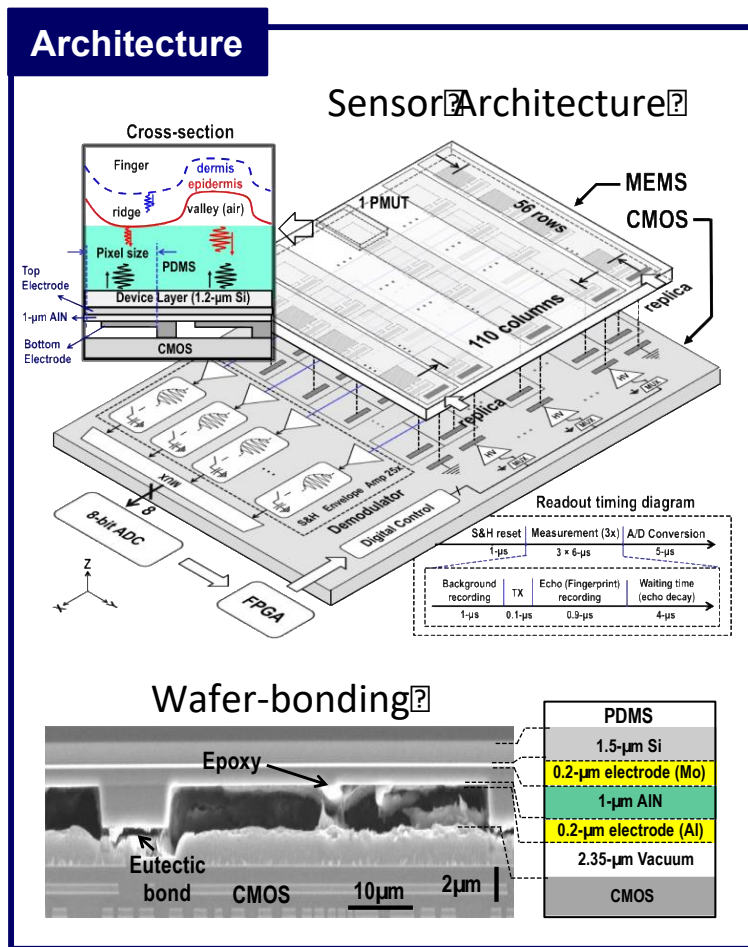
**Resulted Image**

**Epidermis Fingerprint (Surface Layer)**

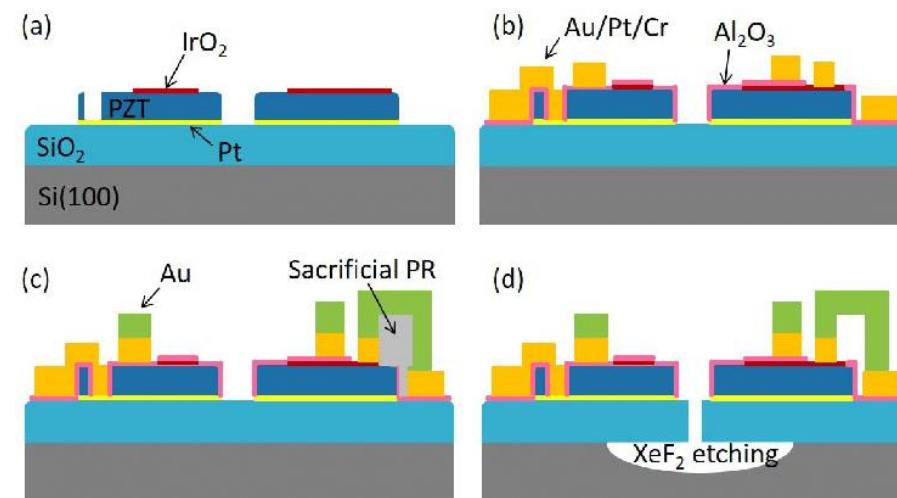
**Dermis Fingerprint (Inner Layer)**



# What Did We Do in BSAC?



MEMS Design

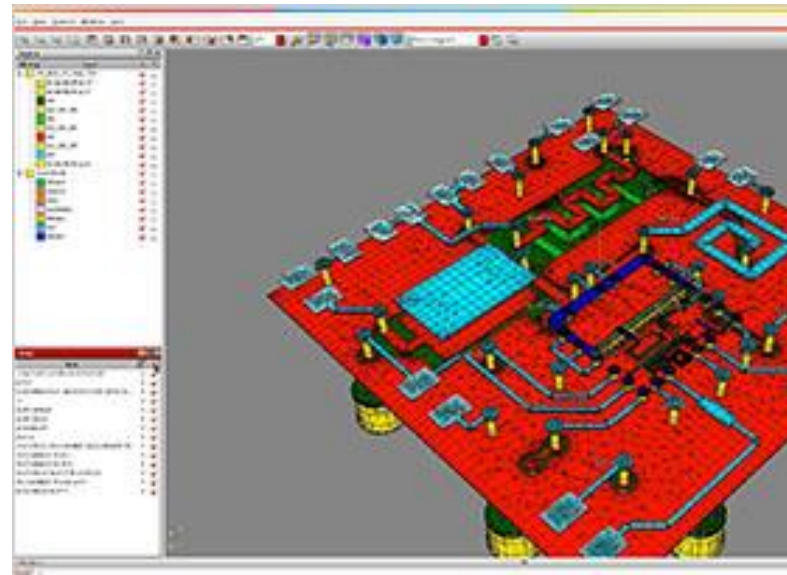
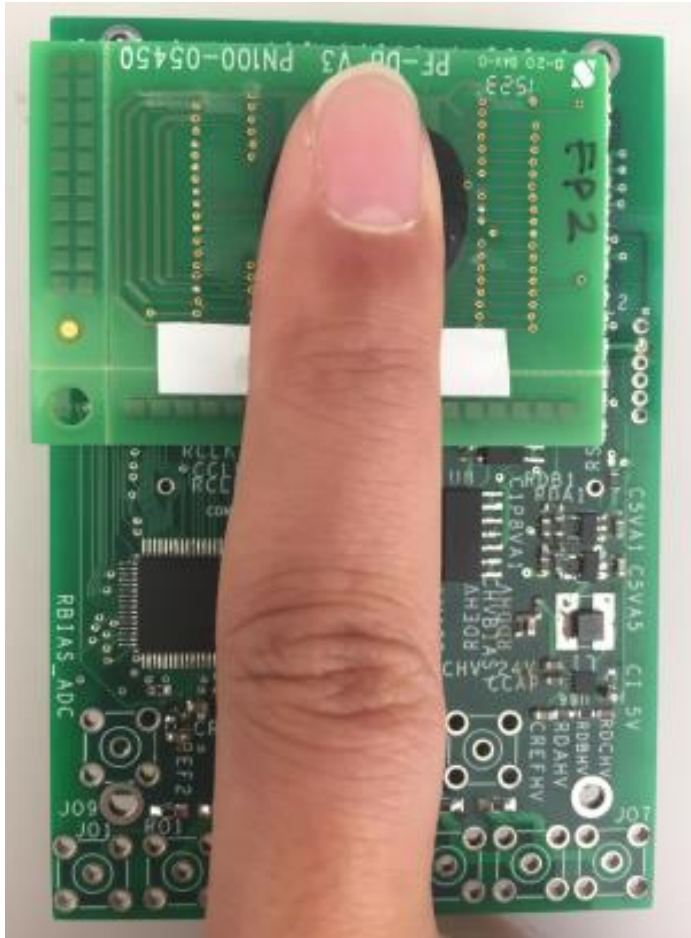


MEMS Fabrication





# What Did We Do in BSAC?



PCB Design



FPGA/Micro-controller Coding

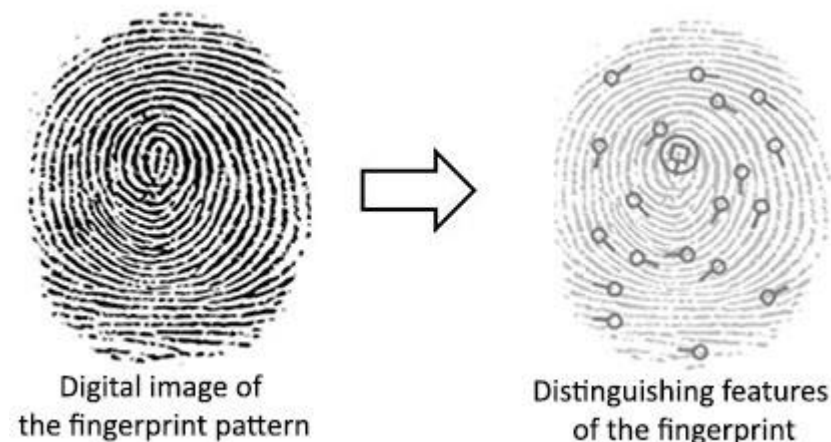
# What Did We Do in BSAC?

<b>Verification</b>					
	<p>Finger with sweat</p>				
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Capacitive Fingerprint Sensor	Proposed Ultrasonic Fingerprint Sensor				
Secure	<table border="1"> <tr> <td>Fake Finger on our Sensor</td> <td>Resulted Image</td> </tr> <tr> <td></td> <td></td> </tr> </table>	Fake Finger on our Sensor	Resulted Image		
Fake Finger on our Sensor	Resulted Image				
3D Imaging	<table border="1"> <tr> <td>Epidermis Fingerprint (Surface Layer)</td> <td>Dermis Fingerprint (Inner Layer)</td> </tr> <tr> <td></td> <td></td> </tr> </table>	Epidermis Fingerprint (Surface Layer)	Dermis Fingerprint (Inner Layer)		
Epidermis Fingerprint (Surface Layer)	Dermis Fingerprint (Inner Layer)				

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Software



Algorithm





# Where UltraSense Started



# how many pitches a VC need to hear per year?

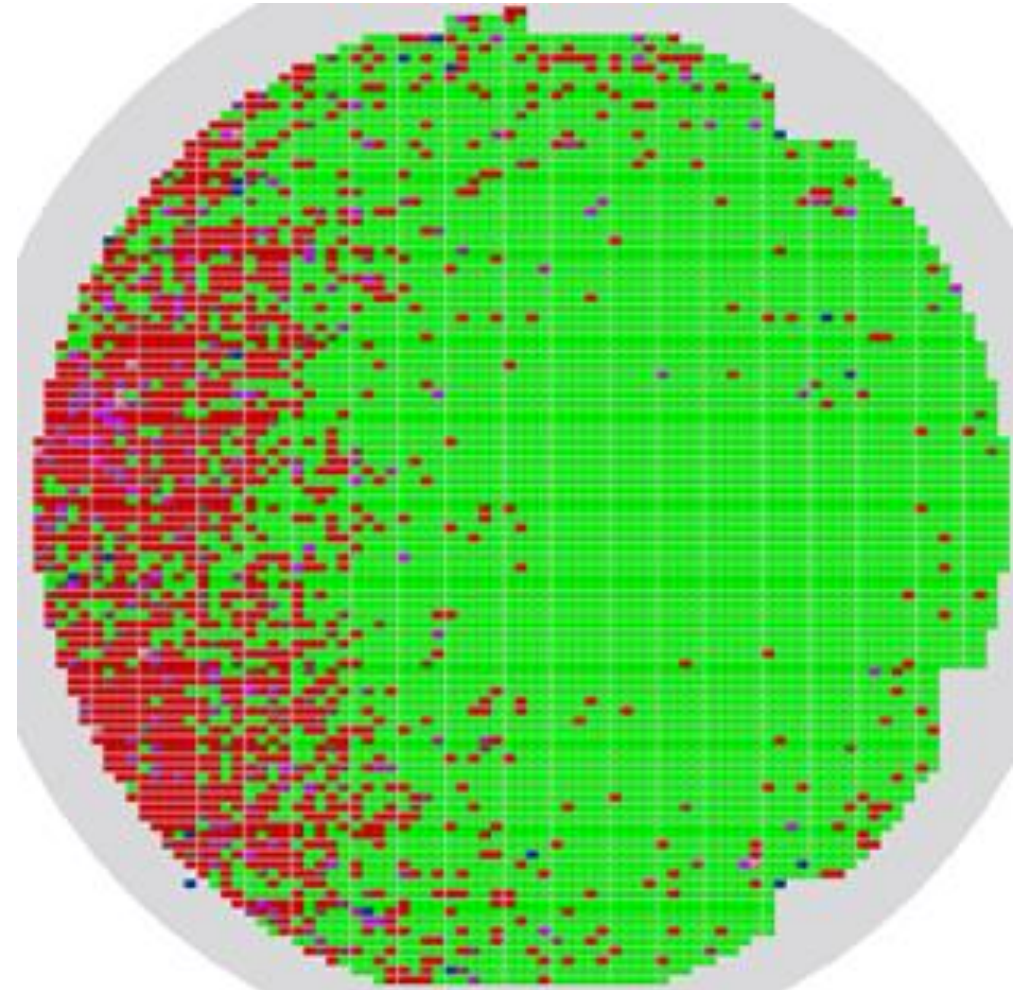
*Company Confidential & Proprietary*

# Learning

- “As broad as you can!”
- Capability of building a demo is the key to start your startup journey.
- Corporate: one guy do one thing all the time to make it perfect.  
Startup: one guy do multiple thing with 60% “good enough”.

# Startup/ Product with Piezoelectric Transducers/MEMS

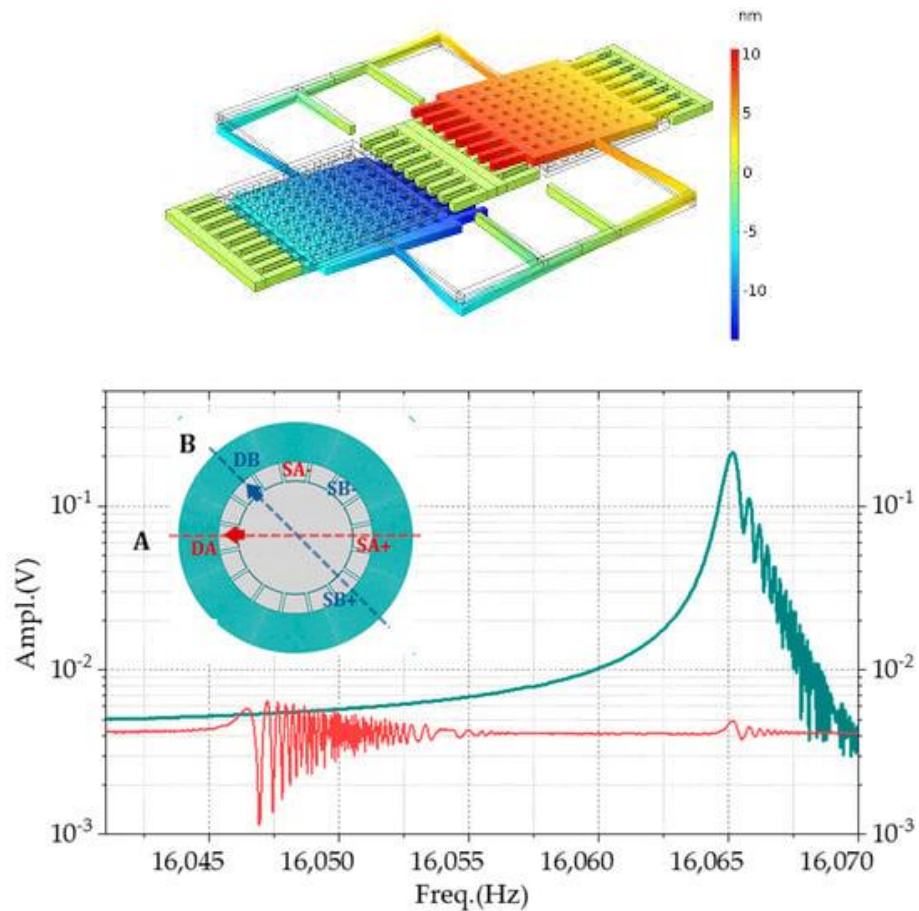
- Chirp Microsystems
- InvenSense's Fingerprint Sensor (UltraPrint)
- UltraSense
- Iota Bioscience
  
- eXo imaging
- xMEMS Microsystems
- Frore Systems



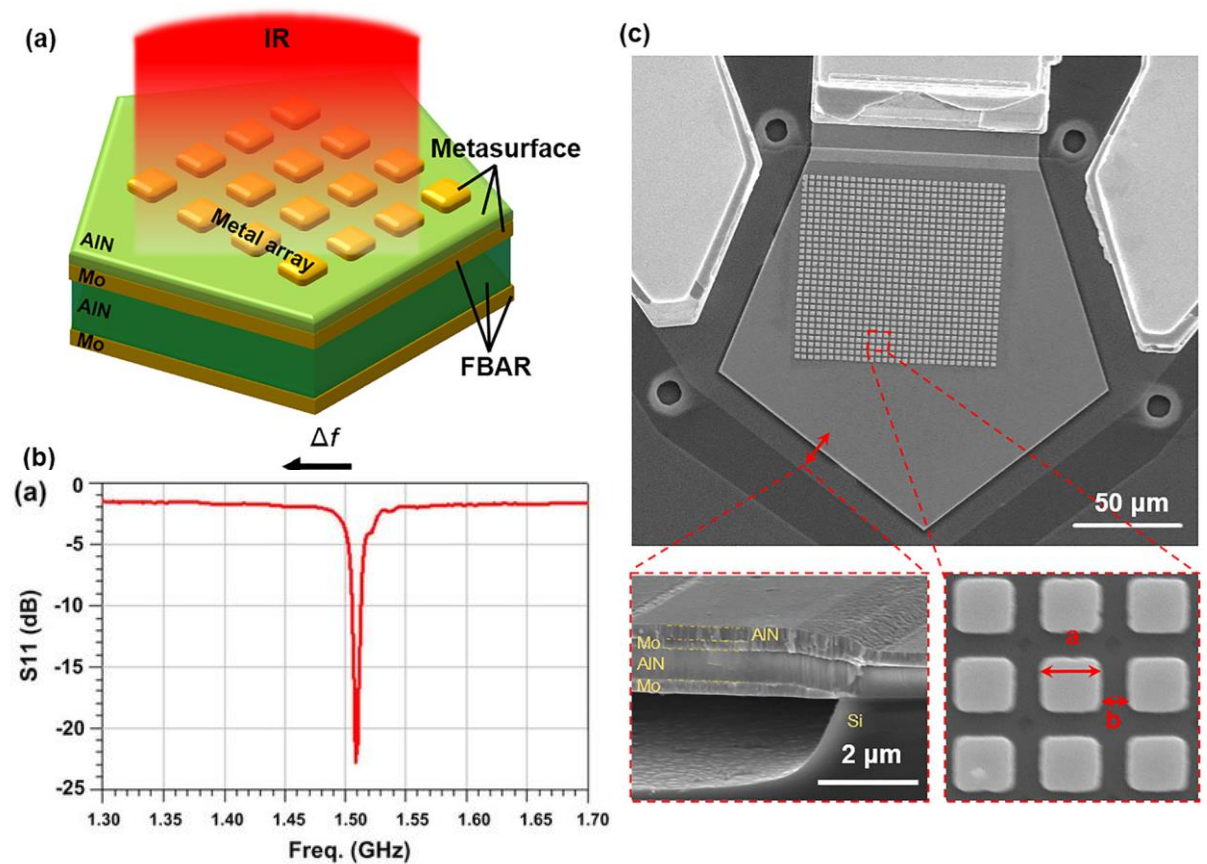


# Sensitivity to Process Control

- MEMS Gyroscope  
e.g. InvenSense

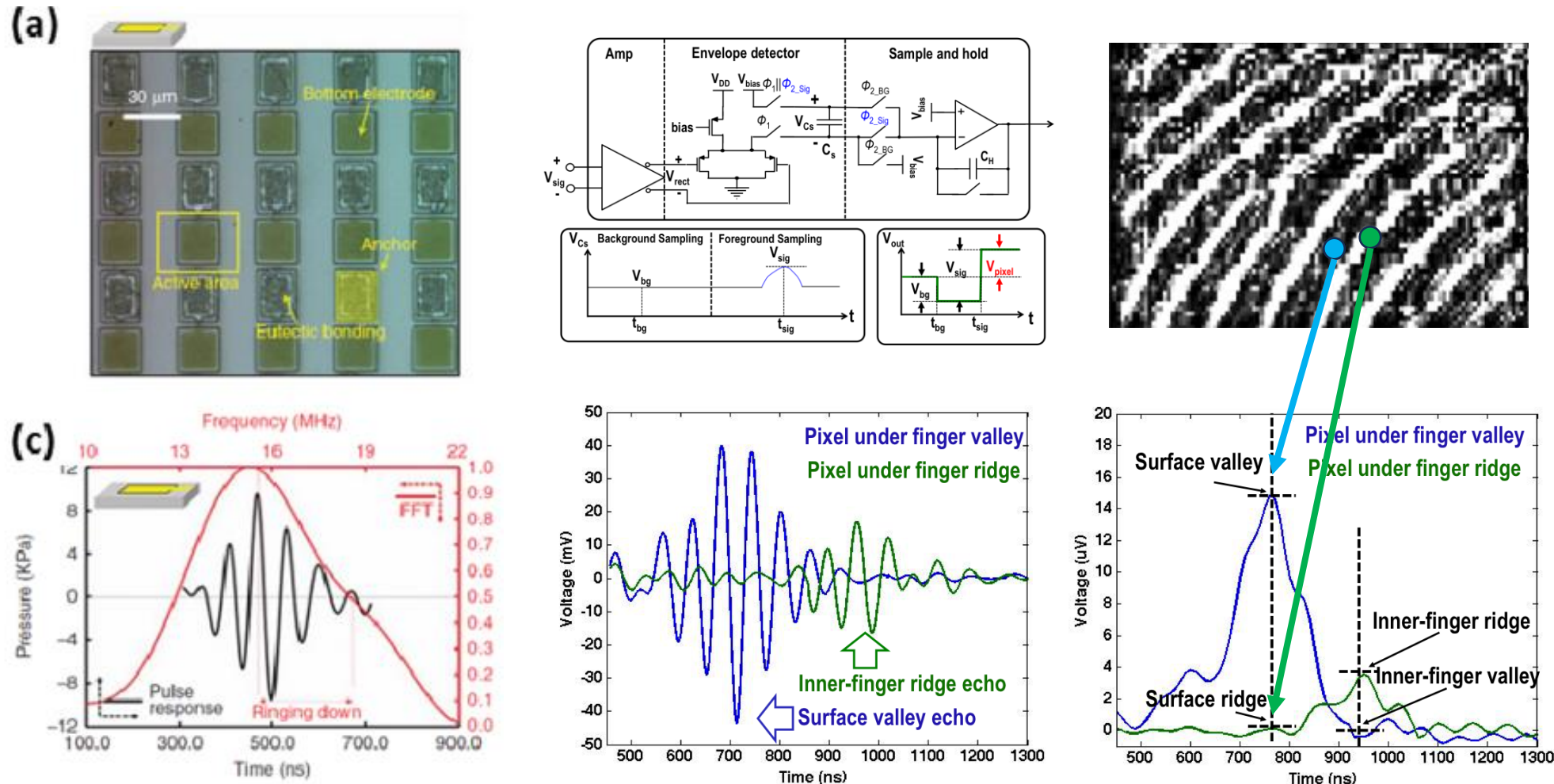


- MEMS Resonators (fbar)  
e.g. SiTime



# Sensitivity to Process Control

- PMUT Fingerprint Sensor Example
- UltraSense's Example (2019 fabout, 2021 MP, >95% yield)



Ref: <https://ieeexplore.ieee.org/abstract/document/7579196/>

# Learning

- Variation for a MEMS process take long time to be mature  
--especially for new stuff!
- Best Case: the application make the device inherently insensitive to process variation.  
--PMUT fingerprint example:
  - (1) Relatively high bandwidth (low Q) → insensitive to resonance frequency variation
  - (2) Care about amplitude but not resonance frequency
  - (3) Care about relative amplitude





**UltraSense Systems**  
is elevating the automotive  
touch experience.

*By replacing mechanical buttons with intuitive Smart Surfaces.*

# A team that has done it before



**Mo Maghsoudnia**  
**Founder / CEO**

Head of technology and manufacturing at InvenSense & NetLogic



**Hao-Yen Tang, PhD**  
**Co-Founder / CTO**

Lead ultrasound fingerprint designer at Qualcomm and InvenSense



**Sina Akhbari, PhD**  
**Co-Founder / Chief Sensor Architect**

Design expert in piezo ultrasonic transducers at InvenSense



**Mo Li, PhD**  
**Vice President Products/System Architect**

Sensor System Architect at Apple, Autonomous Driving Architect at Nio



**Daniel Goehl**  
**Co-Founder / CBO**

Founding team InvenSense & Head of Sales, GM TDK Sensor Sales Grp; founding member of 6 startups



**Hema Sankar**  
**Vice President, Customer Engineering**

Asst Customer Engineering Head for InvenSense, Motorola software



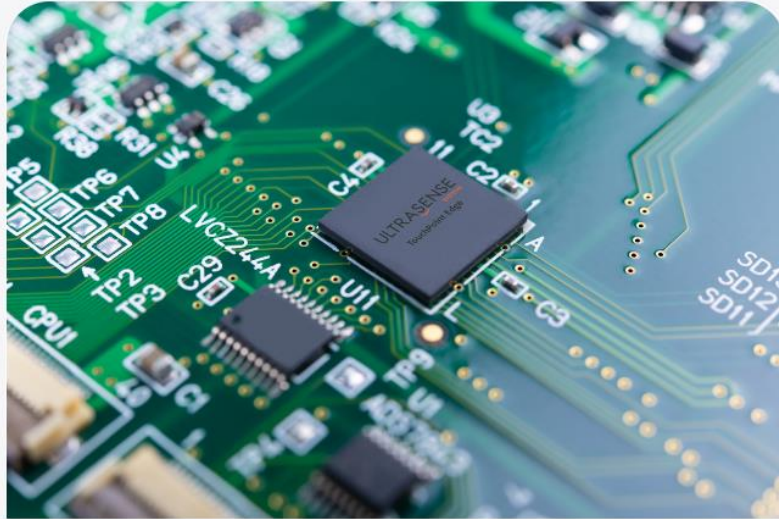
[UltraSense Systems - Crunchbase Company Profile & Funding](#)

Team in place/starting date: 07/16/2018

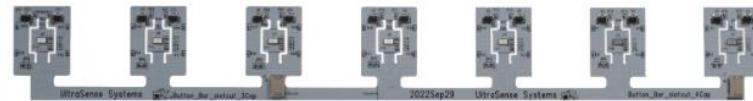
24M USD raised

Lead Investors: Aritman Venture, Bosch Venture

# One Technology Three Solutions



**UltraSense TouchPoint HMI Controllers**



**UltraSense InPlane Sensing Solutions**



**UltraSense Solid-State Interface Module**



# Bringing Smart Surfaces to the automotive experience

2025 Hyundai Genesis  
GV80 EV



Overhead console

Door

Steering wheel

Center console

Pillar

Frunk / trunk

Handles

Charge port

# Multimode: Ultrasound + Strain Sensor on the Same Chip

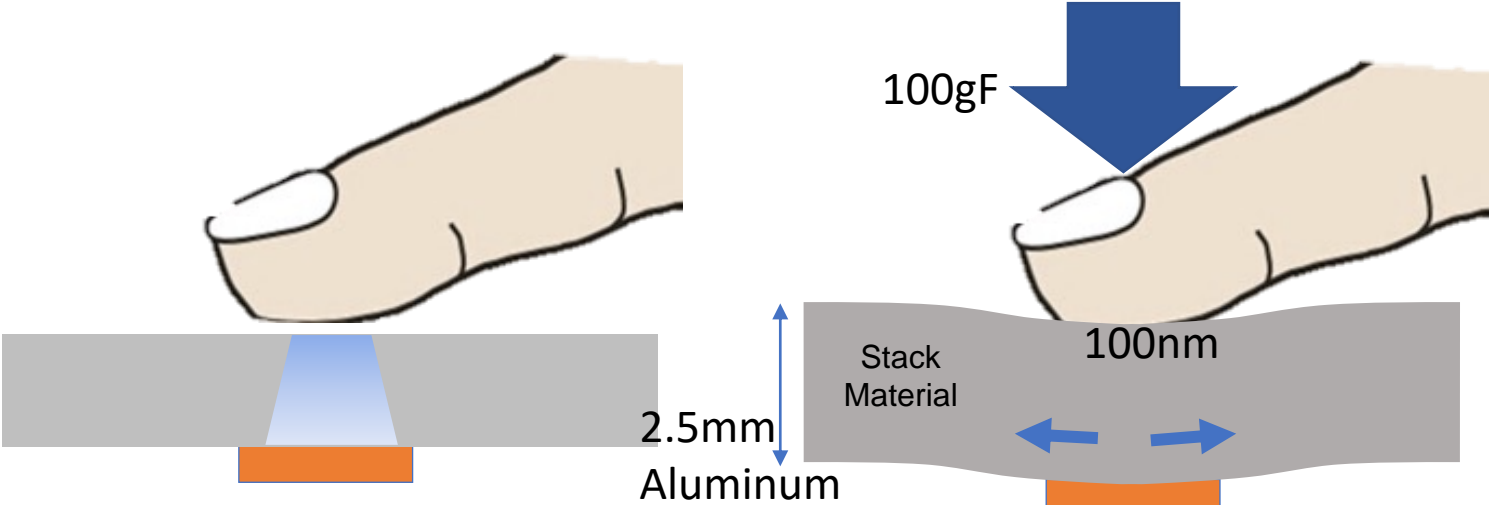
**Ultrasound + Strain on the Same Chip**

2.6mm  
1.4mm  
Package substrate

**Sensor SoC**  
Transducer, MCU, Memory, AFE, Temp

**ML Platform**  
Algorithms, Drivers, Convolutional Neural Net

**Subsystem**  
Module & Attachment Implementation



**Ultrasound Sensor: Detects object (finger) on the button**

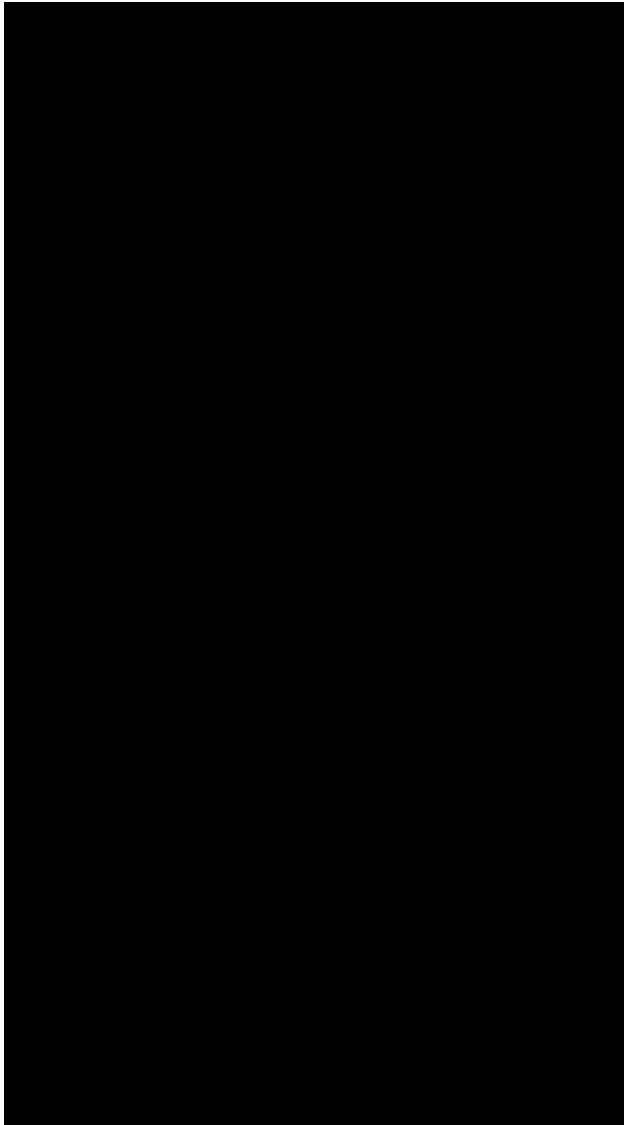
**Strain Sensor: Detects deformation of the button region**

Finger on the button



Finger press the button

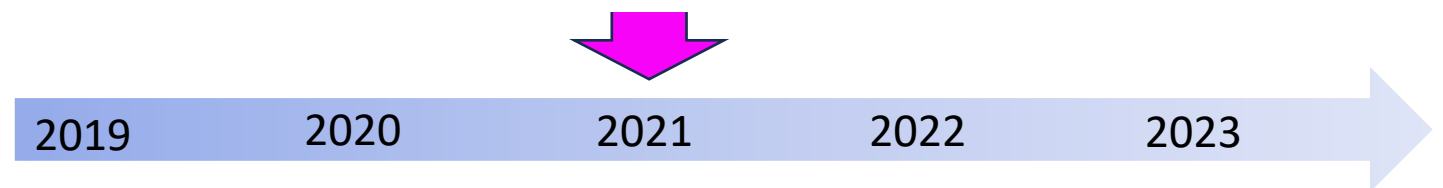
# Enough Bright Part, Now Lets Look at Dark Side..



## LG TO CLOSE MOBILE PHONE BUSINESS WORLDWIDE

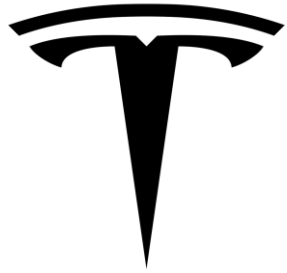
*Stepping Away from Phone Manufacturing and Sales Enables Company to Focus on Growth Sectors Including EVs, IoT and B2B Solutions*

SEOUL, South Korea, April 5, 2021 — LG Electronics Inc. announced that it is closing its mobile business unit. The decision was approved by its board of directors earlier today.

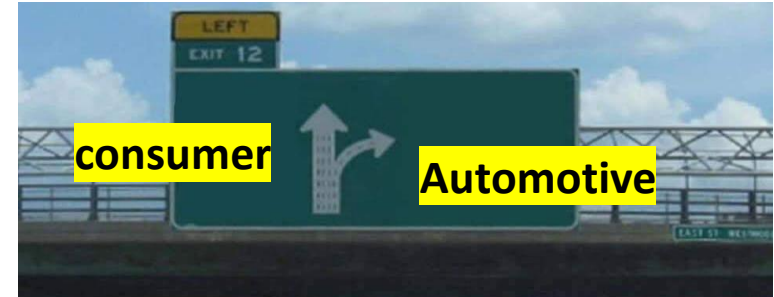




# What We did



Minimalistic Design for EVs



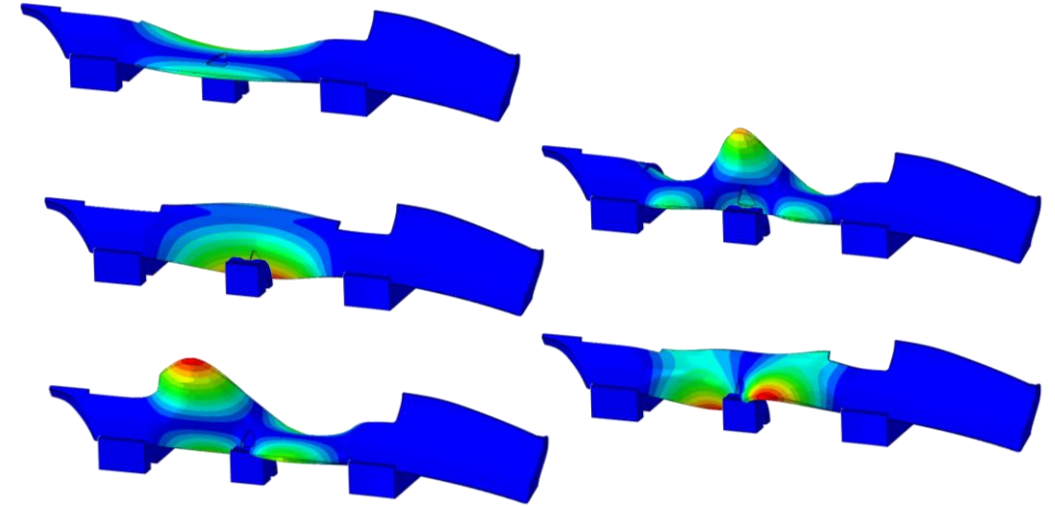
# Challenge

- Temperature Spec: -20~65 → -40~105 (AECQ100)
- Automotive functional Safety: “ASIL”
- Automotive Customers are looking for a “full solution”:
  - Mechanical Assembly
  - Back-lighting
  - Haptic Feedback

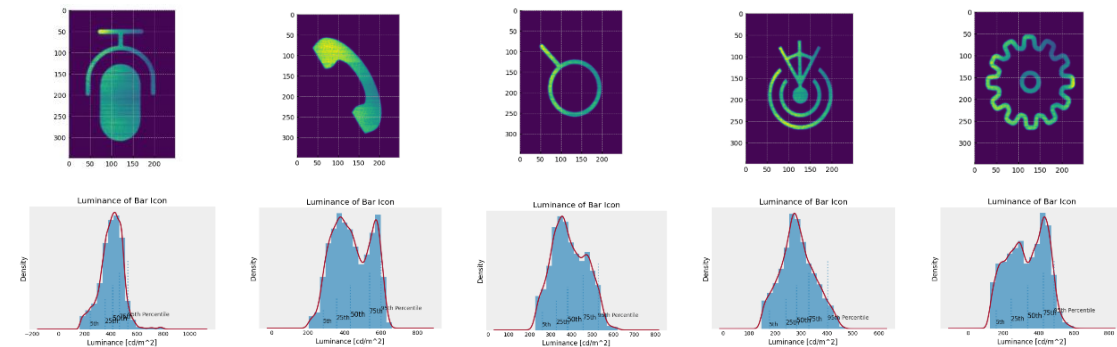
## Calibration Robot



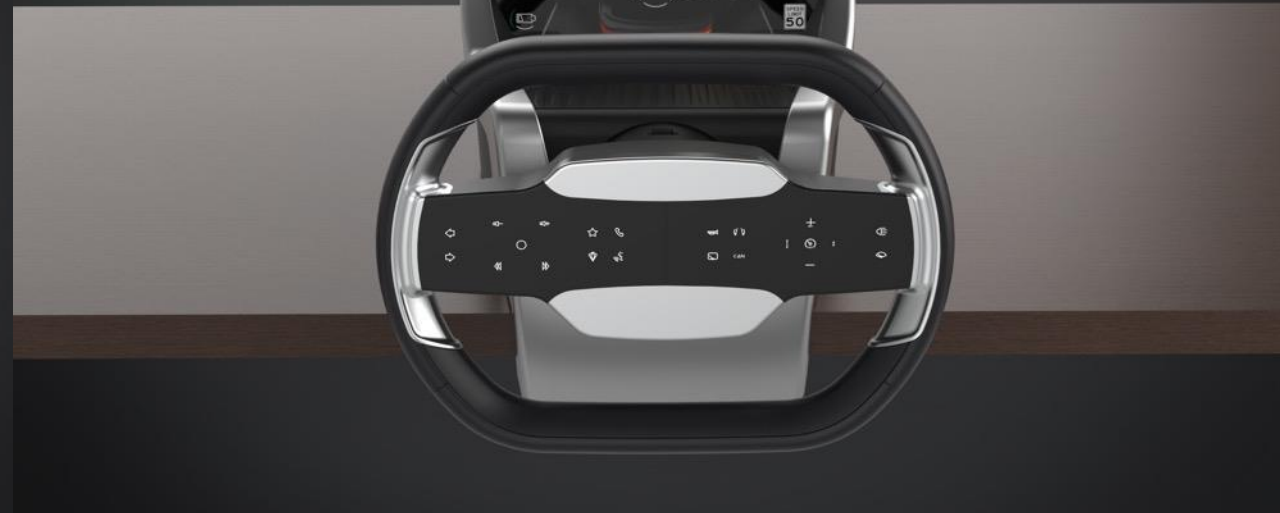
## Haptic Feedback



## Backlight Uniformity



# UltraSense Steering Wheel demo



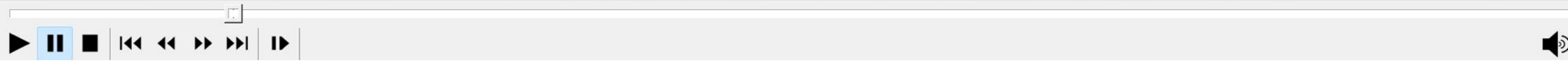
Converts to center console demo



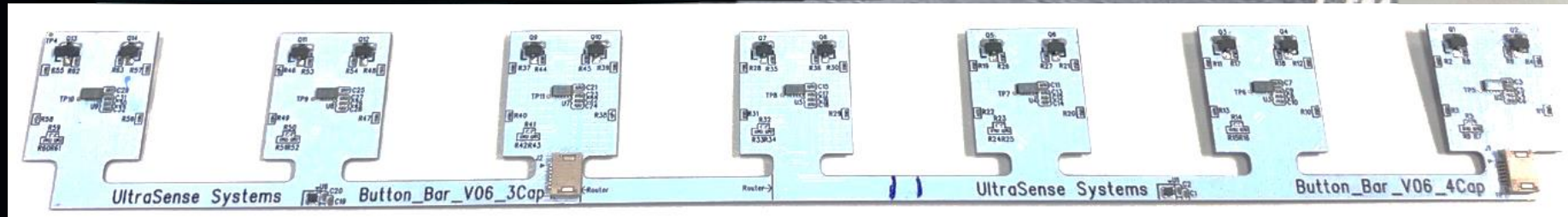
# Shytech / dead front demo



## Secret-Until-Lit Touch Experience Demonstrator



# UltraSense Button Bar demo



# Solid State Interface (SSI) for multiple use cases

## Features

- Press-activated – door cover or button cap
- Programmable force thresholds to open (e.g. 5N)
- Multi-color (RGB) & pattern programmability
- Operable with gloves
- Factory calibrated for plug & play assembly
- Waterproof, IP65
- Integrated LIN comm bus Interface
- Customizable to any form factor (square)

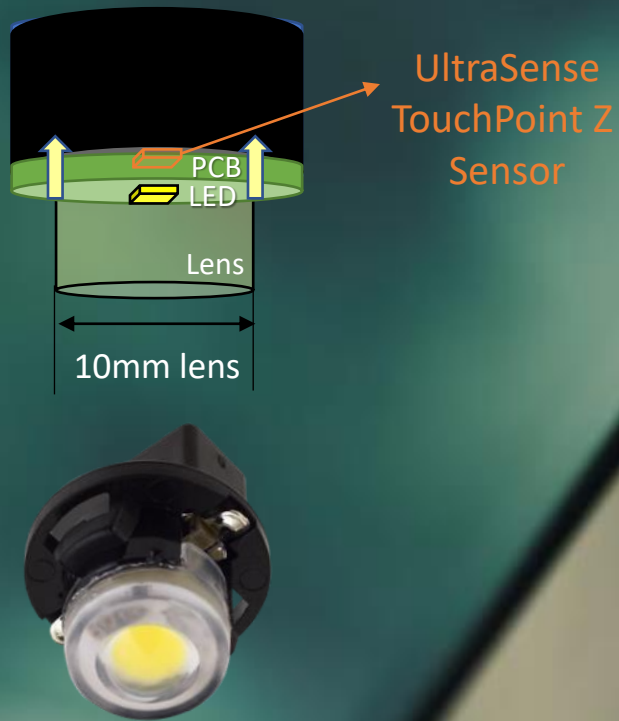
## Use cases

- Charge port door “e-lid” opener
- Frunk / trunk button / liftgate opener





# Solid State Interface (SSI) for overhead lights



- Press exceeds force threshold to power on/control LED
- Configurable force thresholds for power on/off/intensity
- HMI Controller's internal PWM directly controls LED
- No complex attachment of capacitive film
- No extra MCU required to control LED

# Now..

2019

2020

2021

2022

2023



# Learning

- Q\*U\*I\*C\*K
- Don't be afraid of jump out of comfort zone to learn new stuff
  - Refuse to say "I don't know": Try googling. Try asking, Try anything you could!
  - Nothing worse than phd!
- Ride the Tide!



# Finally..

- **Connection**

--50% of technical team recruited by myself  
--Majority of problems I got first answer from friends  
--So, please add my LinkedIn if possible, lets connect 😊

[Hao-Yen Tang | LinkedIn](#)

- **The other 70% of the story:  
“YC's essential startup advice” from Y Combinator”**

--This is a Bible..!  
--Don't quite understand what it's talking about? That's normal. Check it out:

[YC's essential startup advice : YC Startup Library | Y Combinator](#)

## **Y** The Pocket Guide of Essential YC Advice

- Launch now
- Build something people want
- Do things that don't scale
- Find the 90 / 10 solution
- Find 10-100 customers who love your product
- All startups are badly broken at some point
- Write code - talk to users
- "It's not your money"
- Growth is the result of a great product not the precursor
- Don't scale your team/product until you have built something people want
- Valuation is not equal to success or even probability of success
- Avoid long negotiated deals with big customers if you can
- Avoid big company corporate development queries - they will only waste time
- Avoid conferences unless they are the best way to get customers
- Pre-product market fit - do things that don't scale: remain small/nimble
- Startups can only solve one problem well at any given time
- Founder relationships matter more than you think
- Sometimes you need to fire your customers (they might be killing you)
- Ignore your competitors, you will more likely die of suicide than murder
- Most companies don't die because they run out of money
- Be nice! Or at least don't be a jerk
- Get sleep and exercise - take care of yourself