

CES 2019 Notes

by Richard Helfrich

This paper is an assembly of notes collected, along with related input from other sources. These notes cover some exhibitors in selected CES sections. These notes make no attempt to cover all CES or all exhibitors in any one sector or technology.

These notes are limited to a few companies that may be representative of their technological areas and sectors.

CES 2019 was too extensive for one person to visit more than a few percent of exhibits. Spending several minutes at selected exhibits, limits an attendee to no more than 5% of exhibits (220 exhibits out of over 4400) during a week of CES.

The contents of this document are the personal opinions of the author and are not warranted to be complete or accurate.

Photos included were taken with the author's mobile phone camera and may not present products with their ideal rendering found on a company's website.

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Notes covering Selected Sections and Exhibits at CES 2019

Contents

INTRODUCTION	1
SUMMARY	1
Lack of Technological Breakthroughs	1
Smart, Wireless – But Maybe not Secure.....	2
SMART – WHY?	2
SENSORS	2
HEALTH CARE.....	3
Overview	3
FDA Changing 510(k) in 2019	3
Companies	3
SpireHealth www.spire.io/health Health Monitoring Tag.....	4
Withings www.withings.com/us/en/	4
AerBetic https://www.aerbetic.com/ Monitoring Exhaled Gases for Diabetes	4
Omron www.omron.com Wrist Blood Pressure Monitor.....	4
Cochlear www.Cochlear.com Inner Ear Implants.....	4
HOME AUTOMATION	5
Overview	5
Companies	6
Shenzhen UVLED Optical Technology Co., Ltd (59S) http://www.59s.com	6
Kuvings www.kuvings.com Health Friend Smart Juicer (<i>not so smart?</i>)	6
LG www.lg.com Beer Brewer	7
LG www.lg.com Clothes Cleaning Closet– (reduce dry-cleaning).....	7
Toto https://www.toto.com/ Self-Cleaning Toilet – (Helps Handicapped).....	7
ROBOTS	8
Delivery Robots	8
Companies.....	10
Meituan. http://www.meituan.com/	11
ROBOTS for RESTAURANTS / RETAIL	12
Miso Robotics	12
Robot Health Care	13
VEHICLES – ARE THEY ROBOTS WITH WHEELS / PROPELLERS	14
VIDEO DISPLAYS – TVs	14
LG www.lg.com	15
Samsung www.samsung.com	15
NETWORKING, WIRELESS AND DATA SECURITY	15
Wireless for Wide Area and Local	16
Wired Networks and Data Security	16
Bitdefender www.bitdefender.com	17
Next-Gen Network Appliance www.ieiworld.com	17
GADGETS AND MISCELLANEOUS.....	17
Breadware www.breadware.com IoT Product Developer for Others	17
iFlyTek www.iflytek.com/en	18

Notes covering Selected Sections and Exhibits at CES 2019

APPENDIX A – MOST USEFUL PRODUCT	19
Aernos Nano Gas Sensor is my selection of the most useful product at CES 2019.	19
APPENDIX B - TECHNOLOGIES WITH (TOO) MANY EXHIBITORS	20
APPENDIX C – CES PANEL EXAMPLE	21

Notes covering Selected Sections and Exhibits at CES 2019

INTRODUCTION

CES 2019 had more attendees and more exhibitors than ever before. There were too many exhibitors offering Apps, Sports Monitoring Devices, Wearable Devices, Sleep Improving Gadgets, Wireless Devices and Audio products. Many companies exhibiting at CES 2019 were young startups that were not at CES 2018. Most of these young startups could not explain how they would acquire sufficient paying customers, subscribers or sponsors to grow and become profitable in their highly competitive market niche.

Many App companies claimed they addressed a “huge market of billions of users and only needed 0.1% penetration to succeed”. None of them could explain how they would reach that large base of users in order to win 10 million as paying subscribers or as regular users that could be monetized via advertising. It is likely that many of the App startups at CES 2018 no longer exist and this 2019 batch may not survive for CES 2020.

SUMMARY

CES continues as the world's biggest tech and consumer electronics trade show. It appears that a larger percentage of exhibitors and attendees are from outside the US this year. Some network newscasters added the title “Largest Auto Trade Show” to the CES functions. There were exhibits of many concept vehicles (flying cars) along with upcoming production vehicles. Companies that have CES exhibits number more than 4,400^{1, 2, 3} covering 3 major event spaces.

https://ces19.mapyourshow.com/7_0/floorplan/?navbarlink=1

Lack of Technological Breakthroughs

There were thousands of new products at CES and thousands of improved products at CES. Many analysts and reporters as well as sophisticated attendees complained about a lack of real breakthrough products or technologies at CES 2019.

- *Nearly all portable/mobile products are limited by battery power-size-weight-cost.*
- *Most battery powered products need a 10 times or greater improvement in battery storage within the same space and weight and cost used by the best batteries of 2019.*
- *Some battery powered products really need 100 times or greater improvement in battery storage within the same space, weight and cost used by the best batteries of 2019.*
- *Battery costs are dominated by raw materials i.e. cobalt, graphite*

¹ Official exhibits do not include “invitation only meetings, exhibits and events” in several other large convention facilities at hotels such as Wynn-Encore and Aria.

² Several large companies exhibited in multiple buildings to cover a specific types of technology in each.

³ Some mid-sized companies had products in many categories in a modest sized booth

Notes covering Selected Sections and Exhibits at CES 2019

CES will have many breakthrough technologies and products a year after batteries achieve 5x improvements size, weight, cost and power density. Nearly all mobile product sales will boom when batteries achieve 20x improvement in all metrics.

Smart, Wireless – But Maybe not Secure

Nearly all products claim to be SMART and WIRELESS ⁴

Most exhibitors were not able to adequately explain how their App or wireless link was sufficiently secure from hackers. Some personnel at exhibitors were not sure what type of security was implemented or even if security was included in their wireless links.

Every exhibitor could demonstrate their nice-looking user interface.

SMART – WHY?

Making a product smart has become the new mantra of many startups. Exhibitors were using “Smart” more as a marketing tool than to create useful functionality.

- Why does anyone need a smart wastebasket or smart paper shredder that alerts my phone when it is nearly full?
- A really smart wastebasket would travel to the garbage can outside my home and empties itself when it is full, with no participation by a human.
- Even more valuable would be a Robot Butler that performs those and many more mundane tasks.

SENSORS

Sensors are the essential element in nearly all other categories at CES.

Nearly all products contained one to hundreds of sensors in order to be “Smart”. In my view:

The critical elements in every “smart product” are SENSORS (many)

Those sensors detect and/or measure parameters in the physical world. Some exhibitors proclaimed their device was “smarter” with a faster digital processor and a better App interface. However, the processor and App are worthless without sensors. Without sensors, the device would be “dumb” regardless of a super digital processor or fabulous App. Very few could explain the accuracy or their measurements or how that would change over time.

Automobiles are becoming electronics platforms with a large quantity of sensors; some have over 100 processors. The newest automobiles monitor every aspect of the vehicle and actually store data on the driver’s inputs along with every detail of the vehicles systems involved in motion. This data can be accessed and used by insurance

⁴ In many cases one or more Apps claimed the ability to control one or more smart product remotely, anywhere around the world

Notes covering Selected Sections and Exhibits at CES 2019

companies, auto manufacturers and law enforcement under certain conditions, with or without the knowledge of the vehicle owner.

HEALTH CARE

Overview

In terms of these notes, Healthcare Devices are defined as physical devices that require US government FDA approval or at least FDA clearance. This category does not include “fitness devices”, Apps to use with a mobile phone or tablet; but lacking a physical device that requires FDA approval or FDA clearance.

FDA Changing 510(k) in 2019

The US FDA is changing the decades old short-cut process for achieving FDA Approval on Medical Devices and Equipment.

Nearly every company at CES in the process for FDA Approval or Clearance was unaware of the upcoming changes to Approval or Clearance at the FDA. The few that were aware that some change was in process were hoping that they could complete their FDA Approval or Clearance before the change went into effect. They were unaware that the FDA may require some or all prior approvals that do not meet the upcoming standard may need to redo their FDA Approval or Clearance process.

1. FDA is in the process of rolling out a new approach to the 510(k) process. The major change is to require all manufacturers seeking 510(k) approvals to use “predicate devices less than 10 years old”.
<https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm626572.htm>
2. When there are predicates both old (over 10 years since FDA approval) and new (less than 10 years since FDA approval), only the newer predicate device can be used for comparison in the revised 510(k) application. The FDA is trying to ensure that upcoming devices are as good as the most recent devices, including any connectivity links, especially wireless links.
3. This change is likely to increase some costs and complexity for companies pursuing 510(k) device approvals from the FDA. The change will not have a serious impact for large medical device companies. Smaller companies are likely to incur substantial cost increases.

Companies

There were many companies in this product category, although not nearly as many in the Fitness / Sports arenas. There were a few that appear to offer some improvements over 2018 products.

Medical Wearable Solutions www.MedicalWearableSolutions.com

Green Heart Monitoring System (FDA approval in process) Provides 24/7 continuous ECG monitoring with AI processing and remote alerting of physician. Device consists of

Notes covering Selected Sections and Exhibits at CES 2019

a wearable patch with electrodes to detect arrhythmia and Bluetooth link to a mobile phone. *(note this company is in British Columbia, Canada)*

SpireHealth www.spire.io/health Health Monitoring Tag

Health tag attaches to under clothing and can be washed by machine with no deterioration. The tags operate for over a week and then they are disposable.

The tags provide continuous remote monitoring of respiration waveform, sleep, heart rate and variability, activity levels, stress.

Withings www.withings.com/us/en/

ECG Monitor and Activity Watch. (FDA Clearance in process) Continuous ECG waveform to detect Afib that also serves as a water-resistant activity tracker suitable for swimming.

Smart Blood Pressure Monitor with ECG and Digital Stethoscope (product name is "BPM Core") (FDA/CE clearance in process) This upper arm device with display and WiFi tracks and analyzes blood pressure, ECG as well as analyzing waveforms from a digital stethoscope to detect valvular heart disease (VHD). The process requires only 90 seconds.

AerBetic <https://www.aerbetic.com/> Monitoring Exhaled Gases for Diabetes

Diabetes Monitoring and Alert (FDA Clearance in process) by detecting very-low concentrations of exhaled gases in a non-invasive, wearable pendant or watch. The device detects increases of Volatile Organic Compounds without having to test for levels of blood glucose.

Omron www.omron.com Wrist Blood Pressure Monitor

Omron has been around for decades and was the initial producers of the Body Composition Monitor and Scale as well as upper arm blood pressure monitors. Omron also makes and sell various stethoscopes for consumers.

Wrist Blood Pressure Monitor

This Wrist Blood Pressure Monitor contains actual inflatable wrist blood pressure cuff worn as a wristwatch.

This device is not quite as accurate as an upper arm blood pressure cuff but provides results that are within several percent when the user holds the wrist close to the level of the heart. Several other body monitoring functions are included similar to a sports watch.

The device will perform several dozen blood pressure measurements on a single battery charge.

Cochlear www.Cochlear.com Inner Ear Implants

The **Cochlear Auditory Devices** are Inner Ear Implants. The units offered in 2019 have some improvements compared to the models offered in 2018 and prior years. These Cochlear devices have been on the market for many years and there are thousands of users who have undergone the surgery and can hear using the device.

Notes covering Selected Sections and Exhibits at CES 2019

Cochlear implants bypass the damaged sensory hair cells inside the cochlea and convert sound into signals for auditory nerves. These are FDA Approved devices that require surgery along with numerous follow-up visits to activate and adjust the device. Once the device is adjusted to meet the specific needs of a user, it requires only charging from time to time.

There are two components to the implant. The first piece is a small device that is surgically installed under the skin behind the ear with electrodes inserted into the cochlea. The surgical procedure can be performed in an outpatient surgery center under general anesthetic. The second piece is similar to a hearing aid, but instead converts sounds into wireless signals transmitted to the implant.

Nucleus 7 Sound Processor is the external element of the Cochlear implant.

These devices are more expensive than hearing aids plus the added cost of testing, surgery, anesthesia plus several post-surgery visits for adjustments. However, once installed they can operate for years of continuous service. Some Cochlear devices may not be covered by insurance or Medicare so the total cost of devices plus surgery can exceed \$10,000.

Intin Inc. www.oview.kr

Intin makes several health-related products for end consumers.

O'View-W and O'View-M are products related to pregnancy that are expected to be FDA cleared in 2019. There is a small electronic testing unit that is unique for each product. That electronic testing unit wirelessly links to an App on a mobile phone to display and store test results.

O'View-W for females determines ovulation status a full day earlier than the normal urine test using a disposable strip. (photo at right) Tests can be performed on multiple days and tracked by the user.

O'View-M is for males to test sperm count and sperm motility using a disposable mini-cartridge into which a sperm sample is placed. Tests can be performed on multiple days and tracked by the user to help determine how various diet and environmental conditions impact sperm count and sperm motility.



HOME AUTOMATION

Overview

CES had many exhibitors offering home automation in some form or another. Most home automation exhibitors offered some type of mobile App that could interface with

Notes covering Selected Sections and Exhibits at CES 2019

devices connected to Alexa or Google in some manner. The App merely added another portal for control or in some cases the only control mechanism.

Some home automation involved large appliances with added interfaces. An LG refrigerator had a large touchscreen display on the door to enable adding the item and expiration date as you moved items to the refrigerator. That refrigerator would track those expiration dates and may be able to warn the user via an App. The refrigerator would also detect when you removed an item, then add that item to a shopping list (or maybe automatically ordered for home delivery). The door exterior had a large display that displayed the refrigerator contents and connected to WiFi to enable an updated local weather forecast and other data.

This refrigerator was not appealing from a home user perspective.

One company offered a plastic storage container with a “smart lid” which had a sensor that detected when a product inside the container had spoiled based upon the odor molecules emitted by the food. Some food is good well beyond its “Best By Date” while others are no longer edible days before that date. Measuring actual spoilage should be much more valuable.

Companies

There were hundreds of companies offering home automation.

Shenzhen UVLED Optical Technology Co., Ltd (59S) <http://www.59s.com>

LED UV Sterilizer Box

- This company sells sterilizer units under the trade name 59S to kill germs on exterior surfaces in 59 seconds.
- The 59S products are closed before operation to prevent eye damage from intense UV light.
Products range from small containers for very small object to larger boxes suitable for most children’s toys.
- All these products use UV light from LEDs to generate higher-energy wavelengths that can destroy bacteria and most viruses.
- UV at these intensities will not destroy prions that form the agent in Mad Cow disease.

Kuvings www.kuvings.com Health Friend Smart Juicer (not so smart?)

This juicer combined with the mobile App is not as smart as it could/should be.
This juicer uses the typical spin separation of solids and liquids in a centrifugal spinning cylinder-strainer. The notable Kuvings advantage is a separation strainer that is easy to clean compared to older separation juicers – but the juice produced remains the same. It is “allegedly smart” because there is a mobile phone App that provides a recipe of the mix of fruits and vegetables based on a general analysis of each person’s body type and other parameters. Compared to recipe software allowing users to input personal data such as metabolic blood panel test results, this unit does not appear to be smart.

Notes covering Selected Sections and Exhibits at CES 2019

LG www.lg.com **Beer Brewer**
LG Fully Automatic Beer Brewing System – this was the most popular product at CES based on my observation of crowds and TV news cameras/reporters around a product.

This product eliminates the need to know anything about fermenting or brewing other than the style you desire (IPA, Lager, etc.). A consumer puts in the ingredients specified for the style desired and pushes a button. The machine

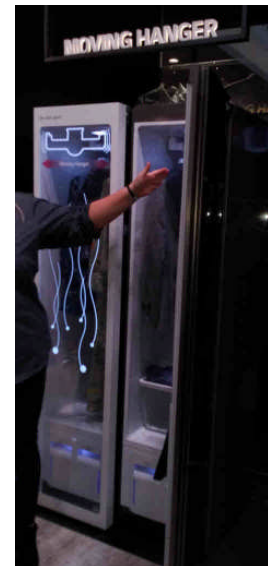


handles mixing, heating, cooling, etc. and after two weeks of fermenting, you can dispense beer in a regular beer tap on the machine. It is not evident why anyone who wanted to make special beers would use this machine. On the other hand, if someone wanted a good draft beer in a specific style, they may be better off buying a “pony keg” (about 2-gallons) and not waiting 2 weeks for their beer.

LG www.lg.com **Clothes Cleaning Closet– (reduce dry-cleaning)**

This is a repeat product for LG but with the addition of a 2nd unit. The major improvement for the product is a lower price point. The LG rep at the exhibit booth indicated that the single-wide clothing cleaning closet is now available at Costco for \$1,600 according to a LG person at this exhibit.

Both new and old units use a combination of steam, ionization and shaking to remove odors, freshen clothing and remove wrinkles. Neither can remove dirt or stains. The combination of steam and shaking removes wrinkles. The door of the closet has a pseudo pants pressing unit that creates a crisp crease in pants. This unit is large and heavy but should reduce the need to bring suits, jackets and pants to a dry cleaner by more than 90%.



Toto <https://www.toto.com/> **Self-Cleaning Toilet – (Helps Handicapped)**

Self-Cleaning Toilet / Bidet Toto has been wildly popular in Silicon Valley for over a decade based on toilets with non-stick nano coatings, despite price premiums that often exceed 100% above other brands.

Toto's 2019 models offered modest improvements over 2018 models, but none were significant other than a minor price cut. These toilets may be attractive to many consumers since they can clean themselves with high-pressure ionized water jets. To make these toilets suitable for auto cleaning, the porcelain surfaces are coated with a nano-scale non-stick layer so a water jet can remove any deposits.

Notes covering Selected Sections and Exhibits at CES 2019

Toilet / Bidet Seat This is an add-on toilet set that offers most of the functionality of the self-contained toilet at a lower price point.

ROBOTS

Robots will eventually replace both knowledge workers as well as unskilled workers and many low-skill workers.

In many cases it is easier to replace knowledge workers where so-called “Artificial Intelligence” (AI) can evaluate vast amounts of data and reach a conclusion as good as, or better than, most trained human beings.

- In certain types of medical diagnoses, AI has demonstrated a correct diagnosis as high as 90% when specialist MDs achieve 70% on average.
- Major financial houses engage in a practice of “High-Frequency Trading” where an AI system creates a buy followed by a sell in microseconds for a small gain on a large number of shares.
- Some brokerage houses are starting to offer “Robo-Advisors” that manage a portfolio of stocks and other investments using AI algorithms and charge a very reduce fee.

Robots have notably improved in dexterity and speed over the last year. One display had a robot that played ping pong with a human player and could return a ball that was hit in a wide range **Omron Forpheus Robot**. However, the human player was not hitting the ball as fast as a good player would.

The important aspects of this ping-pong robot are:

- speed at which the vision system could analyze the ping pong ball in flight
- accurately predict the time when it would reach the area near the robot
- accurately predict the elevation and horizontal location of the ball when it would reach the area near the robot.
- analysis was performed sufficiently fast to allow the processor unit to direct the appropriate action by each of the 5-axis system motors
- move the paddle as needed to return the ball over the net and land within the required zone to meet the rules of ping-pong.

Some futurists fear that robots and AI will replace workers faster than workers can be trained for new jobs created, that will eventually reach larger numbers than jobs replaced. Those other jobs being created typically require greater skills and training⁵.

Delivery Robots

Delivery is a major business sector ripe for replacement by robots, Delivery automation has been stymied by regulatory issues.

⁵ [Automation, jobs, and the future of work](https://www.mckinsey.com/featured-insights/employment-and-growth/automation-jobs-and-the-future-of-work), McKinsey and Company, <https://www.mckinsey.com/featured-insights/employment-and-growth/automation-jobs-and-the-future-of-work>.

Notes covering Selected Sections and Exhibits at CES 2019

- UPS, Fedex, Amazon Delivery and others use a mix of robots and physical humans to receive, inventory, invoice, receive payment, route, sort, ship and deliver a product.
- Humans have been replaced in most non-physical portions of the process where paperwork was once required.
- Major aspects of shipment sorting in warehouses and transship centers are performed by robotic devices reading bar codes or similar labels on packages
- The physical handling of a package on each end of its journey for pick-up and delivery tends to remain the domain of humans:
 - partly due to government restrictions on drones, especially limits on flying near airports and those restrictions are more likely to get tougher
 - partly due to government restrictions fully-autonomous vehicles, but these restrictions are likely to be reduced and ultimately eliminated.
 - partly limited by the range and payload of flying drones.

FLYING DRONES - (large portion of US population within "Restricted Airport Zones)

Flying drones are not viable until government regulations change, and technology improves, especially battery technology. These devices really need 100 times improvement in battery capacity in the same size and weight as the best batteries in production for 2019.

Most people are enamored with package delivery via drones that fly; ala Amazon. Drone delivery is appealing but limited by real-world factors

1. A flying drone may have difficulty reaching the desired (secure) drop point for many office buildings, apartment-condo buildings and other locations where the drop point is inside an entry area.
2. Flying time and therefore range are limited for electric powered drones by the battery technology (weight to energy storage ratio). Noise is a lesser factor for electric drones.
3. Noise is a factor for drones with internal combustion engines, although these units have acceptable range and payload capacity for most deliveries.
4. Payload capacity (weight of the package to be delivered) is severely limited for electric drones.
5. Flying of drones is prohibited or restricted in areas where the majority of people live, since many live within airspace that is regulated in one of the four categories

Federal regulation regarding flying drones are already a challenge for drone operators. https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=22615

There have been recent "close calls" where commercial airline pilots have filed reports of drones close their aircraft. Various pilot associations and airline groups are seeking more stringent FAA regulations on drones.

Notes covering Selected Sections and Exhibits at CES 2019

6. specified in government regulations^{6,7,8,9}: Airspace regulations are likely to become more stringent as more close calls between drones and commercial aircraft are publicized.

GROUND BASED DELIVERY ROBOTS

- Ground-based robots can become autonomous by piggybacking on all the developments involved with self-driving vehicles.
- The combination of robot vehicles (driverless vans) and Robot Dogs provide a practical solution for delivery.
 - There were a number of self-driving vehicles at CES and governments are starting to allow driverless vehicles in a wider range of conditions.
 - This combination handles nearly all delivery conditions by leveraging the range of a van which can travel from a warehouse to the street in front of the delivery address.
 - Then a robot dog (similar to the Boston Dynamics dog) can move the package from the van to the front door and with a robot arm can ring a bell or knock.

Companies

While flying delivery drones make the news, there are large companies that are using one or more land-based devices to deliver packages autonomously. These approaches avoid the complexity, cost and years of effort to achieve FAA flight approval for flying drones and the issues of noise and privacy in residential areas. Most land-based approaches have the ability to delivery heavy and large payloads beyond the capability of flying drones now and in the foreseeable future.

⁶ **Restricted Airspace** such as military bases – Absolute restriction within bases and buffer zones. Permission to fly in these zones for a single flight requires a lengthy process and permission is rarely granted. These restrictions apply to private aircraft as well as drones.

⁷ **Airports/Heliports** – all airports have a 5-mile restricted radius requiring approval for each activity (are over 5,000 “public airports” in the USA along with over 14,000 “private airports” plus about 100 or so military airports and spaceports). Under US federal government regulations, you cannot fly within 5 miles of any of those facilities without going through the required procedures and paperwork; and in many cases receive prior authorization if the drone is commercial. “Commercial drone operators” must submit an application to use a drone each time, days to weeks in advance specifying routes, altitudes and exact times.

⁸ **National Landmarks** – Many have no-fly zones for drones as well as piloted aircraft

⁹ National Oceanic and Atmospheric Administration **Marine Protection Areas** – Prohibit “powered aircraft” whether piloted or a drone.

Notes covering Selected Sections and Exhibits at CES 2019

Continental Corporation <https://www.continental-corporation.com/en>

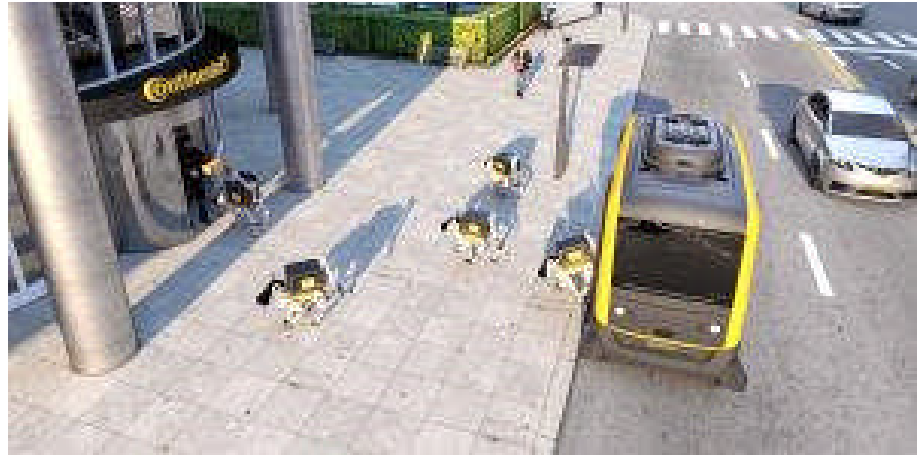
(image source is Continental's promotional materials) **(likely sooner than Drones)**

Continental is a very large company that make the Continental brand of tires, subassemblies for trucks and busses, autonomous-driving technology for highway vehicles and various connectivity systems for vehicles.

Continental is building a

combination of robot dogs and autonomous shuttles; and Continental's concept is shown in the image.

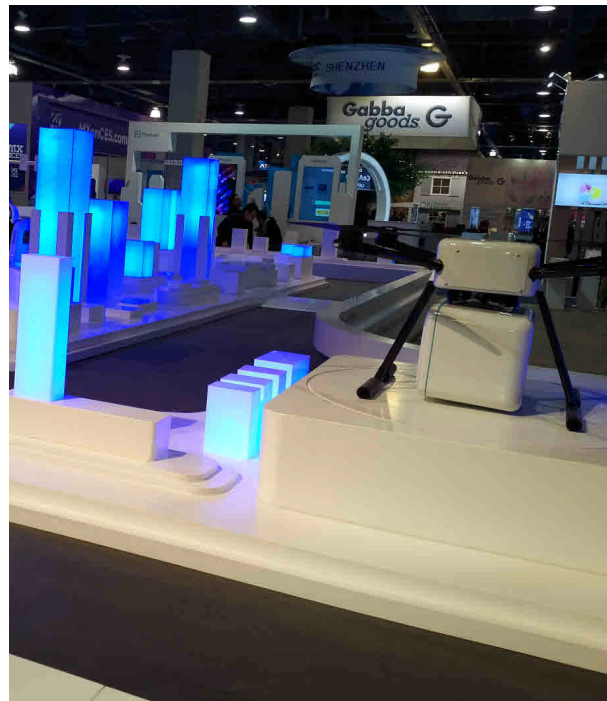
<https://www.continental-corporation.com/en-us/press-/press-releases/seamless-mobility-at-ces-2019-156710>



Meituan. <http://www.meituan.com/>

Meituan is a China-based company that has raised large amounts of private capital that value the company at ~ US \$20B. Meituan is rumored to be considering an IPO in the US during 2019. This is the first appearance at CES for the company. Meituan has limited materials and data in any language other than Chinese.

- Meituan had a large exhibit at CES 2019 that included a model of their actual robot delivery vehicle moving around a test area. (photo)
- Meituan partially solved one step in the delivery process by limiting the delivery vehicle to sidewalks and paths without automotive traffic. It does allow a route that crosses streets when there are suitable crossing sites.
- Meituan claims that a range of sensors can detect and avoid humans, pets and obstacles on a path and navigate around the object.
- One product named Meituan Autonomous Delivery (MAD) (photo of robot and mini route) <https://mad.meituan.com> delivers food and provides courier service in China.
- Meituan claims to have made hundreds of thousands of deliveries in China.



Notes covering Selected Sections and Exhibits at CES 2019

ROBOTS for RESTAURANTS / RETAIL

CES 2019 had a number of robots that are not for end-consumer use.

- Restaurants and hotels employ a large number of low-skill to moderate-skill workers. Companies that employ these workers experience a high rate of turnover along with the challenge of training new workers on their processes, safety, guest interactions.
- Many positions can be easily automated with robots, but some are not likely to be automated quickly, such as housekeepers in hotels that must adjust to each guest's special needs.

Restaurants in the fast food sector, and fast casual sector offer a better opportunity to automate many positions using robots.

- Fully automated fast food restaurants are likely to be the first business that operates without any people other than occasional robot maintenance technician.

Robots at CES 2019 also addressed supermarket applications such as an automatic high-speed continuous bread baking unit that prepares and bakes 10 loaves of bread at a time. It is unlikely that any individual consumer would want or need that much bread.

Miso Robotics

One company that appears to offer a viable business designing, building and selling robots for restaurants is Miso Robotics <https://misorobotics.com/>

A single robot "**flippy**" handles all the cooking work required by many fast food shops; including cooking multiple burgers and deep fry orders at one time to the correct temperature for safety or as demanded by each individual customer.

Flippy has been tested in a Pasadena restaurant and will soon be at Dodger Stadium during Dodger games. **Flippy can make 300 burgers per hour with no mistakes, keep the grill clean and adjust to both peak and slow business periods without overtime at a total cost including amortization and maintenance of less than \$5.00 per hour.**

1. Cooking on the grill - burgers or cheese burgers cooked to each customer's level of doneness determined by internal temp
2. Cleaning the grill by scraping loose food bits off and placing them in the waste bin
3. Cooking in several deep fryers - chicken nuggets, French fry's or other meats/vegetables cooked to the internal temp required by "safe food handling" requirements
4. Using a straining sieve to clean scraps from the deep fryer between cooking and placing scraps in a waste bin.

Notes covering Selected Sections and Exhibits at CES 2019

Another robot not offered by Miso is still needed to handle customer interface to enable the “**restaurant-of-the-future with zero workers**”, but that should be easier:

This restaurant-of-the-future with zero workers is almost certain to produce much lower rates of food-borne illness.

- The order-taking automation is easy and can be a kiosk or mobile phone app, but cash payment would require a kiosk like a ticket machine.
- Order assembly and delivery is modestly difficult. Each order must include the exact items ordered and provided to the correct customer or table.
- Order assembly of several items and delivery is handled by a human - FOR NOW – expect this robot soon from companies in Japan.

Can the fully automated fast food restaurant (McDonald's, Starbucks, etc.) become common within a year or two?

What will happen to the millions of workers in those restaurants?

Robot Health Care

Robot Health Care is both appealing and needed, particularly in countries with a large percentage older people relative to young people; most highly developed countries including Japan, EU countries and the US.

The ultimate health care robot capability with the greatest market opportunity is a robot that can perform a wide range of health care physical functions inside the home of a person with physical limitations.

- Such a robot would handle functions such as physically moving a person.
- The types of motions would cover transferring a person from a bed to a wheelchair, into a bath/shower, from a wheelchair to a sofa, etc.
- Ideally that robot would be able to perform medical testing functions such as taking and analyzing blood or urine samples, along with interfacing with wearable devices for vital signs.
- The ultimate robot would perform therapeutic functions including injecting medications and performing physical therapy.

CES had some panel sessions on health care robots¹⁰.

- Future caregiving robots may provide the full functions of a nurse and physical therapist.
- That is far from the current state that can handle some physical observation of health conditions and speech interaction with the subject.

¹⁰ Creating Tomorrow's Robotic Caregivers

Despite alarmist headlines, robots can benefit humanity in many ways. In caring for the elderly, children with autism and people with special needs, robots can interact with individuals on their terms. Learn how robots can help caregivers support their loved ones.

VEHICLES – ARE THEY ROBOTS WITH WHEELS / PROPELLERS

There were many auto companies and vehicles at CES with the notable exception of Tesla. There were vast crowds in long lines waiting to ride or just sit inside prototype self-driving vehicles. At CES 2019 there were a few Lyft ride-share vehicles (BMW's) that were nearly Level 5 autonomous – except for navigating the pick-up and drop-off locations in the densely crowded CES sites where a human driver was required.

- This year attendees at CES expected to experience fully-autonomous prototype vehicles (Level 5) that would arrive in dealer showrooms as 2021 production models.
- On the other hand, auto companies have pursued a cautious approach. Manufacturers are focused on advanced driver assist that still requires a driver to monitor the vehicle in most situations (Level 4) with some limited potential for Level 5 on some roads.

CES attendees have been enamored of fully self-driving vehicles that have interiors resembling a living room since CES 2017. I believe it may take a decade before those vehicles arrive in dealer showrooms for sale. Vehicle manufacturers continue to evaluate potential litigation and outsize product liability that may in some court cases, shift liability from “distracted drivers” to alleged design failures by vehicle manufacturers selling “self-driving vehicles. Vehicle manufacturers express concerns regarding self-driving vehicles sharing roads with human-driven vehicles. Regardless of actual blame, self-driving vehicle manufacturers are certain that attorneys will sue the manufacturer of the self-driving vehicle.

Many auto enthusiasts view the future of vehicles as “Delivery Robots”.

- Individuals no longer own vehicles
- Passengers simply summon a ride-share service when transportation is desired.
- One company even touted a future vehicle that could be quickly converted from a package delivery vehicle to a passenger delivery vehicle.

VIDEO DISPLAYS – TVs

The next big thing in video displays is ultra-high definition television (UHDTV) commonly called 8K resolution with 33.2 million pixels per. Each frame has 7,680 horizontal pixels by 3,840 vertical pixels. (limited benefit for screens smaller than 100 inches)

This ultra-video 8K was pushed to market in order to get consumers to upgrade their TVs.

- LG and Samsung have large display factories in Korea with tens of billions of dollars of production equipment.

Notes covering Selected Sections and Exhibits at CES 2019

- China has decided that displays are a market that they should dominate, with brands such as TCL.
- TCL has built large flat panel factories in China so there is at least a 20% oversupply in global production capacity relative to global demand.
- The 8K technology was developed now to convince consumers to upgrade their perfectly good 4K TVs.
- There is a lack of 8K content from TV and movie studios although many recent movies have been produced in 8K
- There is no practical method to deliver content via streaming and no service, even Netflix, offers 8K.
- There are no Blu-Ray disks with sufficient capacity to hold a 2-hour 8K movie with the best compression that does not noticeably degrade the 8K experience.

Consumers can purchase 8K displays from many major TV producers such as LG, Samsung and TCL. The displays look stunning using 8K demo videos at CES. The newest video media is Ultra HD Blu-Ray that can achieve 100GB per disk. That is sufficient for short 8K videos, but not full-length movies.

LG www.lg.com

LG Signature OLED TV R (roll-up TV) This is the new “Rollup Video Screen” from LG. The display is an “organic light-emitting diode) OLED meaning that the display is a polymer plastic sheet with the LEDs made using plastic transistors inside the plastic film. (useful for people that want to display their priceless Picasso when not watching TV.)

- OLED displays are by their nature, flexible.
- LG has taken advantage of that flexible feature and made a TV that rolls up into a small box.
- It functions like an old window shade, but the LG unit is automated with a motor extending-retracting mechanism.
- The initial units are 65-inch diagonal TVs.
- These OLED TV R units can be ordered now for delivery starting in March 2019.
- Prices were not announced but expected to be about \$15,000 for 2019.
- The size of the market for these products may not be very large.
- How many people will pay a hefty premium to have a TV that rolls to provide a view of the wall – unless you have a famous work of art on the wall.

Samsung www.samsung.com

Q900FN QLED 8K TV is an 85-inch very bright unit that can be purchased starting in October 2019. Like all 8K displays, the issue is content and not just how nice it looks.

NETWORKING, WIRELESS AND DATA SECURITY

Products at CES 2019 without wireless data links tended to be small stand-alone appliances or equipment containing a very high-speed wired link beyond continuous wireless data rates. It was difficult to find any product at CES 2019 that did not include

Notes covering Selected Sections and Exhibits at CES 2019

some aspect of a wireless data link, whether that wireless link added value or not.

One critical aspect of both consumer-grade wired, and wireless communication is data security. Consumers send all their financial, medical and personal data over communications links that are not highly secure, or in many cases insecure. It is a matter of luck that more people's data is not hacked and used for nefarious functions.

Wireless for Wide Area and Local

- There was far too much hoopla about 5G wide-area Wireless Technology at CES 2019. The 5G standard can achieve somewhat better data speeds in an area where there are few other users.
- The major improvement offered by 5G is the ability to deliver similar speeds in a densely crowded urban environment
- A very large number of users within a very small area, such as a stadium, can each receive a different high-speed wireless stream at the same time.
- Wireless 5G base stations are powered by the grid so power consumption is not an issue.
- Streaming full-rate wireless video to a mobile phone will consume power that will degrade useful operating time on the phone battery
- Using the mobile phone camera(s) to stream full-rate wireless video to a remote location will consume much greater power and substantially degrade useful battery operating time.

Companies such as AT&T have TV advertising promoting 5G speeds. Unfortunately for AT&T, they have not installed actual 5G base stations and may not anytime soon.

The speed offered by 5G in congested wireless areas is highly attractive to customers but changes the cost-of-wireless paradigm for wireless service companies.

- The 5G standard will require many more base stations in close proximity to each other to offer high-speed wireless to all customers at the same time.
- The cost to establish a nationwide 5G system is on the order of \$50B according to financial analysts on Wall Street.
- Existing wireless companies do not have \$50B of cash sitting around to invest, but most could issue added stock or bonds.
- More importantly, would that investment provide a suitable return-on-investment to any wireless company?
- To make the 5G world economically viable, wireless companies would have to charge a hefty premium for their 5G customers above the prices of their 4G customers.
- Are there enough customers willing to pay a hefty monthly premium (possibly \$16 to \$26 per device per month) for 5G relative to 4G?

Wired Networks and Data Security

(these high-security hardware units should be used by most people and every single business but are likely to be more complex to setup and update for the average person)

Notes covering Selected Sections and Exhibits at CES 2019

Bitdefender www.bitdefender.com

Cybersecurity Hub is a physical box that connects to the exterior network link coming into a home at speeds up to 1 gigabit per second. The Cybersecurity Hub is a hardware unit that goes ahead of your router and your router is used in bridge mode. Cybersecurity Hub inspects data flows for any type of malicious activity.

Next-Gen Network Appliance www.ieiworld.com

Puzzle Network Appliance

- Firewall, Router and software box at Gb speeds
- Can function as a router and firewall for lesser needs
- With add-in cards the same unit can add functions in 1U format
 - Up to 10 Gb WAN links
 - Virtual Private Network (VPN)
 - Software-Defined Wide-Area-Network (SD-WAN) service chaining
 - Encryption
 - Anti-Spyware
 - Filtering

This is a serious device for a home office or a small business or a small branch office. It will require sophisticated setup by an IT person that understands hardware firewalls and router setup and can tailor that setup to a specific user's needs.

The benefit of this type of device is a much greater level of protection than possible with software along with the ability to handle deep inspection of multiple gigabit per second data streams.

GADGETS AND MISCELLANEOUS

There were thousands of devices at CES 2019 that are not easily classified.

Breadware www.breadware.com IoT Product Developer for Others

Breadware provides a valuable service for Internet-of-Things (IoT) startups and emerging companies that lack one or more internal resources to develop and/or promote an IoT product. Breadware provides capabilities for product definition, prototype development, beta-test preliminary products and product launch. This type of service can provide great value to a startup lacking the ability to design and/or produce a prototype and/or launch a product. There are likely to be divisions within larger companies that require one or more IoT services during this early boom phase of IoT.

This wave of Internet-of-Things products is substantial. Service providers can generate substantial revenue at very good gross margins during early stages of IoT products.

There are many similarities between this IoT boom and the MEMS boom almost 3 decades ago. During that boom there were dozens of companies created to provide a range of MEMS services to thousands of MEMS product startups as well as dozens of large companies that sought to create and market MEMS products but lacked several

Notes covering Selected Sections and Exhibits at CES 2019

MEMS capabilities. After a few years, large companies were able to bring a full suite of MEMS capabilities in house and no longer required third party MEMS services.

Very large numbers of startups and smaller companies making and selling MEMS products continued to require several MEMS development and launch services for several years. Many MEMS-product startups needed outside design, prototyping and product launch services in particular. Many of these MEMS-product startups could not pay a full price for MEMS services in cash. Some MEMS-service providers closed down when they could not find customers able to pay all cash for services. Other MEMS-service providers sold their services for a mix of cash and securities (notes, convertible debt, stock, warrants, or other instruments).

Unfortunately, most of those securities issued by MEMS-product startups and small businesses became worthless due to escalating competition. Only a few percent of the many MEMS-product startup companies grew and prospered. As a result, a handful of the companies offering MEMS design, development and marketing services survived and succeeded for ten or more years.

Will the IoT product sector follow the same path as the MEMS-product sector?

Will Breadware successfully navigate the maturing IoT sector over the next decade?

iFlyTek www.iflytek.com/en

iFlyTek makes audio, navigation and other devices for several applications.

One device that could offer value is a real-time translator that allows a conversation between two people that have no common language. The complexity of real-time translation requires extensive signal processing, especially when speakers may have accents. Given the computational complexity that ups power consumption, the battery drain could limit the operating time of the headphones. There did not appear to be a port to connect an external battery.

Mobius – Real-Time Multi-Language Translator

Real-time translation headphones

This device claims to allow two people to converse where each speaks a different language. Each person wears headphones linked to a mobile phone that is used as a microphone and user interface. The Mobius translation software is resident in the earphones and includes a DSP processor, proprietary algorithms and Bluetooth link to headphones. Each of two people speak into the other person's phone that is set to translate from their own language to the listener's language. As each one speaks in their own language, the listener hears the translated version in real time. The initial device supports Chinese (dialects not specified), English, Japanese, Korean, French, Spanish, and Russian.

APPENDIX A – MOST USEFUL PRODUCT

Aernos Nano Gas Sensor is my selection of the most useful product at CES 2019.

<http://www.aernos.com/>

This device is the most useful product based upon the quantity of end-user applications, number of companies incorporating the sensor into system products and unit volume.

Aernos has achieved these results through:

- Development of various nano-layers that can specifically detect specific gases.
- Detection structures on the device to quantify the gas concentration for each gas
- Integrated electronics that convert ultra-small analog signals from the nano-layer sensors to levels useful for real world signal processing, and conversion to digital.
- Algorithms to analyze the signal to provide useful information.
- External driver electronics to create alerts
- Processor electronics to implement the algorithm
- Integration of all of the above capabilities including multiple gas sensors, sensor interface electronics, digital signal processing and external control electronics onto a single silicon chip of about 2 mm on each side.

These devices are integrated onto a mixed-signal integrated circuit. Aernos produced the initial gas sensor portions of the device at their own semiconductor facility in San Diego, California. The fully-integrated device is produced by independent semiconductor foundries.

It may be necessary for Aernos to add their own unique nanolayers on sensors in the sensing portion of each device in Aernos' own semiconductor facility. Semiconductor foundries have restrictions on materials inside their facilities to prevent contamination. That may create a barrier for competitors in this space.

Sensors are nanoscale in all dimensions to achieve the sensitivity required for many applications where very low concentrations of certain gases may indicate a life-threatening condition.

Existing Aernos-based systems already developed and being shipped are:

- **AerBetic Diabetic Alert Devices** (discussed in the Health Care section of this document)
- **Toxic Gas Detection Device** for industrial workers and first responders

APPENDIX B - TECHNOLOGIES WITH (TOO) MANY EXHIBITORS¹¹

- Wireless Devices garnered the most exhibitors with over 1,000 companies offering wireless devices as their focus or as a core aspect of a product. An example of a “wireless device” company is Kwikset which is a very large lock manufacturer that has products controlled via wireless.
- Software and Apps included over 700 exhibitors, many were very small companies and a good number were seeking investors more so than customers. It is likely many of these companies will not survive until CES 2020.
- Vehicle Technology was third in terms of exhibitors with nearly 700 that included the full spectrum from speakers for a car to a self-driving auto (Kia) to a flying taxi (by Uber). Many vehicle exhibitors backtracked from CES 2018 and plan to keep the steering wheel (Nissan) for a few more years. Several pushed their all-electric vehicles such as Nissan which holds the crown for the most electric vehicles sold worldwide and has extended the range of the Nissan Leaf Plus. Tesla did not participate in CES 2019.

¹¹ Many exhibitors are counted in more than a single category. The mega companies could justify many categories due to an extensive offering of vastly different products. Smaller companies wanted to be in many categories and listed themselves in every category that had any possible relationship to their product-service offering.

APPENDIX C – CES PANEL EXAMPLE

CES 2019 offered numerous free panels open to all attendees in addition to specialized conference sessions entailing substantial costs. These free panels can provide useful information to attendees on a specialized topic. However, presenters on free panels sometimes include a promotional aspect to their presentations that highlight a company with which they are affiliated. Most panelists try to be educational with promotional aspects hardly noticeable. Some panels can be very useful to attendees seeking general information on a topic that is new to an attendee.

There was a panel on restaurant automation at CES 2019 that covered a few of the issues involving automation at restaurants and the elimination of low-skill workers. Issues such as the impact of higher minimum wages on the IRR of an investment into robots was not part of this panel. This panel focused on the technological issues of these robots.

PANEL: On the Menu: Robots Cook Up Faster Food

When and if robots will fill orders with speed, cleanliness and customization as the next generation of chefs.

[Greg Becker](#)

CEO and Founder Nourish Technology Bbox, a small footprint cafe operated by robots (specifically the robotic dream team “Bev” and “Jarvis”) which start each day by grinding organic coffee beans, brewing fresh coffee, and making customer drinks on demand.

[Keith Shaw](#)

Editor RoboBusiness/RBR kshaw@ehpub.com .

[Dr. Randall Wilkinson](#)

CEO Wilkinson Baking Company - Wilkinson Mini Bakery uses robots for in-store baking of bread throughout the day.

[Cynthia Yeung](#)

COO Cafe X Cafe X’s robotic coffee bars produce up to three beverages in 40 seconds which guests order ahead via mobile app and pick up their drink within seconds of arriving.

[David Zito](#)

CEO and Co-Founder Miso Robotics <https://misorobotics.com/>

(see Miso Robotics covered in section above on Robots in Restaurants/Retail)