



**MEMS传感器，机器人，智能汽车**

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# Agenda

- 我自己的经历
- 华登过去几年看到的趋势：半导体性能/成本驱动产业变革
  - 芯片赚钱-产品赚钱-服务赚钱
  - Umbrella，Gopro，大疆，美团
- 下一个是谁呢？手机来了，抢时间！！！
  - 机器人，智能汽车等。花更少的钱，更少的时间！
- 机器人
  - 替代奴隶，家畜，还有员工
  - 工业机器人：制造业！
  - 服务机器人：人口大国
  - 传感器：从第六感到第一百感。
- 智能汽车
  - ADAS
  - 电动汽车
  - Uber
  - 传感器：从替代到创新
- 华登

# 50 Years of Moore's Law

The experts look ahead

## Cramming more components onto integrated circuits

With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip

By Gordon E. Moore

Director, Research and Development Laboratories, Fairchild Semiconductor division of Fairchild Camera and Instrument Corp.

The future of integrated electronics is the future of electronics itself. The advantages of integration will bring about a proliferation of electronics, pushing this science into many new areas.

Integrated circuits will lead to such wonders as home computers—or at least terminals connected to a central computer—automatic controls for automobiles, and personal portable communications equipment. The electronic wristwatch needs only a display to be feasible today.

But the biggest potential lies in the production of large

machine instead of being concentrated in a central unit. In addition, the improved reliability made possible by integrated circuits will allow the construction of larger processing units. Machines similar to those in existence today will be built at lower costs and with faster turn-around.

### Present and future

By integrated electronics, I mean all the various technologies which are referred to as microelectronics today as well as any additional ones that result in electronics func-

**Integrated circuits will lead to such wonders as home computers - or at least terminals connected to a central computer - automatic controls for automobiles, and personal portable communications equipment.**

— Gordon Moore, 1965

**In the beginning, it was just a way of chronicling the progress. But gradually, it became something that the various industry participants recognized. ... You had to be at least that fast or you were falling behind.**

— Gordon Moore, 2015

a two-mil square can also contain several kilohms of resistance or a few diodes. This allows at least 500 components per linear inch or a quarter million per square inch. Thus, 65,000 components need occupy only about one-fourth a square inch.

On the silicon wafer currently used, usually an inch or more in diameter, there is ample room for such a structure if the components can be closely packed with no space wasted for interconnection patterns. This is realistic, since efforts to achieve a level of complexity above the presently available integrated circuits are already underway using multilayer metalization patterns separated by dielectric films. Such a density of components can be achieved by present optical techniques and does not require the more exotic techniques, such as electron beam operations, which are being studied to make even smaller structures.

### Increasing the yield

There is no fundamental obstacle to achieving device yields of 100%. At present, packaging costs so far exceed the cost of the semiconductor structure itself that there is no incentive to improve yields, but they can be raised as high as

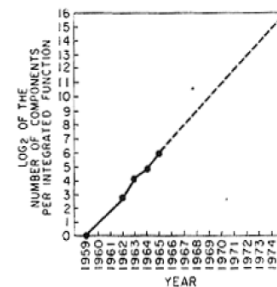
is economically justified. No barrier exists comparable to the thermodynamic equilibrium considerations that often limit yields in chemical reactions; it is not even necessary to do any fundamental research or to replace present processes. Only the engineering effort is needed.

In the early days of integrated circuitry, when yields were extremely low, there was such incentive. Today ordinary integrated circuits are made with yields comparable with those obtained for individual semiconductor devices. The same pattern will make larger arrays economical, if other considerations make such arrays desirable.

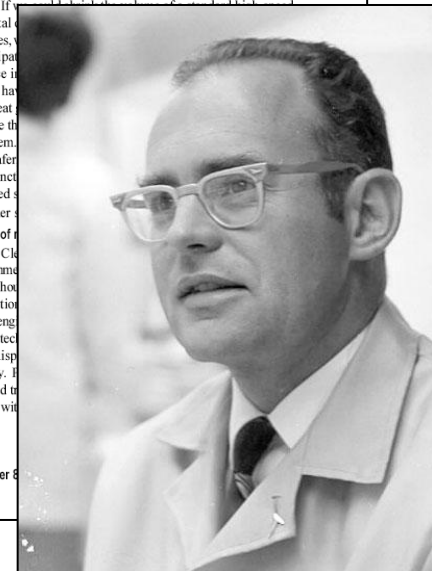
### Heat problem

Will it be possible to remove the heat generated by tens of thousands of components in a single silicon chip?

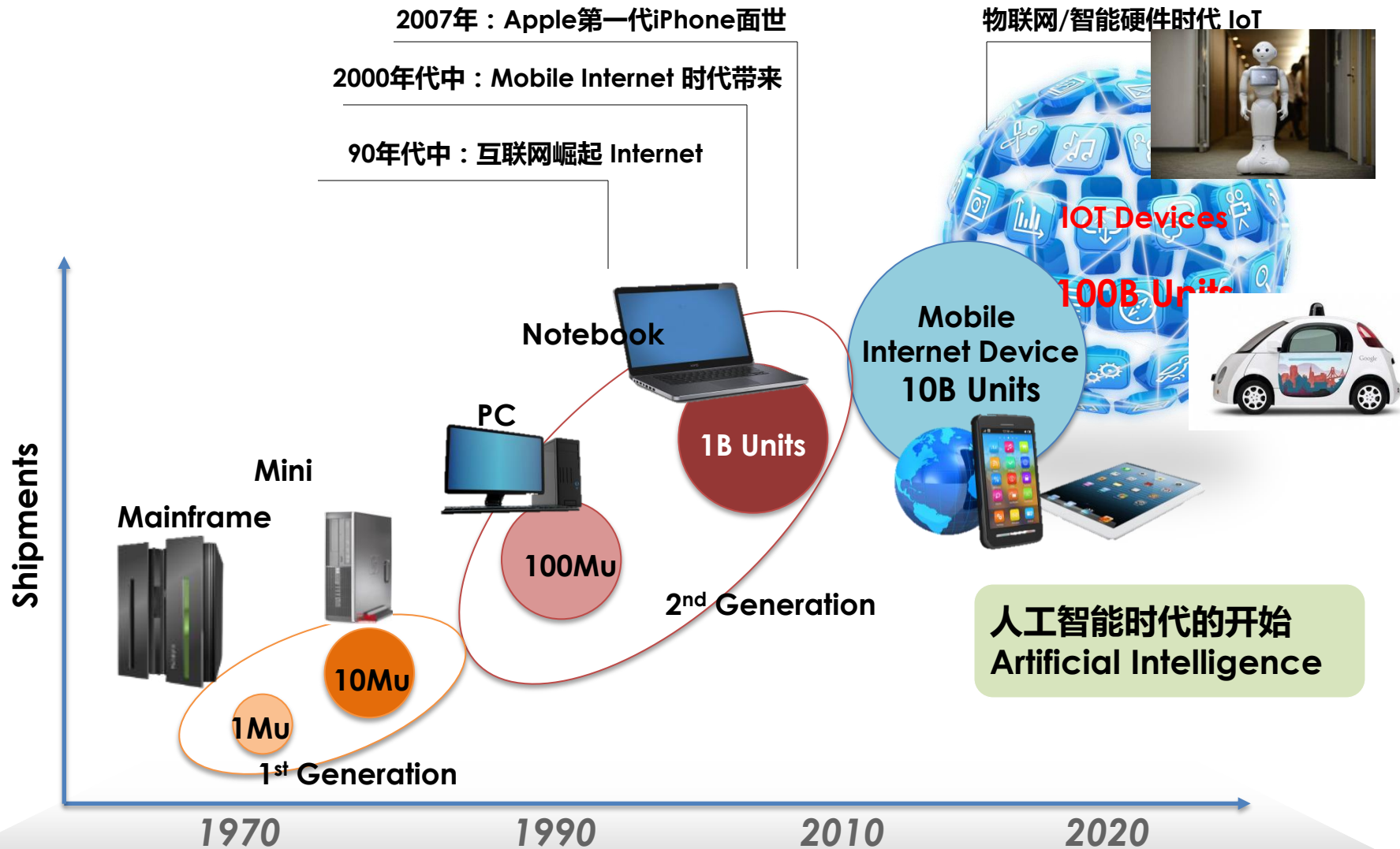
If digital systems, self-heating, dissipation, and heat drive the system, a wafer distinct from the integrated circuit is higher. Day of the future, we should function the engineering, the technology, the array. It could be a function with



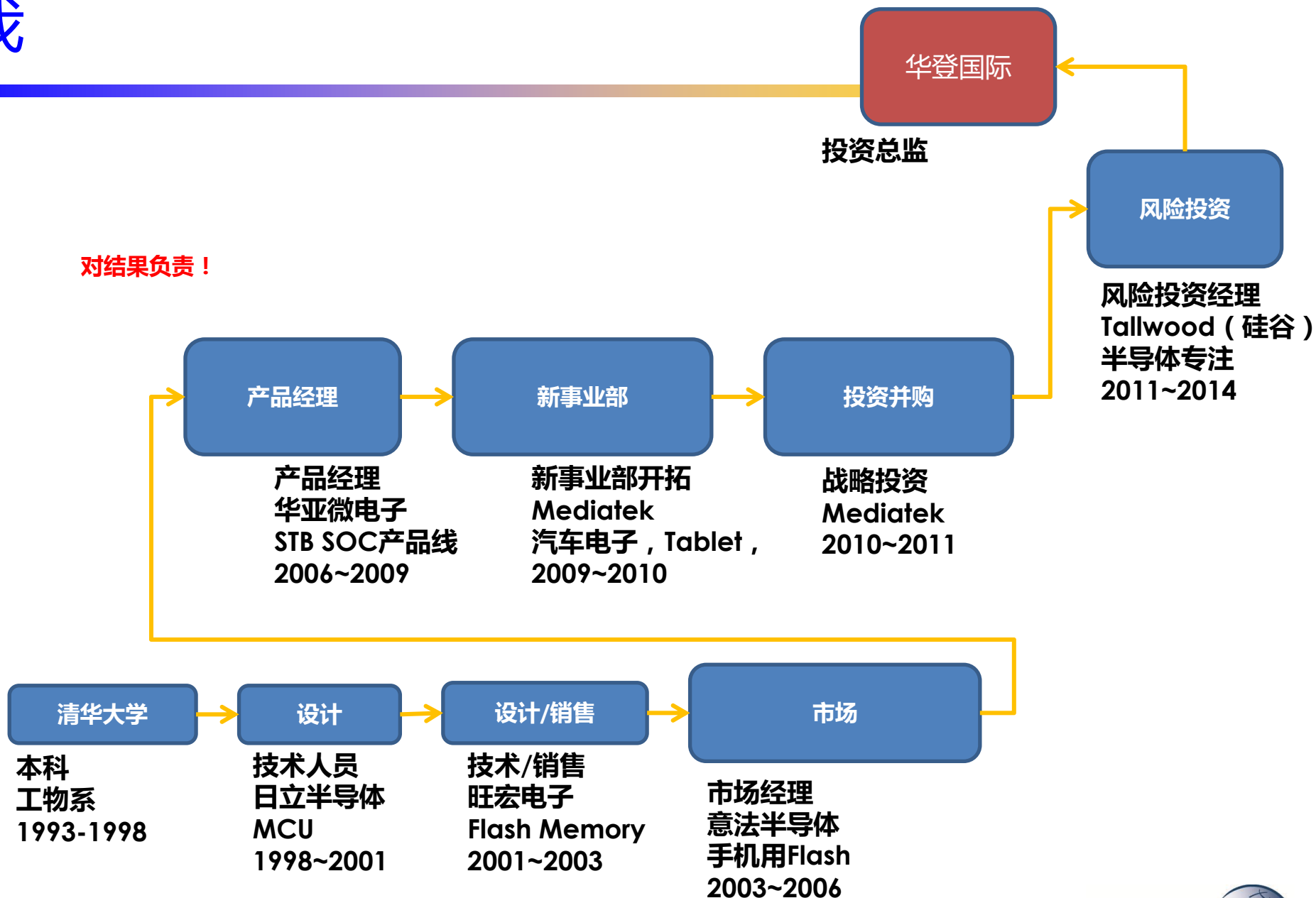
Electronics, Volume 38, Number 5



# 半导体的发展：Smaller, Smarter and Smarter



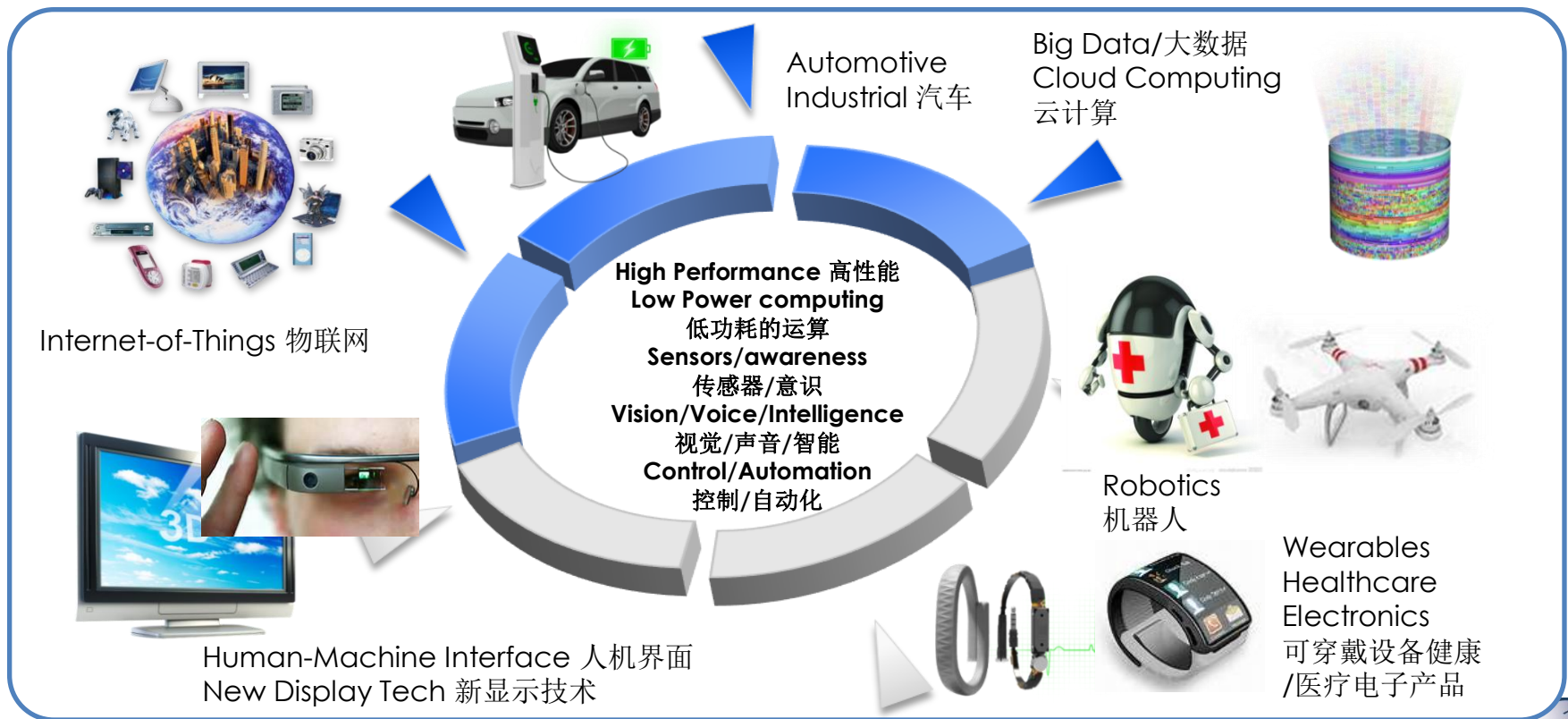
# 我



# 华登国际 投资电子产业链，28年，100家

## Semi

- Invest in Semiconductor value-chain
  - Core technologies: Semiconductors / sensors / Electronic Materials
  - Innovative Electronic Systems 创新的电子系统
  - Algorithm/Software/IP 算法/软件/ IP





# GoPro : Wearable Camera

## GoPro App

Control. View. Share.



**GoPro**  
Be a *HERO*.™

# DJI 大疆 : Flying Camera



大疆创新





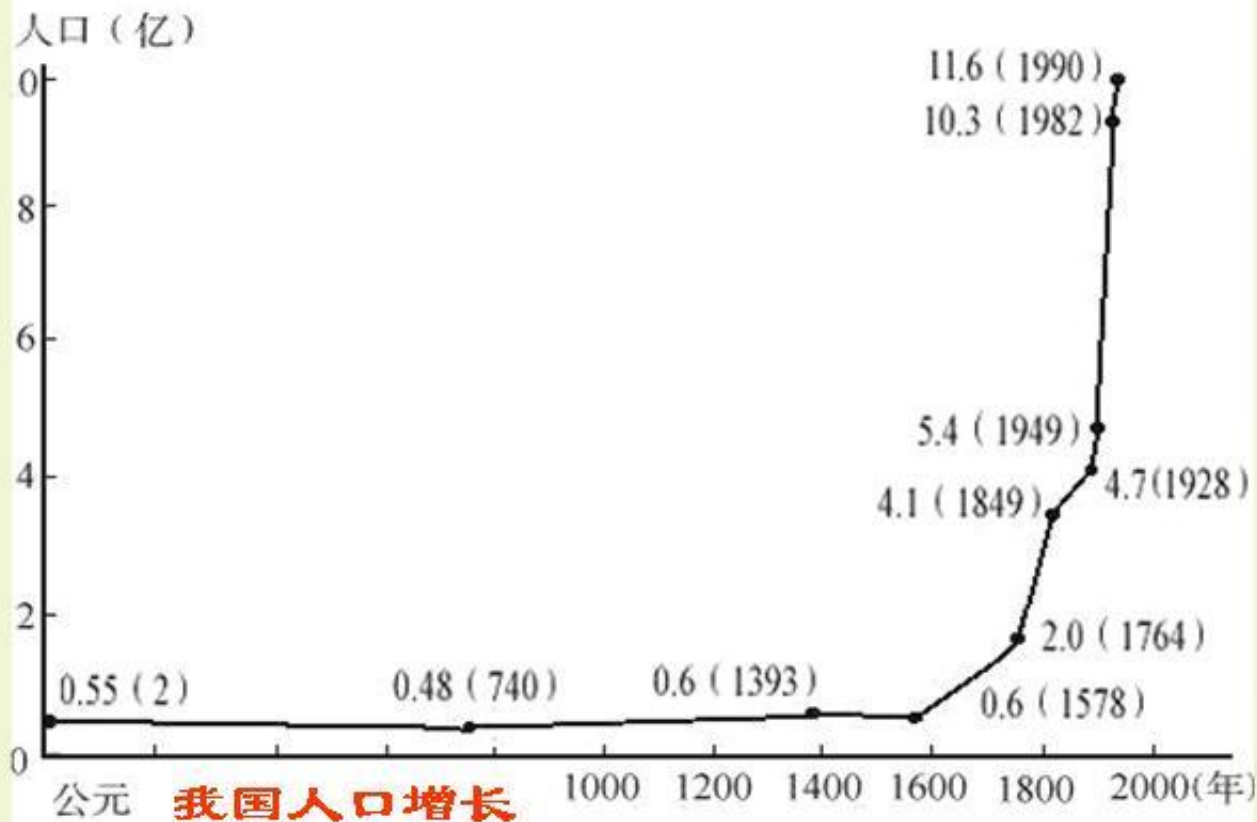


➤ What is the NEXT?

➤ 大疆的vision？, Gopro不能做什么？花的时间！

# 当人类有了越来越多的选择.....时间是limitation

时间：奴隶耕地90% → 牛耕地70% → 拖拉机耕地 30% → 未来0%

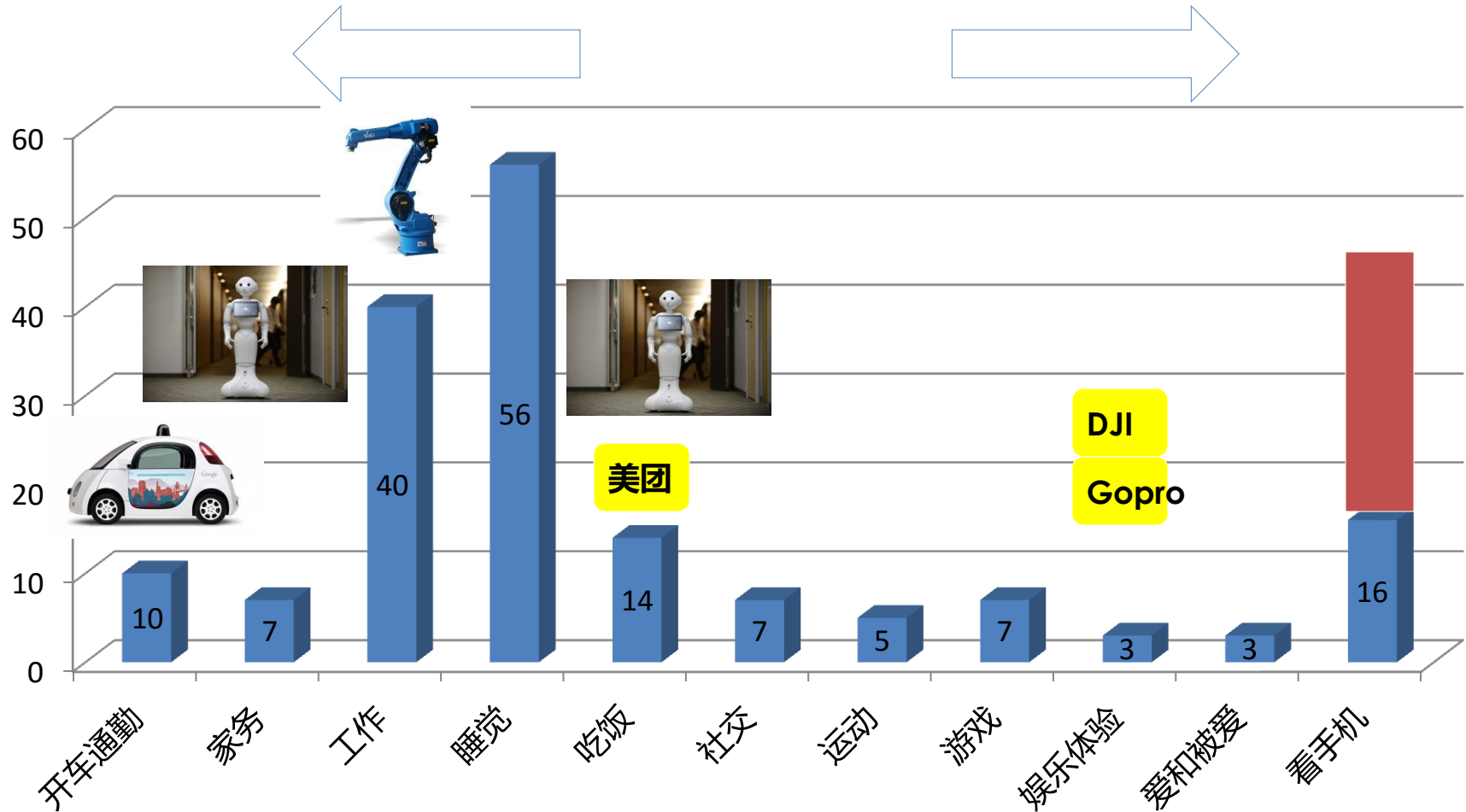


美国农业规模化，中国制造业规模化，

# 今天？ 时间（一周168小时）用在.....

不喜欢的事情：机器来做

喜欢的事情：人来做



人因此获得大量时间，成为更自由的人。

## 1. 机器人

- 工业机器人
- 服务机器人



# 机器人广泛应用

	Flying	Swimming	4+ Legged	2 Legged	4+ Wheeled	2 Wheeled	Arms	Head
Defense								
Industry								
Security								
Medical								
Transport								
Commercial								
Consumer								

# 中国机器人的发展：满足需求！

IC进入中国

山寨手机

积累实力

创新/资本

机器人进入中国

强大的制造业

满足需求

创新/资本

大量人口

最大的电商

# 全世界机器人:服务更多的人.....



# 机器人: 越来越便宜

- 工业机器人性能逐步不断提高，而单机价格呈现下降趋势，机器替代人工经济性日益凸显。一台焊接机械手成本**20-30万元**，可替代**2-3名**熟练工。东部地区焊接工人工资： $5000 \times 12 \times 3 = 18$ 万，2年回本；中部地区焊接工人工资： $3500 \times 12 \times 3 = 12.6$ 万，3年回本。
- 富士康集团宣布的**3年引进100万台**机器人的计划虽然看似不切实际（全球工业机器人保有量仅有一百多万台），却能从一个侧面反映出企业越来越强的用机器替代人工的冲动。

图4：韩国工业机器人价格呈下降趋势

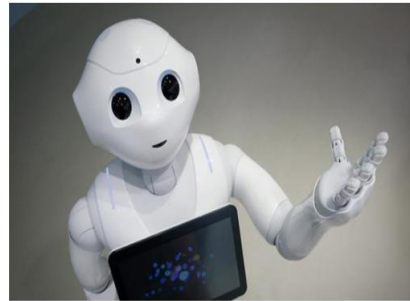
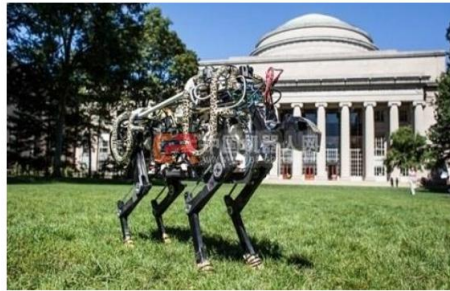


资料来源: WIND, 中国银河证券研究部



# 服务机器人：功能越来越强

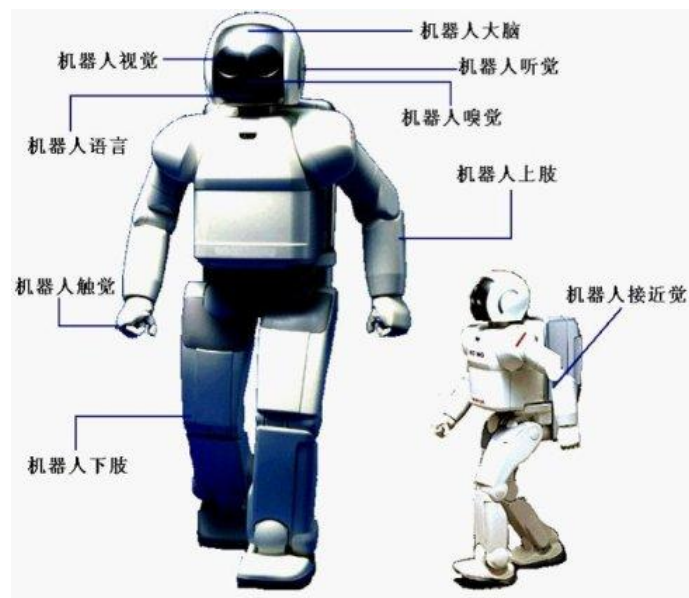
- Society: Aging, one child policy, lonely old age, etc
- Huge investment in service robots in Japan



# 机器人需要传感器以变得更加智能

Sensors for drones and robots revenue forecast, by technology: 2010 - 2021





**如何让机器人更聪明？更多的传感器！！！！**

# 前沿产品：



仿人机器人ASIMO（日本語：アシモ，中文：阿西莫）



# 简述：

拥有  
360  
度全  
方位  
感应

视觉感应器：眼部摄影机通过连续拍摄图片，再与数据库内容作比较，以轮廓的特征识别人类及辨别来者身份

水平感应器：由红外线感应器和CCD摄像机构成的sensymg系统共同工作，可避开障碍物。

超音波感应器：以音波测量3m范围内的物体，即使在毫无灯光的黑暗中行使也完全无碍。

当机器人的脚接触地面时，它将受到**来自地面反作用力**的影响，这个力称之为地面反作用力。所有这些力都必须要被平衡掉，而ASIMO的控制目标就是要找到一个姿势能够**平衡掉所有的力**。这称做“zero moment point” (ZMP)。当上下楼梯时，脚底的压力传感器进行压力分布测量的话，可以预先测出边缘的位置。下楼梯时的着地点也可以同样进行预测。



## Smart Cars

- ADAS
- E-Car
- Uber

Your Autopilot has arrived

Tesla <newsletter@teslamotors.com>

To hingwongjz@sbcglobal.net

Oct 16 at 4:42 AM

Starting today, every Model S comes equipped with Tesla Version 7 software and Autopilot capabilities. Model S is designed to keep getting better over time. Our latest software update allows Model S to use its unique combination of cameras, radar, ultrasonic sensors, and data to **steer down the highway, change lanes, and adjust speed in response to traffic. Once you've arrived at your destination, Model S scans for a parking space and parallel parks on your command.**

Model S can't make traffic disappear, but Version 7 software makes it a lot easier, safer, and more pleasant to endure.

To experience Model S for yourself, book a test drive at your nearest store.

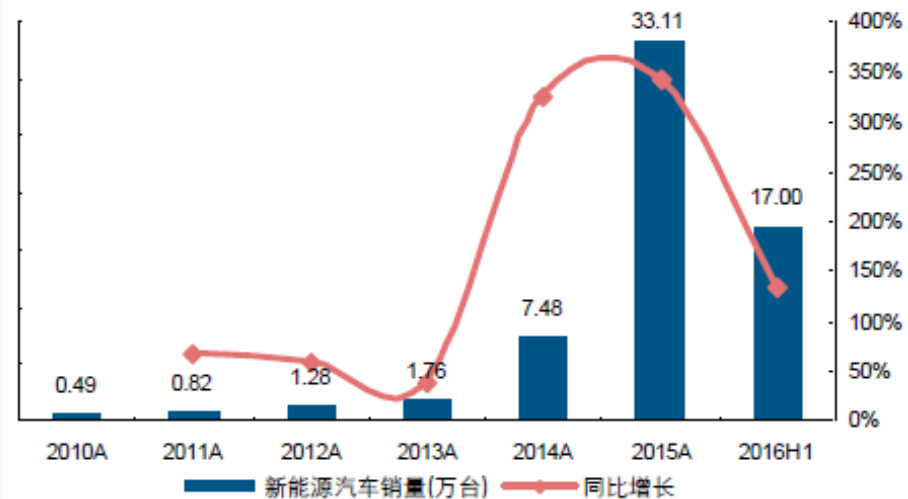
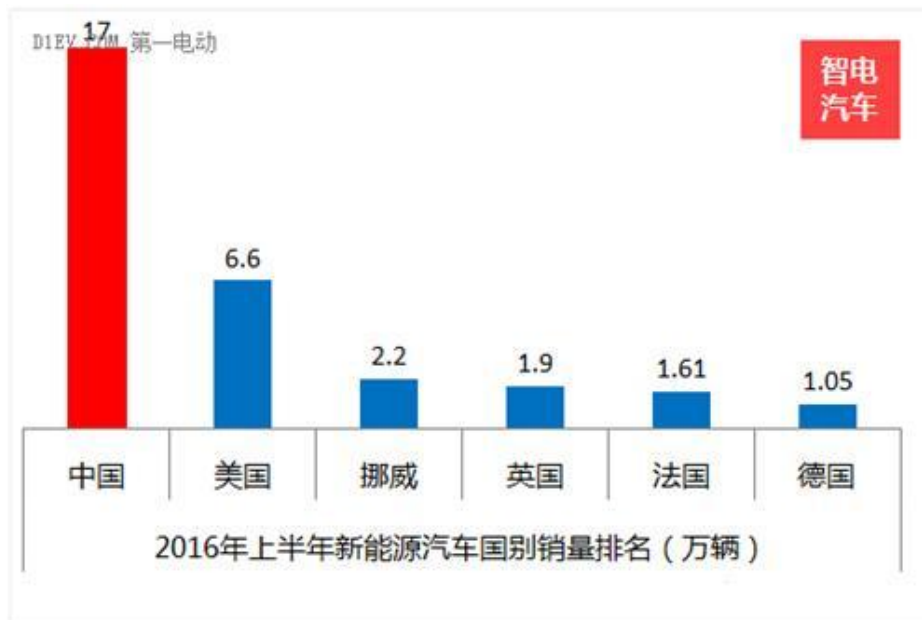


# Smart Cars

## An Emerging Platform



# 中国，电动汽车



雾霾，省钱，烧钱.....10%的油钱。。。！

降低成本，让人用得起

# Uber+ADAS= ?

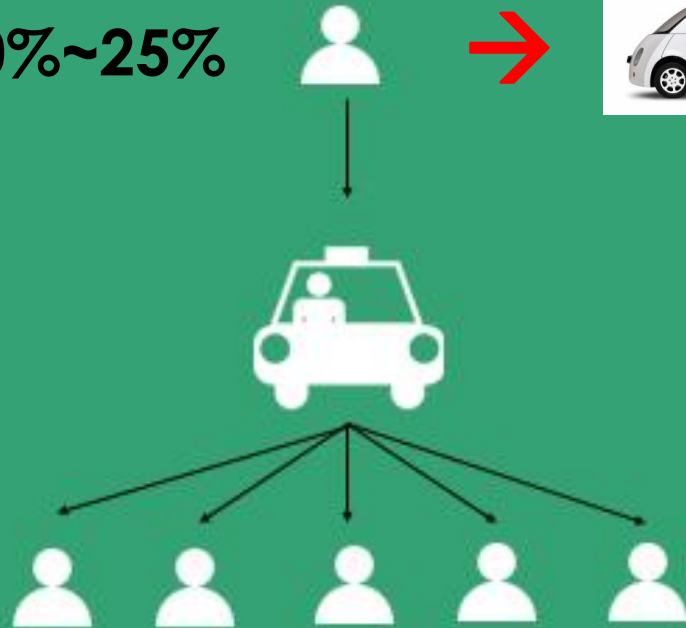
UBER



共享私家车

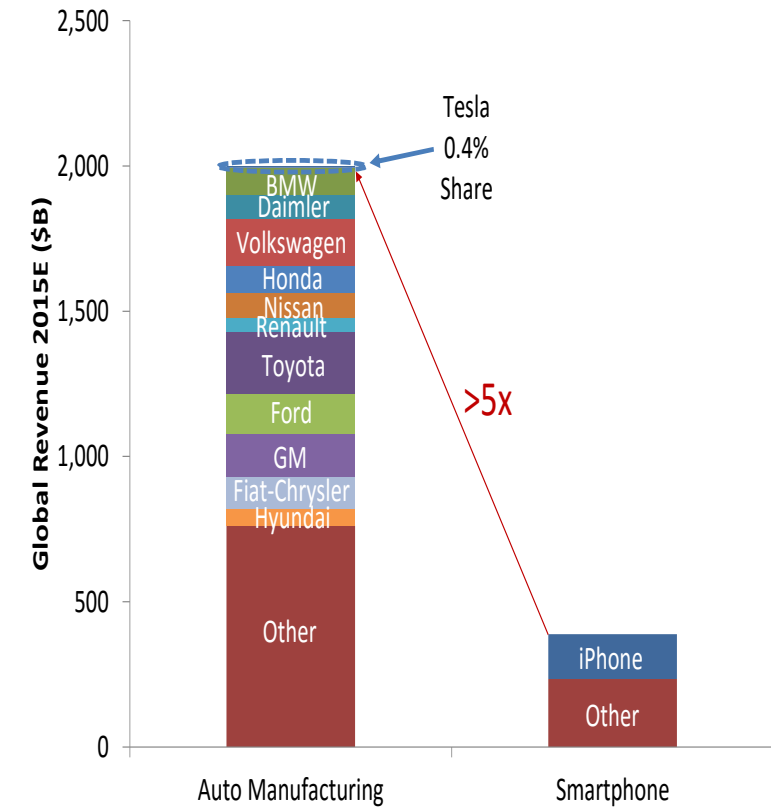
估值500亿美金

20%~25%



更方便

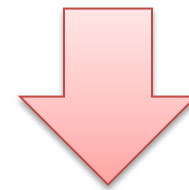
# Apple Cars



Source: FactSet, J.D. Power, Jefferies

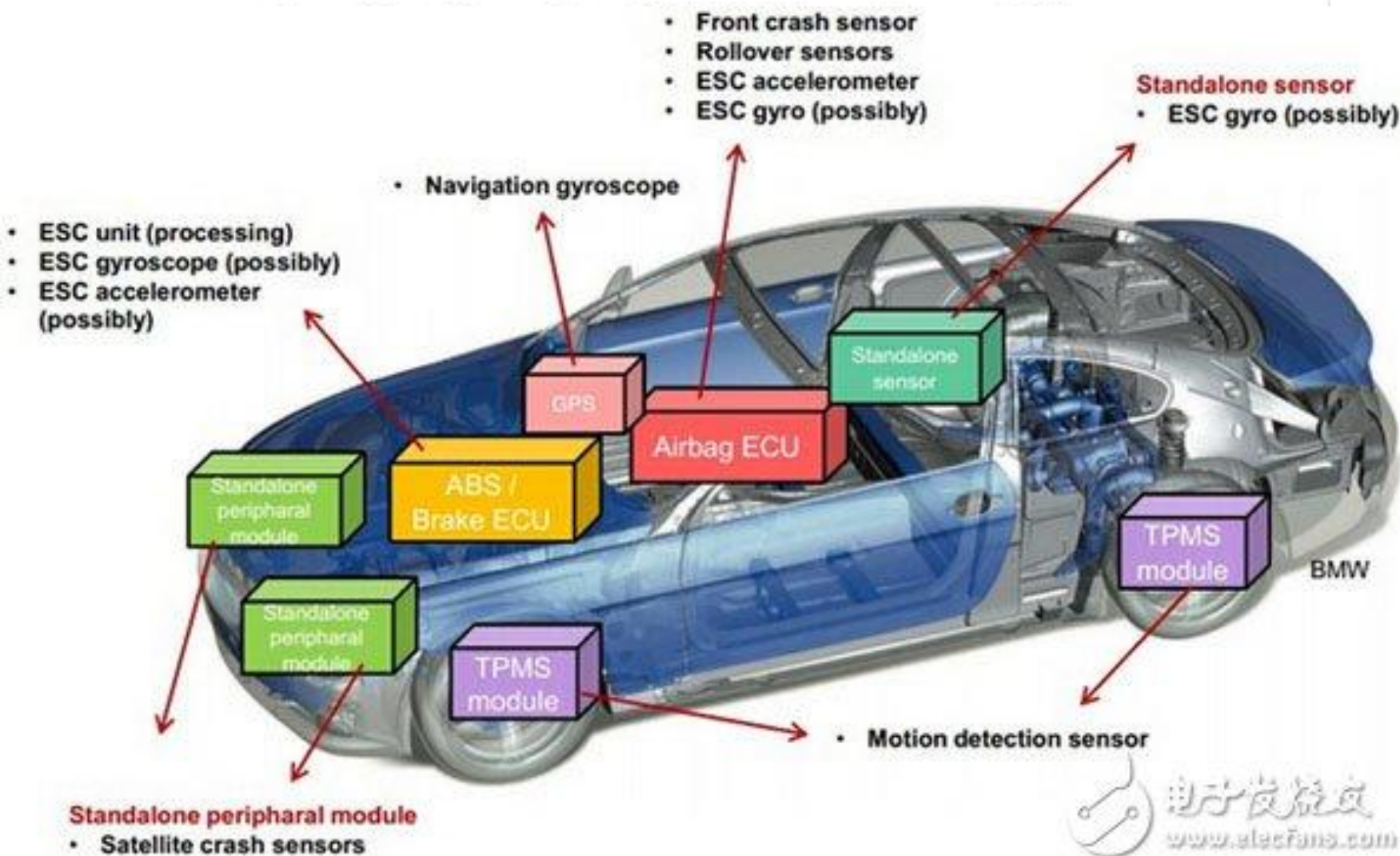


投资10亿美金

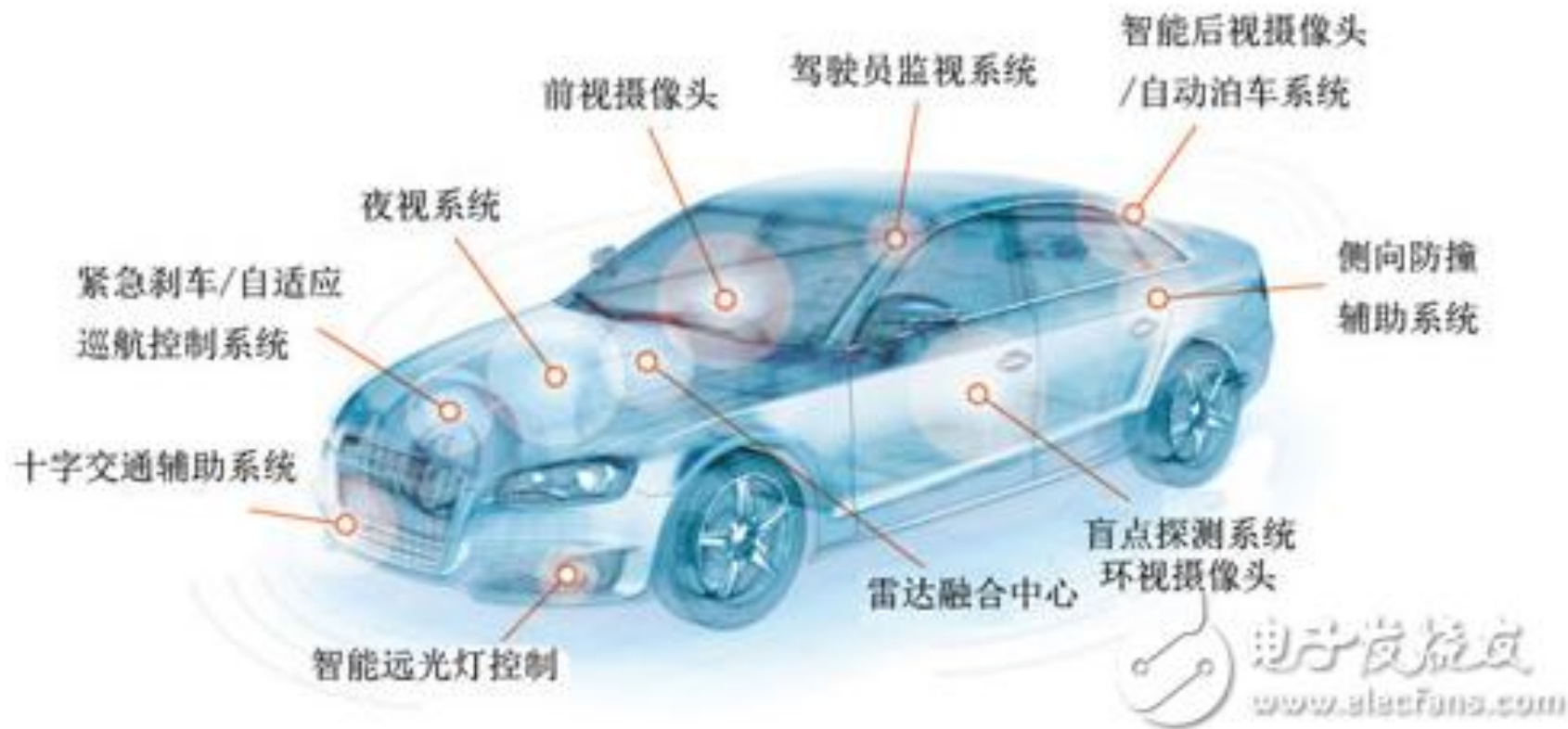


滴滴出行  
滴滴一下 美好出行

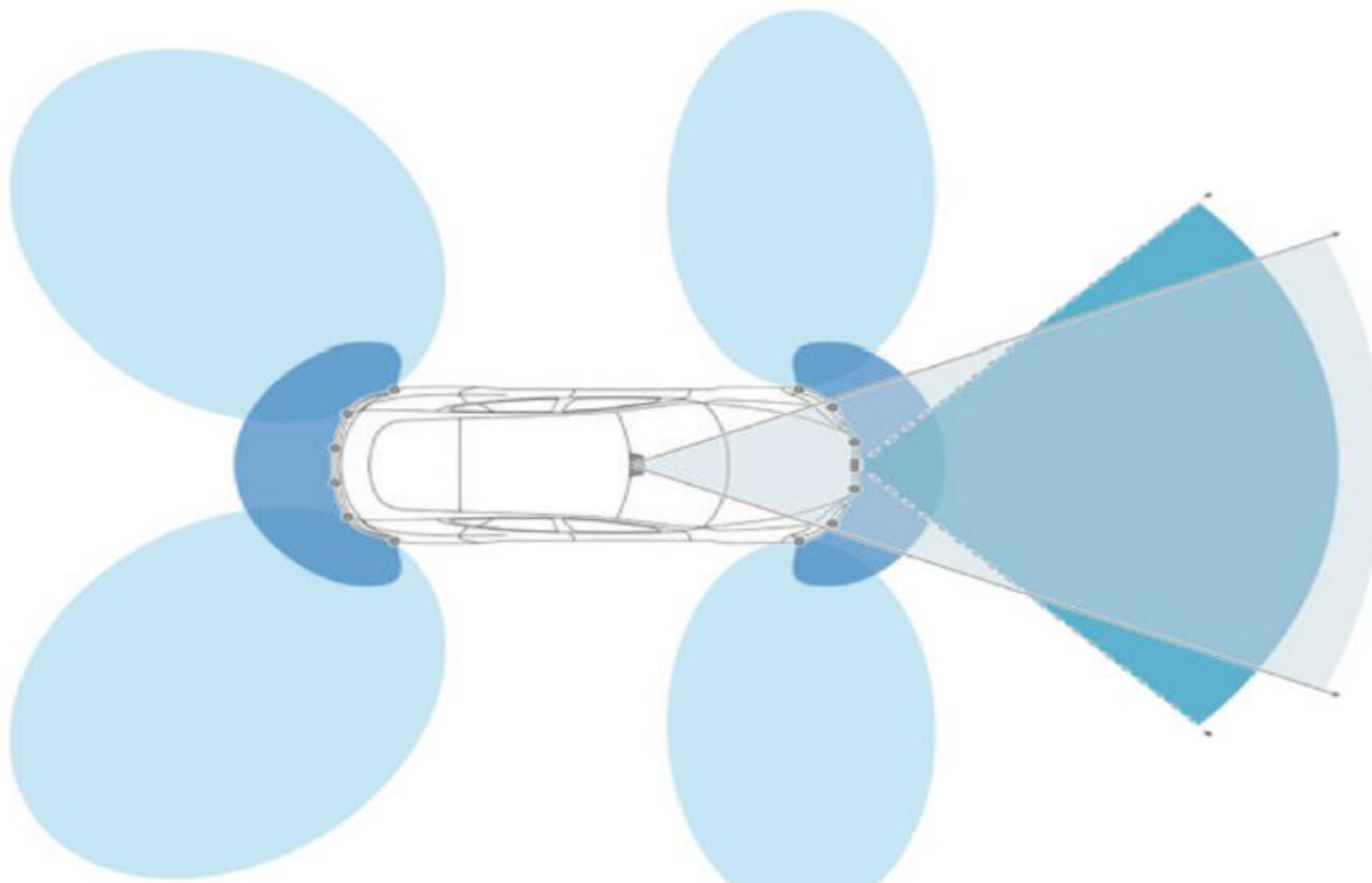
# 汽车中的MEMS传感器



# ADAS需要的传感器



# 特斯拉之撞



**强光+拖车+高车+侧面来车 , , , ( 电灯 , 高铁 , , , )**

**如何解决？ 更多的传感器！！！！**



# 传感器 - 产业链

Top 30 MEMS players' positioning:  
devices vs. systems vs. number of MEMS product lines



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# 谢谢大家！