



## 科技部 微感測器與致動器產學聯盟 Micro Sensors and Actuators Technologies Consortium ( $\mu$ SAT)

Coordinator: 國立清華大學動機系 方維倫特聘教授



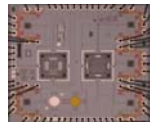
- **Background**
- **Strategy**
- **Solutions**
- **Achievements**
- **Summary**



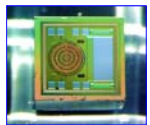


## MEMS Applications

- From **Automobile** to **Consumer** and **Wearable**



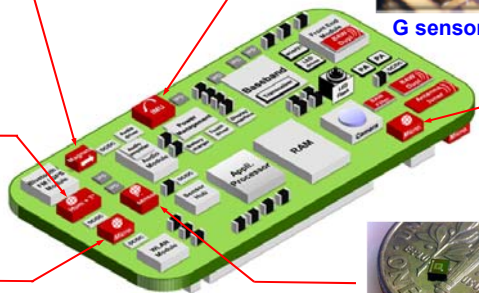
M sensor



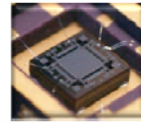
Humidity sensor



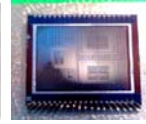
Microphone



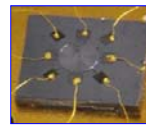
Yole report, 2013



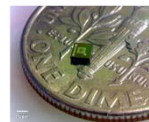
G sensor



Gyro



Microphone

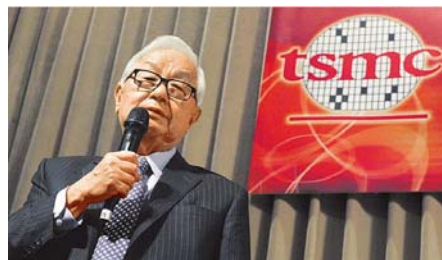


P sensor



## IoT – the Next Big Things

- The next big things
  - + Highlight by Dr. Morris Chang of TSMC in 2014
  - + Major players: Google, Apple, Cisco, Alibaba, Huawei, etc.
  - + **Semiconductor remain the key enabling tech.**



[www.appledaily.com.tw](http://www.appledaily.com.tw)

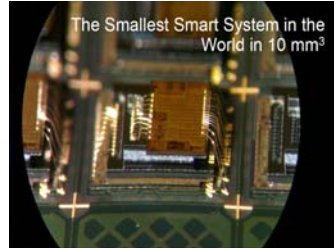




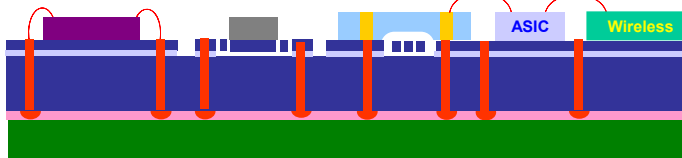
## Semiconductor: Key Tech for *IoT*

- Key Techs for *IoT*

- + MEMS and Sensors
- + Advanced packaging
- + Ultra low power

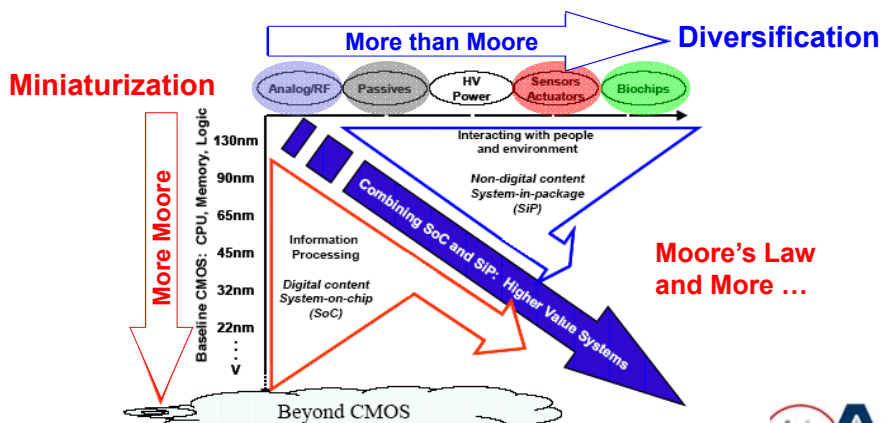


Sensors + Microcontroller + Low Power Radio



## Moore's Law and More than Moore

- Add value to the existing CMOS tech



Source: ITRS Roadmap 2005, [www.itrs.net](http://www.itrs.net)





## Background of PI

- **Industry related activities of Prof. Fang**
  - + Vice Chair, **SEMI Taiwan MEMS Committee**, 2014-present
  - + Committee, **SEMI Taiwan MEMS Committee**, 2010-2014
  - + 常務理事, **中華民國微系統暨奈米科技協會**, 2008-present
  - + 理事長, **中華民國微系統暨奈米科技協會**, 2013 ~ 2014
  - + Chief Delegate of Taiwan, **Micromachine Summit**, 2008-2012
  - + General Chair, **Micromachine Summit**, 2012
- **Industry related networking of Prof. Fang**
  - + Near **40 PhD graduates** in MEMS related industry
  - + Close collaboration with MEMS industry



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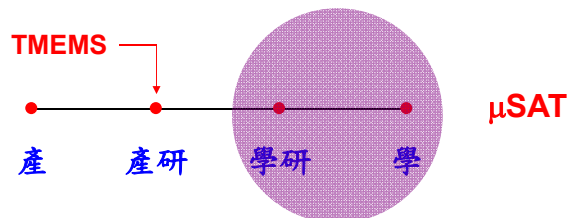
## SWOT Analysis

- **Strength** of MEMS Industry/Tech at Taiwan
  - + Semiconductor Eco-systems
  - + International visibility
  - + MEMS researches : **top 3-5 in the world**
  - + Right time for More-Than-Moore
- **Weakness** of MEMS Industry/Tech at Taiwan
  - + MEMS different with Microelectronics
  - + SME (中小企業) – limited man power & capital investment
  - + Limited experienced/senior MEMS experts
  - + Inefficient link between academia and industrial



## Existing Organizations

- **SEMI Taiwan – MEMS Committee**
- **微系統暨奈米科技協會 (NMA)**
  - + 技術交流 - 舉辦年度會議
  - + 技術推廣 - 刊物 或 網路
  - + 策略交流與探討 - 主管與資深人員
- **微機電產業發展聯盟 (TMEMS) – ITRI South**





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## Professors of $\mu$ SAT

方維倫 清大動機	李昇憲 清大奈微	陳榮順 清大動機	盧向成 清大電機	傅建中 清大奈微	王玉麟 清大奈微	羅丞曜 清大奈微	鄒慶福 逢甲自控
白明憲 清大動機	葉廷仁 清大動機	邱一 交大電機	陳政寰 交大光電	張嘉辰 中正電機	江政達 嘉大電機	沈志雄 彰師機械	蔡宗亨 中正電機





## Partners of $\mu$ SAT



- CIC
- NDL
- ITRC
- NCHC
- SRRC
  
- ITRI

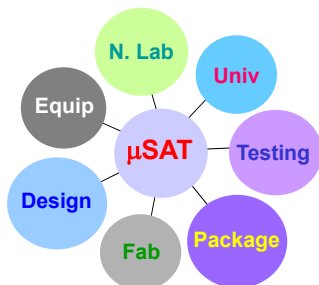
NTHU (CML)

National Lab Research Inst. Univ. MEMS Fab



## Role of $\mu$ SAT

- The **Google, First aid, Networking center for MEMS Industry**
  - + Knowledge bank for MEMS industry
  - + Think tank for MEMS industry
  - + Matchmaker for MEMS Industry





## Service of $\mu$ SAT

- 技術論壇
- 訓練課程 – 開放學校課程、on-site 授課
- 技術諮詢 – 工程師、技術主管、決策主管
- 業界媒合 – 異業結盟、同業上中下游整合
- 測試技術與服務
- 人才媒合
- 產學計畫
- 國外推廣
- 其他...



## Goal of $\mu$ SAT

- The **7-11** for MEMS Technology  
+ Service for **anyone, any time, and any place**







## Members of $\mu$ SAT

System	Fabless/ Fab-light	Material Equipment	Fab	Packaging/ Testing



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## MEMS Forum



APM



TSMC



ASE



KYEC



EVEST



iST



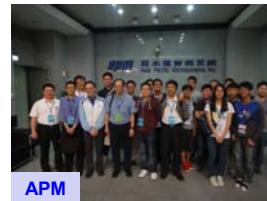
## On-site Training and Visit



mCube



TXC



APM



ASE



Richtek



Sensirion





## On-campus Recruiting

- Participant: ~200 attendees, ~30 member companies



2014/07/08



2015/08/04



## Technology Service



SEM



Optical Profiler



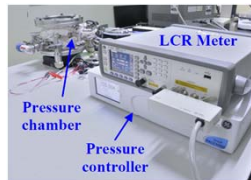
IR camera



LDV



Strobe Scope



P Sensor Calibration





## International Promotion

- 聯盟推廣活動-國外
  - + IMEC, Belgium, 2015
  - + Bosch Sensortec, Germany, 2015
  - + Transducers Conf., Alaska, 2015
  - + EXPRESS Meeting (supported by EU), Belgium, 2015
  - + MEMS Engineer Forum, Japan, 2015
  - + EPFL, Switzerland, 2014



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## Acknowledgements

- MOST
- $\mu$ SAT member companies
- $\mu$ SAT co-PIs 清大李昇憲教授, NDL葉文冠主任
- $\mu$ SAT partners – NDL, CIC, SRRC, NCHC
- SEMI Taiwan
- My PhD graduates
- My graduate students and  $\mu$ SAT assistant Ms. Lin



# Many thanks

歡迎隨時和  $\mu$ SAT 聯繫: <http://www.usat.org.tw/>

