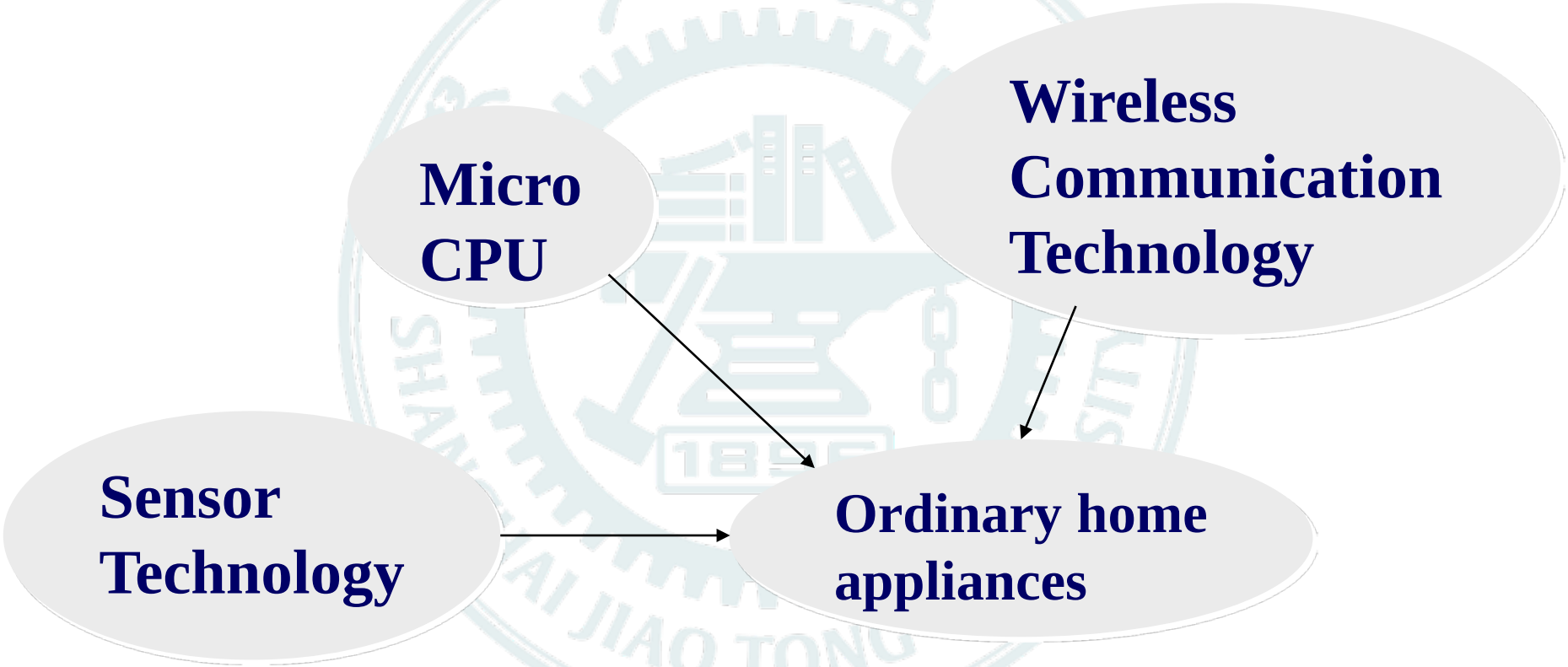
Intelligent home appliances

董镕诚

What is intelligent home appliances?



Features of intelligent home appliances

1. Connect to network
2. Work automatically
3. High compatibility
4. Easy to use

Technology Limitations

1. Intrusive installation
2. Lack of network interoperability
3. Environmental diversity
4. Security

3 general steps to achieve smart home

Transform limited information to distance between each pair of devices

Transform relative distance to relative position

Detect the movement of the devices and relocate them

Two localization technology

1. RSSI based self-localization: high universality, but suffered from multipath effect
2. CSI based self-localization: higher accuracy, but only available for several adapter.

RSSI localization
Distance Estimation Model:

$$PL(d) = PL(d0) + 10nlog\left(\frac{d}{d0}\right) + \varepsilon$$

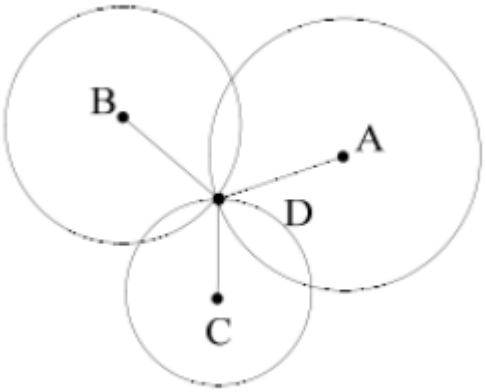
PL(d) is the path loss of the distance d, PL(d0) is the path loss of unit distance d0, n is path loss exponent, Ɛ is the error term. To calculate n and Ɛ, we can use the method of machine learning, such as least square.

$$RSSI = PT + GT - PL(d)$$

Transform distance to positions

Trilateration, Multidimensional scaling, etc

A(x1,y1), B(x2,y2), C(x3,y3) are known APs, D(x,y) is the position we want, and we have known the distance of AD=d1, BD=d2 and CD=d3. Solve the equations and we can get x and y.



$$\sqrt{(x-x1)^2+(y-y1)^2}=d1$$

$$\sqrt{(x-x2)^2+(y-y2)^2}=d2$$

$$\sqrt{(x-x3)^2+(y-y3)^2}=d3$$

Dynamic Detection: two trade-offs

- Time
- Location
- Accuracy
- Time-delay

Thanks for listening

Reference

1. http://www.docin.com/p-1178653476.html WiFi雷达：从RSSI到CSI
2. HIRP FLAGSHIP Proposal Template Xinyu Tong
3. https://wenku.baidu.com/view/54eaa942453610661fd9f430.html 基于RSSI的室内定位算法研究