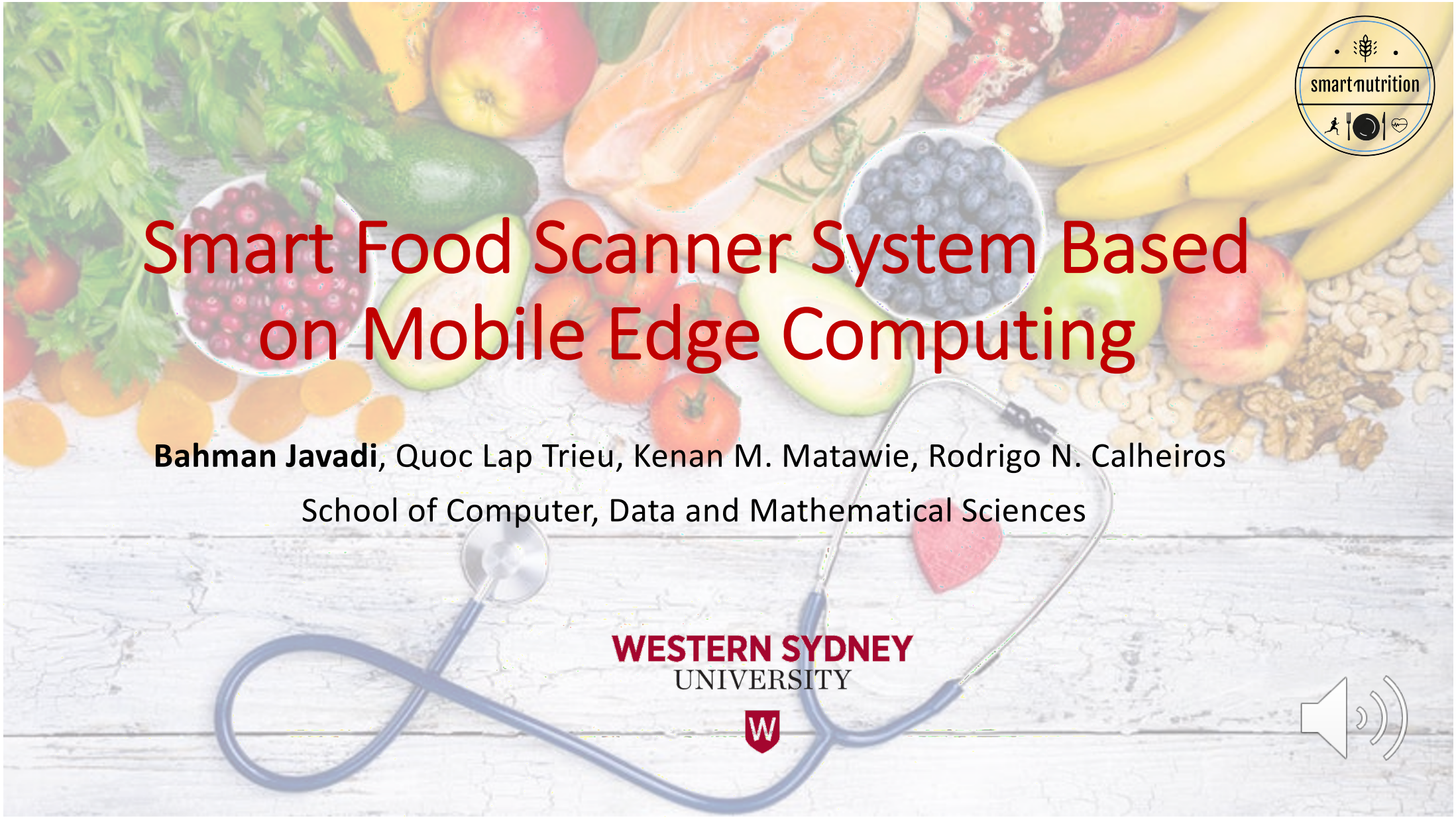

Smart Food Scanner System Based on Mobile Edge Computing

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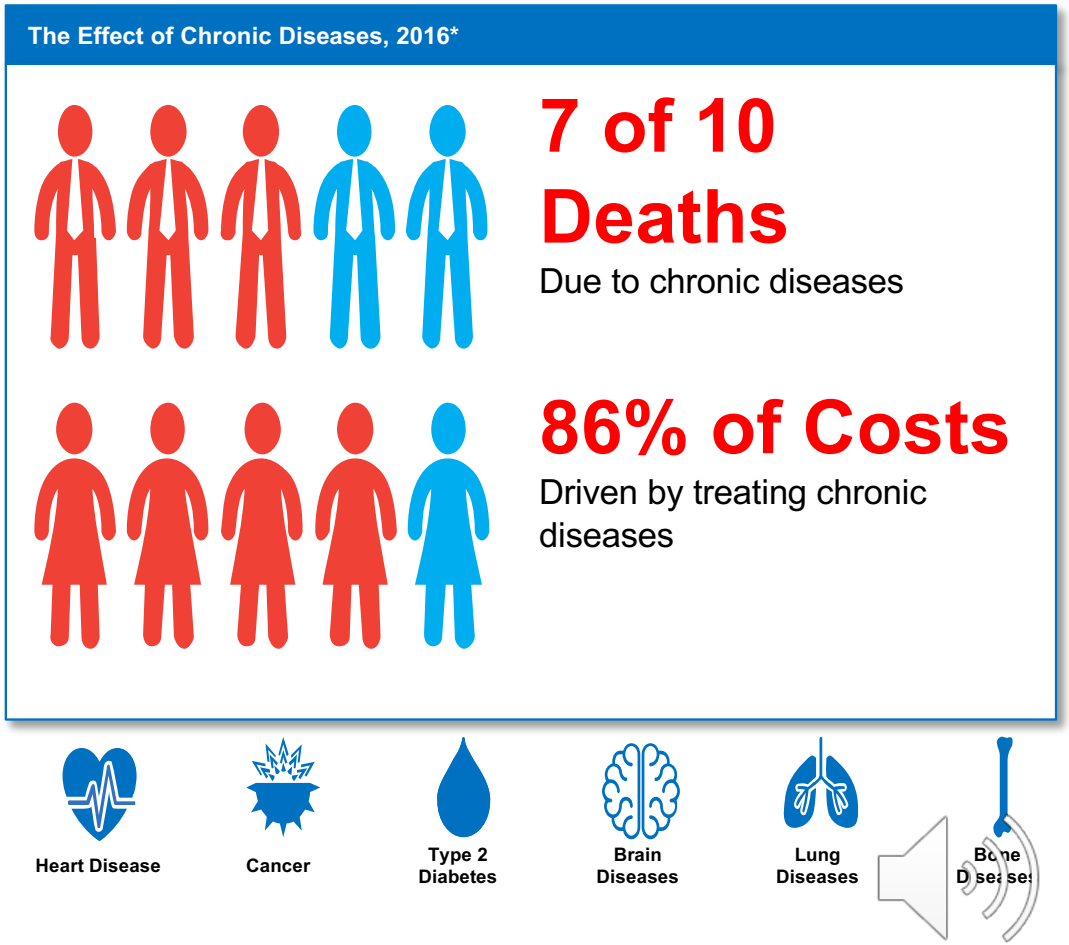
Chronic Diseases

Disease Type	Death per year
Communicable Diseases (e.g. COVID-19)	4 million
Non-Communicable Diseases (e.g. Cancer)	41 million

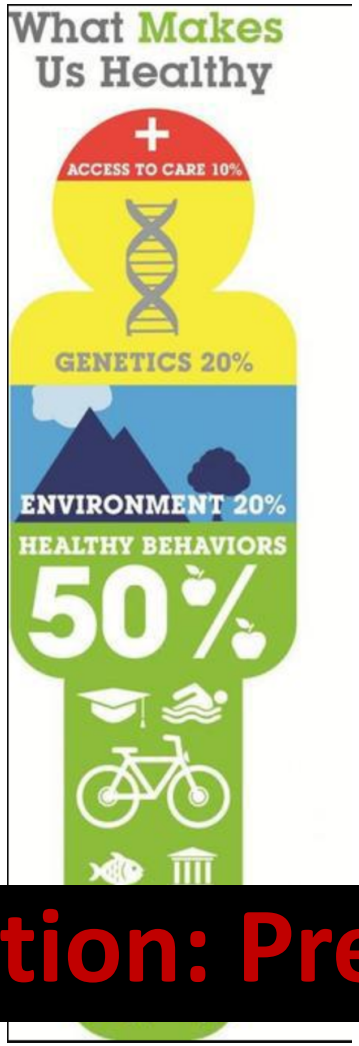
* Ref: World Health Organization



Diet-Related Health Issues

- Overweight and obesity in Adults
  - Australia: 63%
  - Annual cost: $20B

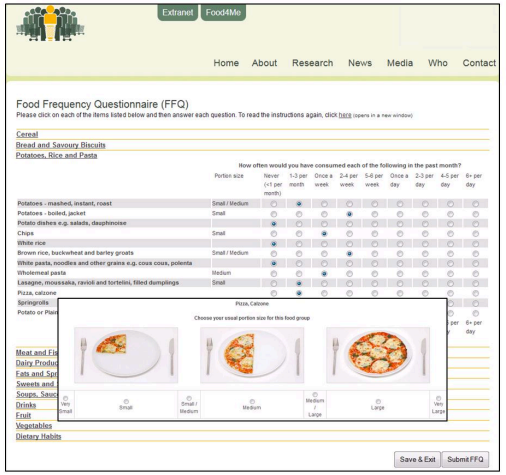
The problem: What is right vs What is Easy

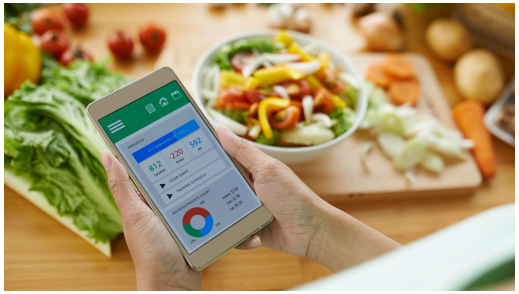


Solution: Precision Healthcare

Nutrition Monitoring System

- Manual methods
  - 24 hour recalls
  - Food frequency questionnaires
  - Smartphones
- Issues
  - Participants burden
  - Imprecise
  - Low completion rate (~15%)



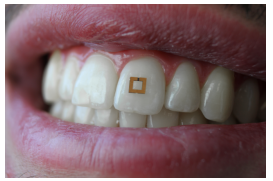


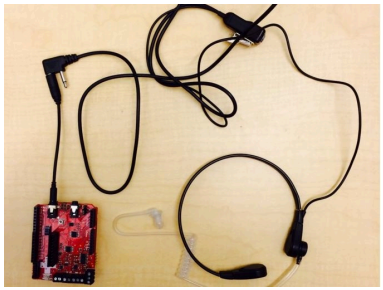
Nutrition Monitoring System

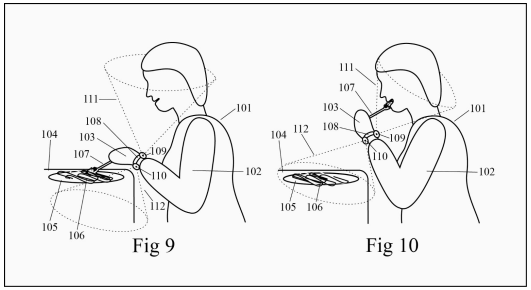
- Automatic methods
  - Sensor-based
  - Environment sensors
  - Removing the participant burden
- Issues
  - Imprecise (lack of food detection)
  - Not practical for free-living style
  - Privacy

Nutrition Monitoring System

- Automatic methods
  - Sensor-based
  - Wearable sensors
  - Real time food intake monitoring
- Issues
  - Average accuracy of 90%
  - Only tested in lab environments
  - Single dimension







Smart Nutrition Monitoring System

Project Aim: develop a smart technology that enables users to measure and analyse their food intake in terms of basic nutrients (e.g., Fat, Protein, Carbohydrates)

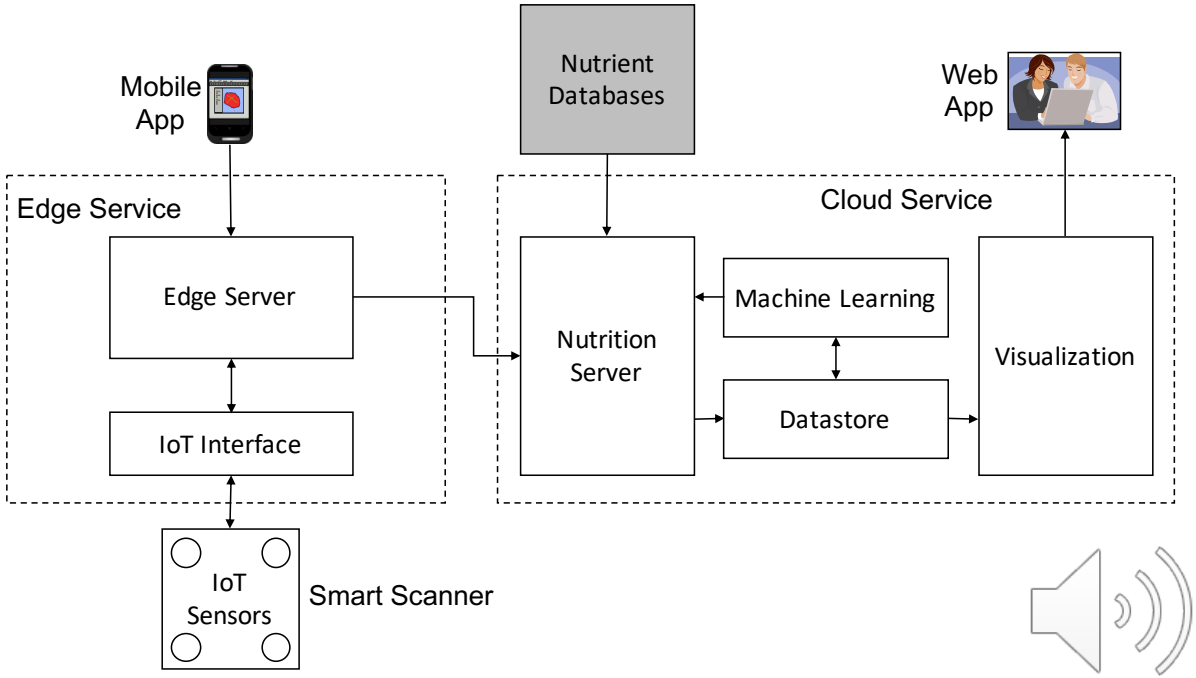
Challenges:

- Participant burden
- Invasiveness
- Low precision
- Low scalability

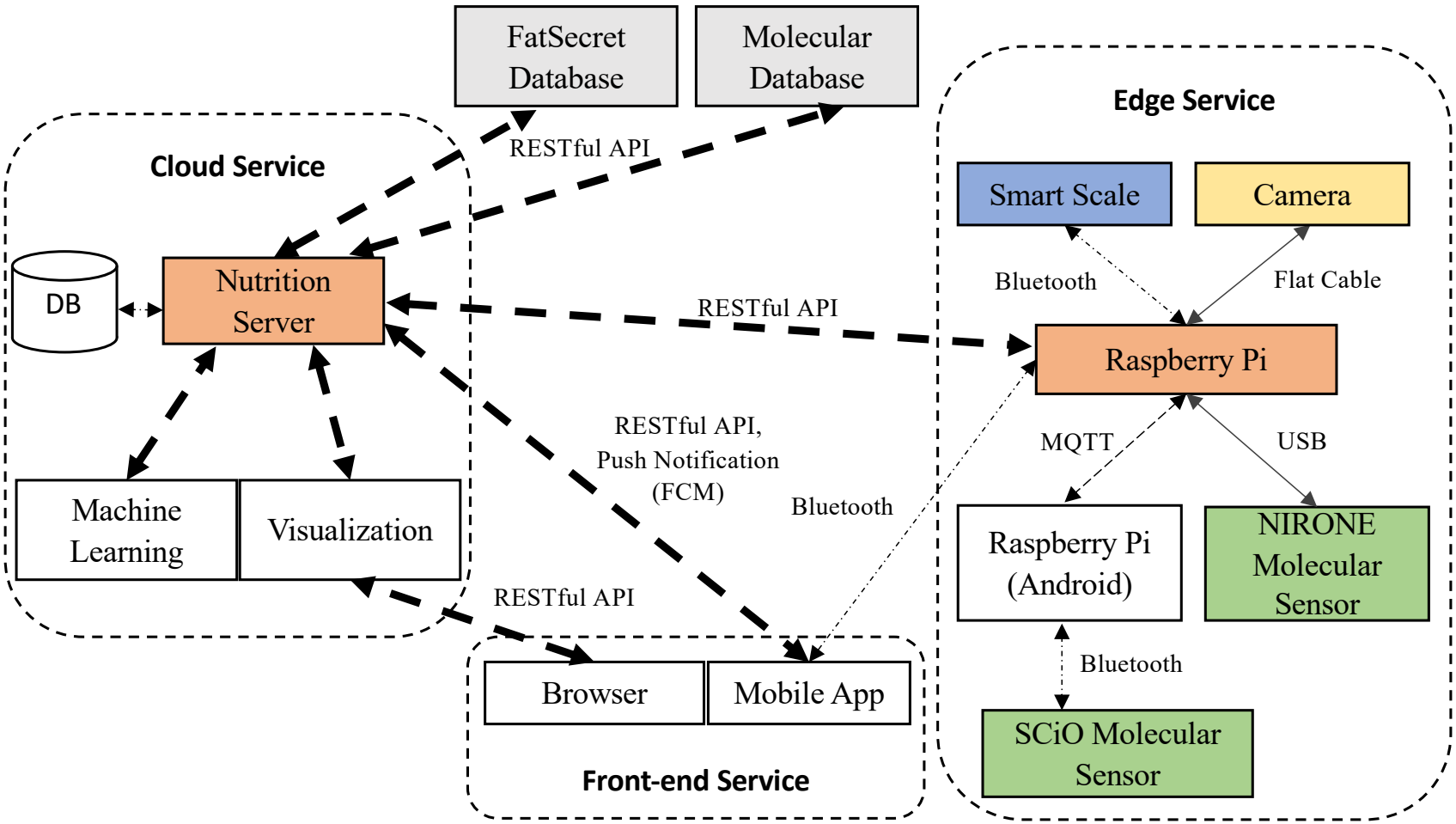
Smart Nutrition Monitoring System using Mobile Edge Computing

Proposed Solution: a smart food scanner with heterogenous Internet of Things (IoT) sensors using Mobile Edge Computing

- Automatic
- Non-invasive
- Ingredient level



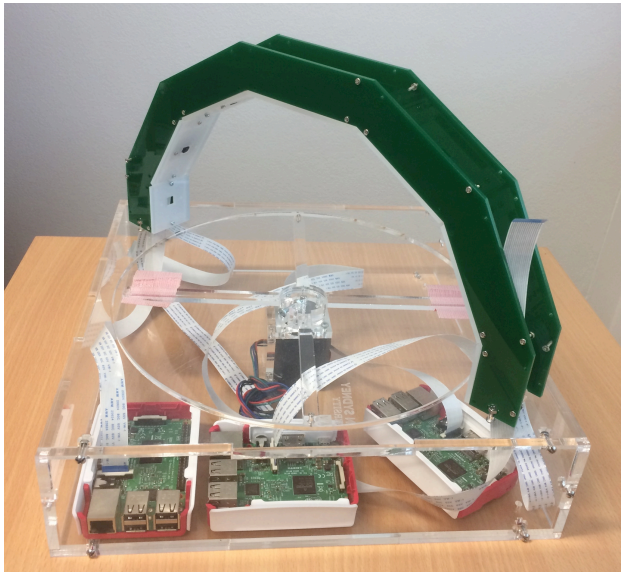
System Prototype



Near-infrared (NIR) Spectroscopy

Sensor	Wavelength	Scan time	Food Type
NIRONE	750 nm up to 2500 nm	<0.5 seconds, result shows 1.5 to 2 seconds	Homogenous, Raw/Cooked
SCio	700-1100nm	2-5 seconds	Homogenous, Raw
TellSpec	900nm to 1700nm	1 to 3 seconds	Homogenous, Raw/Cooked

Performance Evaluation



Item	Module	Specifications
Mobile	Android Smartphone	1.9Ghz octa-core Exynos CPU, 2GB RAM
Edge	Raspberry Pi Model B	1.4Ghz quad-core ARM CPU, 1GB RAM
Cloud	AWS EC2 Instance	t2.medium, 2 vCPUs, 4GB RAM
ML	AWS EC2 Instance	p2.xlarge, 4 vCPUs, 1GPU, 61GB RAM
Sensor 1	Camera	Raspberry Pi 8MP Camera
Sensor 2	Scale	SITU Smart Scale
Sensor 3	SCiO Sensor	Molecular Sensor 700-1100nm
Sensor 4	NIRONE Sensor	Molecular Sensor 1750-2150nm

Results: Time Analysis

TABLE 2. EDGE SERVICE TIMING (SECONDS).

Scanner	Camera	Scale	SCiO Sensor	Upload to Cloud
9.85	3.35	6.92	4.79	11.26

TABLE 3. CLOUD SERVICE TIMING (SECONDS).

Machine Learning	SCiO Analysis	FatSecret API	DB update
2.15	3.46	0.45	3.35

Results: Power Analysis

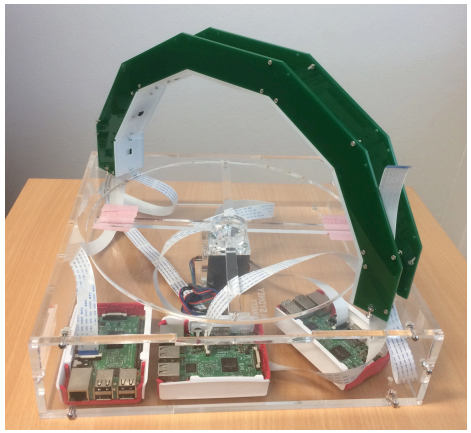
Mobile Edge vs Mobile Cloud

- Flexibility
- Scalability
- Mobile battery saving
- Mobile resource saving

TABLE 4. MOBILE POWER CONSUMPTION (WATT).

Mobile Edge	Mobile Cloud
2.80	8.11

Smart Food Scanner Demo



Thank You

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