Capacitive Sensing, Communications and Identification Tags: Toward Printable Ubiquitous IoT

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Motivations

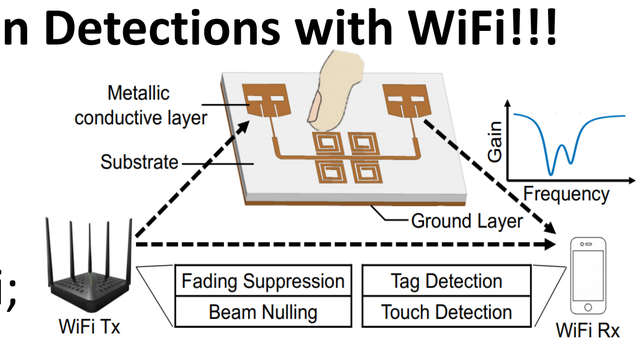
- **Massive Sensing and Actuation:**
  - Massive and ubiquitous Smart space and IoT;
  - From dumb things to smart sensors;
  - From visible wearable circuit based sensors to invisible ubiquitous printable sensors;
- **Invisible Interactions and Identifications:**
  - Harvest invisible everyday surface and objects;
  - Identify & differentiate ubiquitous touches;
- **Ubiquitous Communications:**
  - Invisible tagging for object sensing and human-machine-object communications;

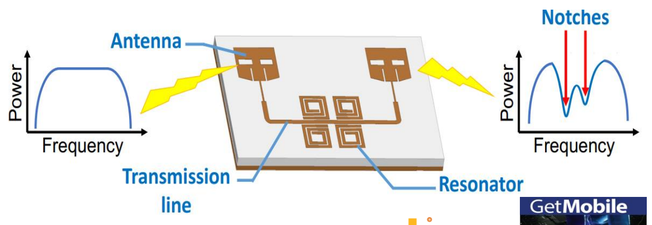
Requirements

- **Low Cost & Ease of Manufacture:**
  - Can they be manufactured and *printed* by *anyone* at *anytime, anywhere massively* by *anyone* with basic office skills?
- **Flexible and Invisible:**
  - Can they be *transformed* to any sensor as needed?
  - Can they be *attached* at any object ubiquitously?

Preliminary Work

- **LiveTags: Interaction Detections with WiFi!!!**
  - Identify and differentiate touches through off-the-shelf WiFi;
  - Attach intelligence to everyday dumb objects;





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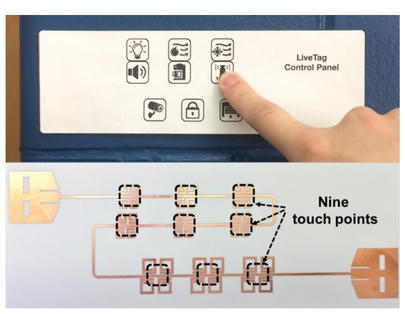
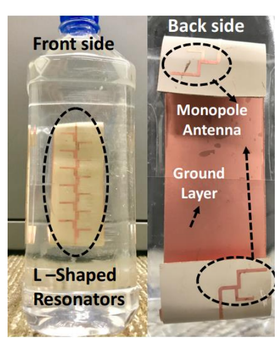
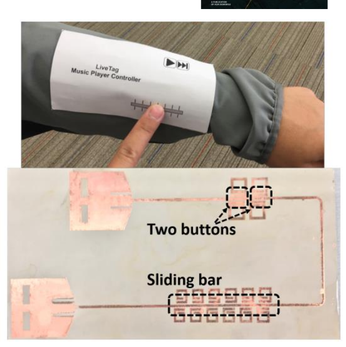
- **A Wide Variety of Applications:**



Buttons

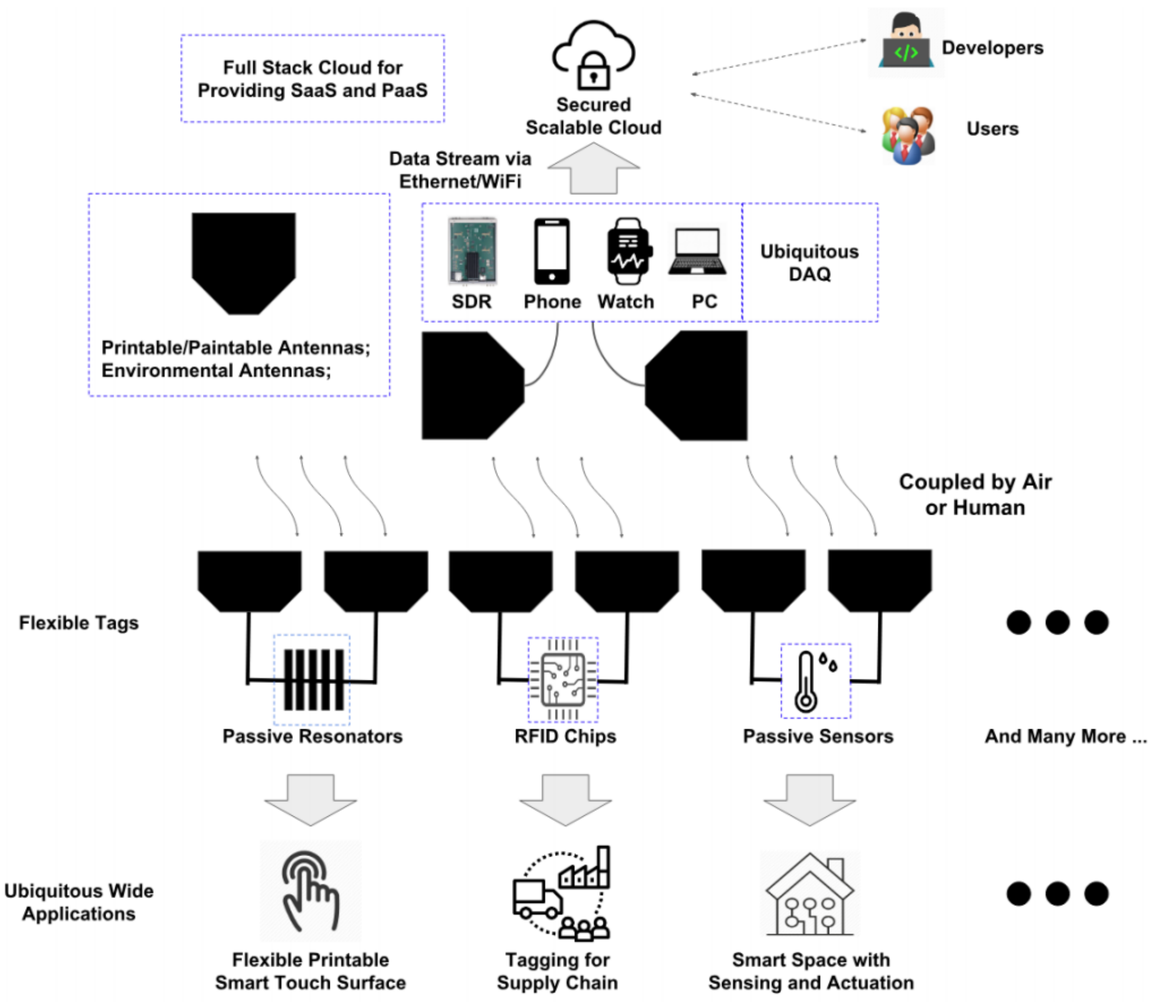


Water Level Detecter



Slider

Toward Printable IoTs

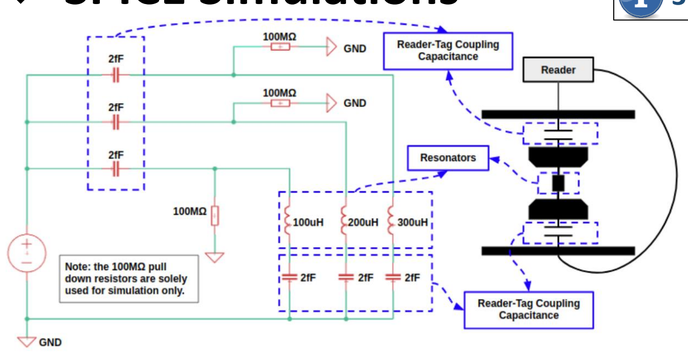


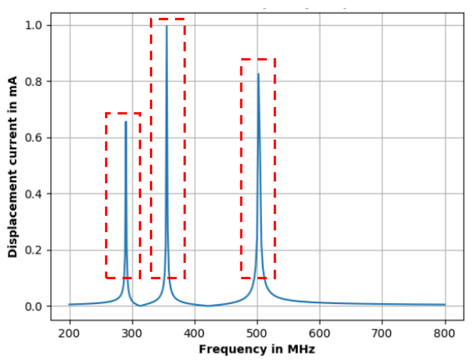
- ✓ **Flexible:** Design & make sensors as LEGO-bot;
- ✓ **Printable:** Fabricate sensors at anywhere, anytime by anyone without professional skills!
- ✓ **Interconnectable:** Full-stack secure systems for robust printable IoT ecosystems;

Feasibility Study

- **SPICE Simulations**

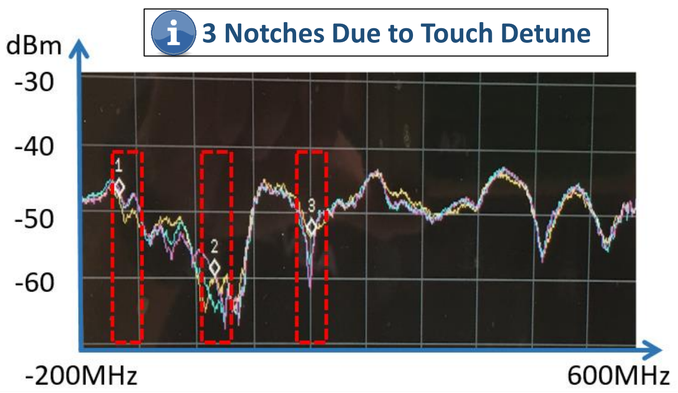
3 Peaks Due to Inductive Resonations

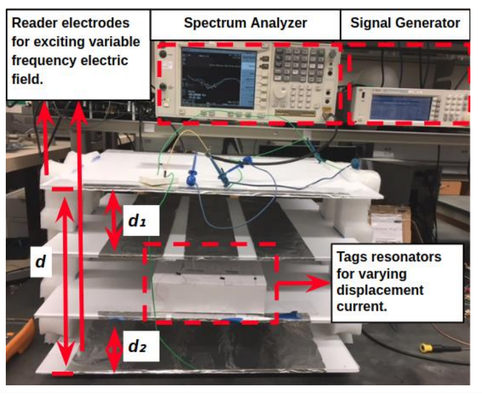




- **Laboratory Measurements**

3 Notches Due to Touch Detune





Continue Works

- **Evaluations of Sensing Modalities;**
- **Sensing System Design and Prototyping;**
- **Interconnectivity: Toward Ubiquitous Invisible Printable IoT;**

Acknowledgements

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