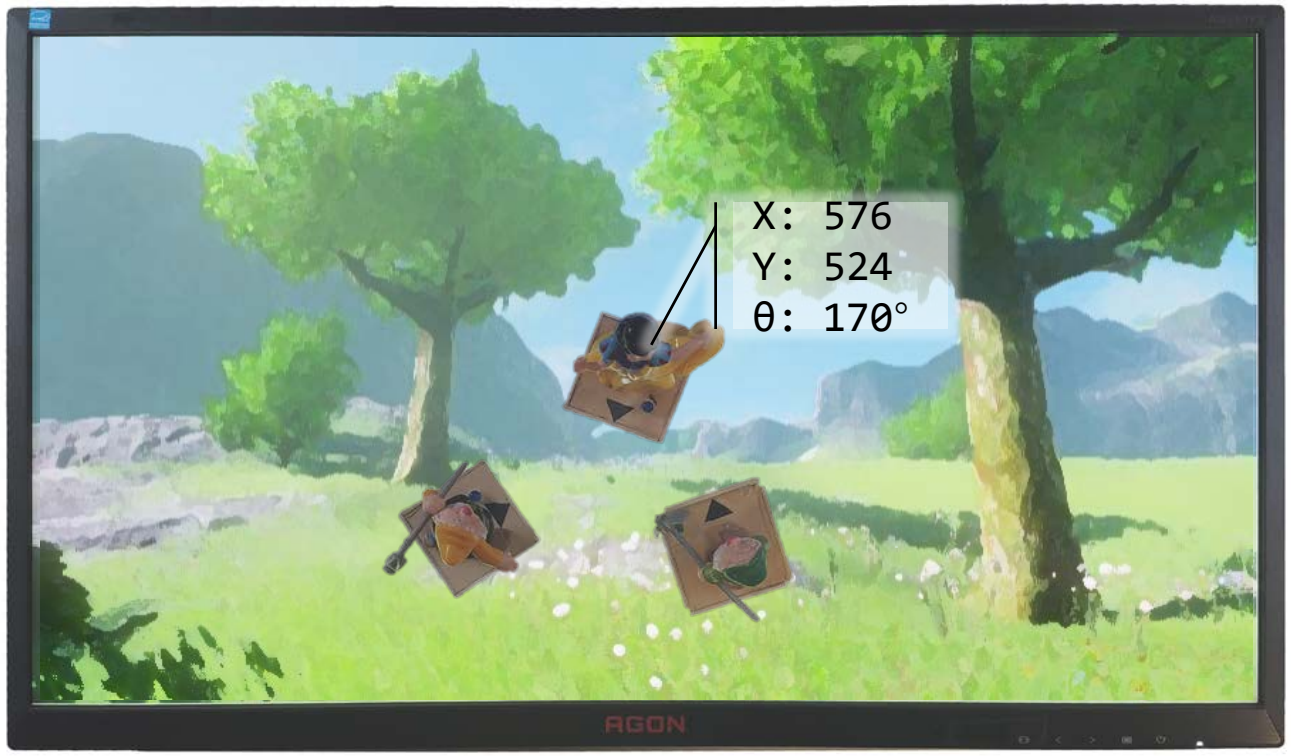
Enabling Tangible Interaction on Non-touch Displays with Optical Mouse Sensor and Visible Light Communication

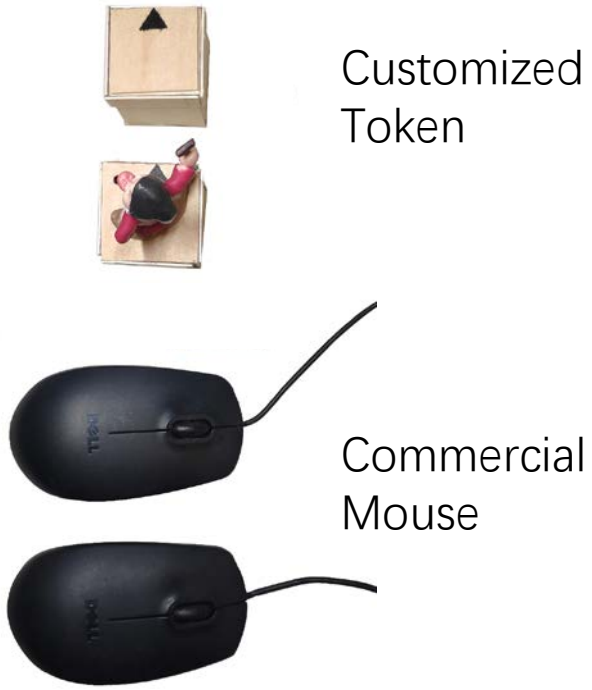
Yihui Yan, Zezhe Huang, Feiyang Xudu, Zhice Yang

ShanghaiTech University

Overview

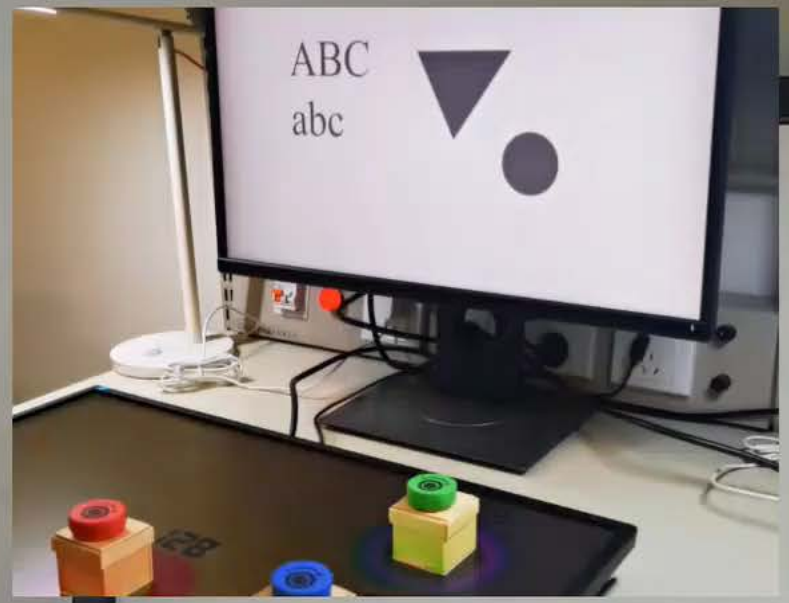


Screen



MouseToken Tangible

B
A

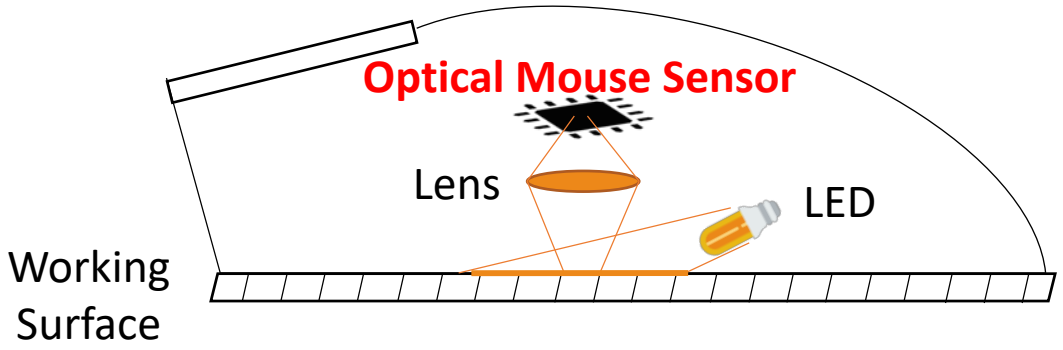

ABC
abc

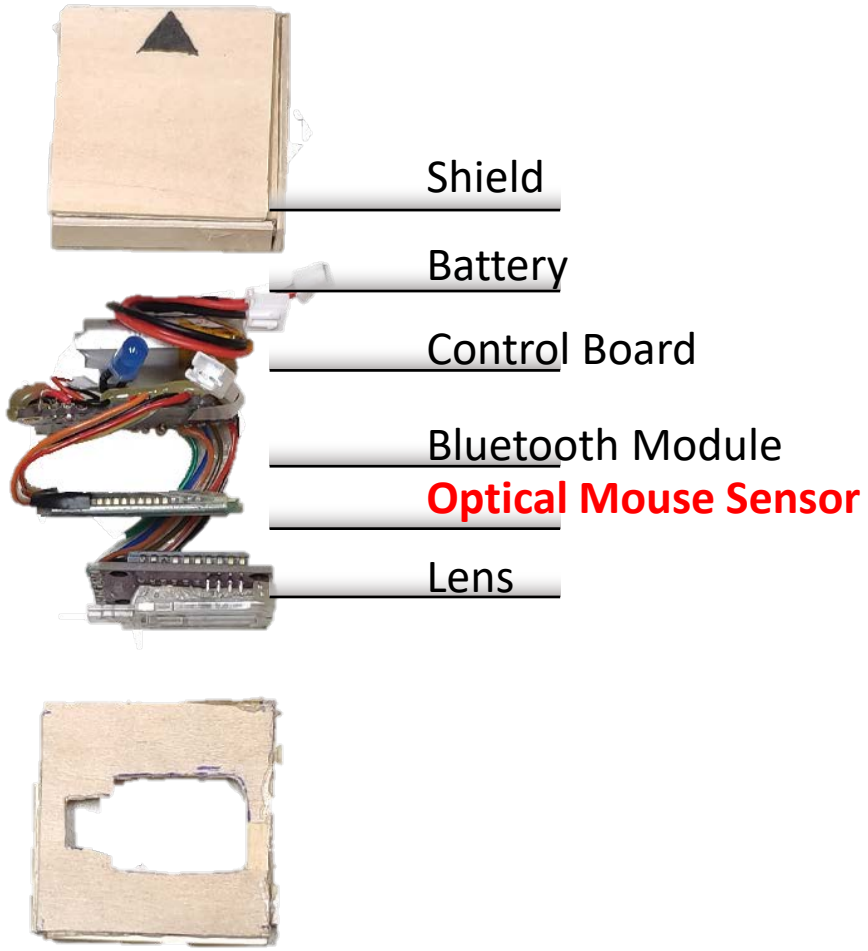
Key Benefits

- Works for both touch and non-touch screens
  - does not have the grounding issue

- Cost-effectiveness
  - screen + mouse has been met in many personal computers
  - customized tokens are cheap
  - easy-setup and no hardware modification

MouseToken

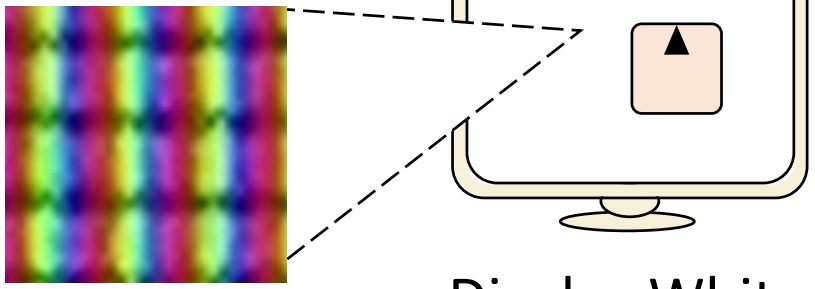




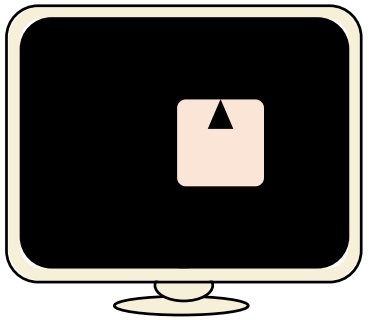
- **Commercial Optical Mouse**
- **Customized Token**

Optical Mouse Sensor

RGB Pixels of
the Display Panel

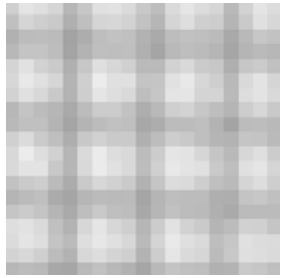


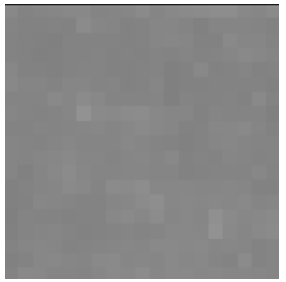
Display White



Display Black

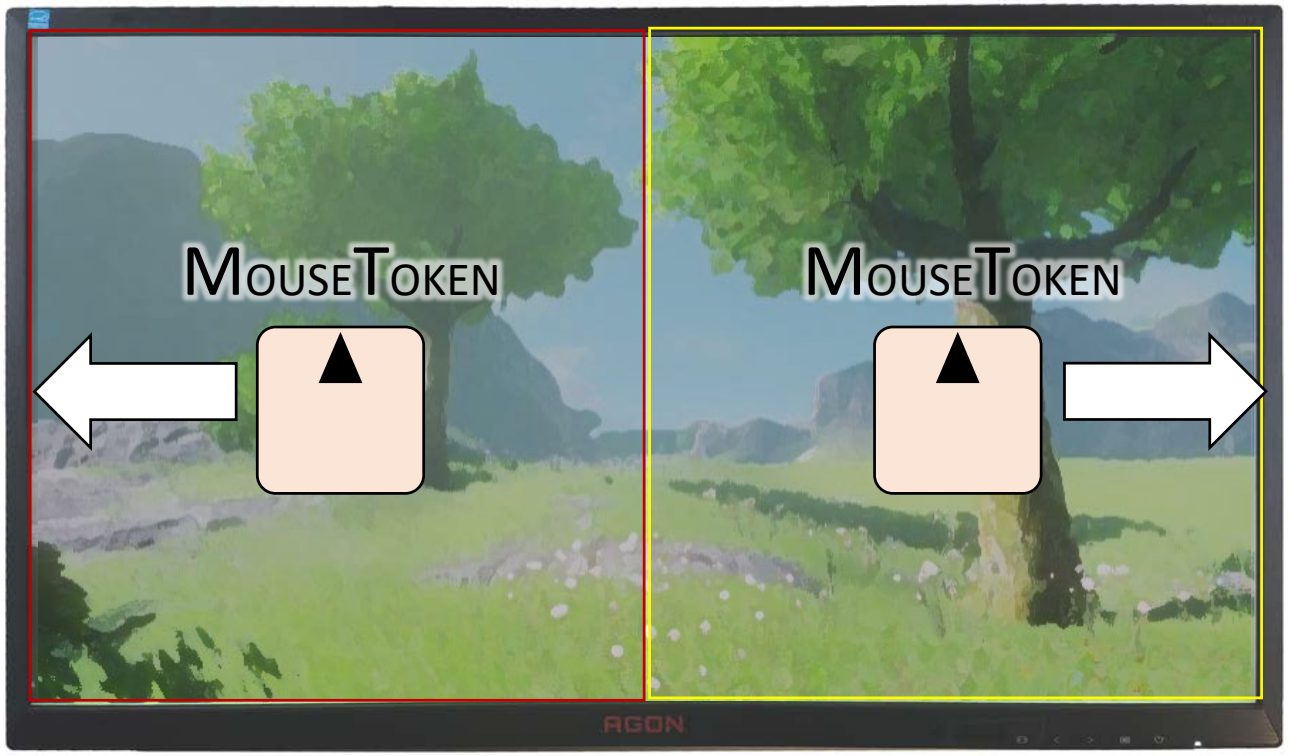
Images Captured by
Optical Mouse Sensor:

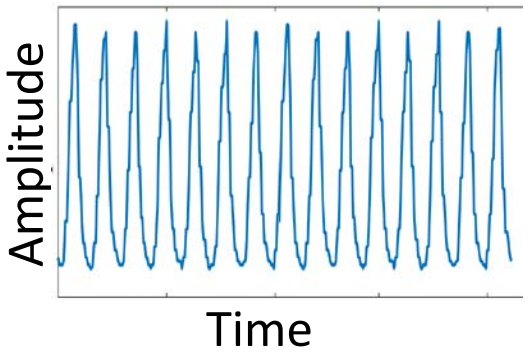




Positioning with Visible Light Communication

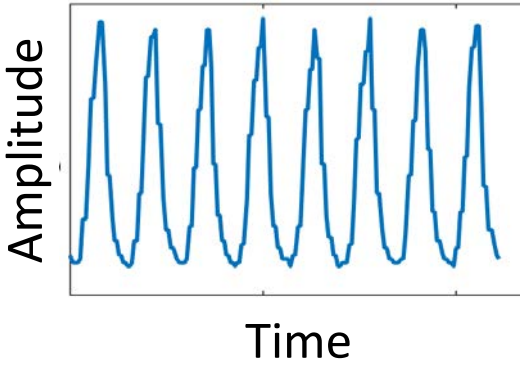
Light Intensity of the Captured Images





Frequency == High

Left

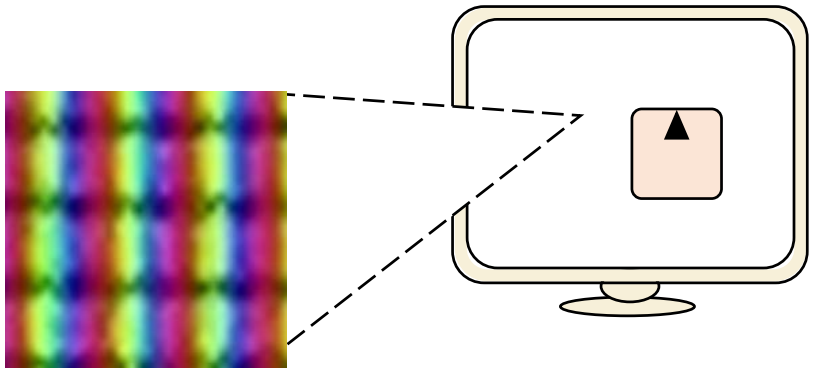


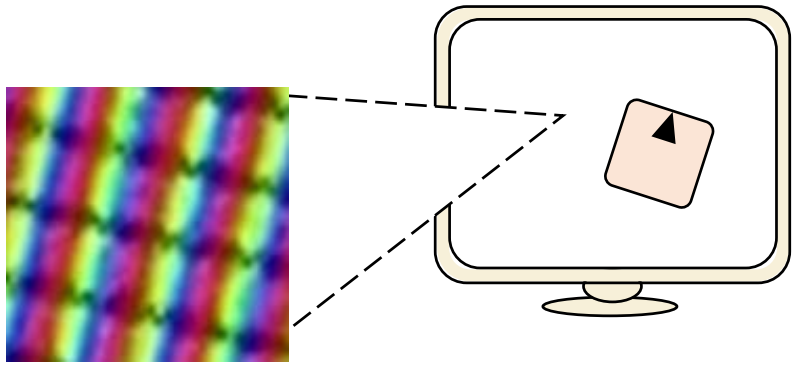
Frequency == Low

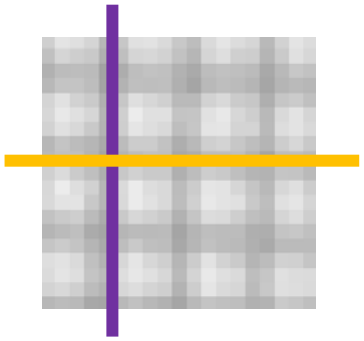
Right

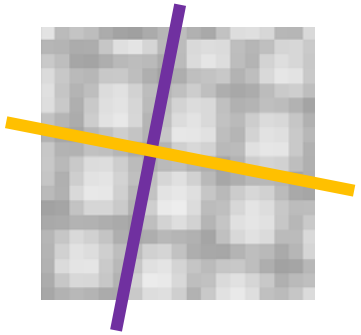
Positioning with Visible Light Communication

Determine Orientation with Pixel Gaps







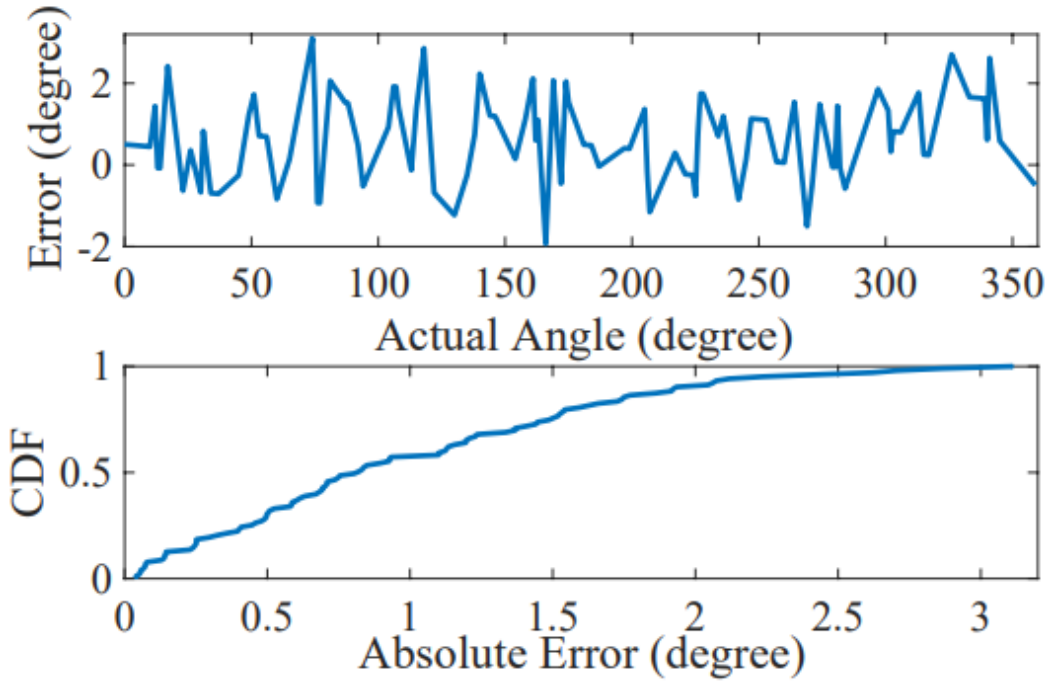


Implementation

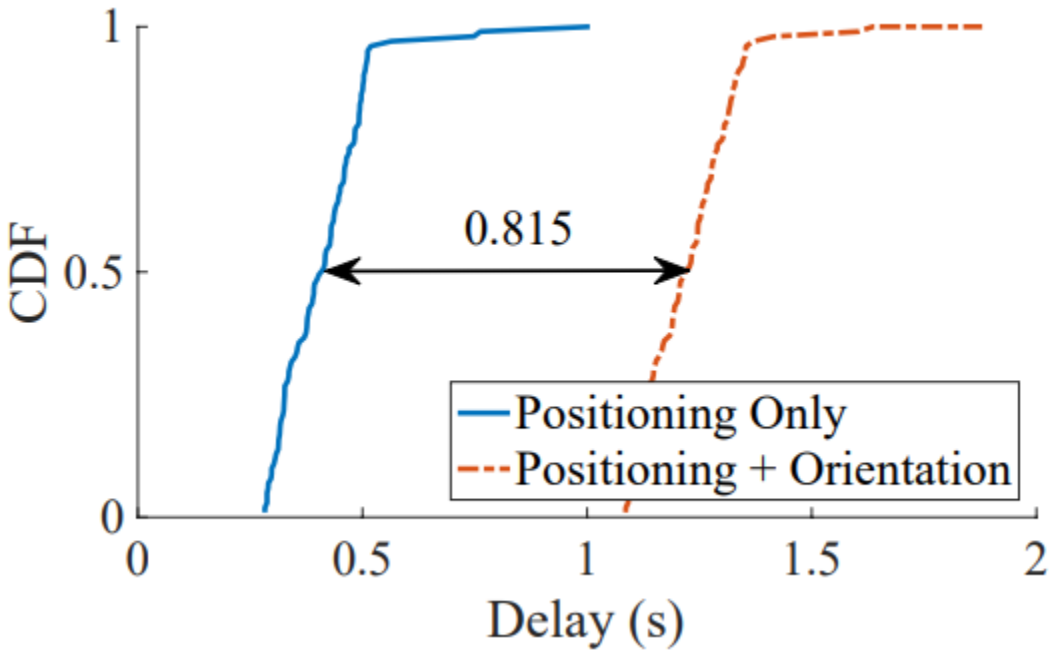
- Screen
  - AOC AG251FZ 240Hz@1080p gaming monitor
- Commercial Mouse
  - Dell MS111, Logitech M100, and Logitech UAG96B
- Customized Token
  - Processor: STM32F103C8T6
  - Bluetooth: CSR BC417143B
  - Mouse Sensor: Avago S5085
- Host System
  - RX550 HDMI 2.0
  - OpenGL

Tracking Performance

- **Positioning Precision:** 1.2 × 1.2 cm^2



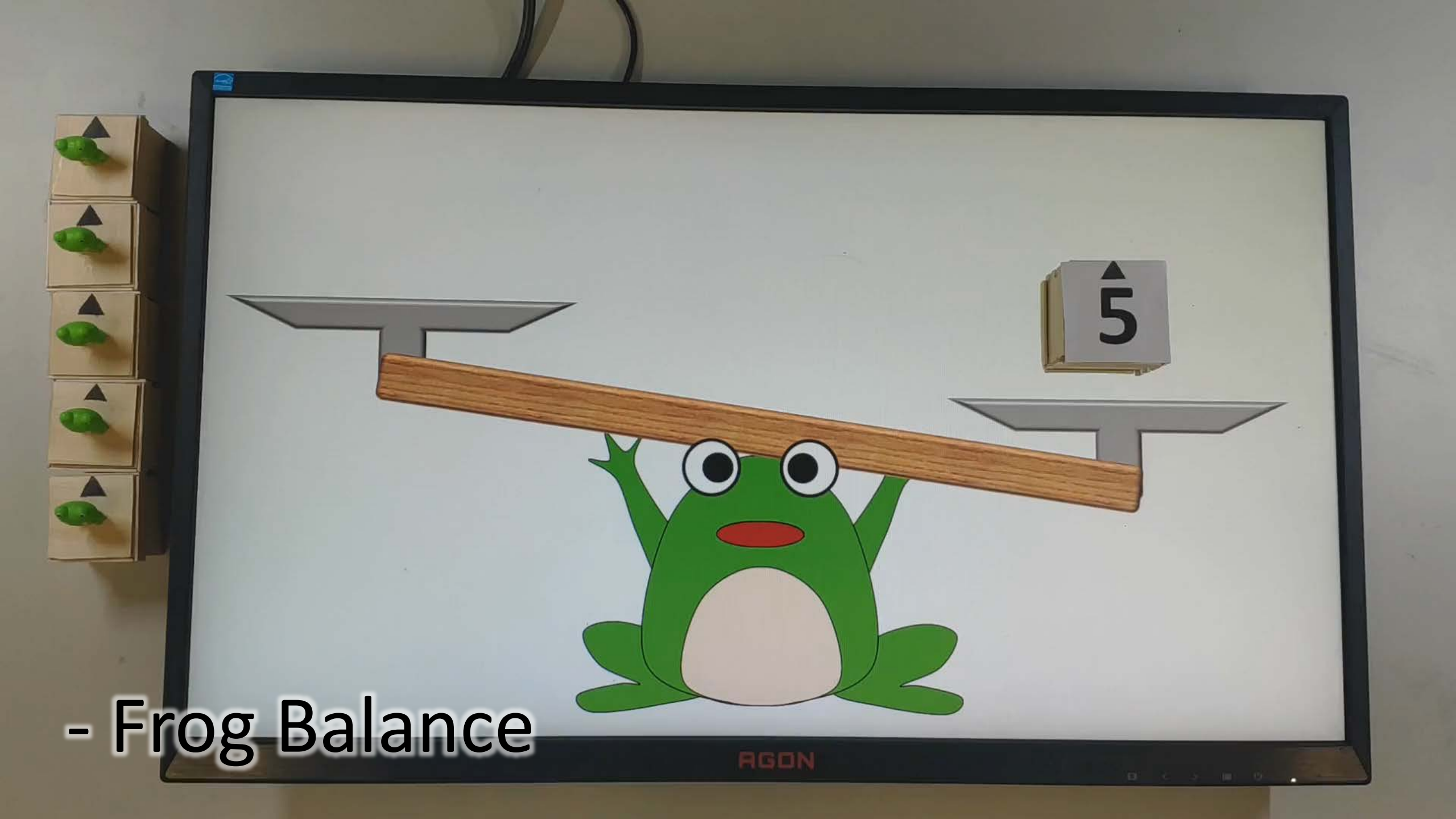
- **Error of Orientation Estimation**



- **Tracking Latency**

Applications

- Puzzle Board



- Frog Balance

- Color Widgets

- Hybrid Game Board

Conclusion

- A precise and unobtrusive method to track on-screen objects
  - The method is based on visible light communication

- A cost-effective TUI system
  - Its tangible uses optical mouse sensor to receive the light signals for tracking

Thank You!

Contact:
Yihui Yan yanyh@shanghaitech.edu.cn
Zhice Yang yangzhc@shanghaitech.edu.cn