Blinking LEDs and improving Augmented Reality interactability

Giovanni Lin
Supervisor: Miguel Chavez Tapia
Professor: Marco Zúñiga Zamalloa
g.lin@student.tudelft.nl

1. Background

- Augmented Reality (AR) can make our environments more interactable.
- Daily life appliances get treated as inanimate objects by current AR technologies.
- Visible Light Communication through blinking LEDs is a potential solution to this.

2. Problem Analysis

- Previous research [1], [2] on LEDs and AR have been done on a limited set of smartphones with high recording frame rates.
- Technology must be applicable to all kinds of phones.
- Blinking LEDs can cause flicker at low blinking rates.

3. Research Question

- Are blinking LEDs a viable solution to the improvement of AR interactability with daily life appliances?

Sub questions:

- How fast does an LED need to blink to prevent flicker?
- How does each parameter affect effectivity?

4. Experiment Setup

- Check whether smartphones with different cameras, high and low recording frame rates, can decode a message from a blinking LED.
- First do a check for flicker, if flicker is present don't do filming, due to potential health risks.
- If there is no flicker, check the the throughput of the LED at different distances.
- Compare results to those of LightAnchors [1] and InfoLED [2].

5. Results

- Only the highest recording frame rate used in this experiment (240 Frames Per Second (FPS)) is able to transmit data without flicker.
- Recording frame rates lower than 240 FPS (60 and 120 FPS) cause flicker.
- 240 FPS work at half a meter and one meter.
- Does not work at two meters because the LED goes out of focus, due to environmental factors.
- Results for flicker do not align with those of LightAnchors [1] and InfoLED [2]
- Previous research [1], [2] is able to go to further distances due to dynamically tracking the LED

6. Conclusion

- Only 240 FPS cameras work adequately without causing flicker.
- Not all phones have 240 FPS cameras, 60 FPS and 120 FPS are more prominent.
- This makes it hard to consider Visible Light Communication via blinking LEDs as a viable solution.
- Repeat experiment when 240 FPS cameras have become the baseline.

7. References

[1] Karan Ahuja, Sujeath Pareddy, Robert Xiao, Mayank Goel, and Chris Harrison. LightAnchors: Appropriating point lights for spatially-anchored augmented reality interfaces. In Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology, pages 189–196, 2019
[2] Jackie Yang and James A. Landay. InfoLED: Augment- ing LED indicator lights for device positioning and communication. In Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology, pages 175–187, 2019.