Demo: Card-stunt as a Service: Empowering a Massively Packed Crowd for Instant Collective Expressiveness

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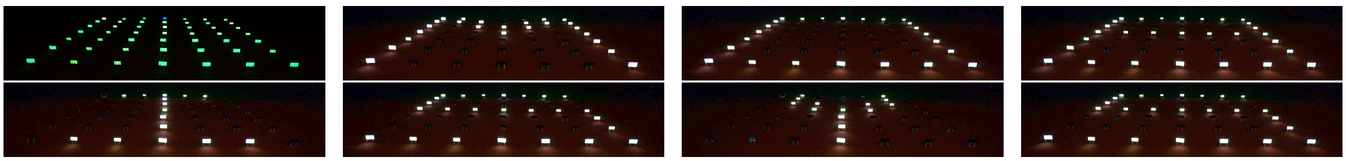

Figure 1: CaaS displays "MOBISYS" one letter after another on 49 smartphones.

1. INTRODUCTION

Consider a massive crowd who gathered together to convey their common voice to public, e.g., supporters of a team sitting together in a stadium, people doing a candlelight vigil in a public square, and so on. Imagine that they hold up their smartphone displays which collectively compose a huge public screen; the crowd's messages are now shown big on the top of them. We present CaaS [3], a mobile service to realize such an instant, massive, collective visualization with commodity smartphones and cloud services. In this demo, we demonstrate the collective localization feature of CaaS so that the audience can watch a given pattern or symbol collectively displayed on top of arbitrarily positioned phones (See the video demo, https://goo.gl/GfsORc).

2. CHALLENGES AND APPROACH

The key challenge to enable CaaS is instantly localizing a large number of devices, even up to tens of thousands, within accuracy and latency tolerances, without any custom infrastructure other than commodity smartphones and Internet connectivity. Existing approaches for stitching small displays require a custom infrastructure to localize each device such as an omniscient camera [2]. GPS is not accurate enough to clearly distinguish individual devices of a packed crowd, which are often less than one meter apart from each other. While existing device-to-device localization techniques [1] even provide centimeter-level accuracies, they are hardly applicable to the problem of localizing a large number of densely packed co-located devices with tight time constraints.

To address the challenge, CaaS utilizes simultaneous AoA (angle of arrival) sensing through VLC (visual-light communication) among all participating devices. As shown in Figure 2, when a screen of 'A' transmits its identifier signals encoded in hue transition sequences, the rear camera of 'B' captures the signals seen within its FoV (field of view). B computes the AoA between its camera and the center of A's screen. To maximize line-of-sight paths between devices, all participants are asked to hold up their smartphones overhead for a few seconds at the same time. After sensing AoAs, each device sends observed AoA data to a CaaS cloud server which reconstructs the device locations to be optimal for the given observed AoAs and some error margins. The details of whole process for localization are presented in [3].

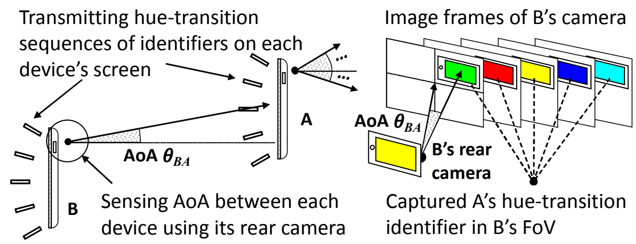

Figure 2: VLC for AoA sensing between smartphones.

3. DEMONSTRATION

We will demonstrate CaaS with arbitrarily located multiple devices on a table. Due to a limited number of devices under our ownership, the devices to be shipped to the demo venue may be fewer than those recruited in our full deployments [3]. Once AoA sensings are complete, CaaS server interface shows the relative localization result within a few seconds. As soon as the CaaS coordinator chooses an image to show, the image is pixelated to fit the spatial placements of the devices. Each device displays the right pixel with respect to its relative location. Animated images also can be displayed (See Figure 1). We believe CaaS will create new user experience for co-located crowds. CaaS would help them express their messages through a huge collective display consisting of small lights from individual smartphone.

4. REFERENCES

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