Topic Summary

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This research seeks to an investigate an accessible and intuitive computational kit for young children to learn the basics of computational thinking. Currently, there are many computational kits for students but there are only a few that support tangible programming. Since young children aged 5 to 9 are naturally physical learners, tangible programming is important for them to effectively learn. Learning experiences with physical objects would also positively affect their overall development by offering them opportunities to collaborate and communicate as well as to actively use their bodies than one on screen-based devices. However, those require special hardware or sensors so it is not accessible to everyone due to the high price. To design a more accessible and suitable computational kit for young children, we explore frameworks for designing developmentally appropriate technology, low-cost materials, and new technologies.

I suggest a low-cost coding system, Draw2Code, that allows children to program to create interactive 2D AR stickers using paper coding blocks and

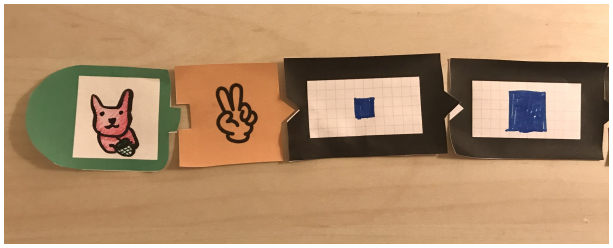

Figure 1: Example codes using Draw2Code's paper coding blocks. There are three types of coding blocks: 1) the Spirit block that users can draw a character or object on it, 2) the Event block for triggering the spirit to animate, 3) the Action block for storing size and position data of the spirit per each frame. These codes mean that when you show V hand sign to the system, the spirit of the bunny drawing will be bigger in two frames of animation.

a mobile device. In this system, we suggest a novel programming language that requires users to draw to code. Using video-sensing, the system supports tangible programming and physical interaction in a low-cost way.

The goal of this study is to evaluate the usability of the system, learners' engagement in the system and the coding subject, and their computational thinking learning. Our hypothesis is that this system will engage young children in coding and help them to be confident in coding. It will also inspire creativity in the process of designing both physical and virtual worlds with open-ended projects.

Comparing to other screen-based applications that are designed for a solo user, it would allow multiple learners to collaboratively program together. We also believe that this system can lower the barrier to introducing coding in more young children beyond traditional target learners.

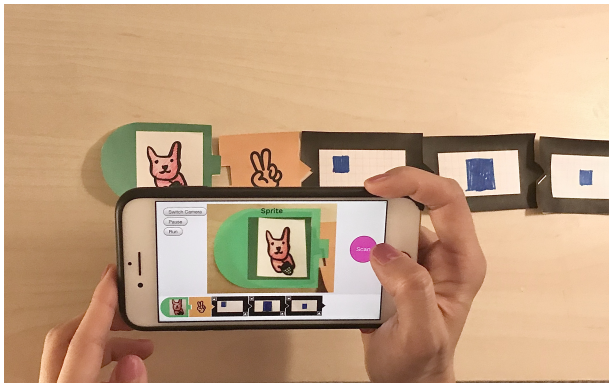

Figure 2: Scanning paper coding blocks using a mobile device

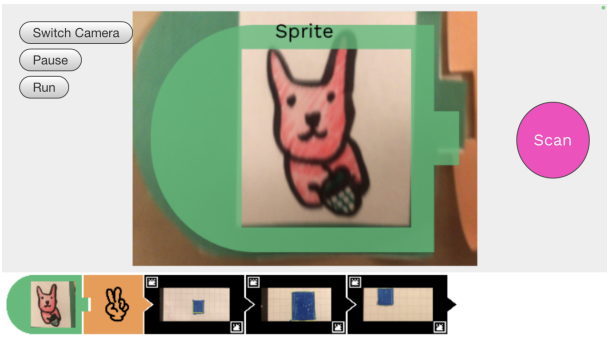

Figure 3: Draw2Code interface (current prototype) showing the Scan mode. A currently recognized coding block's image is shown overlaying the video in the middle. Users can add a coding block by hitting the Scan button on the right when it is recognized. All the scanned coding blocks are saved in the system and shown at the bottom.

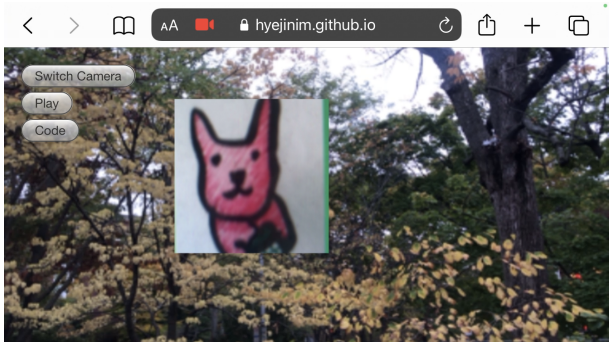

Figure 4: Draw2Code interface (current prototype) showing the Run mode. A spirit drawn by a user is displayed and animated over the video on the screen