



idealab
HisarCS

Pomelo

Interactive Education Robot

ABOUT POMELO

"Pomelo" is a collaborative robot that teaches children basic algorithmic skills through intelligible physical coding blocks, answers questions through Google Assistant and plays social games with kids to improve their interactive skills.

TEACHING THE BASICS OF ALGORITHMIC THINKING

Pomelo can be programmed to move in desired patterns and directions through the physical ArUco Marker coding blocks. Teachers can create and assign puzzles or mazes for the students to solve using the aforementioned physical code blocks. Such tasks will improve the algorithmic skills of the children while the physical code blocks enable the participation of a younger audience.

PROMOTE SOCIAL ACTIVITIES THROUGH GAMES

Pomelo induces and facilitates social interaction between kids through games such as karaoke, dance, and storytelling while also introducing the concept of human-robot social interaction within a group setting.

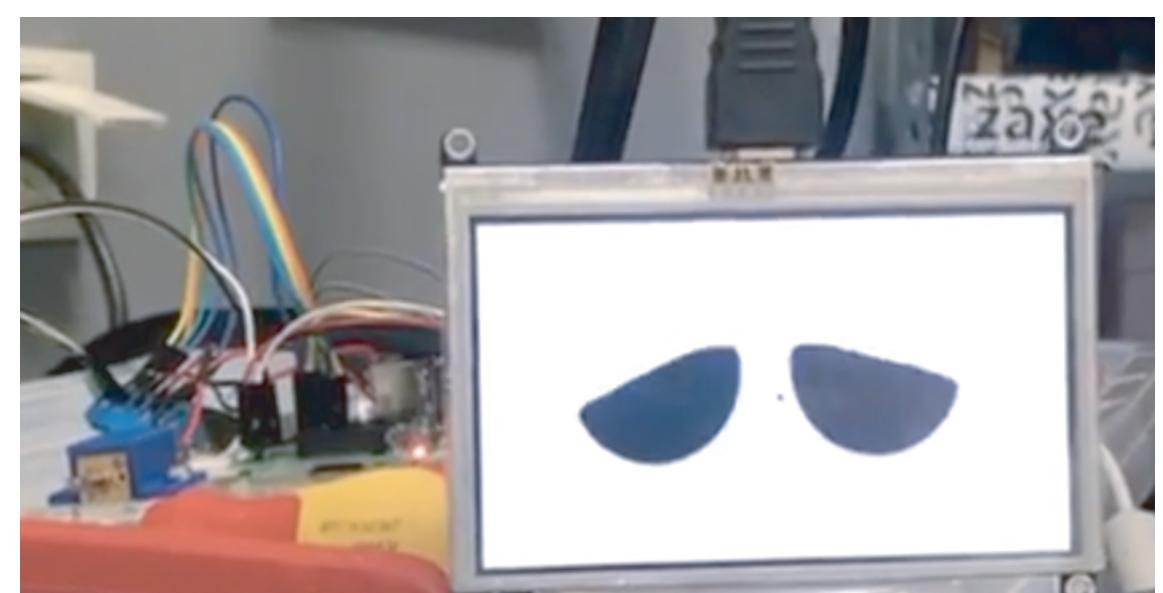


Figure 3: Sad Emotion Display on LCD

ENHANCING PRODUCTIVITY IN LEARNING ENVIRONMENTS

Pomelo increases the efficiency classroom environments by answering students' questions during an activity within the lesson. Pomelo is on sleep mode when the teacher is teaching a topic to the class so that it doesn't distract the attention of the students.

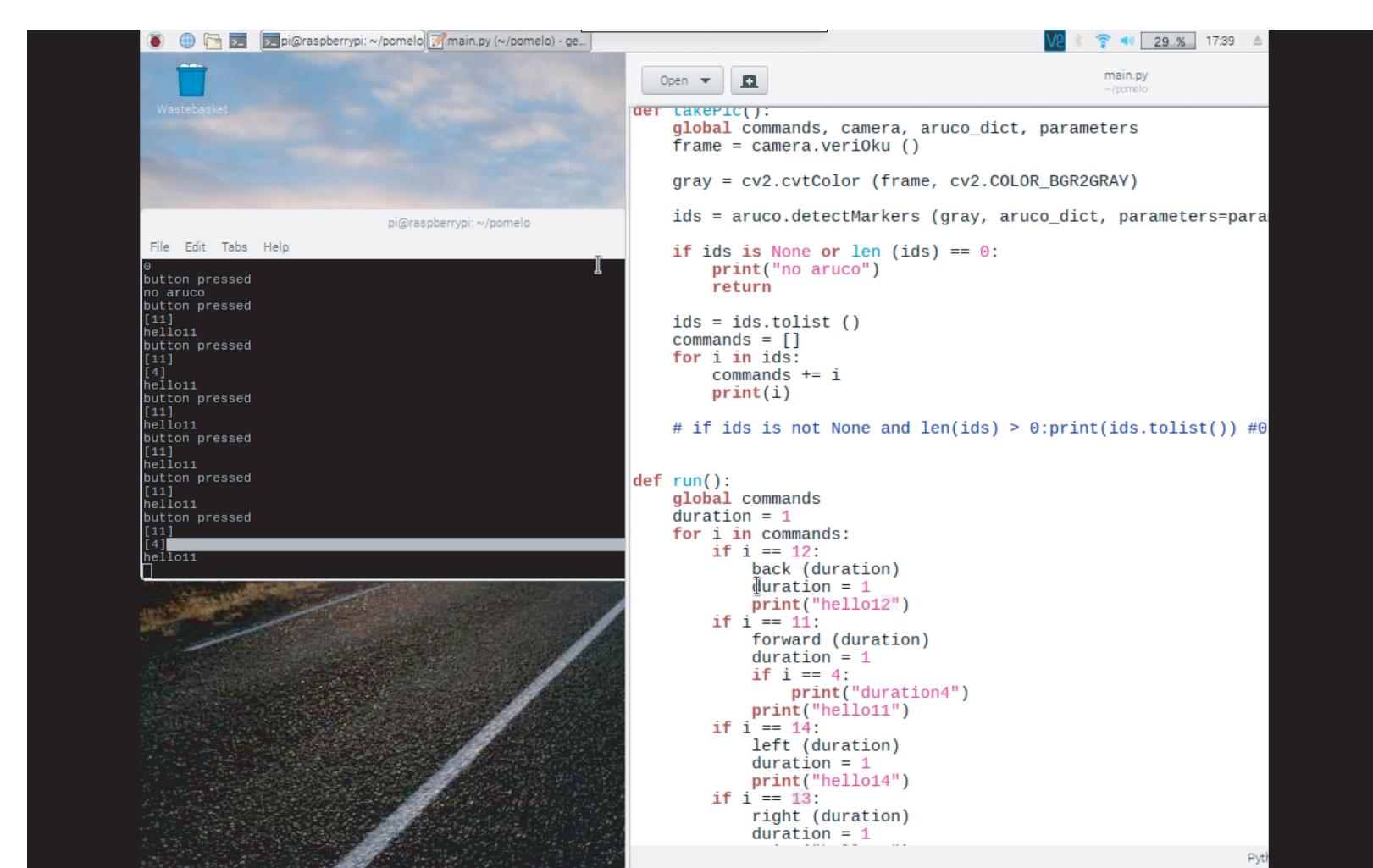


Figure 8: Aruco Block Programming



Figure 1: Maya Rendering of eyes

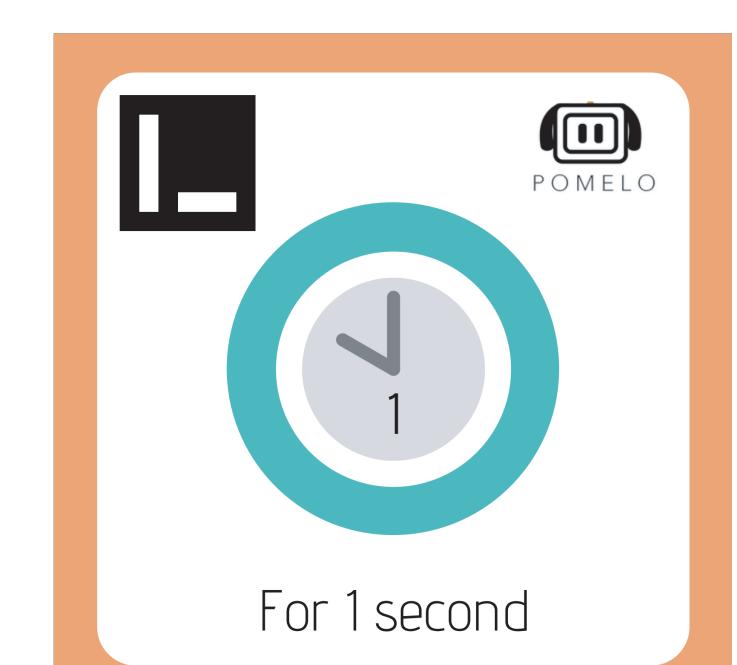


Figure 2: Aruco Blocks

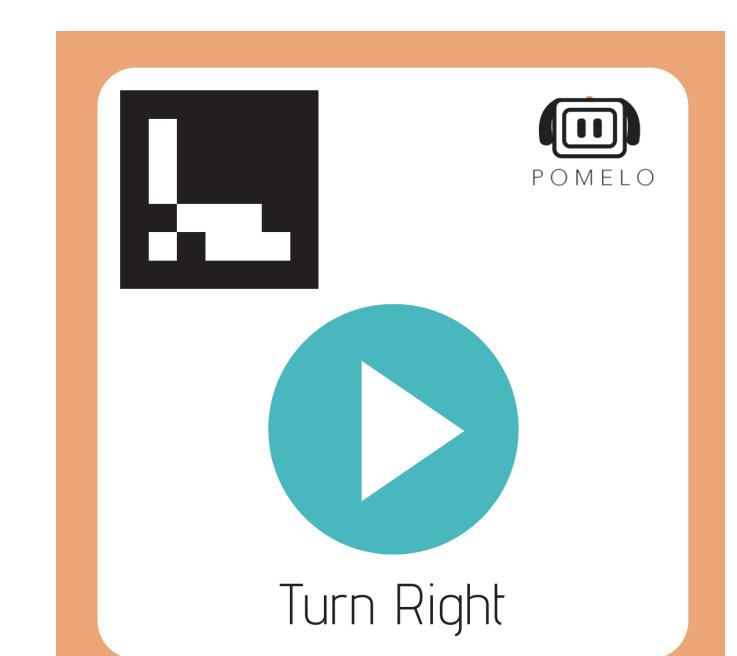


Figure 2: Aruco Blocks

DESIGN AND TECHNOLOGY

In our robot, we have used Raspberry Pi 3 as our main processor and the Pololu DRV8835 motor driver as an additional microcontroller that controls the DC motors. Pomelo has a rear-wheel drive with two caster wheels upfront to provide the necessary movement for kinetic interaction and completing tasks. To execute the code written on the 'code blocks' we have used ArUco Marker identifiers on each block which we recognize through a Raspberry Pi camera placed in Pomelo's mouth and the OpenCV ArUco library. We used an XPT2046 4.3" LCD screen to display Pomelo's eyes that were drawn and rendered using the Maya 2018 software. Pomelo's eyes are designed to react to user input and interaction by showcasing varying emotions. The Raspberry Pi has been connected to Google Assistant through the Voice HAT Board which allows the processing of audio input. This system allows pomelo to interact with students and answer questions, respond and communicate through the API.



Figure 5: 3D printed prototype

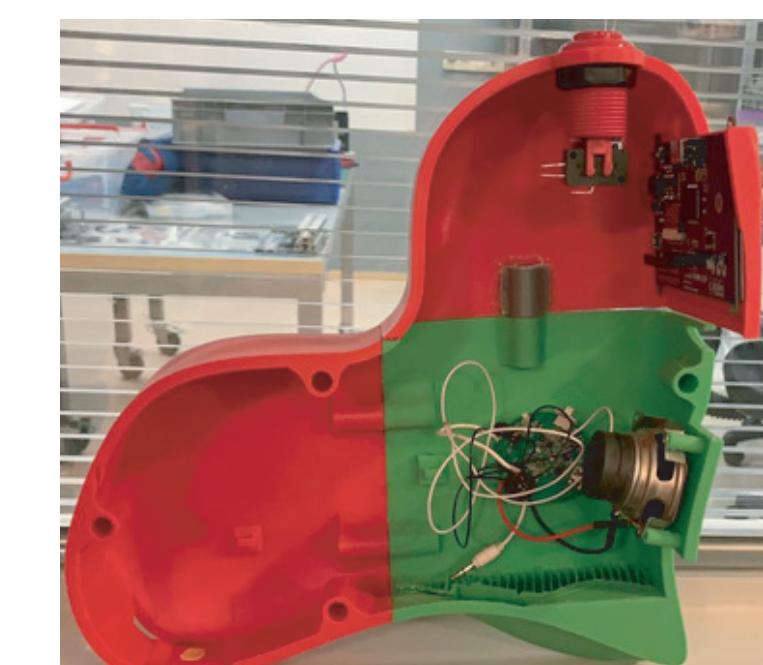


Figure 6: Electronics



Figure 7: Rendered Design

ALGORITHMIC STRUCTURE

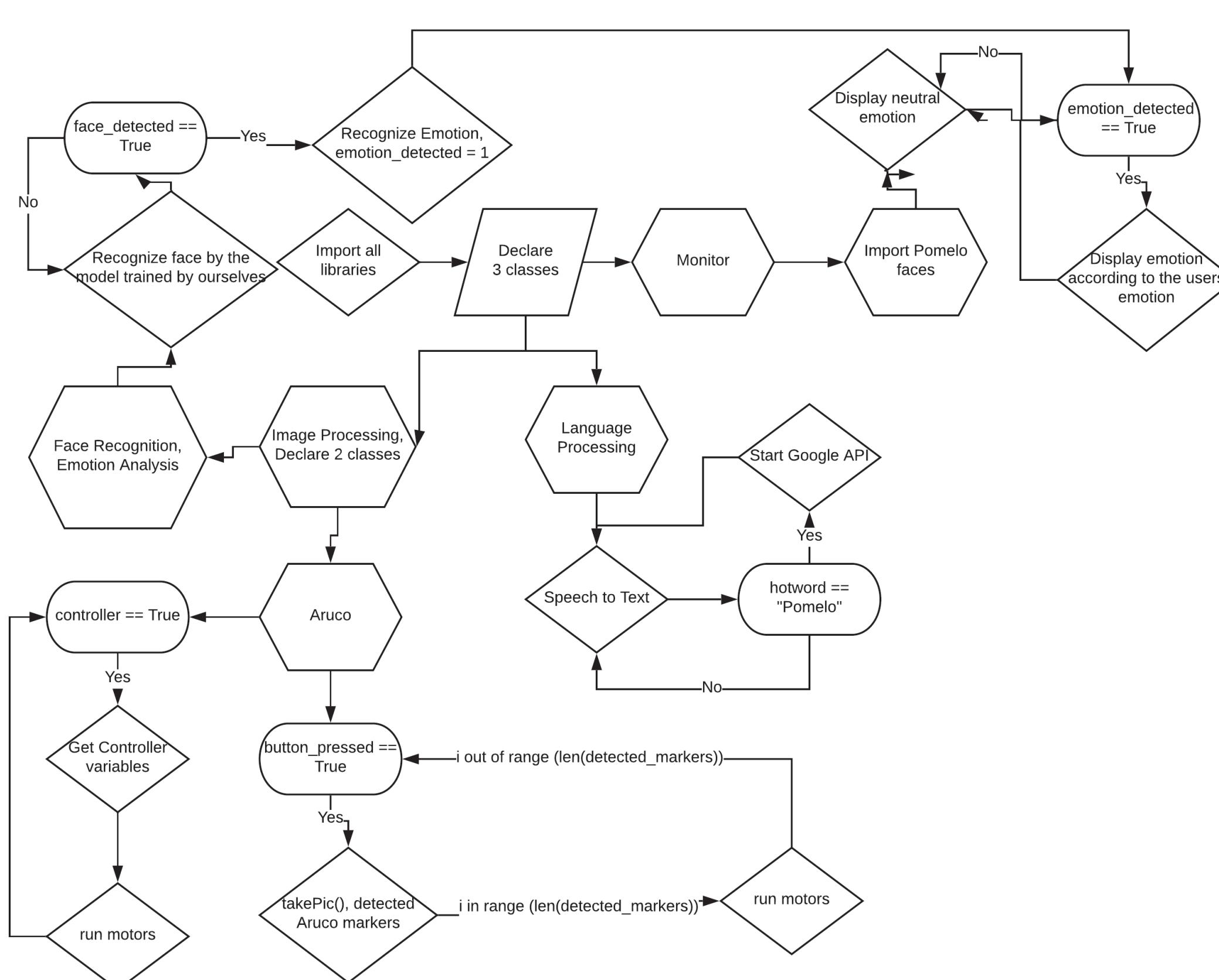


Figure 9: Testing

EVALUATION

We have completed the ArUco Marker code block and animated eyes stage of Pomelo and have tested it on two kids from second grade and sixth grade levels. The kids were first allowed to freely interact with and drive Pomelo using a remote control. During this time, the kids were able to get themselves acquainted with Pomelo's movement abilities and patterns. Then the physical code blocks were introduced and their functionality was briefly explained. Following this, the remote control was taken away and the kids were given some more time to freely interact with Pomelo. It was observed that the second-grader enjoyed Pomelo's varying eye movement and expressions as he pressed the button on its head whereas the sixth-grader was interested in coding Pomelo to move in different ways. However, it was also observed that the second-grader developed curiosity and interest in the ArUco Code Blocks after observing the sixth-grader's interaction. We have concluded that increasing the positive reinforcement through visual and audio outputs will increase the interest of younger users and create a more clear system of communication. We have also concluded that the use of physical code blocks simplifies the process and enables the development of algorithmic thinking skills at an earlier age.

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