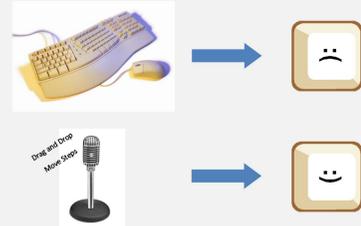


BACKGROUND

- Many K-12 initial programming environments (IPEs) are block-based requiring enough dexterity to use the mouse and keyboard.



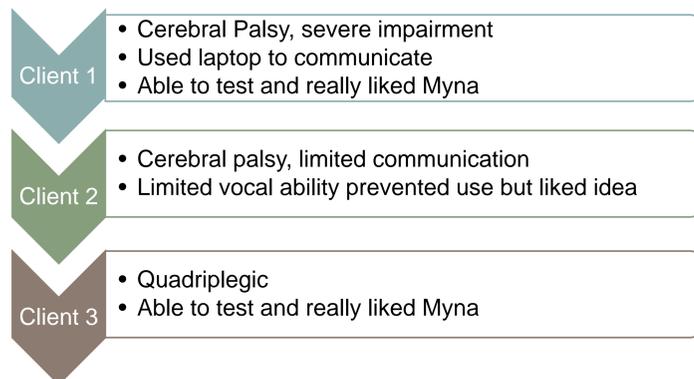
- How to allow students with motor impairments to use the same software?

RESEARCH GOALS

- Design and implement a Vocal User Interface (VUI) to allow students to program by GUI-based IPEs by voice.
- Design and implement a tool to create VUIs dynamically rather than manually.

USER STUDIES

During the Spring of 2013, three clients of United Cerebral Palsy reviewed Myna and offered suggestions to improve the tool.



In April 2013, a pilot study was conducted with five CS graduate students. The participants each completed three programs with the mouse/keyboard and with Myna (voice). Testing showed that there is no significant difference in time (average of 13 seconds difference) between either modality.

Observation	Average Count
Participant stated incorrect Myna command	0.67
Participant stated incorrect Scratch command	0.33
Voice recognition error	3.67
Myna location error	0.93

During the Summer of 2013, a second study was conducted during a United Cerebral Palsy summer camp in which two students were able to fully participate.

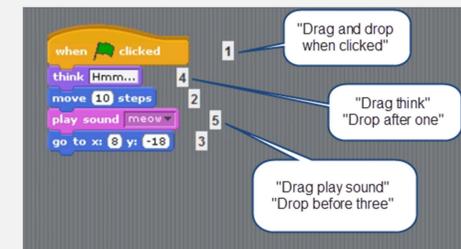
Observation	Session 1		Session 2		Session 3	Session 4
	Student A/Student B	Student A/Student B	Student A/Student B	Student A/Student B		
Type A - Participant stated incorrect vocal command	0	1	0	0	0	0
Type B - Participant stated incorrect Scratch command	0	0	0	0	0	0
Type C - Speech recognition was inaccurate	1/5	0/2	0	0	0	0
Type D - Myna placed the block in the incorrect location	0	2/2	0	0	0	0

MOTIVATION

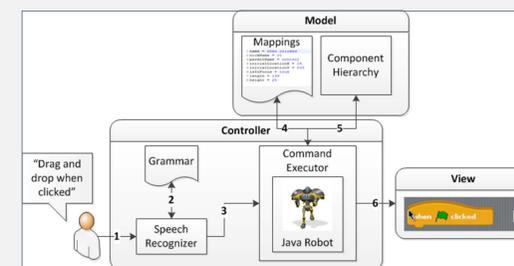
The Association for Computing Machinery (ACM) code of ethics states that all individuals should have equal opportunities to benefit from computer usage. By not providing alternative means of access to new environments for teaching computer science, users with disabilities are being denied learning opportunities that may allow them to explore career paths in computing. The driving motivation for the underlying theme of this research is recognition that more children (or adults) should have the opportunity to learn about Computer Science using Initial Programming Environments (IPEs).

APPROACH

Myna (pictured below) is a Java program that runs parallel to Scratch. When Myna is, the user can begin creating a program within Scratch solely through voice.

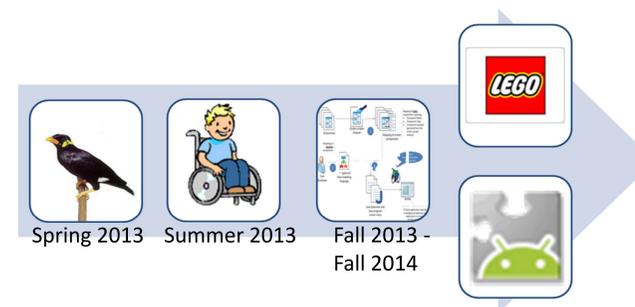


The following is an example of how Myna maps voice commands to actions (pictured below):



The user states, "Drag and drop when clicked." The speech recognizer identifies the command and checks it against the grammar. If the command exists, the command executor locates the mapping and verifies the state. Finally, the Java Robot performs the corresponding mouse/keyboard action.

FUTURE WORK



- To semi-automate the process of collecting the metadata for the components on the screen, a tool is being developed and will be completed Spring 2014.
- Then, a Domain Specific Language will be developed to implement the incorporation of the component data with the Myna behavior.
- Evaluations of this tool will occur during the Summer of 2014.
- Additional user studies will be conducted throughout Spring and Summer 2014.

