Gaze Tracking Enabled Automatic Robot Error Detection

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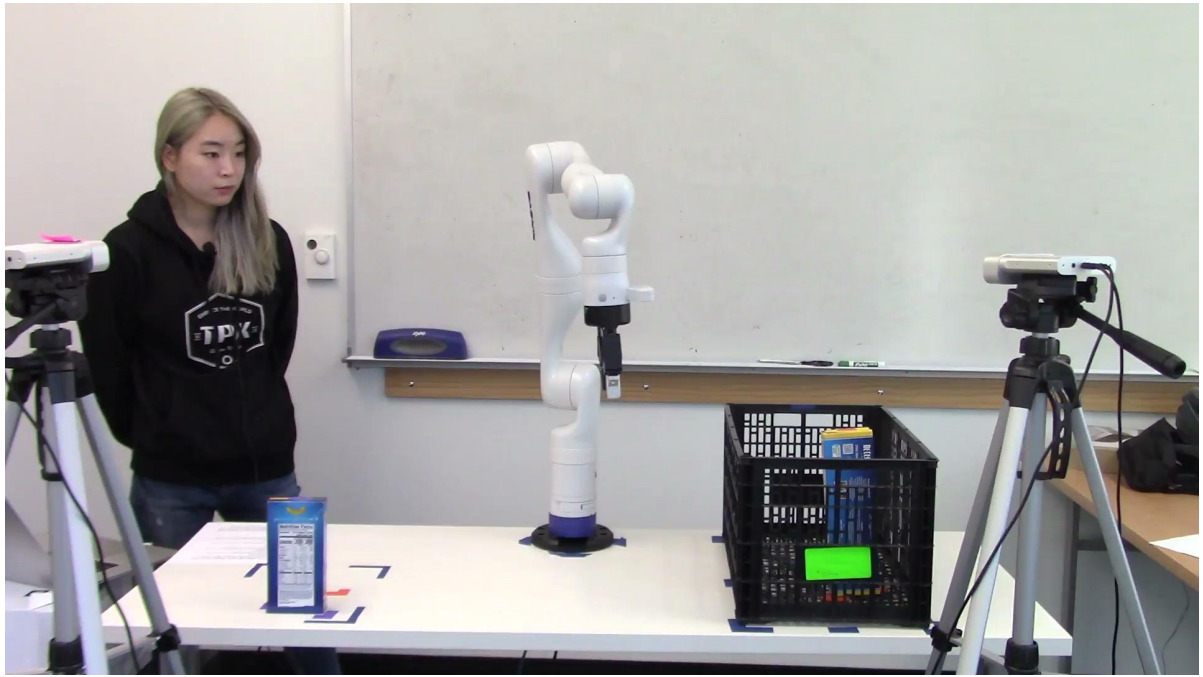
Project Review

Background: Robot Errors

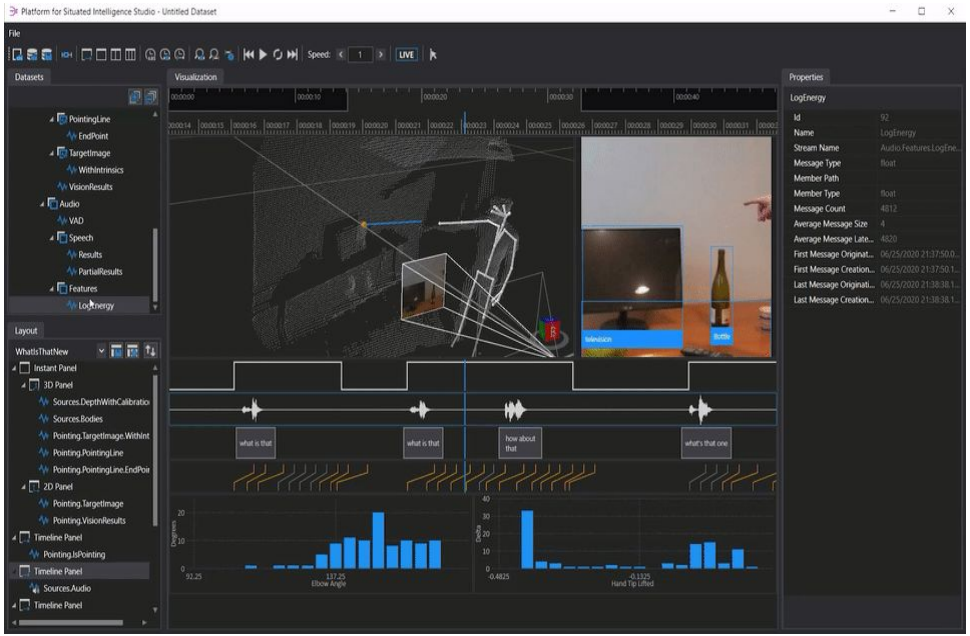
- Robots make mistakes; people react socially to physical interaction errors
- Errors are subjective to task or user, resulting in a variety of reactions



[Sample reaction from Stiber pilot study]

Background: Robot Error Detection

- Prior work by mentors using Microsoft PSI [Platform for Situated Intelligence]
- Human's reaction recorded in PSI system
- PSI Framework analyzes multimodal interactions and incorporates facial action units of a human's expression in response to robot error



https://github.com/microsoft/psi/wiki/Brief-Introduction

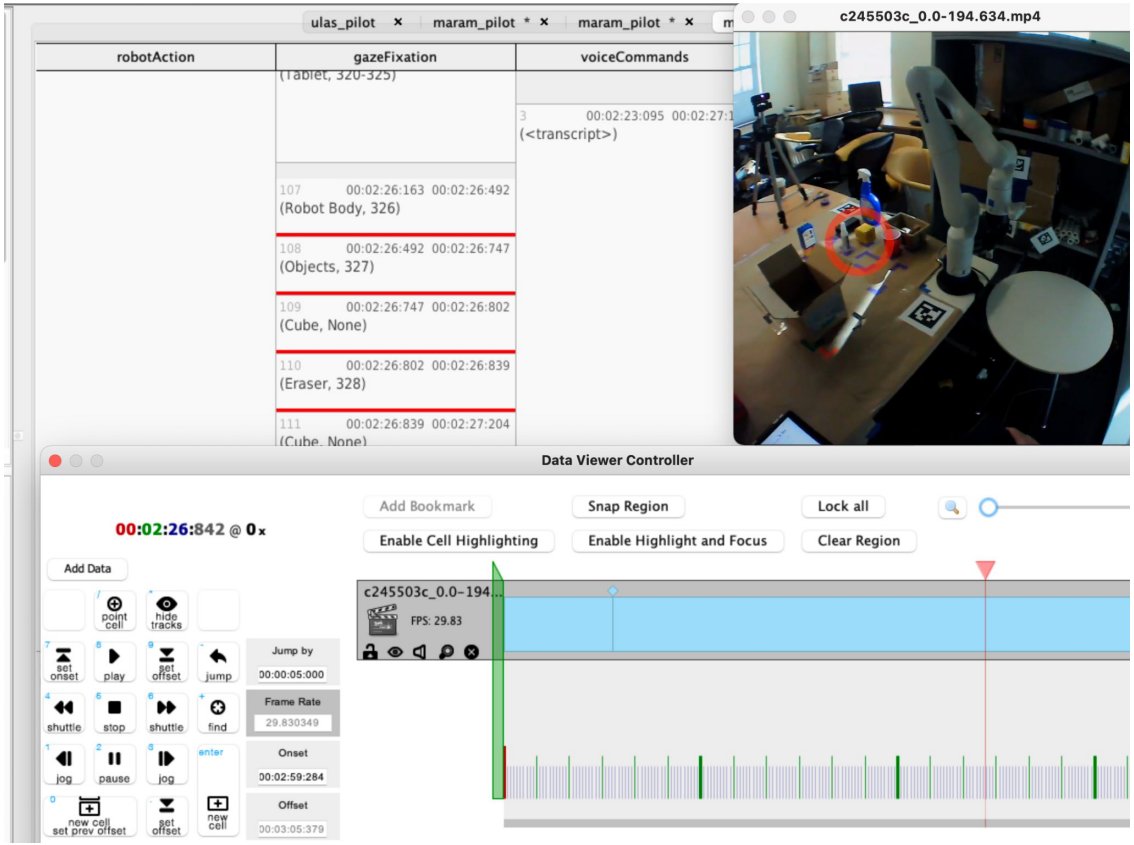
Project Aims

- Collect data to understand human gaze reactions associated with physical robotic error
- Add an additional component to the PSI system - mobile gaze tracker
- Create ML algorithm with data collection to automatically detect the robot error as it occurs

Overall Status

- Learning experience with gaze tracker and AR tags
- 3D localization of gaze within world coordinate system
- Updates to study design after initial pilot study test runs
- Collected and video coded initial user study pilot data

Video Coding Gaze Fixation



Updated Deliverables

Minimum:	● User Study Results and Analysis of Data
Expected:	● Integrate gaze tracker component into PSI for real-time error detection
Maximum:	● ML Algorithm that automatically detects errors using gaze data

Updated Timeline

Description	February				March				April				May	
Reading Preliminary Papers			■	■	■	■								
Learn PSI				■	■	■	■							
Write Gaze Tracker Component										■	■			
Test Gaze Tracker Component										■	■			
Prep For User Study						■	■	■	■	■				
User Study									■	■				
Test Out ML Algorithms											■	■		
Create Poster											■	■		
Present Poster													■	

Updated Milestones

Description	Expected Date Done By	Status
Preliminary Papers Read	3/1/22	**Completed**
PSI Learned	3/10/22	**Completed**
Gaze Tracker Component Written	3/19/22	*In Progress*
Gaze Tracker Component Tested	4/1/22	*In Progress*
User Study Prep Completed	4/1/22	*In Progress*
●Questionnaire Created	3/19/22	**Completed**
~~●Tutorial Created~~	~~3/19/22~~	~~*N/A*~~
●IRB Approval	3/1/22	**Completed**
●Participant Recruitment Process Started	3/27/22	*In Progress*
User Study Conducted	4/9/22	*In Progress*
●Pilot Study Conducted	4/1/22 | New: 4/15/22	*In Progress*
●Half of participants completed study	4/2/22	Not Started
ML Algorithms Tested	4/16/22	Not Started
●Tested Possible Algorithm #1	4/2/22	Not Started
●Tested Possible Algorithm #2	4/9/22	Not Started
Poster Presentation / Report	5/5/22	**Not Started**

Updated Dependencies

Dependency	Contact	Solution	Alternative Plan	Completed
PSI Software	Maia Stiber	Online Github Instructions	N/A	Y
Computer (Windows)	Chien-Ming Huang	Lab Computer	Personal Windows Laptop	Y
Robot	Chien-Ming Huang	Use ICL Lab Kinova robot	N/A	Y
Cameras	N/A	Get cameras from lab	Personal Camera	Y
Room for User Study	Chien-Ming Huang	Malone 335	Talk to Chien-Ming Huang to find available room	Y
Participant Recruitment	Maia Stiber	Follow IRB protocol	N/A	In Progress
Data/Code Backup	N/A	Github/Drive	External HD	Y
IRB Approval	Chien-Ming Huang	Get added to IRB	N/A	Y
SD Card Reader	N/A	USB-C/HDMI/SD Card adapter	USB SD Card reader	Y

Questions

References

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