Cognitive Testing Platform for Nonhuman Primates

CDC Cognitive Testing Platform Team

Objective

Redesign the Primate Cognitive Testing Platform at the CDC to:

Upgrade system interfaces and improve performance

Upgrade legacy game code from Visual Basic to Python

Reduce unit costs by **75%**

Improve reliability of the pellet feeder

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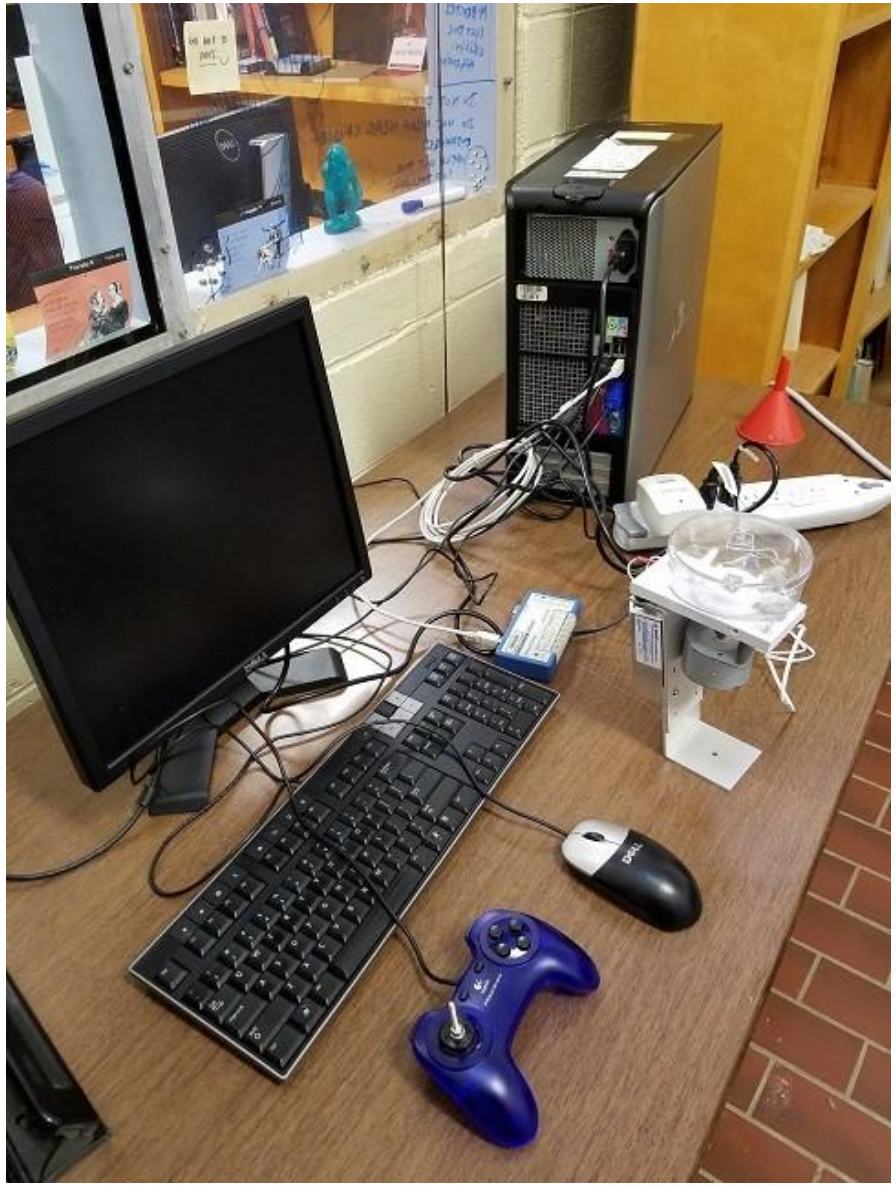
Background

CDC System to test primate cognitive performance using:

- Visual stimulus in the form of a game
- Joystick response
- Feeder system feedback reward



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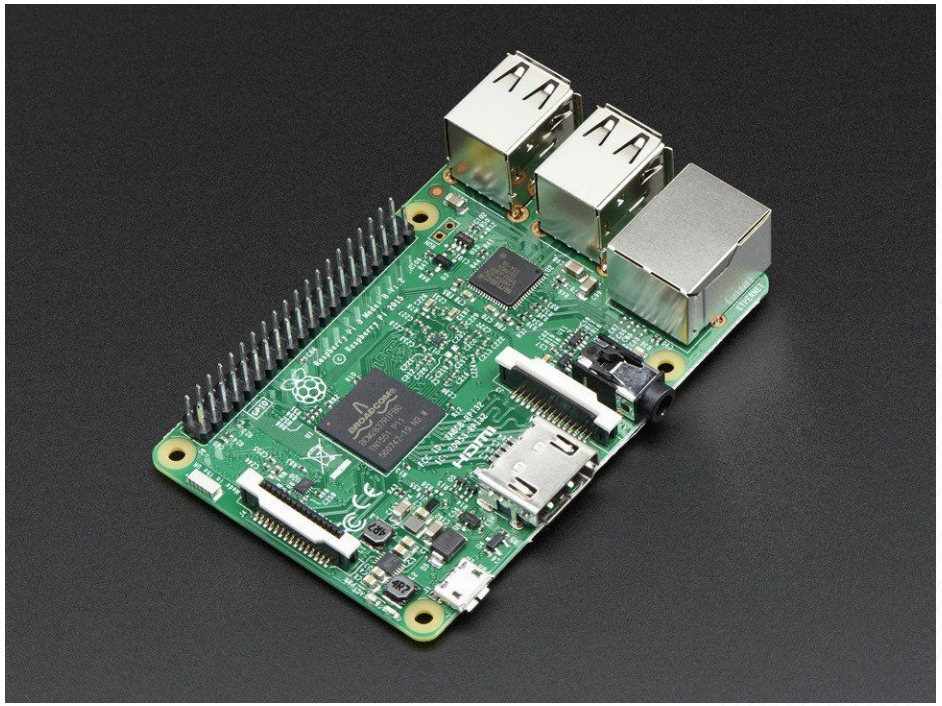
Concerns

- High unit cost
- Games coded in Visual Basic
- Stability in gameplay
- Feeder design causes jamming or multiple pellets to be dispersed

Design Approach

We propose modernizing the system with:

1. A Raspberry Pi 3 to interface peripherals and run the game code
2. Python coding for the games
3. A new 3D printed feeder apparatus to eliminate system jamming
4. A stepper motor to control pellet dispensing
5. A new enclosure to secure these components



Technical Specifications 1: Pellet Feeder

Feature	Requirement
Pellet Bowl	Does not become clogged with pellets
Stepper Motor Electric and Mechanical Design	V_input = 3.2V, 200 PPR, I_input < 3A [3]
Feeder Tube Measurements	Diameter = 2 x Diameter of Pellet, Length = 3’
Dispenser Module for pellets	Attach point = Outer Diameter of feeder tube

Technical Specifications 2: Python Interface

Feature	Requirement
Response time between signal and feedback	20us
Customization of Individual Game Parameters	Between Sessions by GUI
Processor Overhead	30-35%
Formatting of Result Output	CSV
Piping of Result Output	Serial

Project Demonstration

1. Successfully completing a game with the device under CDC supervision

2. Ensuring that the delay between response and feedback is sufficiently minimal as determined by a CDC expert.

3. Validating that the new feeder mechanism does not become jammed.

4. Validating that the output CSV is properly formatted for processing.

Marketing and Cost Analytics

Basic budget for one (1) cognitive testing system for non-human primates

Desktop Computer		1@$299
Pellet Dispensers		1@$459
A/D converters		1@ $139
AV carts		1@$80
Lexan monitor panels		1@$394
HDPE		1@$25.00
Joystick		1@100.00
Funnel/associated hardware		1@150.00
PVC pipe	1 inch pipe 5 feet	1@$5.40
PVC pipe ½ inch 10 feet		1@$4.79
Aluminum angle	8 feet	1@93.02

Total for 1 test system = $1,749.21

Table 4: Prototype Cost Breakdown

Part	Quantity	Unit Price	Total Price
Raspberry Pi Model 3 B	1	$25.00	$25.00
Cubic Inch of 3D-Printed ABS for Pellet Feeder (Bowl, Tubes, Dispenser)	4	$17.00	$68.00
Cubic Inch of 3D-Printed ABS for I/O Enclosures	6	$17.00	$102.00
Stepper Motor for Pellet Feeder	1	$30.95	$30.95
Stepper Motor Driver Circuit	1	$14.95	$14.95
AV cart	1	$80.00	$80.00
Joystick	1	$25.00	$25.00
Monitor	1	$66.99	$66.99
I/O Cables	1	$30.00	$30.00
Total Cost			**$442.89**

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Current Status

- Taking more concrete measurements of the current system and cages to begin printing feeder parts right away
- Compiling list of games and their specifications to start Python codebase
- Set to meet with the CDC next week