

ASEE Zone 1 Spring Conference

**How Raspberry Pi Technology Can Enhance
Students' Learning Opportunities in Technology**

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Agenda

- Definition - What is Raspberry pi?
- History
- Our Project
 - Phase 1 - RPi + Brick Pi Interface
 - Phase 2 - RPi + Pi Storms Interface
- Skills Developed
- Q & A

Raspberry Pi - Definition

- An inexpensive, ubiquitous, Linux based platform that will change how we do business in the educational technology field.
- Credit-card sized computer - costs \$35.
- Plugs into a computer monitor or TV.
- Uses a standard keyboard and mouse.



Raspberry Pi - History

- Invented by a tiny UK charity
- First Released 2/2012
- 19,000,000+ sold (as of 3/2018)
- Original Target Market
- Outside Markets Unanticipated
- Manufactured in Pencoed, Wales
 - (some China and Japan)
 - Current RPi = Raspberry Pi 3 Model B+

Our Project Goal

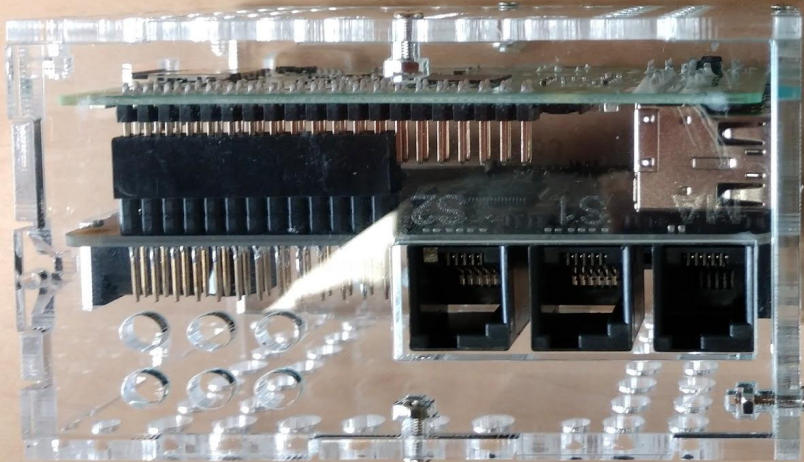
ACT Capstone Students - Design and develop User Friendly Activity for young or non-techie students to learn programming

Modules

RPi



Brick Pi



Pi Storm



Project Requirements

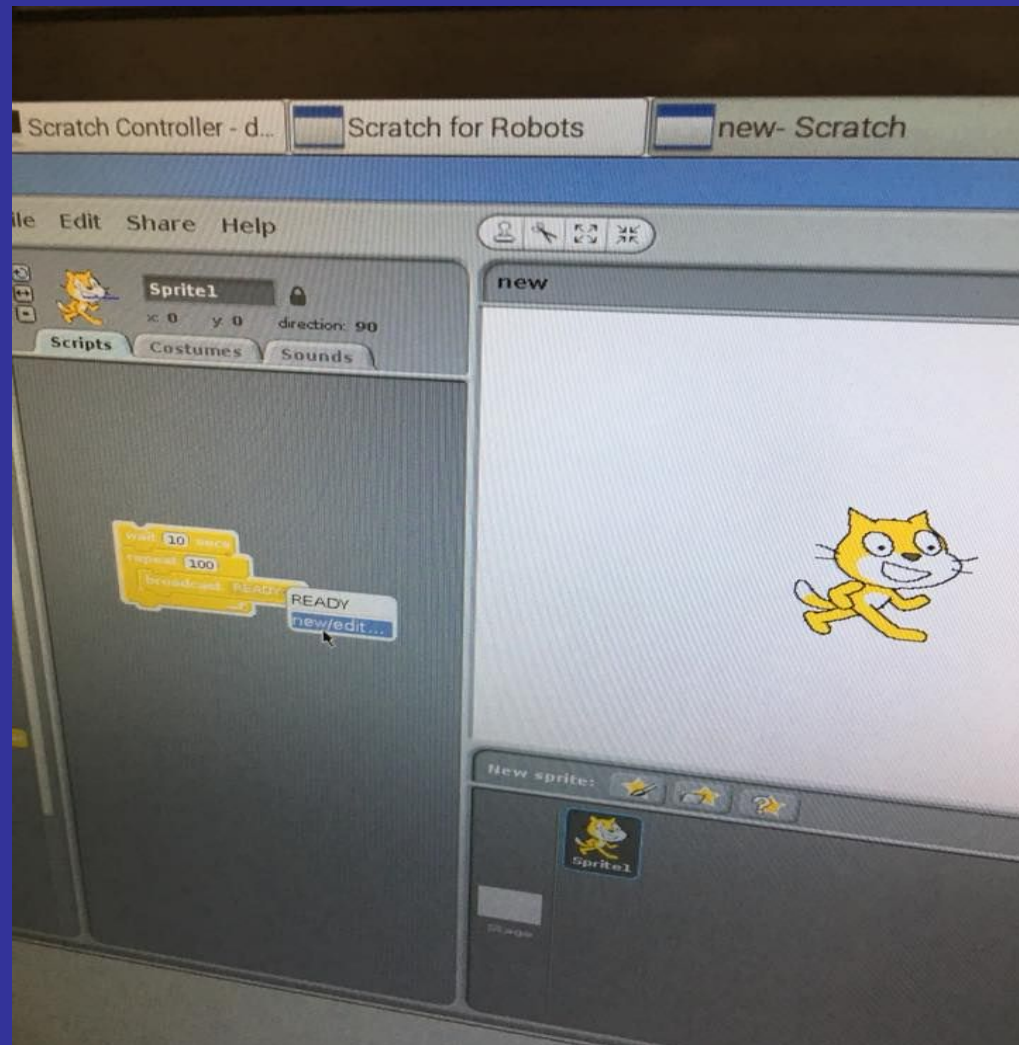
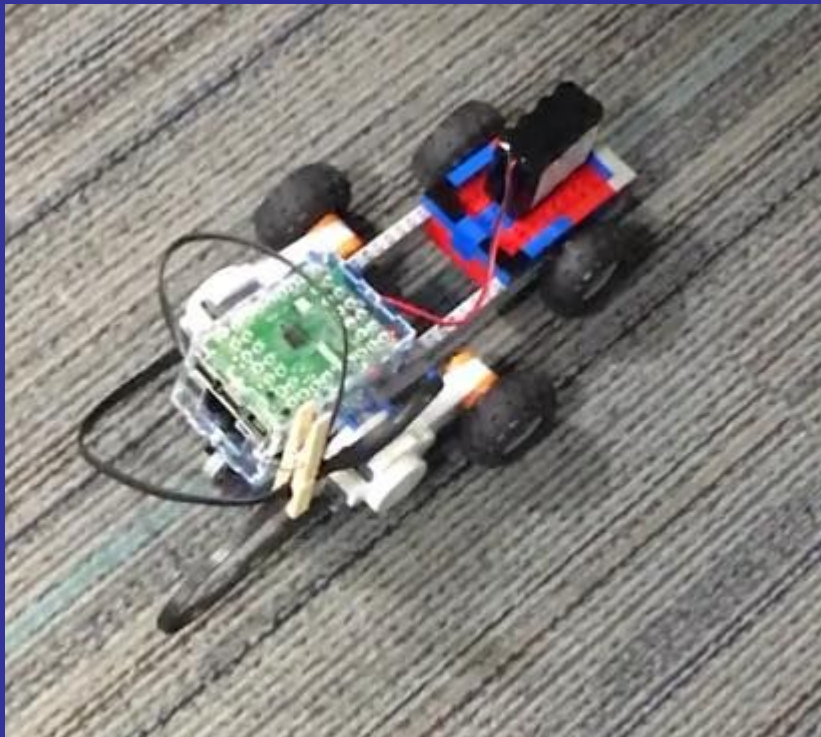
- Hardware
 - Raspberry Pi
 - Brick Pi - Lego Interface
 - Pi Storms - Lego Interface
 - Peripheral Devices (Motors, etc.)
- Software
 - Raspian Pi - OS Environment
 - Python - high level coding
 - Scratch, Blockly - easy to learn, teach students how to program

Project Phase 1 Brick Pi

- Replace Lego NXT (Left) with equivalent RPi Design (Right)



Design Mistakes = Learning Opportunities



Design Mistakes = Learning Opportunities



Out-of-the-Box Thinking, New Skill Development



Programming Using Scratch



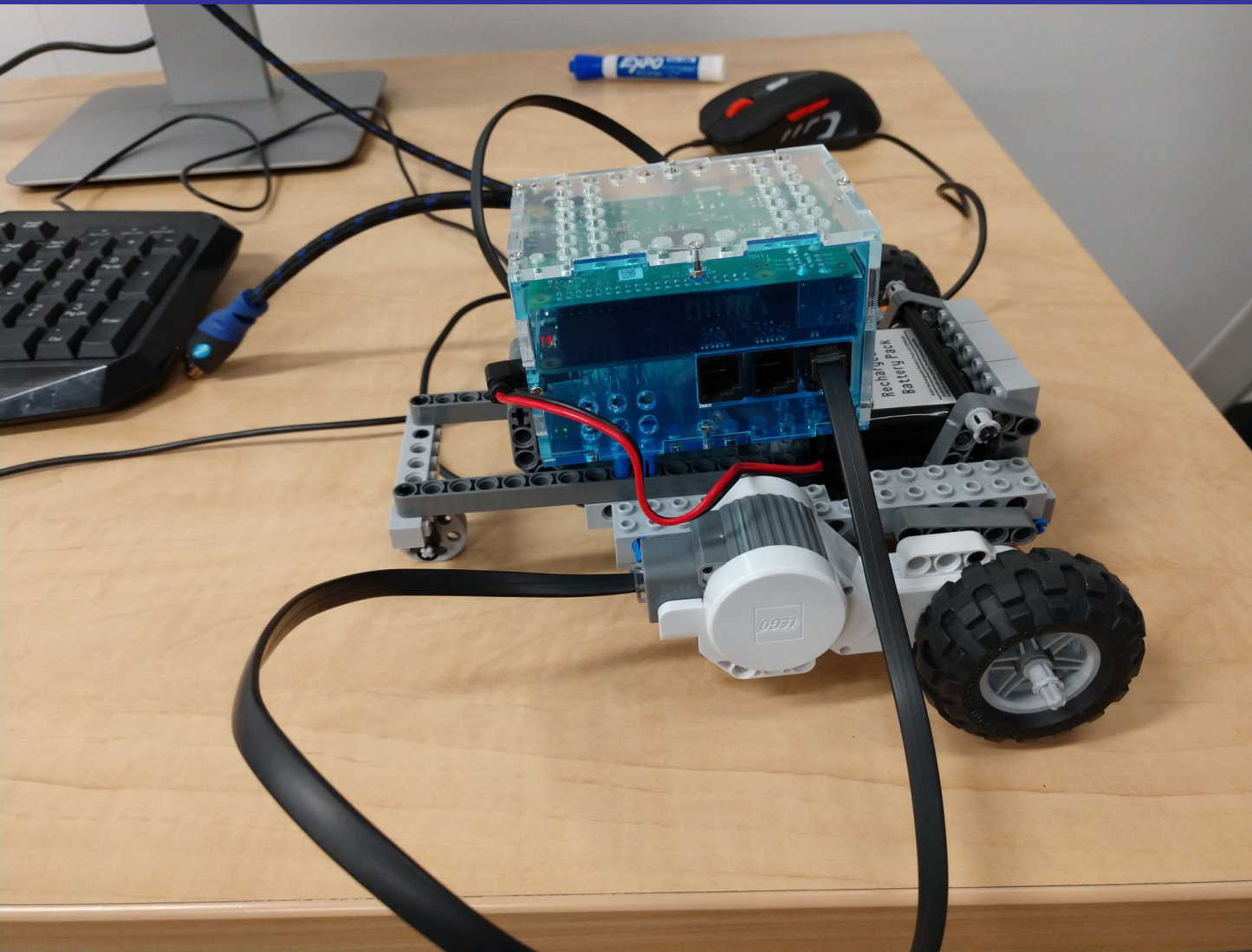
Testing on Non-Techie Students



Testing on Non-Techie Students



Phase 1 - Final Working Prototype



Phase 2 - Pi Storms

- Unlike Brick Pi, PiStorm has built-in WiFi
- Has touch screen controls
- Programming and control via web interface.
- Monitor and keyboard or USB not required
- Program in Blockly graphical environment or in Python

Phase 2 - Pi Storms

- Access PiStorms unit via web interface or secure shell
- Highly Customizable
- Portable

PiStorms Control Interface

Essentially a web server running on the Pi

The screenshot shows a web browser window displaying the PiStorms Control Interface. The browser's address bar shows the URL `192.168.10.102` and the page is marked as "Not secure". The interface has a red header with the text "PiStorms Web" and a hamburger menu icon. A dark sidebar on the left contains navigation links under "LINKS" (Home, Programs, Screenshots, Remote Control, Logs, Messages) and "HELP" (Documentation, Blog, Forum, Submit a Bug). The main content area is titled "About Device" and lists the following information: Device: PiStorms, Software version: 4.016, Firmware version: V2.08, Hostname: PiStorms102, eth0: not present, wlan0: 192.168.10.102, and Home folder: /home/pi/PiStorms/programs/. To the right of this information is a green battery status widget showing "BATTERY 8.28 V Well Charged". Below the battery widget is a "System" section with four control buttons: "Shutdown" (red), "Reboot" (blue), "Stop Browser" (orange), and "Start Browser" (green). The footer of the page reads "PiStorms by mindsensors.com".

Python Programming

```
9 # This program is distributed in the hope that it will be useful,
10 # but WITHOUT ANY WARRANTY; without even the implied warranty of
11 # MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
12 # GNU General Public License for more details.
13 #
14 # You should have received a copy of the GNU General Public License
15 # along with this program; if not, write to the Free Software
16 # Foundation, Inc., 675 Mass Ave, Cambridge, MA 02139, USA.
17 #
18 #mindsensors.com invests time and resources providing this open source code,
19 #please support mindsensors.com by purchasing products from mindsensors.com!
20 #Learn more product option visit us @ http://www.mindsensors.com/
21
22 import os, socket
23 import ConfigParser
24 from PiStorms import PiStorms
25 psm = PiStorms()
26
27 config = ConfigParser.RawConfigParser()
28 config.read("/usr/local/mindsensors/conf/msdev.cfg")
29 homefolder = config.get("msdev", "homefolder")
30 try:
31     with open(os.path.join(homefolder, ".version"), "r") as f:
32         version_no = f.readline().strip()
33 except IOError:
34     version_no = "unknown"
35
36 psm.screen.drawDisplay("About Me")
37 psm.screen.termPrintln("Device: {}".format(psm.GetDeviceId().rstrip("\0")))
38 psm.screen.termPrintln("Feature: {}".format(psm.psc.GetDeviceFeatures().rstrip("\0")))
39 psm.screen.termPrintln("f/w version: {}".format(psm.GetFirmwareVersion().rstrip("\0")))
40 psm.screen.termPrintln("s/w version: {}".format(version_no))
41 psm.screen.termPrintln("Hostname: {}".format(socket.gethostname()))
42 psm.screen.termPrintln("Battery: {}V".format(psm.battVoltage()))
43
44 def getIP(iface):
45     ip = os.popen('ifconfig {} | grep "inet addr" | cut -d: -f2 | cut -d" " -f1'.format(iface)).read().rstrip()
46     return ip if ip != '' else "not present"
47 def updateNetworkInfo():
48     psm.screen.termPrintAt(5, "eth0: {}".format(getIP("eth0")))
49     psm.screen.termPrintAt(6, "wlan0: {}".format(getIP("wlan0")))
50 psm.untilKeyPressOrTouch(updateNetworkInfo)
51
52 psm.screen.termPrintAt(8, "Exiting to menu")
53
```

Blockly Programming

Not secure | 192.168.10.102/programs.php

10-test.py

Edit 10-test.py

Save

- Logic
- Loops
- Math
- Text
- Lists
- Color
- Custom Vars
- Functions
- Motors**
- Sensors
- Screen
- LED
- Buttons
- System

set speed of motor BAM1 to 50

get position of BAM1

reset position of BAM1

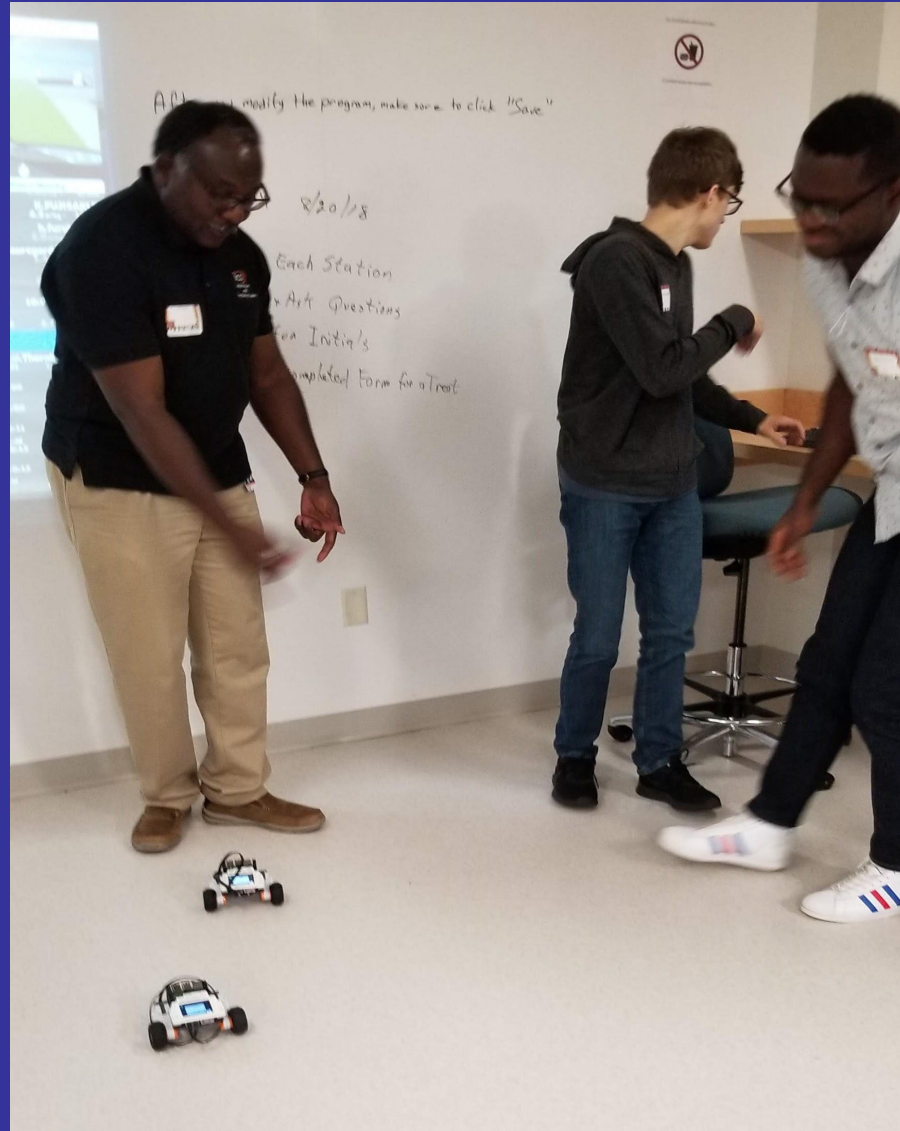
set motor BAM1 to brake

set motor BAM1 to float

set motor BAM1 to hold

sync speed of bank A motors to 50

Implementing User Friendly Activity at SVP Sampling



Skills Developed

- Programming low level, high level
- Hardware/software Interface - motors, etc.
- Working as a Team
- Adaptation - Building prototypes, soldering, etc.
- Time Management - deadline driven
- Presentation & Explanation Skills
 - Low level to non techie students
 - High level explaining design and programming to researchers and faculty

Question & Answer

