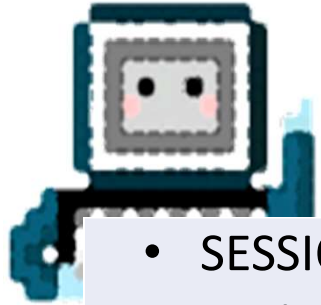# AOLME Curriculum Session 6

Level 1

- SESSION 1: **Basic of Raspberry PI and Linux-***(motivational overview of projects-images, ls, cd)*

- SESSION 2: **Introduction to Python Programming** *(print, algebra, strings)*

- SESSION 3: **Algorithms: Loops, Conditionals, and Sequential Thinking** *(for and while loops, range commands, if statements, inequalities, sprite movement)*

- SESSION 4: **The Coordinate Plane and Black & White Images in Python**

- SESSION 5: **Binary and Hexadecimal number systems**

- SESSION 6: **Images and Their Components (histograms)**

- SESSION 7: **Creation of Images and Video**

- FINAL PROJECT: VIDEO

Creation of images and videos

OBJECTIVES:

1. Create a single frame
2. Create a video using two frames
3. Create a video character
4. Review and discuss old video projects

Selected ACTIVITIES

1. Create a frame row by row
2. Make a video using two frames
3. Create a video character
4. Move a video character
5. Open a project from Level I and discuss project ideas
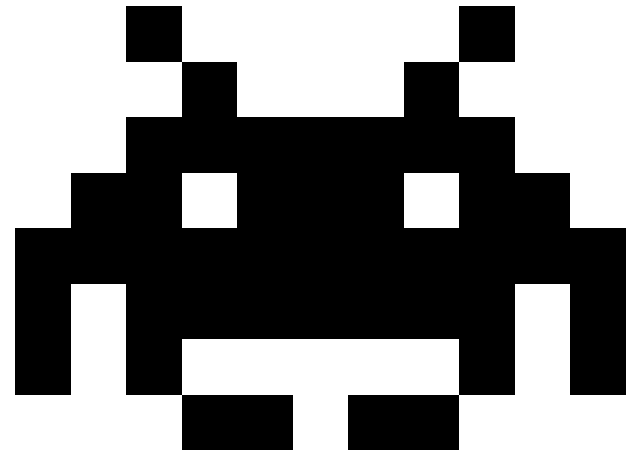
Hints

Select a large block of text:

- Hold down the Shift key and then move around the file with the arrow keys to select the text.

Select until the end of the line:

- Windows: Hold down the Shift key and press the End key.
- Linux on Pi: Hold down the Shift key and press the down arrow key.

Select until the beginning of the line:

- Windows: Hold down the Shift key and press the Home key
- Linux on Pi: Hold down the Shift key and press the up arrow key.

Cut, copy, and paste using the mouse:

- Hold down the right mouse button to access cut, copy, and paste.

Cut, copy, and past using the keyboard:

- Control+C for copy
- Control+X for cut
- Control+V for paste

Code to visualize a single video frame and comment when done:

```
im_show (frame1)            # Make sure to replace frame1 with the frame that you want to see.
wait = input("Press a key")   # Stops execution until you press a key
```

After you are done, you can comment out the code by placing a # at the beginning of each line.

7.1. Create a Frame Row by Row

1. **Create image.** Create a 3x4 color image using the provided page.

2. **Compute hexadecimal codes for each color.** Use RRGGBB for each hex code. Eg. Red is FF0000.

Hexadecimal Color Codes

3. **Create variables to store the colors that repeat and the frame.**

Create variables for each color. For example:

```
r = "FF0000"  # hex code for red
b = "0000FF"   # hex code for blue
```

To create a red frame of size rows x cols, we use:
```
frame0 = np.array([[r]*cols for row in range (rows)])
```

4. **Python IDLE.** Open IDLE and navigate the directory to **/home/pi/AOLME/Session7/**. Open the file **FrameEx.py**, run it and then modify the code to create your image.

To specify your image, you will need to **specify the size** and enter it **row-by-row**. For example, for the 0th row for a two-column image, we use
```
frame0[0] = [r,  b]  # Modify!
```

7.2. Make a Video Using Two Frames

1. **Create a second video frame using the previous activity. It must be the same size.**

   Create the color variables
   Create the video frame variable
   Specify the frame row-by-row

1. **Python IDLE.** Open IDLE and navigate the directory to **/home/pi/AOLME/Session7/.**

   Run *VideoEx1.py*. Then modify the code to play your two video frames.

   Note that you specify your video using the ***frame_list*** variable:

   frame_list = [frame0, frame1] # list of frames

3. **Replay:** Modify the video to play slower and faster. Modify the ***frame_list*** to play frame2 more times.

frame_list = [frame0, frame1]   # list of frames
fps= 2   # frames per sec
play_video= vid_show(frame_list, fps)# play on screen

4. **Analyze:** Study *VideoEx1.py* and find the parts of the code that perform the following:

   Import libraries
   Define colors
   Define frames
   Define the list of frames
   Play the video

Discuss the structure of the code.

7.3. Create a video character

1. Python IDLE. Open IDLE and navigate the directory to **/home/pi/AOLME/Session7/.** Run *VideoEx2.py*. **What do you see?**

Note that the following code copies the contents of variable frame0 into frame1:

        frame1 = frame0.copy()

2. Analyze: Study the code and *change* a pixel.

Note that the following code changes pixels:
        frame1[0][2] = b
        frame1[3][2] = b

3. Analyze: Open and run the file *im_fill_Ex.py*. *Change* the color and location of the rectangle:

start_row = 1
end_row   = 2
start_col = 0
end_col   = 1
im_fill(frame1, [start_row, end_row], [start_col, end_col], v)

4. Create: Think of a small video character. Program your character and make it appear against the background.

Hint: Use im_fill(), row-by-row, or pixel access.

7.4. Move a Video Character

1. Python IDLE. Open IDLE and navigate the directory to **/home/pi/AOLME/Session7/.** Then run **VideoDemo.py**
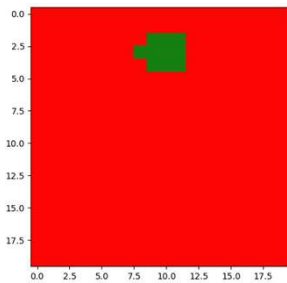
2. Analyze and modify: Find the following code and discuss what it does. **How does it work?**

```
move_r = 2
for row in range(rows):
    for col in range(cols-move_r):
        frame2[row][col+move_r]=frame1[row][col]
```

Go through the code and discuss the code that produces the other 3 movements. **Modify the code!**

3. **Think & Program:** Think of how you want to move your character. Program your own movement.

For each movement, make sure to use the code from the three movements that you found earlier.

4. **Write:** The team and summary expert will discuss what you learned so far.

7.5. Discuss Level 1 Projects

1. Python IDLE. Open IDLE and navigate the directory to **/home/pi/AOLME/Session7/.** Then select a folder from a school and a project to run. Run different projects.

2. Analyze: Let the facilitator discuss their project.

Go through the code and discuss the code with the rest of the group. **Modify the code!**

3. **Replay:** Find the commands vid_show(), frame_list, and fps and modify them.

4. **Write:** The team and summary expert will discuss what you learned in this session.

Which ideas do you want to implement in your project?

7.5. Discuss Level 1 Projects

Resources for the Activity	Recommended steps for the Activity

Resources for the Activity

1. Activity Card
Folder: **/home/pi/AOLME/Session7/ and projects under this directory.**

2. Raspberry Pi kit
3. Student journal

Evaluate how did the team roles work?

<u>Discussion Expert</u>: Leads the team discussion asking questions about what the session is about.

<u>Fair Participation Expert</u>: makes sure of fair participation of everyone.

<u>Hardware Setup/Teardown Expert</u>: in charge of setting up & putting away materials and computer equipment.

<u>Summary Expert</u>: summarizes and records team questions and what the teams has learned.

Recommended steps for the Activity

1. Make sure students 'play' with the code.
2. Make sure co-facilitator discusses their code.
3. Let the students ask questions about the project that the co-facilitator worked on. Try not to tell them, instead ask questions to prompt their thinking.
4. Have students debrief and write about what they learned in session 7.

Start discussing ideas for the project.

AOLME PROJECT - LEVEL 1- SESSION 7- 2018