Raspberry Pi

Challenge Day



Aberystwyth Robotics Club Patricia Shaw



Challenges Outline

- Bronze Challenge:
 - Connect up the devices to the Raspberry Pi, including wiring LEDs and attaching pi cam
- Silver Challenge:
 - Dice roller, Python program to light up LEDs based on dice roll
- Gold Challenge:
 - Face game (replacing paddle in paddleball game with face detected using camera



Bronze Challenge

- The Raspberry Pi is a single board computer
- To use it, we need to connect external devices (peripherals) to it
- These include:
 - Keyboard
 - Mouse
 - Monitor
- We also need to connect them to mains, and if Internet is required an ethernet cable as well







Pi Camera

- 1. Carefully lift slightly the cream flap
- Slide in the ribbon cable so the side with metal pins is towards the HDMI cable
- 3. Making sure the ribbon cable is straight, press the cream flap back down again

Note: very little force should be required.





LEDs

- Using the breadboard provided
 - Connect –ve row on breadboard to a GND pin on the pi
 - Insert the LEDs into the breadboard
 - Connect the resistor sides of the LEDs to GPIO pins 17, 27, 22, 13, 19, 26
 - Connect the other LED pins to the -ve row of the breadboard





Testing if it works

- Ask a member of staff to check your wiring before switching on the mains power to the Pi
- The Pi should boot up to a graphical desktop environment
- Open a Terminal by clicking the little black box on the bar across the top of the screen



Testing LEDs

• Type in the following commands to turn one of the LEDs on then off again

gpio -g mode 17 out
gpio -g write 17 1
gpio -g write 17 0

• You can change the number 17 to test the other LEDs



Testing the pi camera

• Again in the terminal, type in the following command:

```
raspistill -o image.jpg
```

- This should briefly load a window showing the current camera view, then save the view to the file image.jpg in the home directory
- Open the File Manager (yellow boxes icon) to check the image



Silver Challenge

- Using Python, write a program to control the LEDs and randomly generate dice rolls. The next two slides give useful reminders, followed by a step-by step guide if needed
- Firstly load the Python editor:
 - On raspberry pi computer
 - Click on raspberry in top left corner
 - In the "Programming" menu select "Thonny"
- In the editor open the file "gpioLEDs.py" in the "arc" folder
- The necessary libraries are already imported and a list containing the pins with LEDs connected is defined



Raspberry Pi libraries

• As a reminder, here are some commands for interacting with pins using the RPi.GPIO library

import RPi.GPI0 as GPI0
GPI0.setmode(GPI0.B0ARD)
GPI0.setup(channel, GPI0.IN)
GPI0.setup(channel, GPI0.OUT)
GPI0.output(channel, GPI0.HIGH)





Useful Python syntax

• Loops

for i in listName:
 #do something with list item i

for i in range(lower, upper):
 #do something with number i
 myList[i] # access list index i

while conditionTrue:
 #do something

• Other useful commands

answer = input("Question: ")

randNum = randint(lower, upper)

time.sleep(1.0) # duration in secs

if condition: # when true else: #when false



• Step 1: Ensure all leds are set as output mode

• Write a for loop that goes through each item in a list

for i in listName:
 #do something with list item i

• Set the pin to output mode using:

GPIO.setup(i, GPIO.OUT)



• Step 2: Turn all LEDs on in sequence

- Write a for loop that goes through each item in a list
- Set the pin to "HIGH" to turn on the LED

GPI0.output(i, GPI0.HIGH)

• Wait for a short time (time in seconds)

time.sleep(1.0)

- Step 3: Turn all LEDs off in sequence
 - Repeat step 2, this time setting the output to GPIO.LOW



• Step 4: Generate random dice roll

• Use the random library to generate a random number between 1 and 6

diceRoll = randint(1,6)

Step 5: Print the random number generated

print("You rolled ", diceRoll)

• Step <u>6: Turn on the matching number of LEDs</u>

for i in range(0, diceRoll):
 GPI0.output(leds[i], GPI0.HIGH)

Step 7: After a short delay, turn off all the LEDs



• Step 8: Add a while loop to repeat steps 4-7

```
while True:
#indent code for steps 4-7
```

• Step 9: Inside the while loop, ask the user if they want to roll a dice (y/n)

```
answer = input("Question: ")
```

• Step 10: If 'y' then perform steps 4-7, else break

```
if answer=='y':
# when true
else:
break
```



Gold Challenge

- Using the pi camera and face detection to play the paddleball game
- Step 1: Open the file facegame.py in the folder "arc/facegame"
 - Run the program to load the camera image
 - A face detector is already implemented for you
 - An image of a smiley face is overlayed on the image where a face is detected
 - Move your face around to see if it can track your face. What movements can't it track?



Face game

• Step 2: Drawing faces on a piece of paper

- Draw different faces on paper
- What is the simplest face that the program will still detect?

• Step 3: Adding an enemy ball

- The game for a single ball is fully implemented
- The challenge here is to add a second ball of a different colour
- The enemy ball bounces off all four sides of the window
- The player needs to avoid hitting the enemy ball
- If the player does hit the enemy ball, they lose a life



Congratulations!



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