



#### **Raspberry Pi 4 Automation**

NANNA

# **DAY 2 : Understanding the Mouse as Inputting Device**

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# Don Wilcher

Visit 'Lecturer Profile' in your console for more details.

# Agenda:

- What is a Human Interface Device (HID)
- HID Concept

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- Anatomy of an Optical Mouse
- Lab: Mouse-Processing Activities
- Lab: A Simple Mouse based Inputting Device









#### What is a Human Interface Device?

Human Interface Device (*HID*) A class of peripheral devices that enables people to input data or interact directly with the computer. HID devices include:

- a mouse.
- a keyboard.
- a joystick.

The HID specification is a part of the <u>USB standard</u> thus USB mice and other USB user input devices are HID compliant. Bluetooth also supports the HID USB protocol (see <u>Bluetooth profiles</u>).

PCMag.(n.d.). HID. Retrieved from https://www.pcmag.com/encyclopedia/term/hid



















Source:

O'Sullivan, D., & Igoe, T. (2004). *Physical computing: Sensing and controlling the physical world with computers*. Boston, MA: Thompson.





# Question 1



# Besides the HIDs shown in slide 6, what other devices could be used for such an application?





# HID Concept

HID consists of two fundamental concepts:

- Report Descriptor
- Reports

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Reports are the actual data that is exchanged between a device and a software client.

The Report Descriptor describes the format and meaning of the data that the device supports.

Microsoft Docs. (2020). *Introduction to human interface devices (hid)*. Retrieved from https://docs.microsoft.com/en-us/windows-hardware/drivers/hid/





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### **HID Concept...**

### Data is routed between the HID Driver and USB/HID Device



USB Implementers' Forum. (2001). Universal serial bus (usb): Device class definition for human interface devices (hids). Retrieved from https://www.usb.org/sites/default/files/hid1\_11.pdf





#### **HID Concept...**

A **Report** descriptor describes each piece of data that the device generates and what the data is actually measuring.



| Report descriptor                  |  |  |  |
|------------------------------------|--|--|--|
| Item(s)<br>(tag, type, size, data) |  |  |  |

For example, a **Report** descriptor defines items that describe a position or button state. Item information is used to:

- Determine where to route input—for example, send input to mouse or joystick API.
- Allow software to assign functionality to input—for example, use joystick input to position a tank.

USB Implementers' Forum. (2001). Universal serial bus (usb): Device class definition for human interface devices (hids). Retrieved from https://www.usb.org/sites/default/files/hid1\_11.pdf





#### Anatomy of an Optical Mouse



Amanda. (2015). *Tech tear down – Computer mouse*. Retrieved from https://electrothoughts.wordpress.com/2015/03/31/tech-tear-down-computer-mouse/





# Question 2



A Report descriptor describes

- a) each piece of data
- b) each piece of signal
- c) each piece of API
- d) none of the above





#### **Anatomy of an Optical Mouse**





#### Pinout of ADNS-2610 Optical Mouse Sensor

| Pin Number | Pin      | Description                    |
|------------|----------|--------------------------------|
| 1          | OSC_IN   | Oscillator input               |
| 2          | OSC_OUT  | Oscillator output              |
| 3          | SDIO     | Serial data (input and output) |
| 4          | SCK      | Serial port clock (Input)      |
| 5          | LED_CNTL | Digital Shutter Signal Out     |
| 6          | GND      | System Ground                  |
| 7          | VDD      | 5V DC Input                    |
| 8          | REFA     | Internal reference             |



Mechanical drawing: top view.

Hareendran, T.K. (n.d.). *Optical mouse – Learn to hack*. Retrieved from https://www.electroschematics.com/optical-mouse-learn-to-hack/





https://media.digikey.com/pdf/Data%20Sheets/Avago%20PDFs/ADNS-2610.pdf

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Lab: Mouse-Processing Activities



The following lab activities will illustrate the HID operations of a typical computer mouse using the Processing Language. Here is the list of lab activities.

- •Lab Activity 1: Making Circles
- •Lab Activity 2: Mouse Press
- •Lab Activity 3: Mouse 1D





#### Lab: Mouse-Processing Activities

#### **Activity 1: Making Circles**

When a mouse is moved, circles will appear on the screen. Clicking the mouse button will change the colors of the circle.









#### Lab: Mouse-Processing Activities

**Activity 2: Mouse Press** 

Making Circles Processing Code

```
void setup() {
  size(480, 120);
}
void draw() {
  if (mousePressed) {
    fill(0);
  } else {
    fill(255);
  }
  ellipse(mouseX, mouseY, 80, 80);
}
```



#### Source:

Reas, C., & Fry, B. (2015). Getting started with processing (2nd ed). Make: Community.





# **Question 3**



# What is the name of the company who manufactures the optical mouse sensor IC?





# Lab: Mouse-Processing Activities

#### Lab 1: Making Circles...

#### Making Circles Processing Code Shown in the IDE







#### Lab: Mouse-Processing Activities

#### Activity 1: Making Circles...









#### Lab: Mouse-Processing Activities...

#### **Activity 2: Mouse Press**

Move the mouse to position the shape. Press the mouse button to invert the color. circles will appear on the screen.









Lab: Mouse-Processing Activities...

Activity 2 : Mouse Press

Source:

**Mouse Press Processing Code** 

```
void setup() {
  size(640, 360);
 noSmooth();
  fill(126);
  background(102);
void draw()
  if (mousePressed) {
    stroke(255);
  } else {
    stroke(0);
  line(mouseX-66, mouseY, mouseX+66, mouseY);
  line(mouseX, mouseY-66, mouseX, mouseY+66);
```

https://processing.org/examples/mousepress.html





#### Lab: Mouse-Processing Activities...

#### **Activity 2 : Mouse Press**

#### **Output Result**









#### Lab: Mouse-Processing Activities

#### Activity 3: Mouse 1D

Move the mouse left and right to shift the balance. The mouse *x* variable is used to control both the size and color of the rectangles.







https://processing.org/examples/mouse1d.html

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Lab: Mouse-Processing Activities

```
Activity 3 : Mouse 1D
                                void setup() {
                                  size(640, 360);
                                  noStroke();
                                  colorMode(RGB, height, height, height);
 Mouse ID Processing Code
                                  rectMode(CENTER);
                                void draw() {
                                  background(0.0);
                                  float r1 = map(mouseX, 0, width, 0, height);
                                  float r2 = height-r1;
                                  fill(r1);
                                  rect(width/2 + r1/2, height/2, r1, r1);
                                  fill(r2);
                                  rect(width/2 - r2/2, height/2, r2, r2);
Source:
```







#### Lab: Mouse-Processing Activities









#### Lab Project: A Simple Mouse Inputting Device









#### Lab Project: A Simple Mouse Inputting Device...

#### **Device Operation:**

Move and click the mouse to generate signals. The top row is the signal from *mouseX*, the middle row is the signal from *mouseY* and the bottom row is the signal from *mousePressed*.









#### Lab Project: A Simple Mouse Inputting Device... Big IDEAS:



- Learners will be able to wire an external pushbutton switch to an optical mouse.
- 2. Learners will be able to upload and run a Mouse Signals processing code on a Raspberry Pi 4 computer.
- 3. Learners will be able to develop additional switching device concepts to interface with an optical mouse.





Lab Project: A Simple Mouse Inputting Device...

#### A Simple Mouse Inputting Device Block Diagram







#### Lab Project: A Simple Mouse Inputting Device... A Simple Mouse Inputting Device Block Diagram



Mouse Signal Software:

https://processing.org/examples/mousesignals.html





#### Lab Project: A Simple Mouse Inputting Device...

Preparing an optical mouse for external interfacing









#### Lab Project: A Simple Mouse Inputting Device...

Solder two solid wires to the micro-switch pins



Preparing an optical mouse for external interfacing...





#### Lab Project: A Simple Mouse Inputting Device...

Soldered wires of optical mouse terminated to external pushbutton switch's pins







#### Lab Project: A Simple Mouse Inputting Device...



Final Prototype Build!

#### https://youtu.be/ZPV7vAHa-Vo





#### Lab Project: A Simple Mouse Inputting Device...



**Output Results** 





# **Question 5**

~ ^ X

What Processing instruction is responsible for the output response illustrated at the bottom of the Mouse\_Signals window?





**Question 4** 



# In reviewing the code in slide 23 what is the name of the function responsible for detecting a mouse being pressed?





## Thank you for attending

Please consider the resources below:

What is a Human Interface Device?

PCMag.(n.d.). HID. Retrieved from https://www.pcmag.com/encyclopedia/term/hid

• Physical Computing

O'Sullivan, D., & Igoe, T. (2004). *Physical computing: Sensing and controlling the physical world with computers*. Boston, MA: Thompson.

HID Concept

Microsoft Docs. (2020). *Introduction to human interface devices (hid)*. Retrieved from https://docs.microsoft.com/en-us/windows-hardware/drivers/hid/

• Making Circles

Reas, C., & Fry, B. (2015). *Getting started with processing* (2nd ed). Make: Community.





# Thank you for attending

Please consider the resources below:

- Mouse Press
   <u>https://processing.org/examples/mousepress.html</u>
- Mouse 1D

https://processing.org/examples/mouse1d.html

- Mouse Signal Software <u>https://processing.org/examples/mousesignals.html</u>
- A Simple Mouse Inputting Device Demo Video
   <u>https://youtu.be/ZPV7vAHa-Vo</u>





# Thank You





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