THE RASPBERRY PI PLATFORM AND PYTHON PROGRAMMING FOR THE RASPBERRY PI

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ABOUT (1)

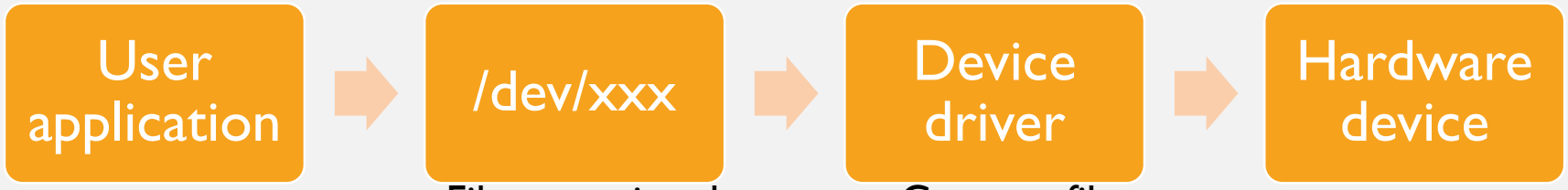
- ✓ ARM microprocessor: Brodcrom ARMCortex A7
- ✓ 40 GPIO Pins (General Purpose Input Output)
- ✓ 4 USB Ports (Keyboard, Mouse)
- ✓ HDMI Port
- ✓ Ethernet Port
- ✓ Micro SD Slot (OS)

Raspberry Pi	Arduino
OS (Libraries, Functions)	No OS
Faster Processor (1,4GHz)	Slower Processor (16MHz)
64 bit	8 bit
More Memory	Less Memory
Lower I/O Voltage (3,3V) **SENSIBLE**	Higher I/O Voltage (5V)

- PS: ARM design processors and sell its license, they don't built them – ARM Intellectual Property
- ARM Processor Family:
  - Classic Processors (ARM)
  - Embedded Processors (Cortex)
  - Application Processors (Cortex)

ABOUT (2)

- Text-based interface (console) vs Graphic interface (desktop)



- NOOBS: New Out Of Box Software → Raspbian (OS Linux-based)
- raspi-config: tool to setup different options
- Overclocking: Increase the clock frequency → Increase the internal voltage level (15% of processor)
  - Quicker execution of instructions (one instruction per clock)
  - Signals have shorter time to travel (reduce time over a clock cycle)
  - Temperature of device increases → Shortens device life

LINUX – RASPBIAN

- Shell: Text-based user interface that executes commands
- Bash (Bourne again shell): Default shell for Raspbian → LXTerminal (vs Terminal)
- man commandName #Manual of a command
- pwd #Current directory
- cd (; arg ; .. ; path) #Change directory
- ls (; -l) #Give contents of current directory → (d:directory,-file) (user/group/other) (rwx:read/write/execute)
- Mkdir #Make directory ; rmdir (; -r {if not empty}) #Remove directory
- nano file #Create a nano editor file (sudo apt-get install nano)
- cat ; head ; last ; tail fileName #Print file content
- cp originalName copyName #Copy file
- mv fileName directory #Move file ; mv fileName newFileName #Rename file
- sudo instruction #Switch user account to root account → Gain the highest permission level
- Processor: Execution of a program; Background processor vs Foreground processor
- ps #Open task monitor ; PID: Process ID ; kill PID #End a processor ; shutdown #Close a processor
- GUI: Graphic User Interface ; File manager: Regular file interface; startx #Start the GUI

GPIO (1)

- Pins:
  - **Power**: 3,3V (1,17) & 5V (2,4)
  - **Ground**: 6, 9, 14, 20, 20, 30, 39
  - **GPIO**: General Purpose Input Output (Only 3,3V)
  - **GPMF**: General Purpose Multi Function (SDA, SCL, UART, SPI)
- import Rpi.GPIO as GPIO #Call GPIO Library
- GPIO.setmode(GPIO.BOARD) #Broadway numbering (In the circle)
- GPIO.setmode(GPIO.GPIO.BCM) #Broadcom numbering (In the box) (It changes from an Rpi to another)
- GPIO.setup(pinNumber,mode) #mode=GPIO.OUT/GPIO.IN #pinMode
- GPIO.output(pinNumber,value) #value=True/False #digitalWrite
- while True #void loop{}
- import time; time.sleep(numberInSeconds) #delay
- value=GPIO.input(pinMode) #digitalRead
- PS: No analogRead, no analogWrite
- sudo pytho3 test.py #Execute a python script

GPIO (2)

- PWM (Pulse With Modulation)
- Duty cycle = Fraction of the duration of high (of voltage)
- pwm_obj=GPIO.PWM(pinNumber,frequencyInHz)
- pwm_obj.start(dutyCycle) #Generate PWM to the pin #dutyCycle 0->100
- pwm_obj.ChangeDutyCycle(dutyCycle)
- PS: PWM frequency is not accurate because of OS (off by over 50% at 10kHz)
- Frequency control: (For more accuracy)

```
while True:
    GPIO.output(18, True)
    time.sleep(0.5)
    GPIO.output(18, False)
    time.sleep(0.5)
```

GUI-BASED PROGRAMS

- Widgets: Visual entities you can interact with (button, menu..)
- Event loop: Wait for an event → Execute (by the user) if there is an event → Wait again
- from Tkinter import * #Python library for widgets
- root=Tk() #Create a window on the screen
- root.geometry('widthxheight') #Give size of geometry
- c=Canvas(root,width=W,height=H) #Create a canvas
- c.pack() #Make canvas appear on the screen
- r=c.create_rectangle(x,y,w,h,fill='color',outline='color') //Create a rectangle
- w=Scale(root,from_=min,to=max,orient=HORIZONTAL/VERTICAL,command=callBackFunction)
- def callBackFunction(duty) #Function called when user changes scale #Duty is the value of the scale