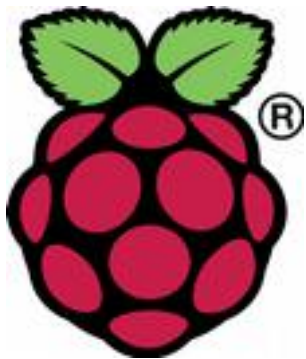




Himbeere mit zwei Augen

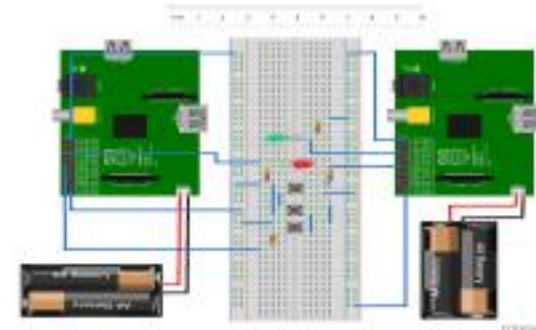
3D-Fotografie mit dem Raspberry Pi Kameramodul

Günter Pomaska, www.3D.imagefact.de, gp@imagefact.de





- Einplatinencomputer Raspberry Pi
- Kameramodul
- Betriebssystem, Kamerabefehle, Python-Software
- Headless-Systeme, Networkmanager, VNC, FTP-Client
- Arducam Multikameraboard
- Synchronauslösung Versuchsaufbau
- Objektive
- To do list: Exif, GPS, Basis-Steuerung, Tiefenmatrix, ...





- Raspberry Pi 3 B+
- ARM Cortex-A53 Quad
- 1400 Mhz, 1024 MB RAM, max 64GB Memory (SD Card)
- HDMI, LAN, USB, WLAN, Bluetooth
- CSI, DSI, SPI, IPC, UART, I/O
- Spannungsversorgung 5 V DC / 2,5 A



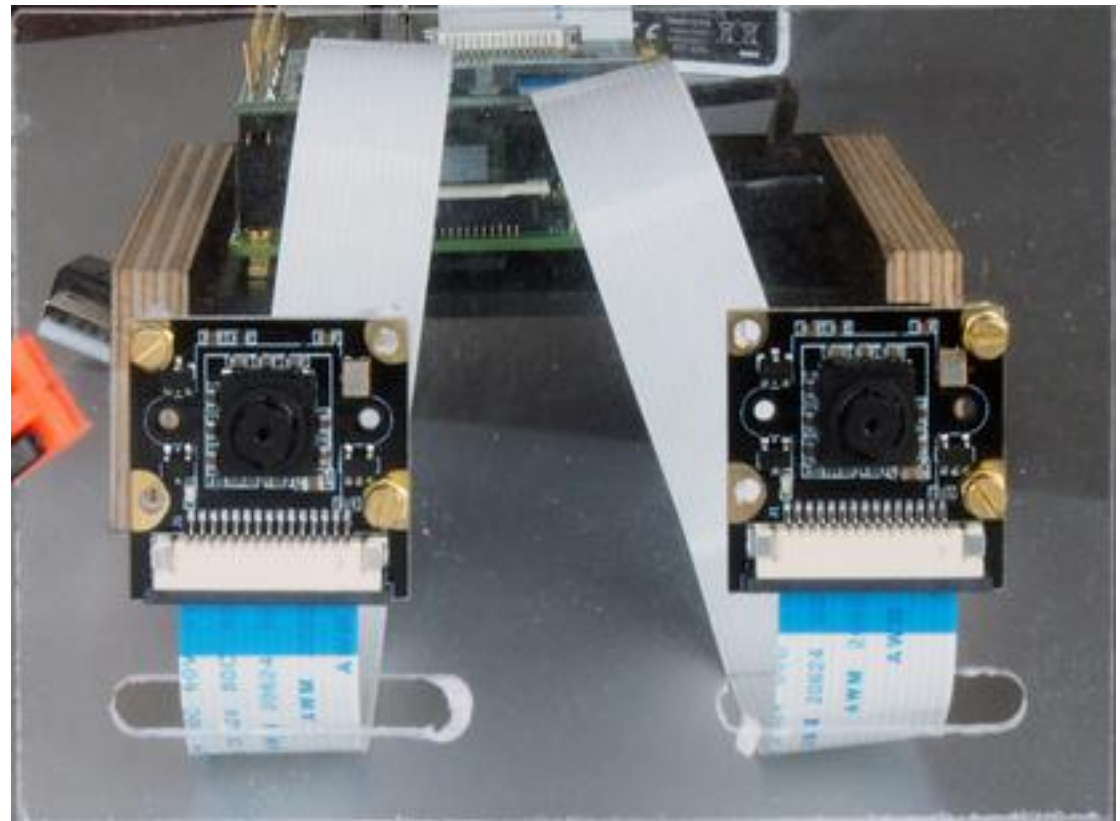


- Raspian Stretch auf SD Karte installieren Win32 Disk Imager
- config.txt Monitor Auflösung
- Netzeinbindung wpa_supplicant.conf
- sudo raspi-config: VNC, SSH, Camera

The image shows three overlapping windows. On the left is the Raspberry Pi website with the 'RASPBIAN' header and download links for 'RASPBIAN STRETCH WITH DESKTOP' and 'RASPBIAN minimal image 3'. In the center is the Win32 Disk Imager application window, showing the 'Image-Datei' field with the path 'C:\go\2018-04-18-raspbian-stretch.img' and the 'Schreiben' (Write) button highlighted. On the right is the Fritz!Box 7490 configuration page, showing the 'Details für wpa_supplicant' section with fields for 'Name', 'WPA-Adresse', and 'WPA-PSK'.

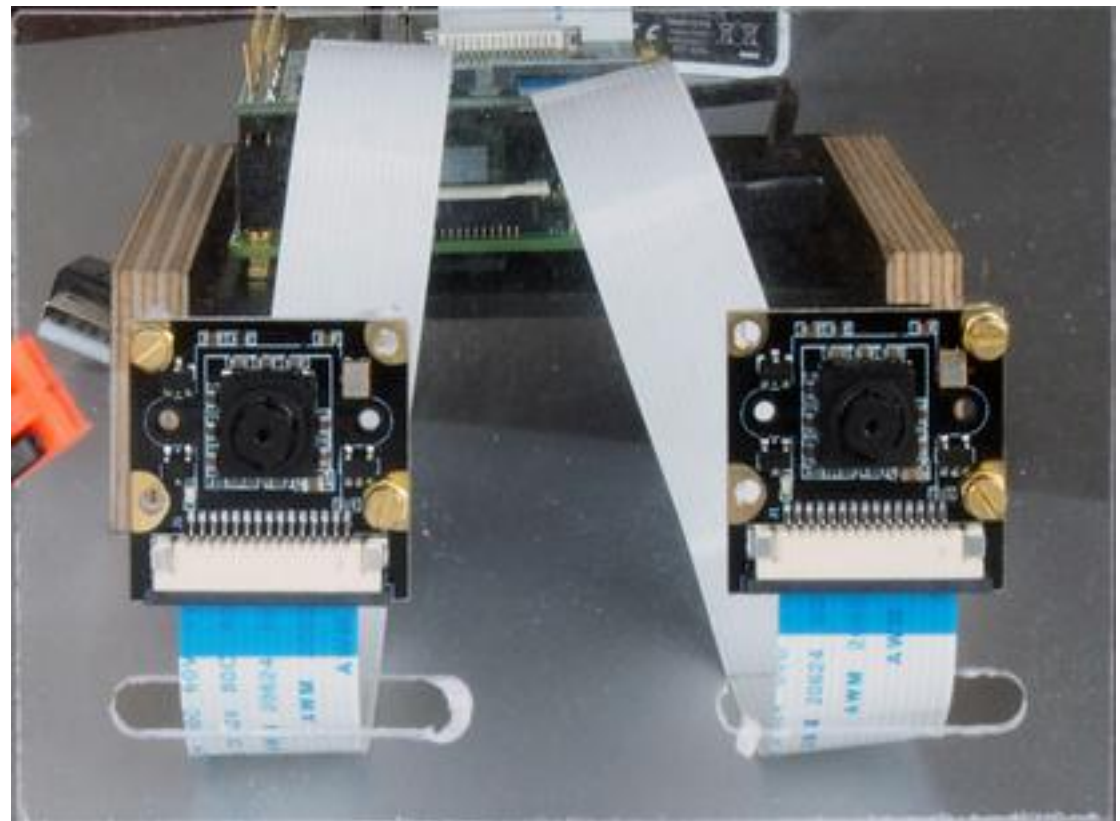


- OmniVision OV 5647
Version 1.3, 5 MP, 2592 x 1944 px
- Sony IMX219
Version 2.x, 8 MP, 3280 x 2464 px
Fixfokus, Video 1080p
3 g, 25 x 23 x 9 mm
- NoIR
Kein Infrarotfilter, Nacht-
aufnahmen





- Hardware kompakt
- Headless, Touchdisplay
- Programmierbar picamera, OpenCV
- Stacking, Zeitraffer
- Bewegungsmelder, Gesichtserkennung
- Monitoring
- Einbindung in Netzwerke
- Ferngesteuert





- `sudo apt-get update`
`sudo apt-get upgrade`
`Sudo raspi-config > enable camera`
- Dokumentation
<http://picamera.readthedocs.io/en/release-1.2/index.html>
- `raspistill -o cam.jpg`
- `#!/bin/bash`
`DATE=$(date +"%Y-%m-%d_%H%M")`
`raspistill -vf -hf -o /home/pi/camera/$DATE.jpg`
- `raspivid -o video.h264 -t 10000`
- Python Software 1.13





- Virtual Network Computing – VNC Server (Raspian integriert)
- VNC Viewer Installation auf Smartphone
- Einbindung in das WLAN
- Feste IP (?)
- Smartphone Hotspot einrichten
- Applikation Autostart
- Preview nicht über VNC





- Steckbar bis zu 16 Kameras – 4 Kameras auf einem Board
- Nicht synchron - sequentiell
- Softwarestrategie:
 - Preview, Settings, Stream, Capture,
Resolution, Ramdisk
- Zeit zwischen zwei Halbbildern
0,8 - 1 s





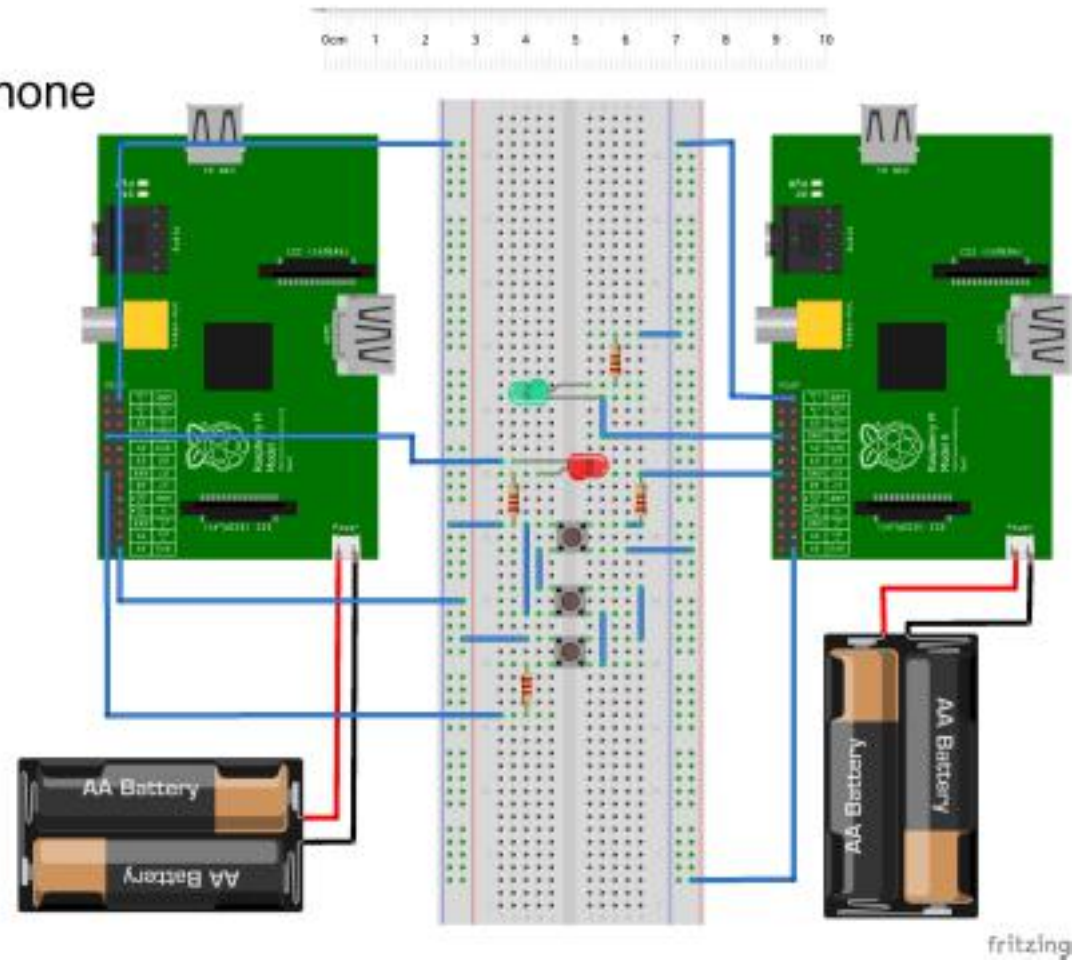
```
def selectArducam(cameraNR):
#   Multikameraboard seriell, nicht synchron
    if cameraNR==1:
        gp.output(7, False); gp.output(11, False); gp.output(12, True)
    if cameraNR==3:
        gp.output(7, False);gp.output(11, True); gp.output(12, False)
    return

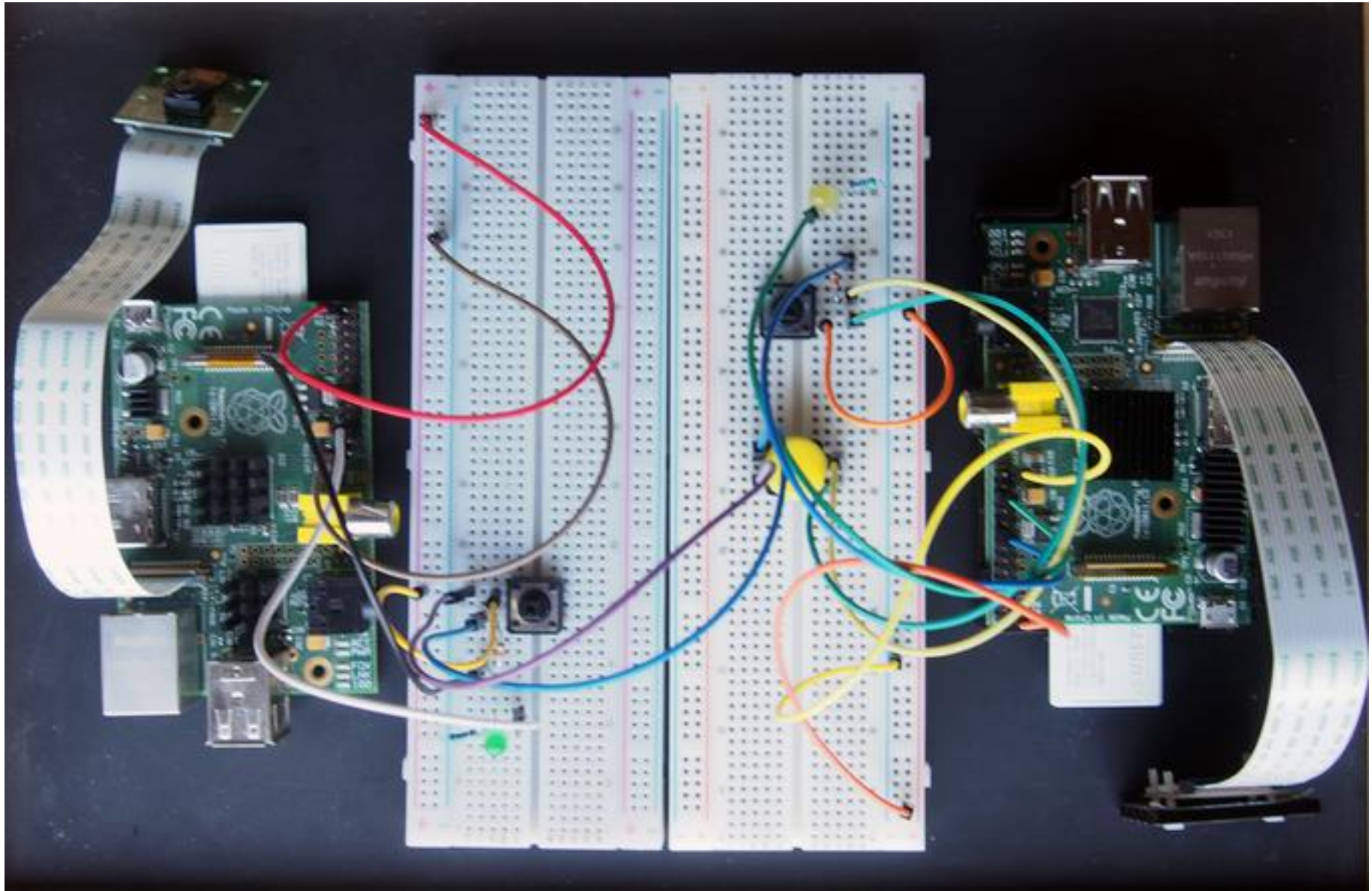
#
with picamera.PiCamera() as camera:
    camera.capture (camFile)
    camera.close()

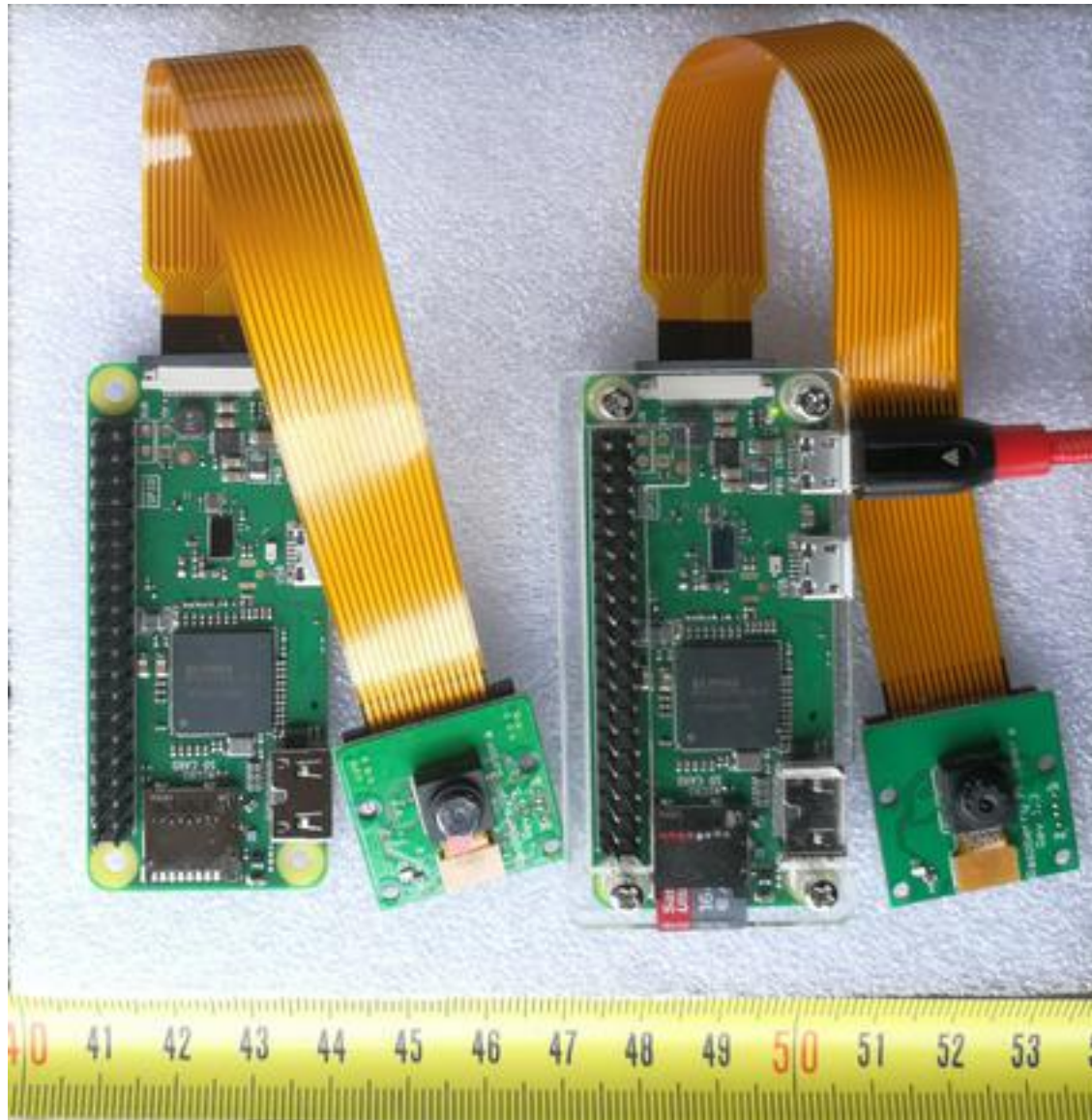
#
stream = io.BytesIO()
with picamera.PiCamera() as camera:
    camera.capture(stream,format='jpeg')
stream.seek(0)
bild = Image.open(stream)
bild.save(camFile)
```



- Robust für den Feldeinsatz
- 1 x HDMI Touch Display
- Variable Basis
- Wechselobjektive M12 / Smartphone
- Synchronisation < 0,1s









- Smartphone Zubehör <https://www.inline-info.com/de/objektive>



- M12 Fassung





- Einfache Kalibrierung

 - Testfeld – Kamera horizontal ausrichten - Sensorabstand messen

- Technische Daten

 - V1.3 sensor size 3.76 × 2.74 mm, pixel pitch 1,4

 - V2 sensor size 3.68 x 2.76 mm (4.6 mm diagonal), pixel pitch 1,2

 - Focal length 3.60 mm / 3.04 mm

 - FoV hor 53.5 / 62.2

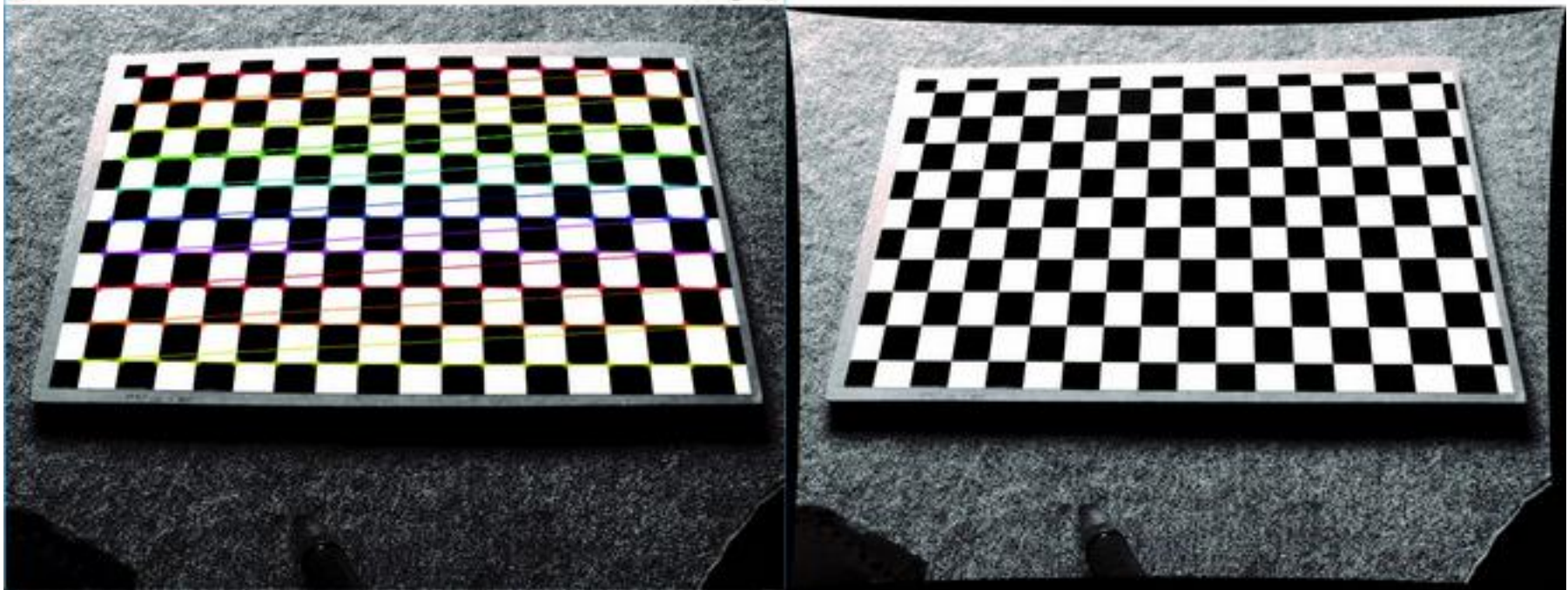
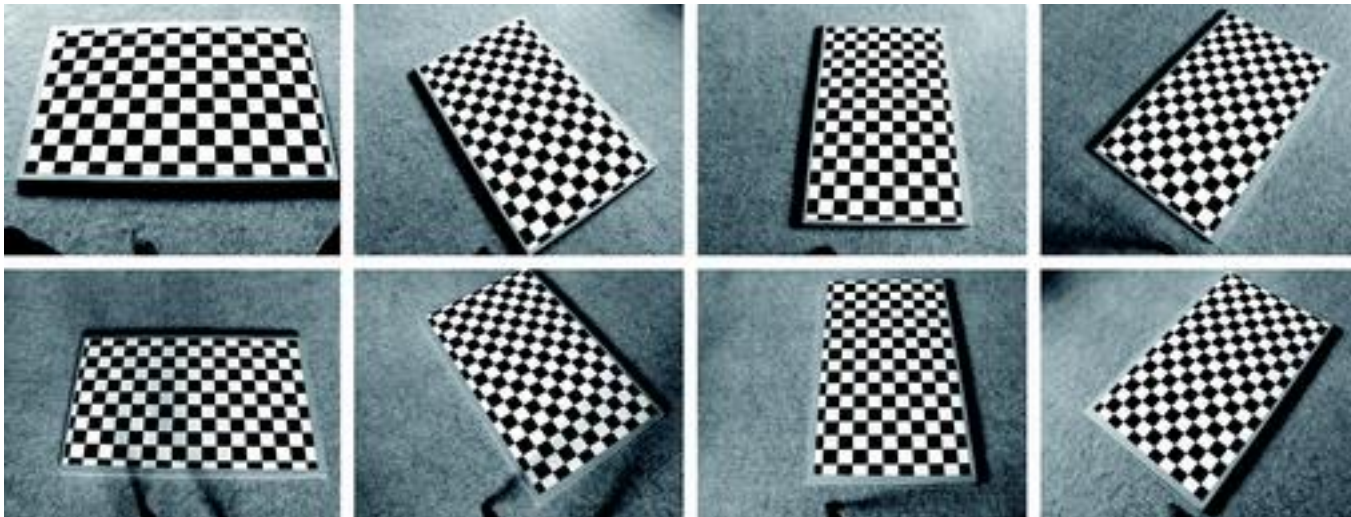
- <https://www.raspberrypi.org/documentation/hardware/camera/README.md>

- Lensdistortion ImageMagick

 - `convert calibration_image.jpg -distort barrel 'a b c' flat.jpg`

- Lensdistortion FFMpeg

 - `ffplay -i source image -vf "lenscorrection=cx=0.38:cy=0.54:k1=-0.227:k2=-0.022"`







- Kofler, Kühnhast, Scherbeck:
Raspberry Pi
Rheinwerk Technik, 2018, 4. Auflage, 1088 Seiten
- Pomaska, Günter
3D-Fotos- und -Videos
Carl Hanser Verlag, 2018, 1. Auflage, 244 Seiten



Vielen Dank für Ihre Aufmerksamkeit



Foto: simpsonscardboard.com