Raspberry Pi Astronomi Uygulamaları

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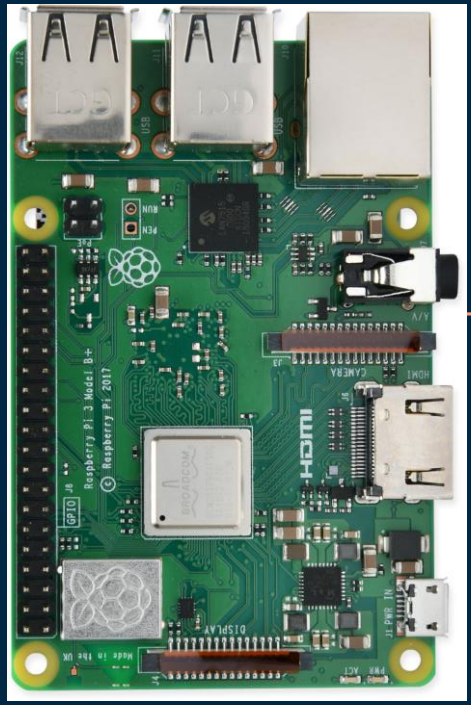
Uğur ŞENASLAN

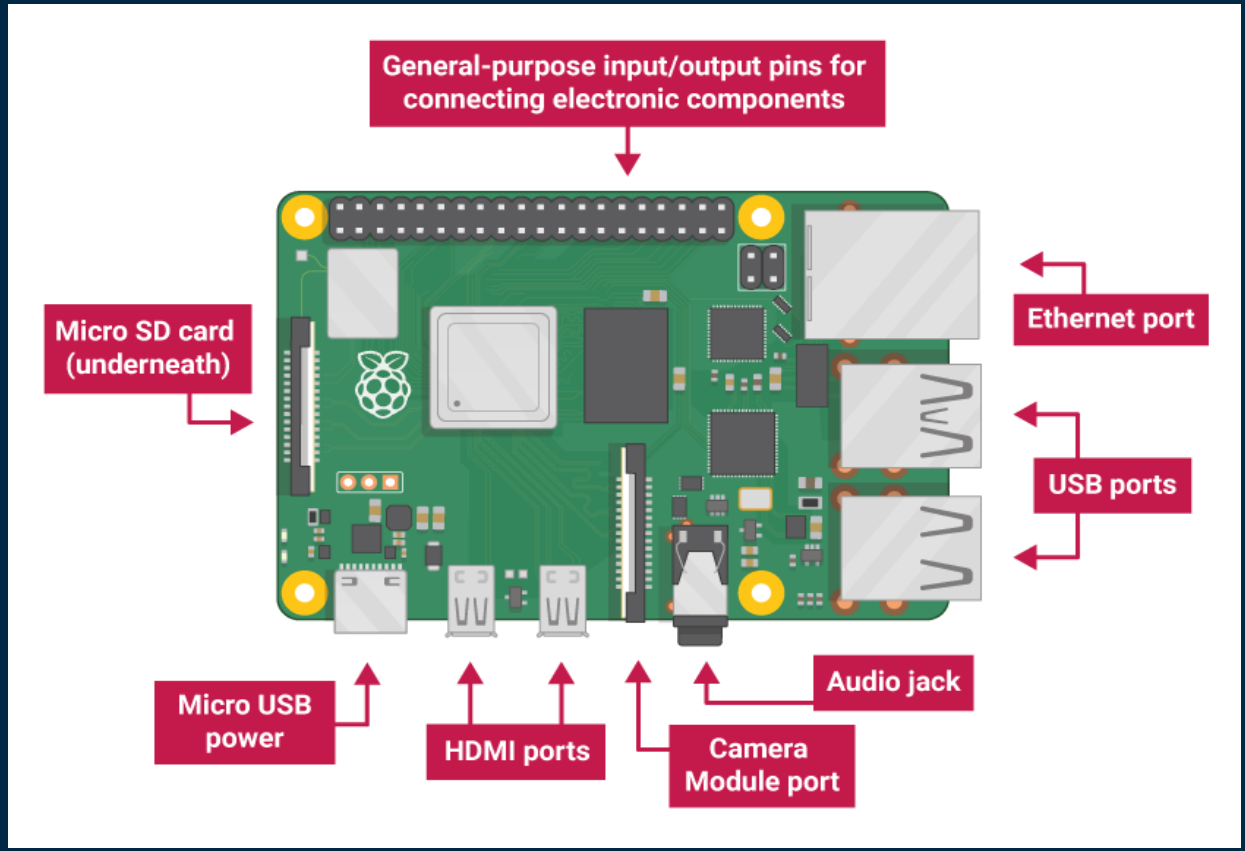
İçindekiler

Raspberry Pi Genel Bakış

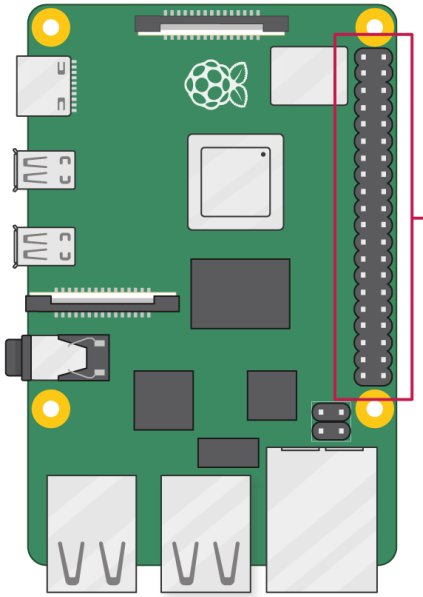
- Mini PC (SBC)
- Herkes için ve düşük maliyetli
- Kendi yazılım programınızı yazmak için
- Kendi elektronik cihazlarınızı yönetmek için
- Güçlü bir işlemci ve linux tabanlı

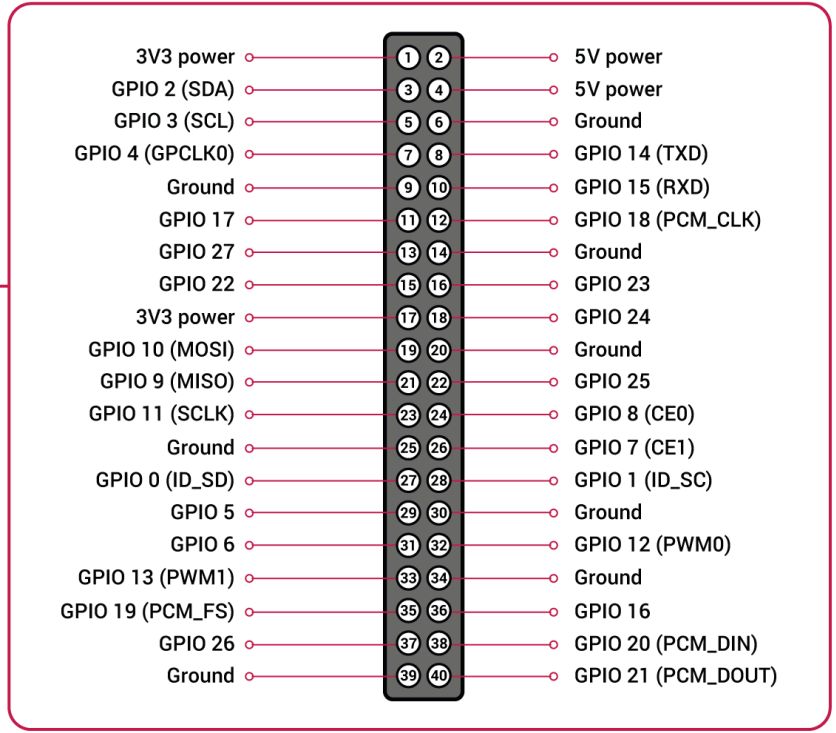


Bileşenleri



GPIO



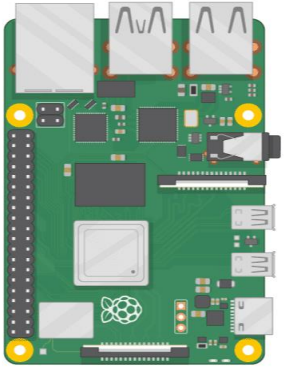

3V3 power 1 2 5V power
GPIO 2 (SDA) 3 4 5V power
GPIO 3 (SCL) 5 6 Ground
GPIO 4 (GPCLK0) 7 8 GPIO 14 (TXD)
Ground 9 10 GPIO 15 (RXD)
GPIO 17 11 12 GPIO 18 (PCM_CLK)
GPIO 27 13 14 Ground
GPIO 22 15 16 GPIO 23
3V3 power 17 18 GPIO 24
GPIO 10 (MOSI) 19 20 Ground
GPIO 9 (MISO) 21 22 GPIO 25
GPIO 11 (SCLK) 23 24 GPIO 8 (CE0)
Ground 25 26 GPIO 7 (CE1)
GPIO 0 (ID_SD) 27 28 GPIO 1 (ID_SC)
GPIO 5 29 30 Ground
GPIO 6 31 32 GPIO 12 (PWM0)
GPIO 13 (PWM1) 33 34 Ground
GPIO 19 (PCM_FS) 35 36 GPIO 16
GPIO 26 37 38 GPIO 20 (PCM_DIN)
Ground 39 40 GPIO 21 (PCM_DOUT)

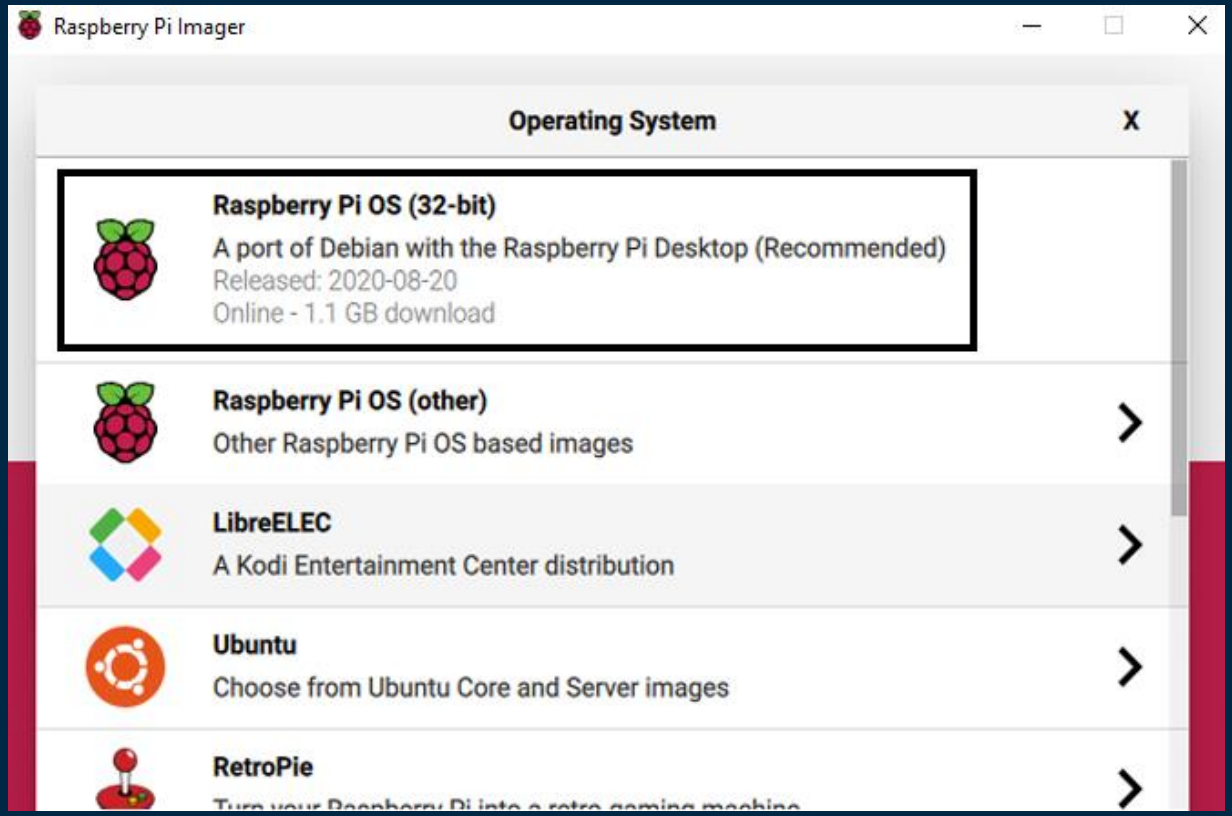
Türleri

	Raspberry Pi Zero	Raspberry Pi Zero W	Raspberry Pi 2	Raspberry Pi 3	Raspberry Pi 3 Model A+	Raspberry Pi 3 B+	Raspberry Pi 4 B
Image							
Release date	2015 Nov 30	2017 Feb 28	2015 Feb 1	2016 Feb 29	2018 Nov 15	2018 Mar 14	2019 Jun 24
Product details							
SOC							
SOC Type	Broadcom BCM2835	Broadcom BCM2835	Broadcom BCM2836	Broadcom BCM2837	Broadcom BCM2837B0	Broadcom BCM2837B0	Broadcom BCM2711
Core Type	ARM1176JZF-S	ARM1176JZF-S	Cortex-A7	Cortex-A53 64-bit	Cortex-A53 64-bit	Cortex-A53 64-bit	Cortex-A72 (ARM v8) 64-bit
No. Of Cores	1	1	4	4	4	4	4
GPU	VideoCore IV	VideoCore IV	VideoCore IV	VideoCore IV 1080p@30	VideoCore IV	VideoCore IV	VideoCore VI
CPU Clock	1 GHz	1 GHz	900 MHz	1.2 GHz	1.4 GHz	1.4 GHz	1.5 GHz
RAM	512 MB	512 MB	1 GB	1 GB DDR2	512 MB DDR2	1 GB DDR2	1 GB , 2 GB, 4 GB LPDDR4
Wired Connectivity							
USB	micro + micro OTG	1 x micro OTG	4 + OTG	4x USB2.0 + micro OTG	1xUSB 2.0	4x USB2.0	2x USB3.0 + 2x USB2.0
Ethernet	✗	✗	10/100M	10/100M	✗	Gigabit - Over USB 2.0	Gigabit
HDMI port	mini	mini	✓	✓	✓	✓	2x micro HDMI
Analog Video Out	via unpopulated pin	via unpopulated pin	shared with audio jack	shared with audio jack	shared with audio jack	shared with audio jack	shared with audio jack
Analog Audio Out	HDMI audio	HDMI audio	3.5mm jack	3.5mm jack	3.5mm jack	3.5mm jack	3.5mm jack
GPIO	40-pins	✓	40-pins	40-pins	40-pins	40-pins	40-pins
LCD Panel	✗	✗	✓	✓	✓	✓	✓
Camera	latest version include a camera connector	✓	✓	✓	✓	✓	✓
Wireless Connectivity (On-Board)							
Wi-Fi	✗	802.11n	✗	802.11n	2.4GHz and 5GHz 802.11 b/g/n/ac	2.4GHz and 5GHz 802.11 b/g/n/ac	2.4GHz and 5GHz 802.11 b/g/n/ac
Bluetooth®	✗	4.1	✗	4.1 LE	4.2, BLE	4.2, BLE	5.0
Power							
Power ratings	160 mA	180 mA	800 mA	1.34 A @5V		1.13 A @5V	1.25 A @5V
Power sources	microUSB, GPIO	microUSB, GPIO	microUSB or GPIO	microUSB or GPIO	microUSB, GPIO	microUSB, GPIO	USB-C
Power Over Ethernet	✗	✗	✗	✗	✗	with PoE Hat	with PoE Hat

Raspberry Pi Kurulum ve Kullanımı

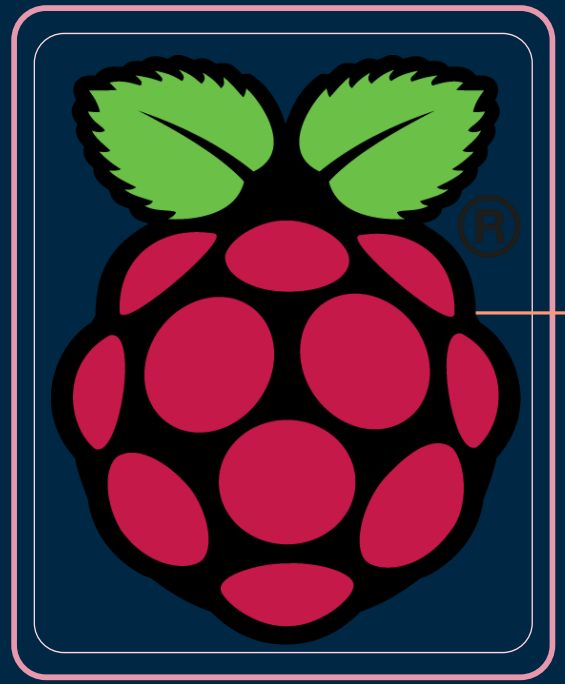
1. İmage İndirme
2. SD Kart Formatlama
3. SD Kart'a İmage Yüklemesi
4. Kablo Bağlantıları
5. Ayar İşlemleri



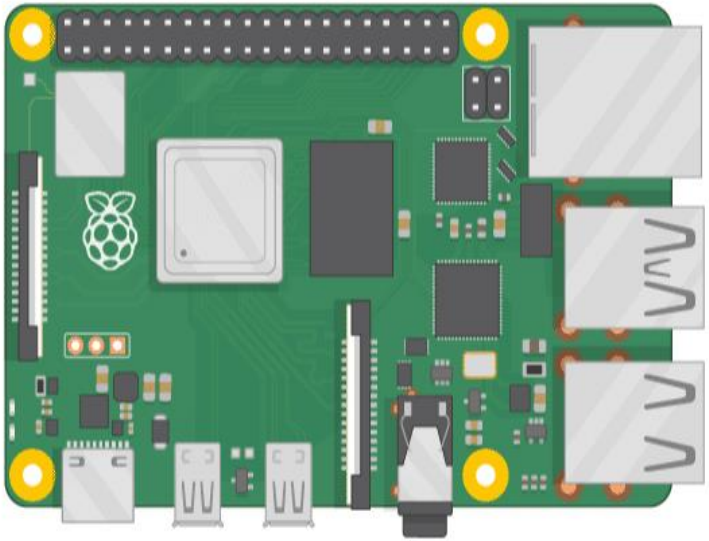

Raspberry Pi Imager
Operating System
X
Raspberry Pi OS (32-bit)
A port of Debian with the Raspberry Pi Desktop (Recommended)
Released: 2020-08-20
Online - 1.1 GB download
Raspberry Pi OS (other)
Other Raspberry Pi OS based images
LibreELEC
A Kodi Entertainment Center distribution
Ubuntu
Choose from Ubuntu Core and Server images
RetroPie

Alternatif İşletim Sistemleri

1. Astroberry
2. Arch
3. Raspbian
4. Ubuntu
5. Windows IoT Çekirdeği

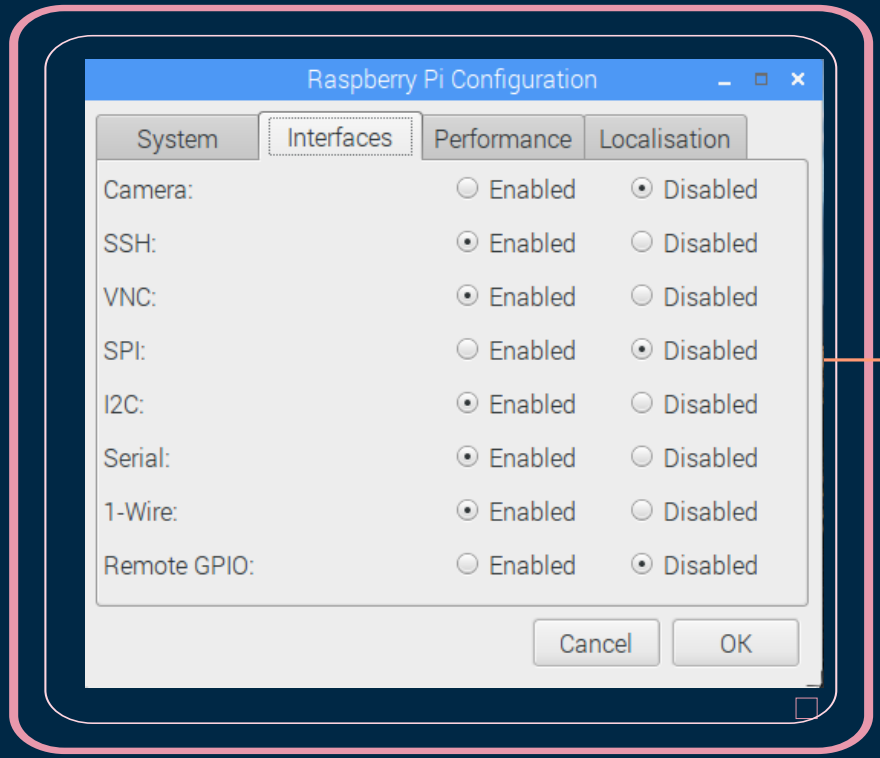



Rufus
Create bootable USB drives the easy way
Rufus 2.7.855
Device
Install Debian GNU/Linux (E:) [16GB]
Partition scheme and target system type
GPT partition scheme for UEFI
File system
FAT32 (Default)
Cluster size
8192 bytes (Default)
New volume label
Debian 8.3.0 amd64 1
Format Options
Check device for bad blocks
1 Pass
Quick format
Create a bootable disk using
ISO Image
Create extended label and icon files

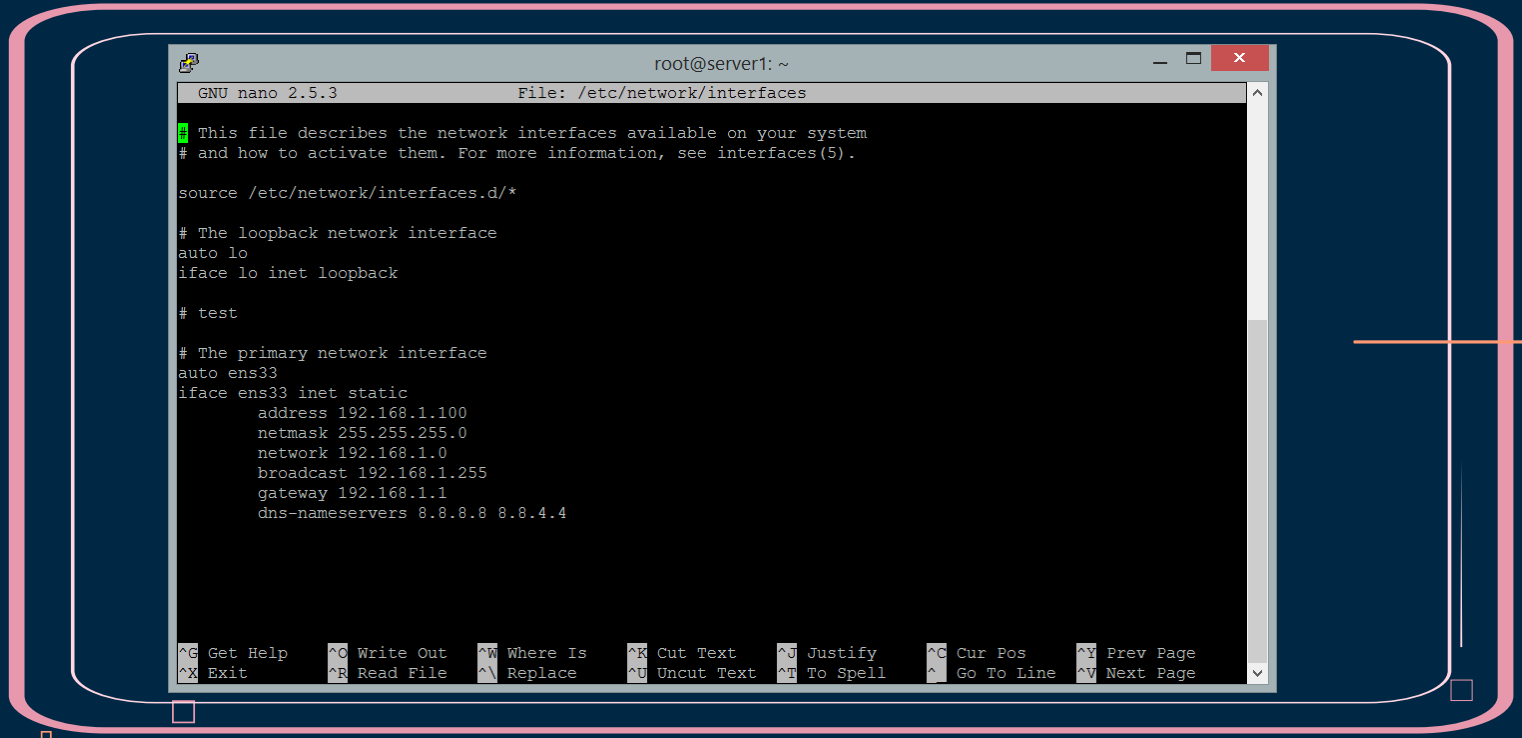


Raspberry Pi Config Ayarları

1. System
2. Interfaces
3. Performance
4. Localisation
5. Static IP Ayarları



Raspberry Pi Ip Ayarları

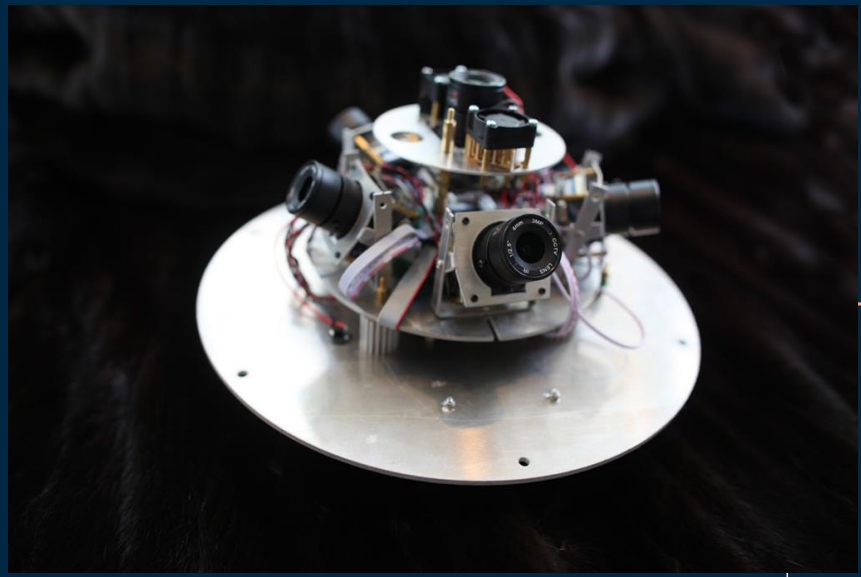


Raspberry Pi ve Astronomi

1. Veri Analizi
2. Sunucu
3. Sensörler
4. Fotoğraf ve Video
5. Otomatik Karar

American Meteor Society (AMS)

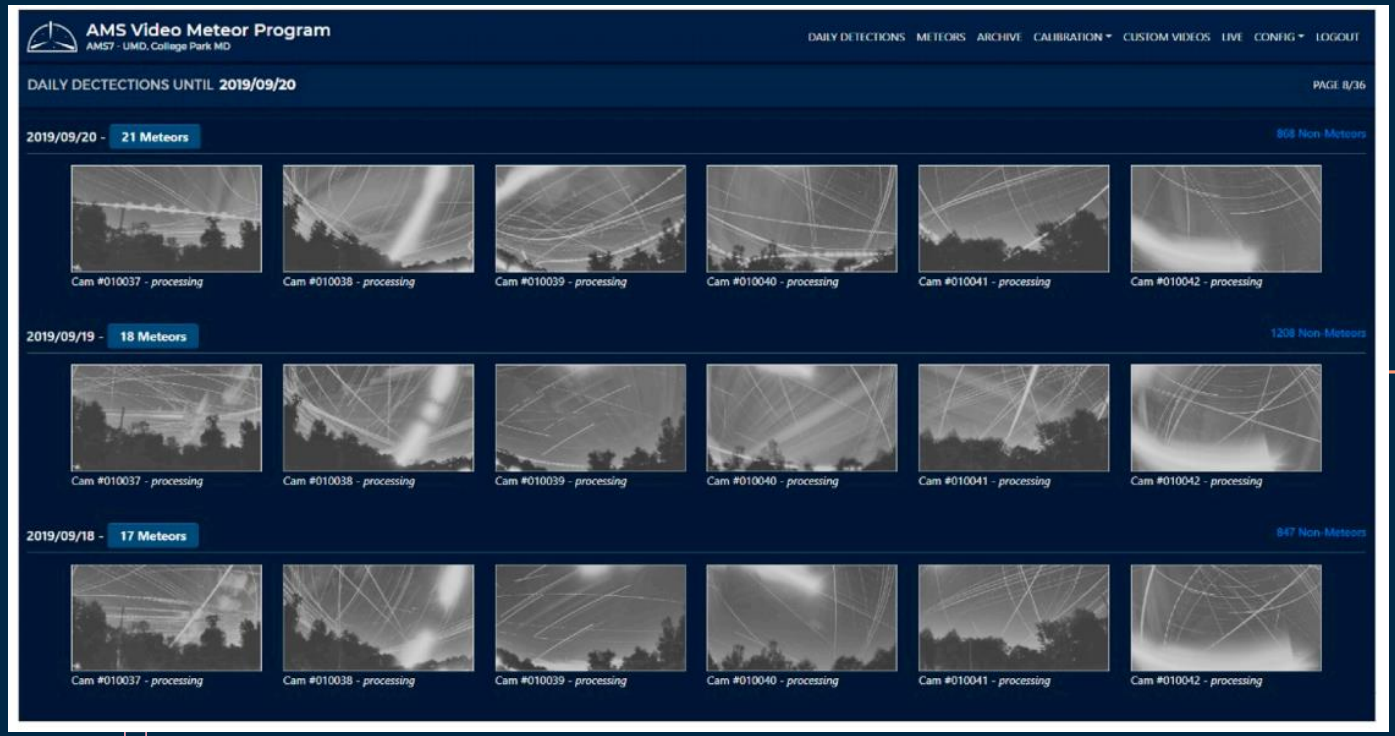
- RMS (Raspberry Pi Meteor Station)
- WMPL (Westren Meteor Python Library)
- Nasa’s All Sky Fireball Network



The all-sky-6 and the Video Meteor Archive system of the AMS Ltd. - NASA/ADS (harvard.edu)

American Meteor Society (AMS)

- Meteor Algılama
- Otomatik Meteor Onayı
- Otomatik Kalibrasyon Ayarı
- Lens Bozulma Modellemesi
- Disk Yönetimi
- Meteor Videolarını Buluta Aktarma
- İnceleme için Otomatik Seonkronizasyon


AMS Video Meteor Program
AMS7 · UMD, College Park MD
DAILY DETECTIONS METEORS ARCHIVE CALIBRATION CUSTOM VIDEOS LIVE CONFIG LOGOUT
DAILY DECTECTIONS UNTIL 2019/09/20
PAGE 8/36
2019/09/20 - 21 Meteors
808 Non-Meteors
Cam #010037 - processing
Cam #010038 - processing
Cam #010039 - processing
Cam #010040 - processing
Cam #010041 - processing
Cam #010042 - processing
2019/09/19 - 18 Meteors
1208 Non-Meteors
Cam #010037 - processing
Cam #010038 - processing
Cam #010039 - processing
Cam #010040 - processing
Cam #010041 - processing
Cam #010042 - processing
2019/09/18 - 17 Meteors
847 Non-Meteors
Cam #010037 - processing
Cam #010038 - processing
Cam #010039 - processing
Cam #010040 - processing
Cam #010041 - processing
Cam #010042 - processing

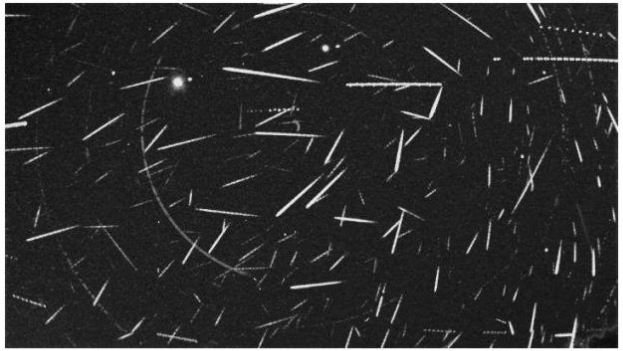


Figure 2 – Perseids detected from Elginfield, Ontario, Canada.

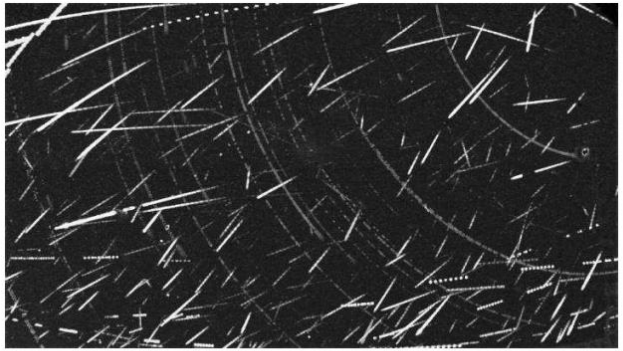
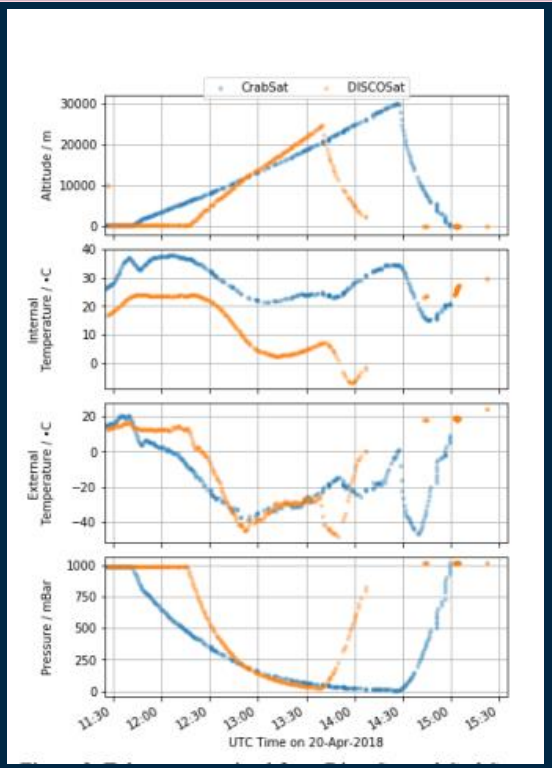


Figure 3 – Perseids detected from Tavistock, Ontario, Canada.

TupperSats

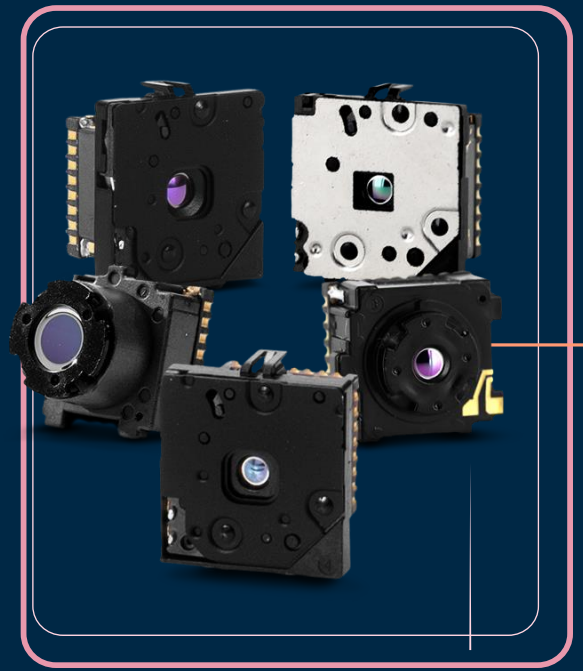
- University College Dublin'in Uzay Bilimi ve Teknolojisi

TupperSats

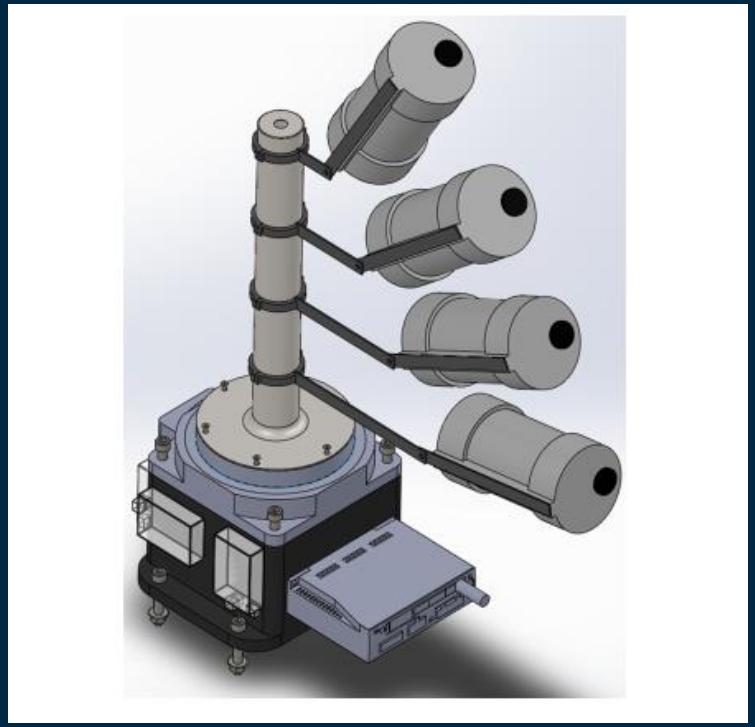

CrabSat
DISCOSat
Altitude / m
30000
20000
10000
0
Internal Temperature / °C
40
30
20
10
0
External Temperature / °C
20
0
−20
−40
Pressure / mBar
1000
750
500
250
0
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
UTC Time on 20-Apr-2018

All-Sky LWIR Imager For Cloud Monitoring

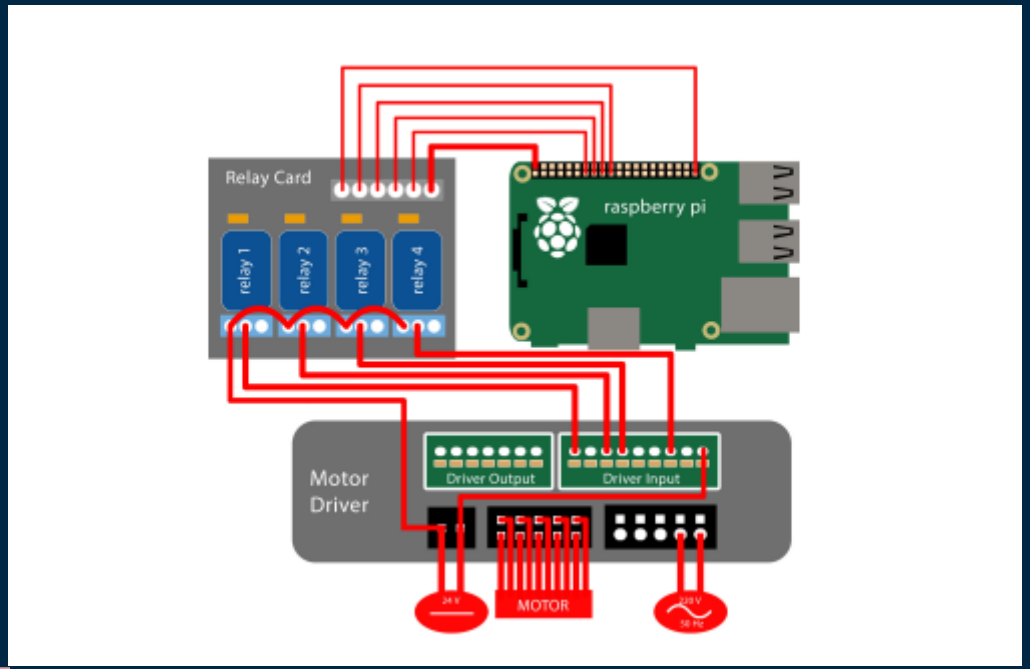
- Bulutların otomatik olarak izlenmesi
- Tüm gökyüzü uzun dalga boylu kızılötesi kamera sistemi
- FLIR Lepton modülü



R-SQM – DAG

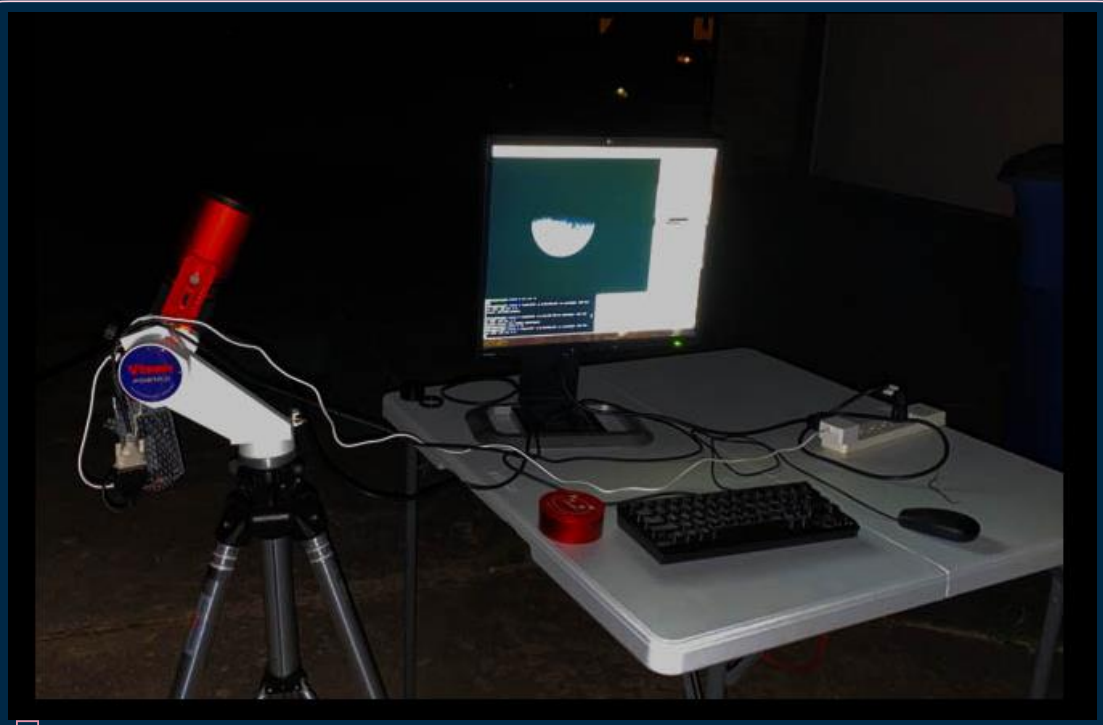


R-SQM – DAG


Relay Card
relay 1
relay 2
relay 3
relay 4
raspberry pi
Motor
Driver
Driver Output
Driver Input
MOTOR

R-SQM – DAG

Astrofotoğrafçılık



Astrofotoğrafçılık

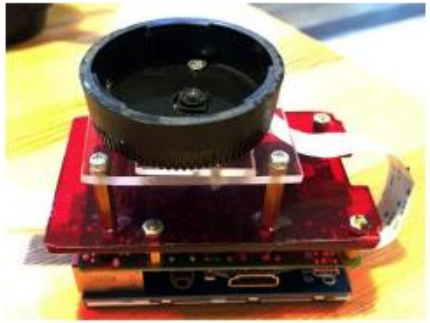


Figure 3. Raspberry pi and PiCam mount using camera lens back cap

Figure 4. The complete setup attached to the telescope

Gözlemevi Kontrolü

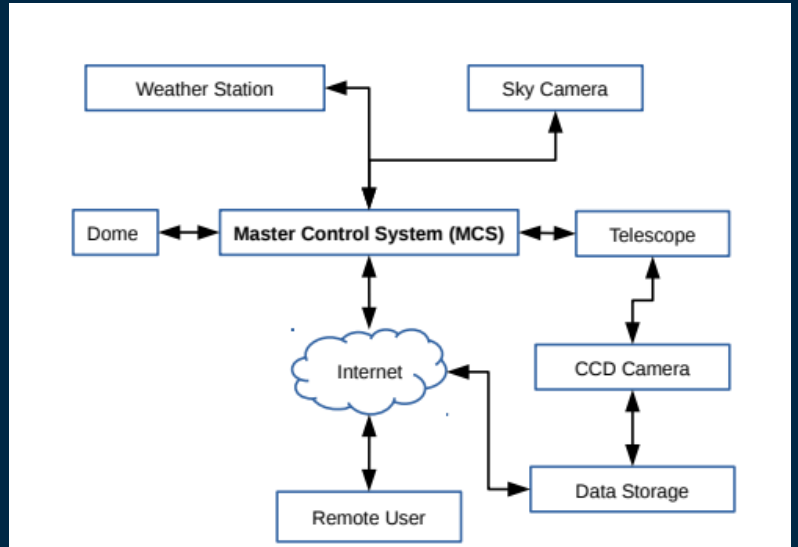


Figure 1: Basic components scheme of an RO. The MCS collects information from the telescope, CCD camera, weather station, sky camera and the observatory dome. Through the network, a remote user can connect to the MCS and control the different components of the RO, as well as access to observational data.

Avantaj ve Dezavantajları

- Ucuz
- Küçük
- Düşük Enerji Tüketimi ve Gereksinimi
- Mikrodenetleyici

- Yavaş
- İnternet Gereksinmleri

TEŞEKKÜRLER