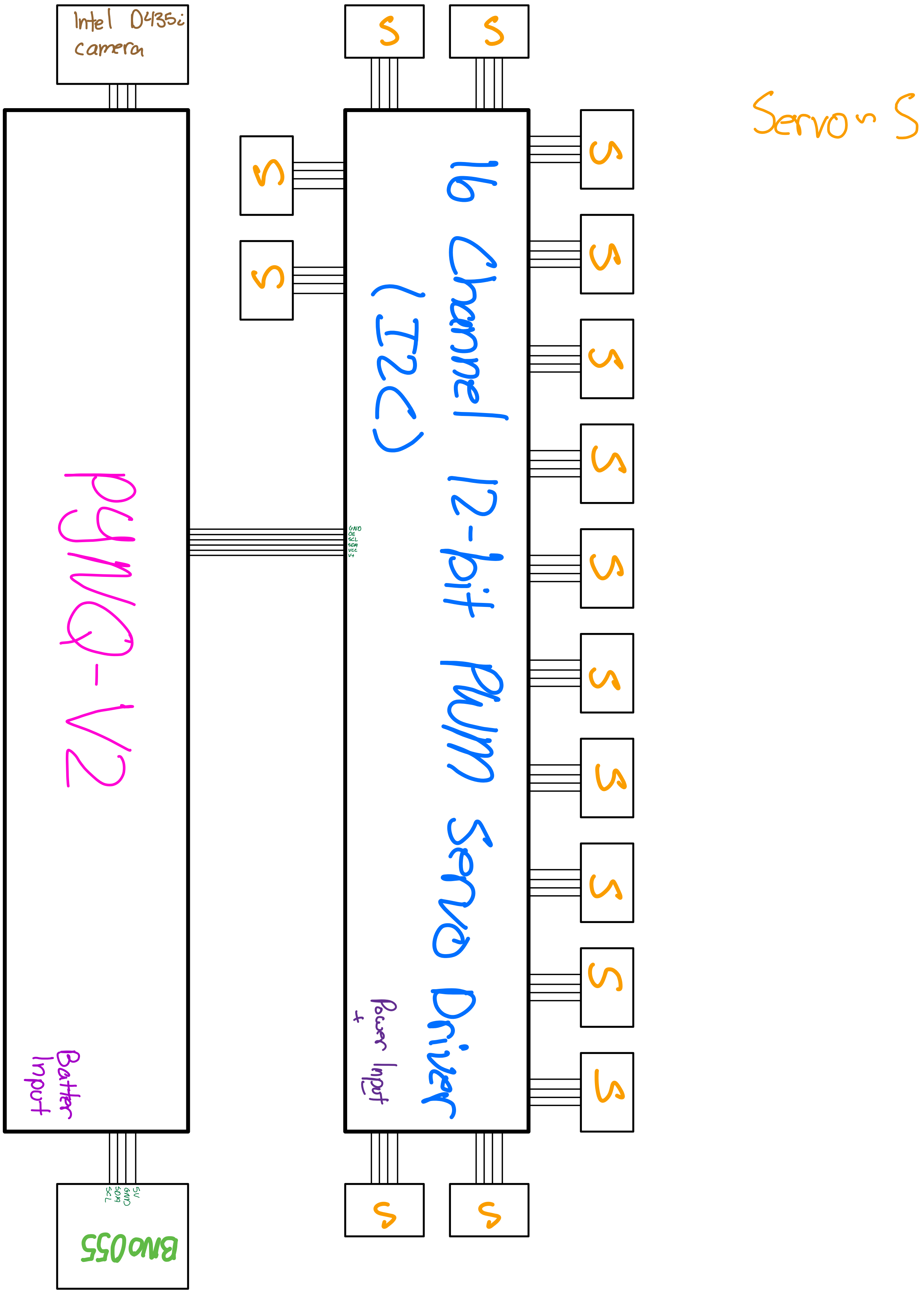

Intel D435i camera
Servo = S
S
PYNQ-V2
16 Channel 12-bit PWM Servo Driver (I2C)
Batter Input
Power Input +
BNO055

PYNQ Board:

- Voltage Input: 7-15V external power regulator
  - Using wall outlet info: 12V @ 3A
- Total power (max): $P = IV = (3A)(12V) = 36W$

Servo specs:

- operating voltage: 4.8V ~ 6.0V
- No load: 170mA = 0.17 A
- Idle: 10mA = 0.01A
- Stall Current: 1500mA = 1.5A
- Power (max load): $P = VI = (6V)(1.5A) = 9W$

16 servos @ 1.5A

16 x 1.5A = 24A

BNO055:

- Voltage Input: 2.4 - 3.6V (V_{DD})
- Total supply Current @ 3V and 100Hz data rate: 12.3mA = 0.123A
- Low power mode/Idle @ 3V: 0.4mA
- sospend mode @ 3V: 0.04 mA

16 Channel Bit Driver:

- Voltage Input: 3V ~ 5.5V
- Max Current per Channel: @ 25mA (external source is needed)
- Decoupling capacitance is possible especially 16 channels are all in use

Intel D435i:

Through USB 3.1 for full access of Bandwidth/resolution/latency but unknown power

- ~~Assuming usb 3.1 max power 100W~~

- 5.25V @ 700mA → P = (5.25V)(0.7A) = 3.675W
- Unsure !!!

- At this moment we are using one camera but may use more. Or may use entirely a new camera or a combinations of different camera

More about Intel Camera:

Mode	Bandwidth, Mbps	1 unit	2 units	3 units	4 units	5 units	6 units
Depth: 848x480, 90fps + Left Color: 848x480, 90fps	**1172**	1172	2345	3517	4689	5861	7034
Depth: 1280x720, 30fps + Left Color: RGB 1280x720, 30fps	**885**	885	1769	2654	3539	4424	5308
Depth: 1280x720, 30fps + Left Mono: RGB 1280x720, 30fps	**664**	664	1327	1991	2654	3318	3981
Depth-only: 848x480, 90fps	**586**	586	1172	1758	2345	2931	3517
Depth-only: 1280x720, 30fps	**442**	442	885	1327	1769	2212	2654
Depth: 840x480, 30fps + Left Color: Mono 848x480, 30fps	**293**	293	586	879	1172	1465	1758
Depth: 640x360, 30fps + Left Color: RGB 640x360, 30fps	**221**	221	442	664	885	1106	1327
Depth-only: 640x360, 30fps	**111**	111	221	332	442	553	664

Target object	Speed [m/s]	Object Distance [m]	Camera	Resolution mode	Object Size [m(pixel)]	Frame-to-Frame Translation in image [pixel]
Pedestrian	1.2	2	D415	1280x720, 30fps	1.7(799)	19
Sprint runner	10	2	D435	848x480, 60fps	1.7(363)	36
Car on freeway (65mph)	30	8	D435	848x480, 60fps	5.0(267)	27
Billiard ball break shot (27mph)	12	1	D435	848x480, 90fps	0.053(23)	55
Moving target of experiment	15	0.5	D435	848x100, 300fps	0.035(22)	43
Table-tennis ball serve (69mph)	31	1	D435	848x100, 300fps	0.044(19)	44
Baseball pitch (105mph)	47	1	D435	848x100, 300fps	0.073(31)	67
Tennis ball serve (164mph)	73	1	D435	848x100, 300fps	0.067(29)	104
Golf ball drive shot (211mph)	94	1	D435	848x100, 300fps	0.042(18)	134

Format	Resolution	Frame Rate (FPS)	Comment
	640x480	6,15,30,60,90	
	640x360	6,15,30,60,90	
	480x270	6,15,30,60,90	
	424x240	6,15,30,60,90	
UYVY [16 bits]	1280x720	6,15,30	Color Stream from Left Imager (D400, D410 & D415)
	848X480	6,15,30,60,90	
	640x480	6,15,30,60,90	
	640x360	6,15,30,60,90	
	480x270	6,15,30,60,90	
	424x240	6,15,30,60,90	
YUY2 [16 bits]	1920x1080	6,15,30	Color Stream from RGB camera (Camera D415 & D435/D435i)
	1280x720	6,15,30	
	960x540	6,15,30,60	
	848x480	6,15,30,60	
	640x480	6,15,30,60	
	640x360	6,15,30,60	
	424x240	6,15,30,60	
	320x240	6,30,60	
	320x180	6,30,60	
Calibration [24 bits]	1920x1080	15,25	D400/D410/D415
	1280x800	15,25	D420/D430/D435/D435i

3.7.7 Vision Processor D4 Board Power Requirements

The Vision Processor D4 Board is powered through VBUS power of the USB connector. The Vision Processor D4 Board in turn power sources the stereo depth module.

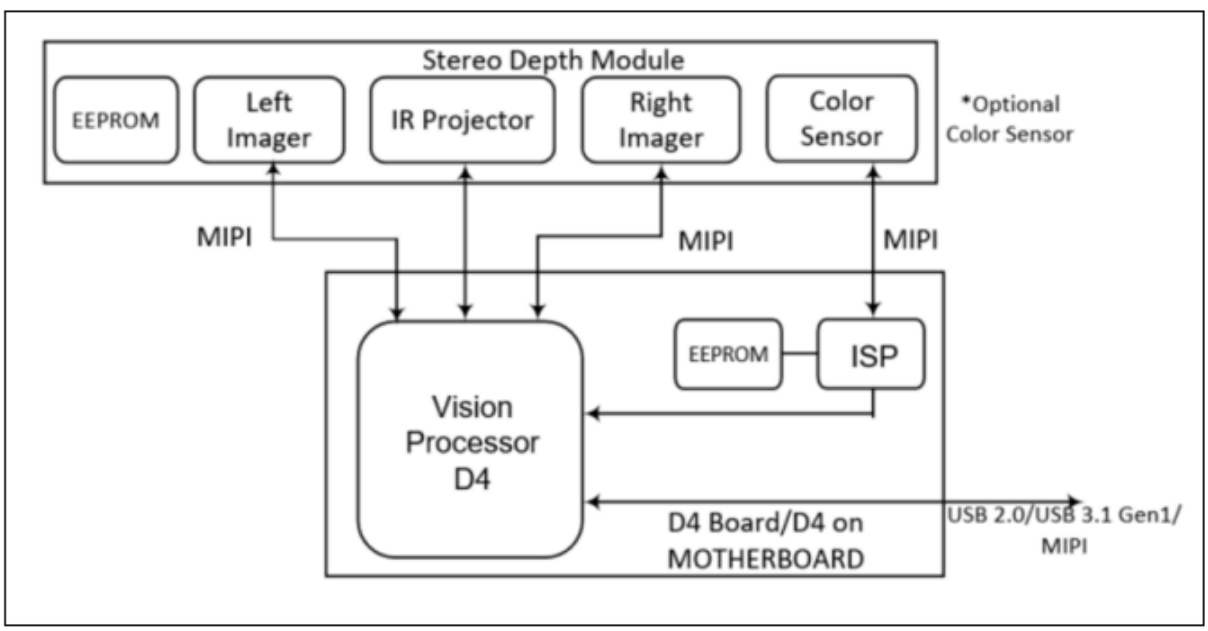
Table 3-39. Vision Processor D4 Board Power Requirements

Parameter		Min	Nom	Max	Unit
VCC	Supply Voltage	4.75	5V	5.25V	V
ICC	Supply Current			700	mA
	Supply Voltage Ramp Rate	0.5		5	ms

USB 3.1 Gen1 supports all resolution/frame rate combinations in a typical dedicated USB port configuration. On a USB hub with other devices (e.g. other RealSense cameras), considerations regarding bandwidth requirements have to be taken.

USB 2.0 supports a subset of the resolution/frame rate combinations given the bandwidth requirements.

- Max. Depth Resolution Simultaneous Stream Configuration with Depth at 640X480, 15 FPS, Left Imager at 640X480, 15 FPS and RGB Camera at 640X480, 30 FPS.
- Max. Depth Frame Rate Simultaneous Stream Configuration with Depth at 480X270, 60 FPS, Left Imager at 480X270, 60 FPS and RGB Camera at 424x240, 30 FPS



Use Sunlight, but avoid glare

1. Most depth cameras degrade dramatically in sunlight. By contrast, both the Intel RealSense D415 and D435 tend *to perform even better in bright light*. The way to understand this is that the depth quality in the Intel RealSense D4xx is directly related to the quality of the input images. It is well known that small cell phone cameras (and the ones used in the Intel RealSense D4xx series) give poor quality grainy images under low light conditions, but provide excellent images in bright sunlight. Sunlight reduces the sensor noise and tend to "brings out" the texture in objects. Moreover, the exposure can be reduced to near 1ms which reduces motion artifacts as well. So the upshot is that the Intel RealSense D4xx cameras actually perform very well in sunlight.
2. One issue to be careful about is lens glare when pointing at or near the sun. It is recommended that the lenses are shielded by baffles to reduce the risk of lens glares.
3. When operating an Intel RealSense D4xx camera outside, it is important to be especially careful in regards to the auto-exposure, especially if the sun or reflections of sun are visible in the image. By default the auto-exposure algorithm tries to keep the average intensity of the whole image within a certain range. If the sun is in that image, everything else will suddenly become black. For many applications, like autonomous robots or cars, it helps to simply change the Region-of-interest of the auto-exposure algorithm to a smaller size, or specifically to the lower half of the image.