Underwater Video Recording System
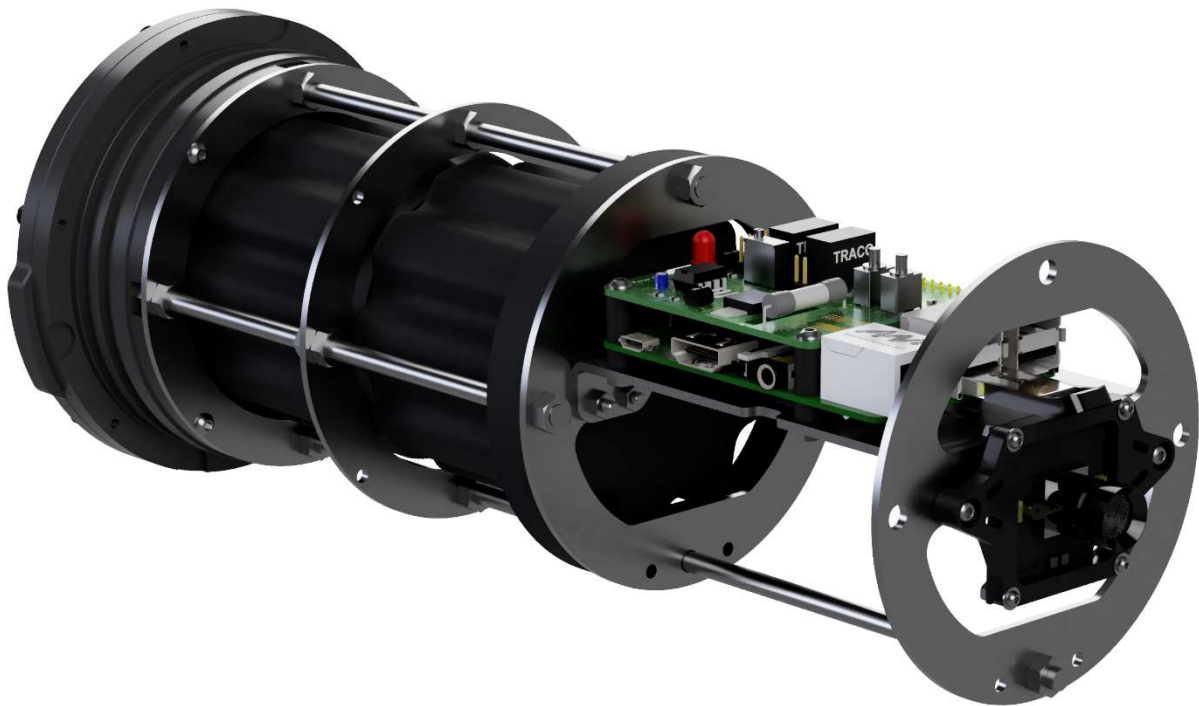
Dredge Mounted Camera v1.2

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Overview

Dredge Mounted Camera v1.2 is an upgraded unit developed to aid scallop fisheries with industry research and regulation. The frame of the system has been upgraded with sturdy aluminum sheet metal parts. The camera module has been replaced with a USB low light camera that offers audio and native video encoding.

Specifications

Video	HD usb low light camera 2.1MP (1920x1080p @30fps)
Run Time	84hr – 3 ½ days
Dept Rating	Acrylic Housing – 100m (328ft) Aluminum Housing – 400m (1312ft)
Memory	256GB USB3.0 flash drive
Battery Pack	266Wh 14.8V 18Ah Lithium-ion
Charger	20A,10A Fast/Balance charging 1-2hr charge time
Dimension	Housing O.D. – 114.3mm (4.5") Length – 340mm (13.4")
Weight	Acrylic Assembly – 6.4 lb (2.9 kg) Aluminum Assembly – 6.8 lb (3.1 kg)

Aluminum Frame

The unit uses aluminum frame parts and clamp to further increase the rigidity of the structure during underwater collisions or dredge vibrations.
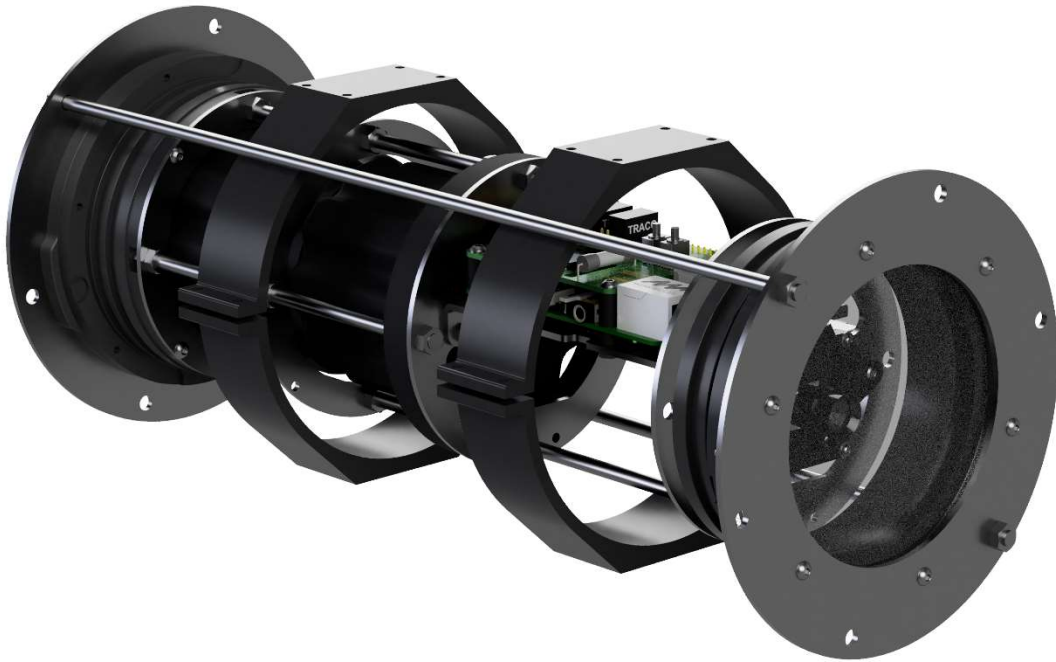
The aluminum frame is held together using M5 threaded rods and nuts. The assembly includes 3D printer plastic parts – frame spacer, battery support and camera mount. The camera module is pressed against the aluminum and includes a Thermal Interface Material (TIM) to dissipate the heat generated by the module.

The outer clamp is simplifier by using 2 aluminum rings which are fastened directly to the flanges. Two M5 threaded rods and nuts are using to press and hold the flanges.

Camera Settings

Parameters can be added or removed from the file if necessary. In the absence of value, the unit will utilize a default option. The format of the setup file has been simplifier and divided into 3 section:

- [video] – contains video specific parameters, such as output format, resolutions, sections length, etc.
- [system] – contains system parameters such as date-time, log interval, etc.
- [camera] – contains camera specific settings such as brightness, contrast, gamma, etc.

To change camera parameters, such as brightness or contrast, connect the USB camera to a PC and tune the video quality. Use your media player's settings to adjust the camera output, record the values and write them to the setup.txt file.

Parameter	Value	Description
[video]		
`section length`	0 – inf (in minutes)	This parameter specifies the video section length in minutes. (default 60).
`resolution`	[width]x[length]	Camera module provides various resolution settings.
`output format`	mkv, mp4, avi	Camera output video format. (default MKV)
[system]		
`set date-time`	DD-MM-YYYY **T** HH:MM:SS	Set time manually before each deployment. allow 1min for the system to boot.
`led interval`	0 – inf (in seconds)	Interval for the blinking red recording light (0 – off)
[camera]		
`brightness`	-64 to 64	Default 0
`contrast`	0 to 64	Default 32
`saturation`	0 to 128	Default 64
`hue`	-40 to 40	Default 0
`gamma`	72 to 500	Default 100
`gain`	0 to 100	Default 0
`power_line_frequency`	0 to 2	Default 1
`white_balance_temperature`	2800 to 6500	Default 4600
`sharpness`	0 to 6	Default 3
`backlight_compensation`	0 to 2	Default 1
`exposure_auto`	0 to 3	Default 3
`exposure_absolute`	1 to 5000	Default 156

Video Output

The USB camera includes a microphone and an onboard video encoder, which can stream H.264 format directly to the Raspberry Pi. The Pi's function is to merge the audio and video stream into a container such as MP4, MKV, AVI etc. The MKV container is most desirable as it allows the stream to be interrupted without corrupting or crashing the recording file. MKV is playable to most media players and is seen as interchangeable with MP4.

The camera's video stream does not have a timestamp built in. Without the video processing, either on the Pi or on PC, the only time indication is name of the video file:

[index]_[date]_[time]
XXX_YYYY-MM-DD_HH-MM.mkv

Storage Requirements

The h264 video stream, and subsequently the MKV file, is compressed by using the difference between the frames. As a result, more motion and sunlight captured by the lens will result in a larger video file. It is difficult to predict the video size without field tests, thus, the user is encouraged to monitor the file size during various deployment conditions.

The maximum file usage can be estimated using the maximum video bitrate of 10k Bps (1.25MBps). The 256GB storage device will be sufficient for 58 hours. In practice, the files might be much smaller, and the disk will not need to be replaced until the battery is depleted. The following formula is used to calculate the number of hours using the maximum file size:

$$recording\ hours = \frac{storage\ (GB) * 1024}{1.25 * 60 * 60}$$

Run Time

The power consumption varies depending on the video load and the USB power requirements. The typical average power consumption is 3W. Using the battery capacity of 266Wh, the run time can be estimated as follows:

Typical power consumption	3W	266Wh/3W = 106.4 hr
Low load power consumption	2.5W	266/2.5W = 133 hr
High load power consumption	3.5W	266/3.5W = 88.6 hr

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