FishEyA - Live Broadcasting Around 360 Degrees

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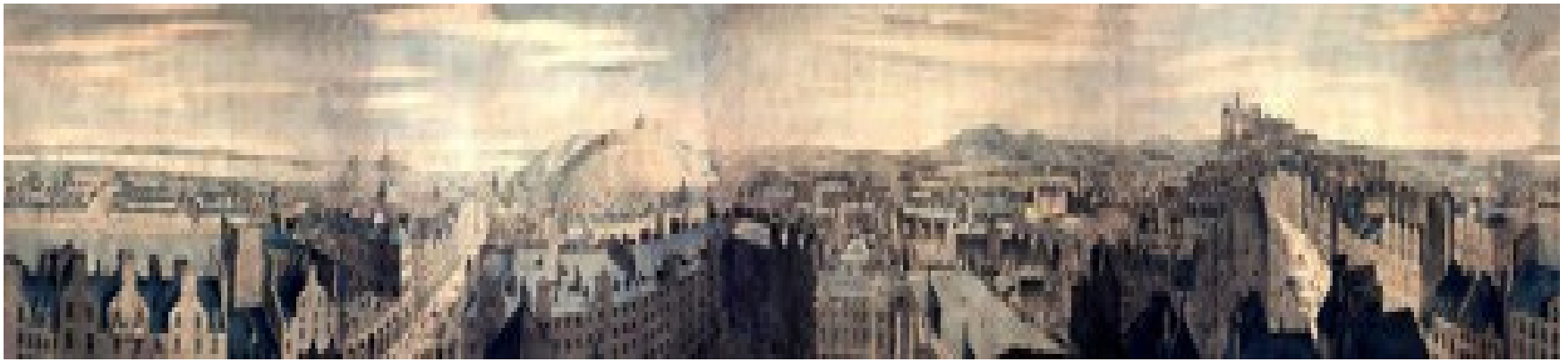


Top: **Panoramic painting of Edinburgh by Robert Barker: 1792**
Bottom: Panoramic photograph of 'Cow Girls' at the Pendleton 'Round Up,' taken in 1911 with Kodak's Cirkut camera.

http://www.pbs.org/pov/blog/2011/08/360_video_panoramas_new_tools_storytelling_gallery/#.VFfjG_l5Ph7

We aim to build up a low-cost prototype system for cognitive studies around a live 360 degrees vision.

Photo by Joe Nicora, via Flickr

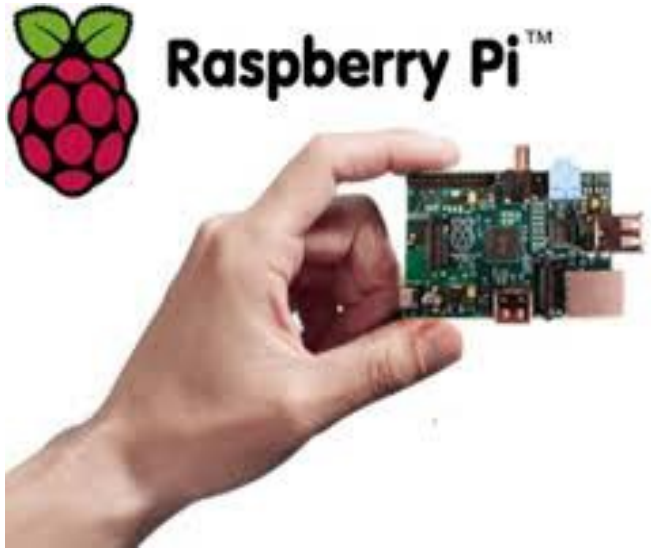
Have, *e.g.*, an original broadcasting channel that could transmit and cover in real time a panoramic vision at a distance and with minimal computation.

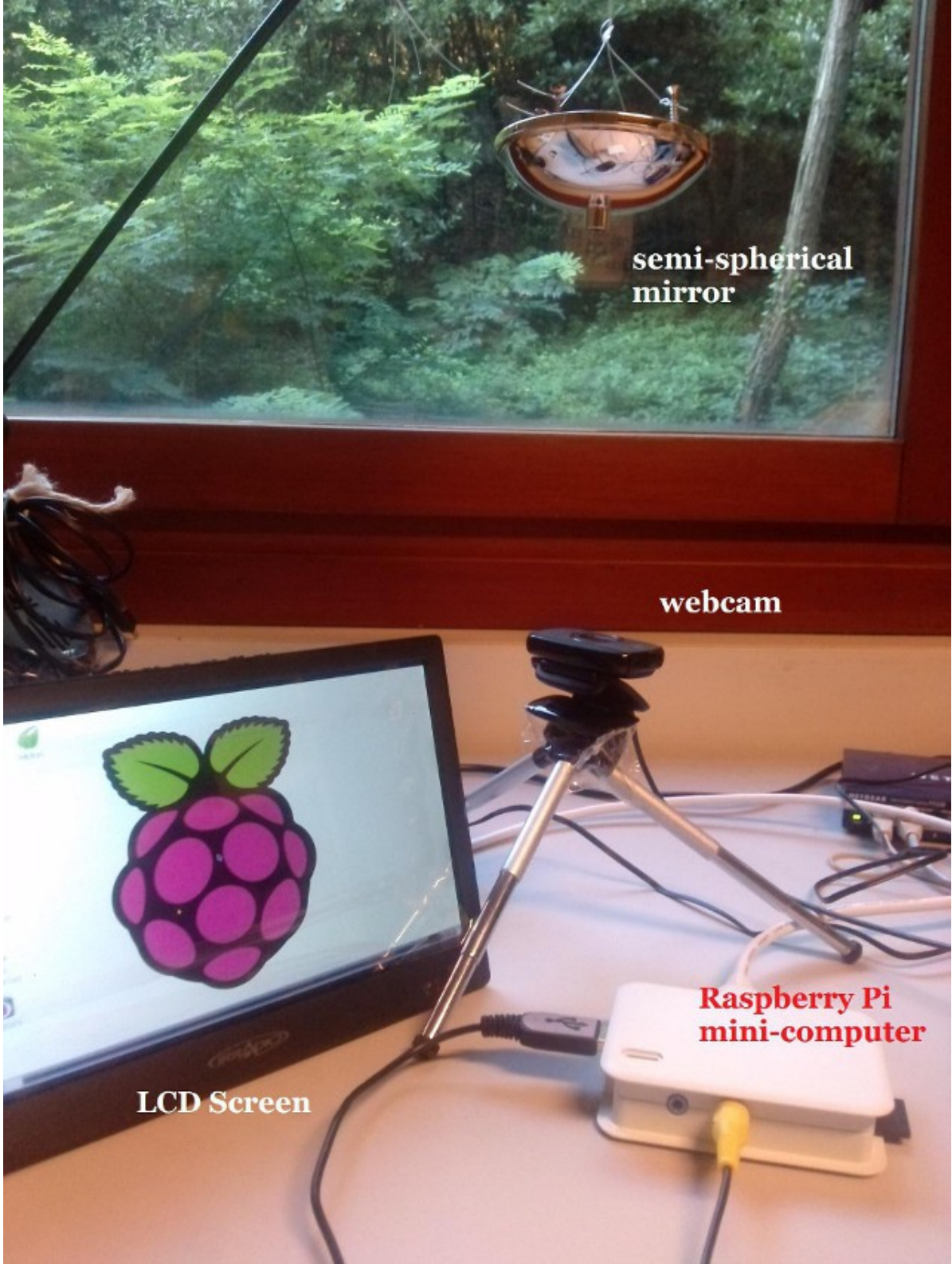
Develop optimized software to run in mini-computers: Raspberry/Banana Pi, BeagleBone having a light GUI to easily configure the 360° visual field and activate the streaming signal.

Example: Disney's Circle-Vision 360, a multi-projector format that surrounded theme park theater visitors

Live 360° streaming setup

(video of 15-25 fps, 352x288 resolution) displayed in the LCD screen (10 inch).





Technical Approach

Acute spectral view **implies to decode simultaneously more information in the shortest possible time due to more visual stimuli**.

We developed an **automated engine to unwrap the webcam frames in real time** using open source software: **OpenCV 2.4.9, ffmpeg 2.3.2, qt5 and mplayer,** optimized and compiled to run in a Raspberry Pi (RPi) mini-computer (using Raspbian GMU/Linux 7), Banana Pi (Bpi) and BeagleBone.

One of the challenges for a live panoramic broadcasting as compared to techniques used for ordinary streaming technologies, which cannot handle 360°, is the unwrap in real time of the video frames. This is achieved **implementing a transformation from polar to Cartesian coordinates**.

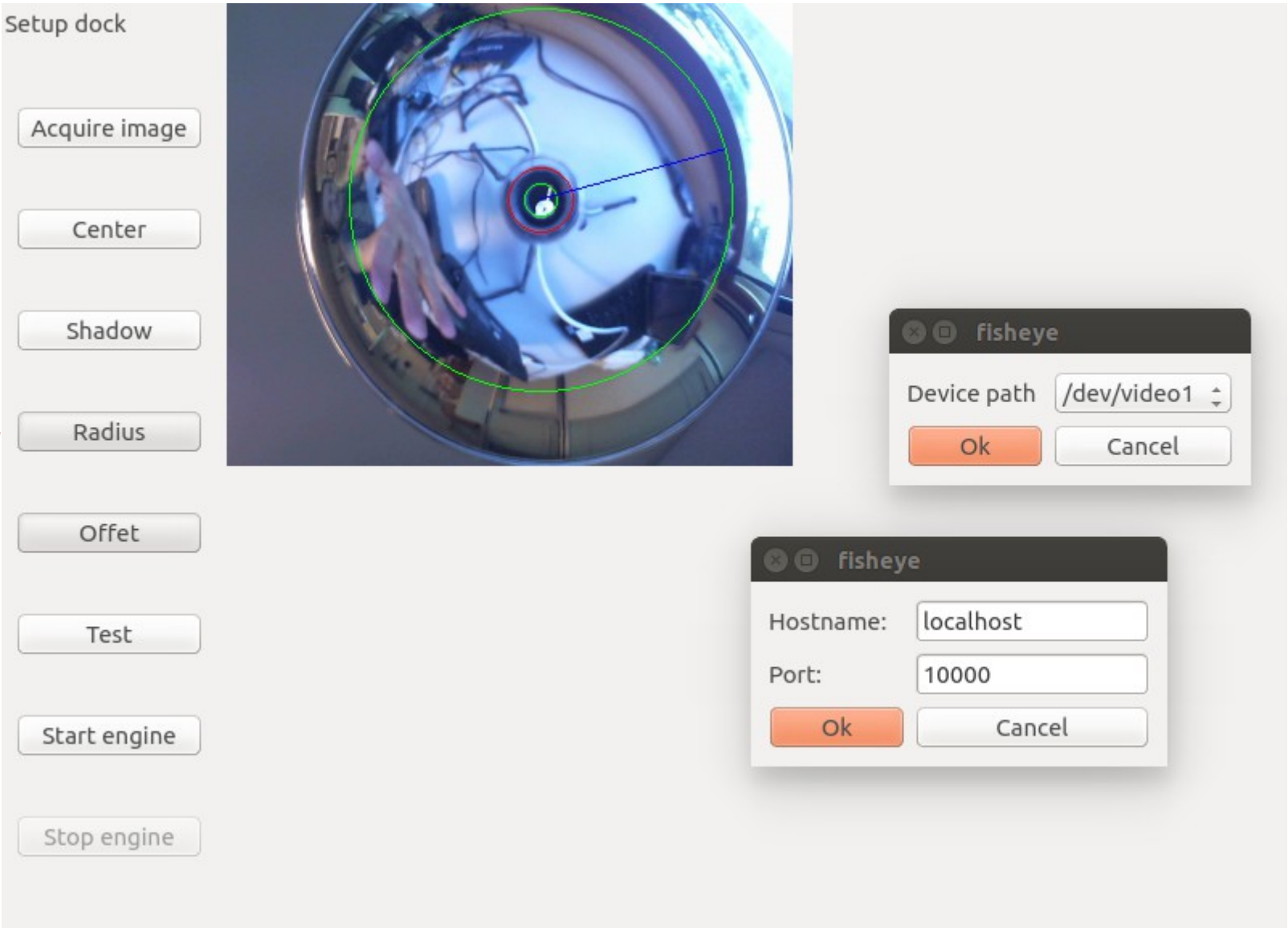
After having selected the center of the mirror from the GUI, and its (semi-spherical projected visual) radius, our script covers segments of circumference from 0 to 360 degrees. The pixels in these segments are then mapped into a rectangular area corresponding to the image to be visualized on the LCD screen. This "distortion mapping" is done only once at the start up of the FishEyA streaming. **The unwrapping exploits the available openCV API functions: remap and warpAffine**.

Live 360° Panoramic Vision: GUI

Control Panel for the manual configuration of the semi-spherical video capture to be automatically unwrapped in real time.

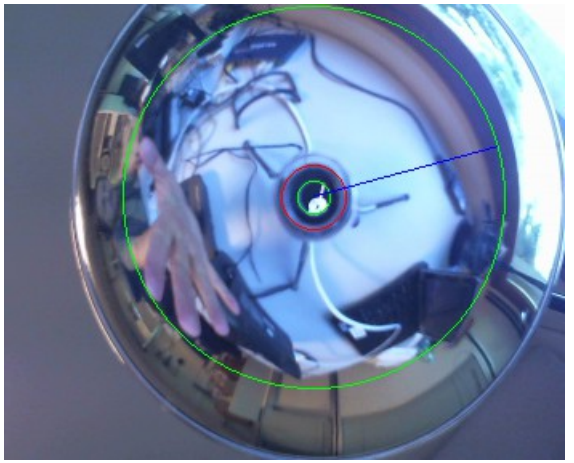
Buttons allows locating the image center, its inner and outer radii, the preferred offset to positioning the images mapping, and the start/stop of the live streaming.

Hostname, port and video device are given for the real time transmission



Live Outlook at 360°

Live 360° streaming in a LCD screen of the unwrapped image



Alternative 180° + 180° Live View

Latency via timestamp()

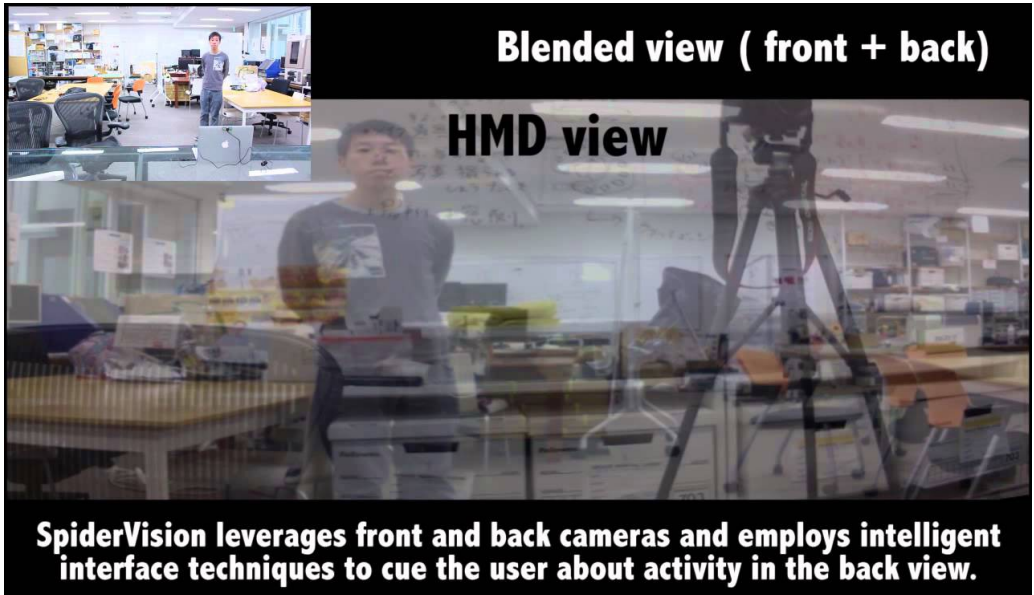
center: 178 134, *radius:* 86, *shadow:* 11, *angle*=-0.306676 / *Logitech HD Webcam C910*

HARDWARE		Average SECONDS x FRAME			
		number of frames considered			
		25	100	1000	10000
NetBook	Dell Inspiron Mini (year 2009) Intel Atom N270, 32 Bit 1.6 GHz, 500 MB RAM Ubuntu 14.04, 32-bit	0.02240	0.02188	0.02150	0.02195
Banana Pi	new generation single-board (2014) ARM dual-core processor, 32-bit 1 Ghz,1GB SDRAM O.S. compatible with Raspberry Pi	0.09438	0.06306	0.04520	0.04411
BeagleBone Black	Mini, low-cost computer (Rev C) AM3358 processor, 32-bit 1 GHz, 512 MB DRAM Raspbian O.S.	0.09314	0.06792	0.06555	0.05470
Raspberry Pi	mini, low-cost computer (B+) ARM1176JZFS processor, 32-bit 700 MHz, 512 MB SRAM Raspbian O.S.	0.09488	0.08866	0.09272	0.09213

Previous/Other Works

*Ardouin J., Lécuyer A., Marchal M., Riant C. and Marchand E. 2012 "**FlyVIZ": A Novel Display Device to Provide Humans with 360° Vision by Coupling Catadioptric Camera with HMD** (Proceedings of VRST'12), 18th ACM Symp. on Virtual Reality Software and Technology, 41-44.*

*Fan K., Huber J., Nanayakkara S. and Inami M. 2014 "**SpiderVision": Extending the Human Field of View for Augmented Awareness** (Proceedings AH'14), 5th Augmented Human International Conference ACM, Article No. 49.*



Joey: full motion 360º desktop video camera providing capture, live webcast, and two-way panoramic teleconferencing – sept 2014

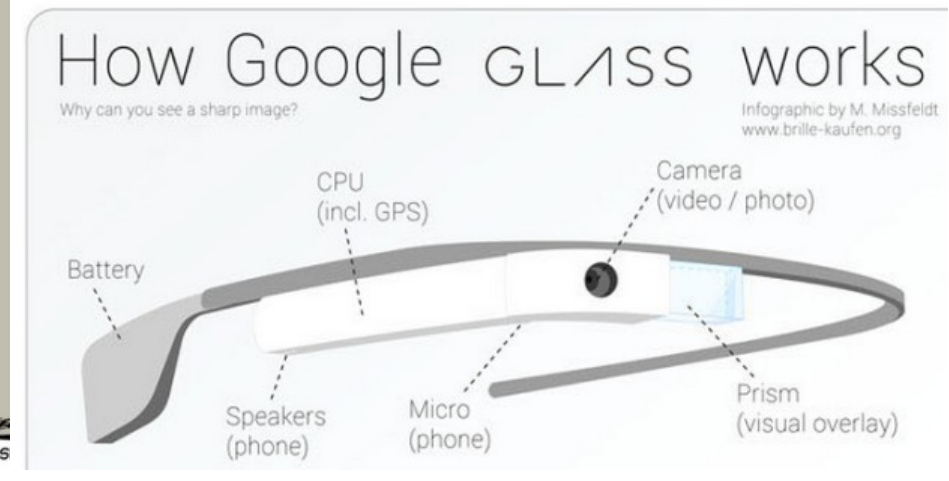
360.tv cam

360fly cam (spring 2015)

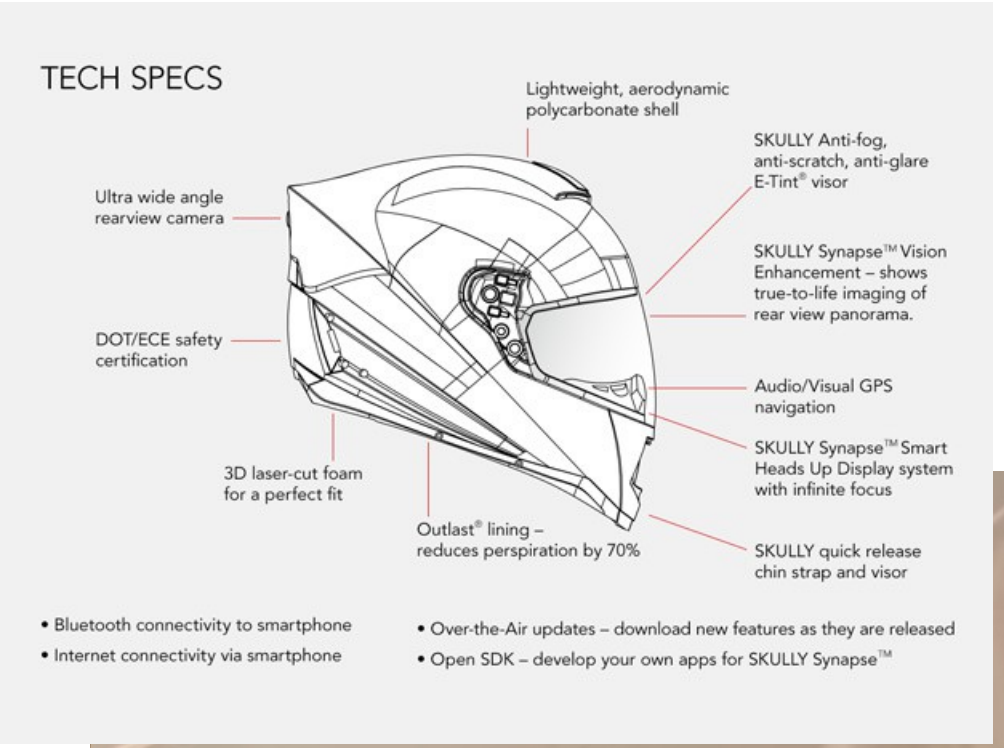
First **360° PIXPRO Action CAM Kodak**
(sept 2014)

Oculus Rift / Google Glass

Augmented 3D Reality



Skully augmented-reality (safety-focused) motorcycle helmet



180-degree **rear-facing camera**, and a little screen placed in the bottom right portion of field of view. Due to mid-2015, cost $1,399