



A wireless security camera, powered by the sun

2016-2017 Senior Capstone Engineering
Design Project



The World's **Sixth Sense**™

6/8/2017



Agenda

- Design History
- System Aesthetics/Specifications
- Power Management
- Web and Android Application
- Unit Costs
- Plans for Production



Introducing

Helios

with FLIR Lepton

A wireless security camera,
powered by the sun

High Level Overview



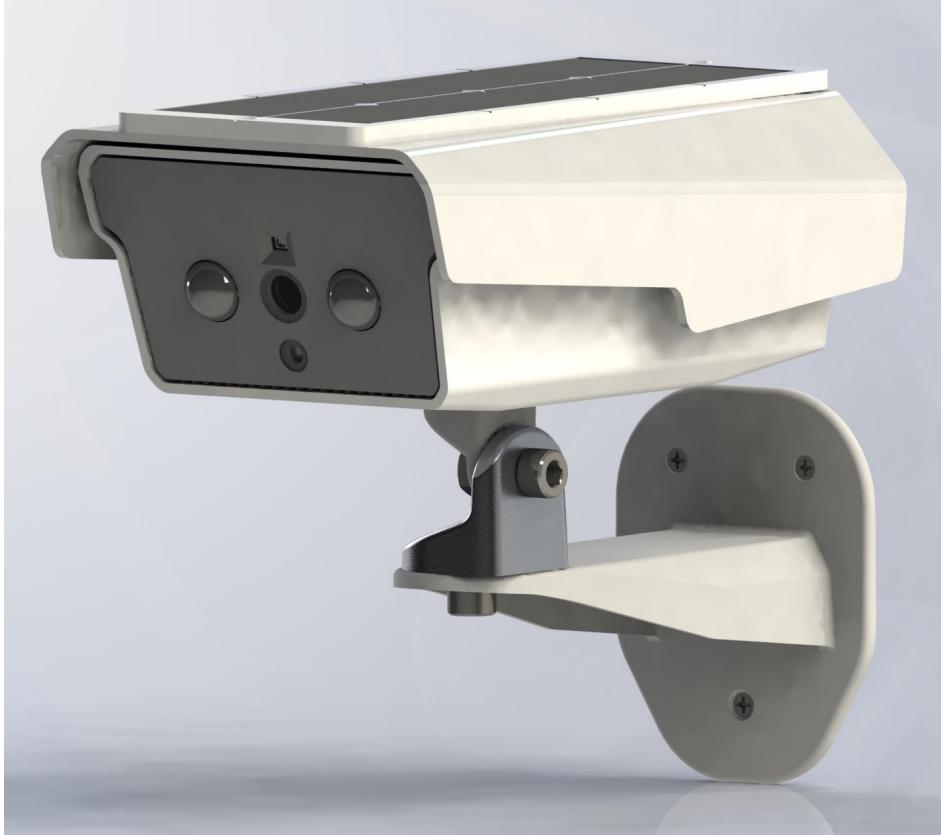
User Experience



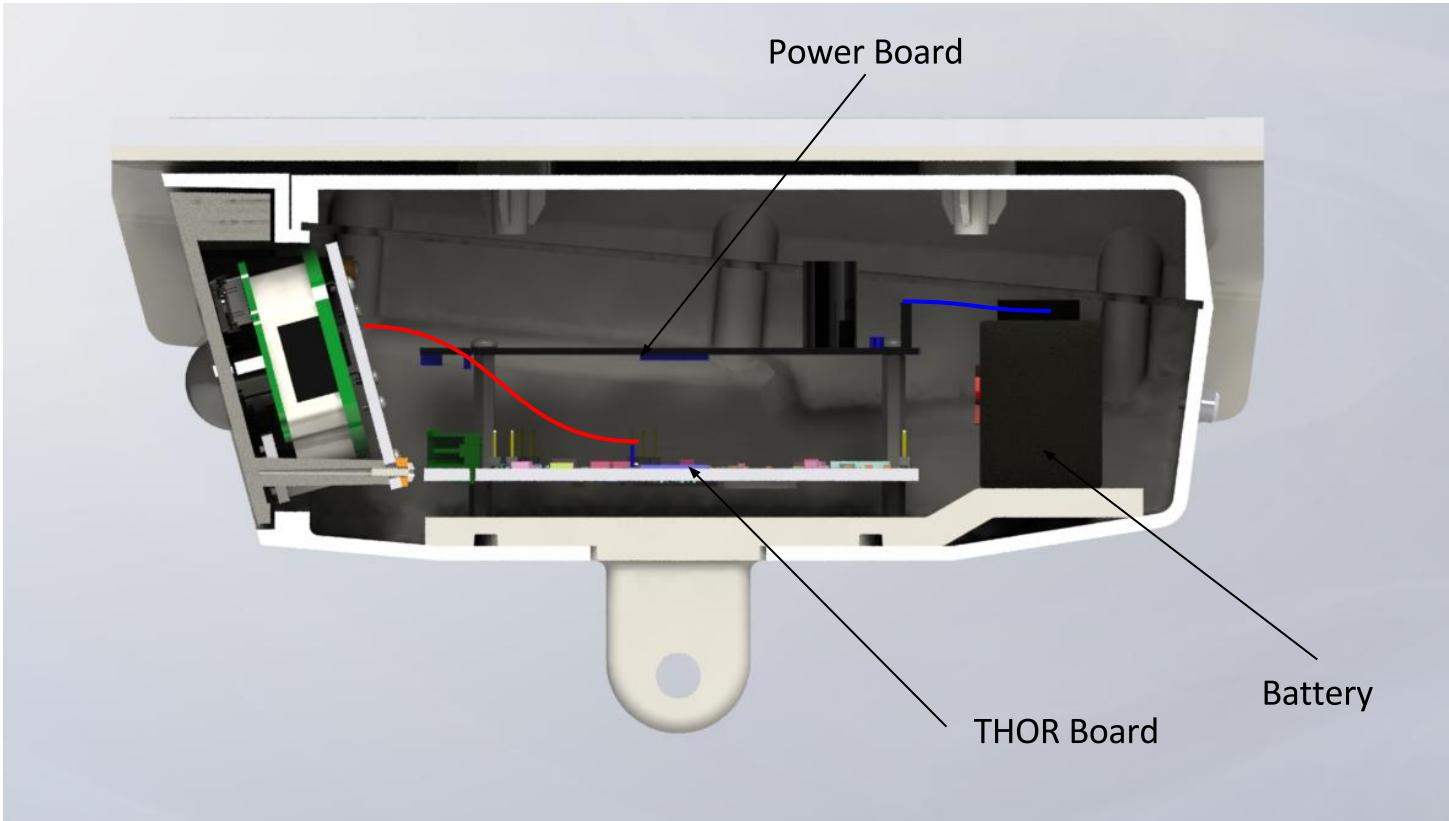
Key Specifications

Engineering Characteristic	Target Spec (Minimum requirement)	Tested Spec
Submerged in 1m Water	30 min*	30 min
Dust tight	8 hours*	8 hours
Minimum Solar levels	2.9 hours/day	2 hours/day
Temperature Range	-20 to +50 °C	-30 to +60 °C
Weight	15 pounds	10 pounds
Connectivity	WiFi	WiFi (large range)
Battery Life	2.5 hours**	3.7
Price (in bulk)	\$500	\$300

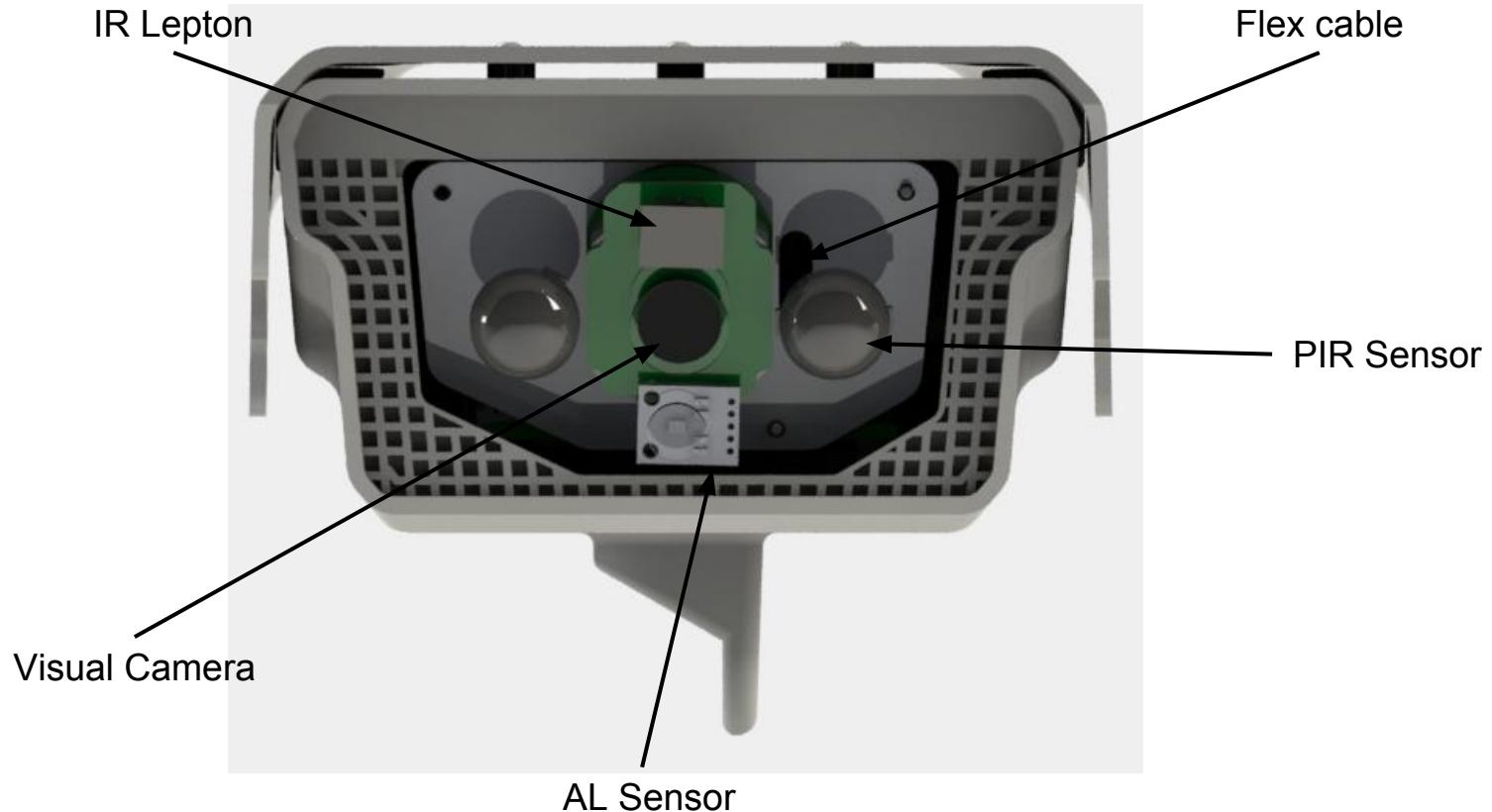
Current Design



Inside Camera Housing

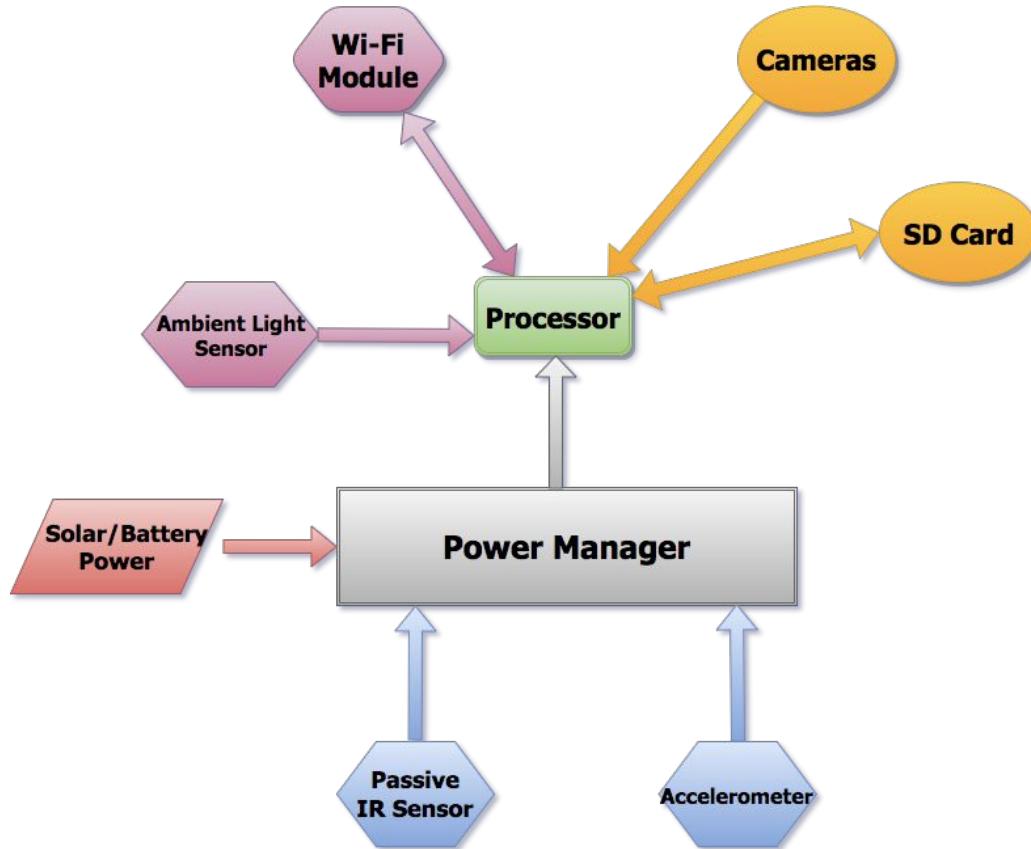


Inside Camera Housing

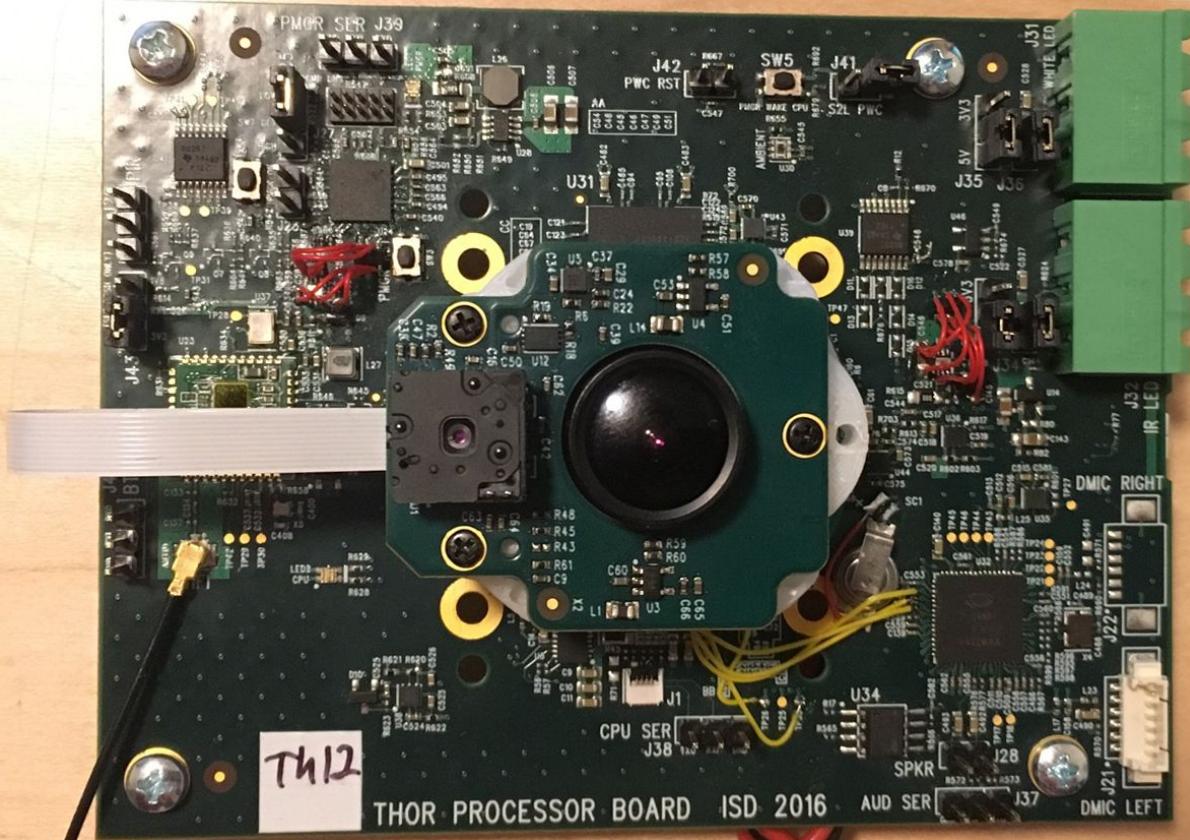


Electronics and Circuits

High Level Block Diagram



THOR Board

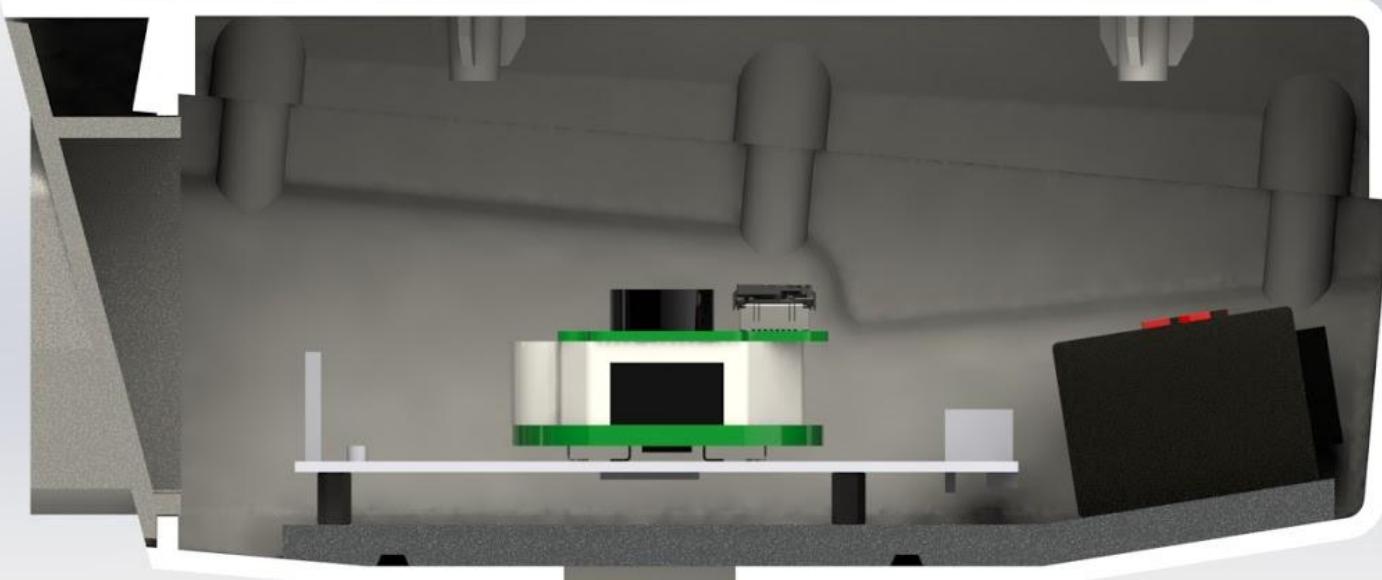


PIR Sensor

- Detect motion within a 105° field of view
- Alerts THOR board through MCU:
-CPU: Low power mode → Record



MIPI Flex Cable



Flex Cable



Front



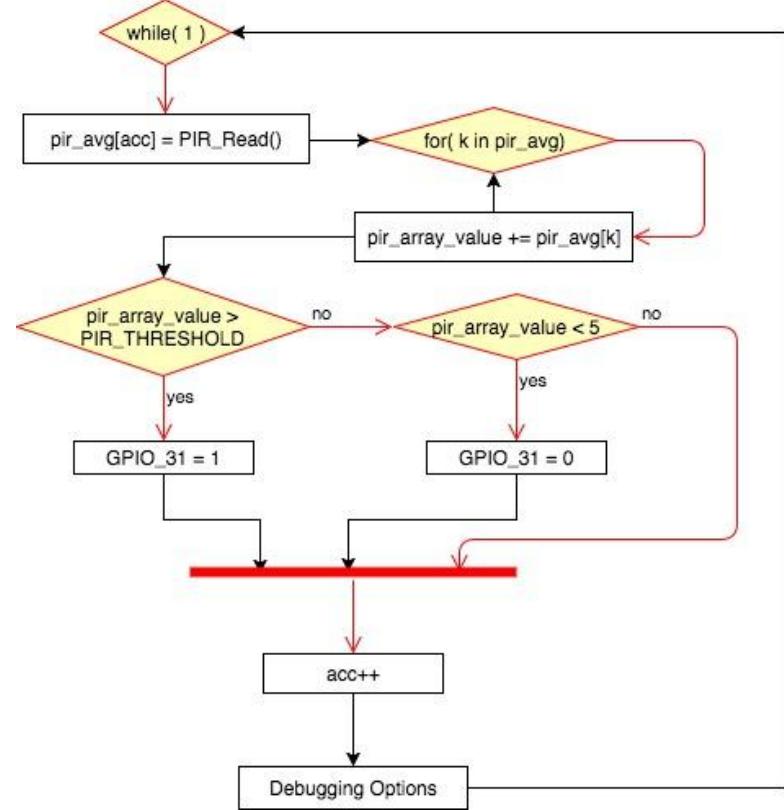
Back

Interrupt Controller

- Communication between sensors and camera
 - Integral to camera's success
- Keep SoC in low power mode to preserve battery life
- Fast response time
 - Old solution: 18 sec delay
 - New solution: 200ms delay

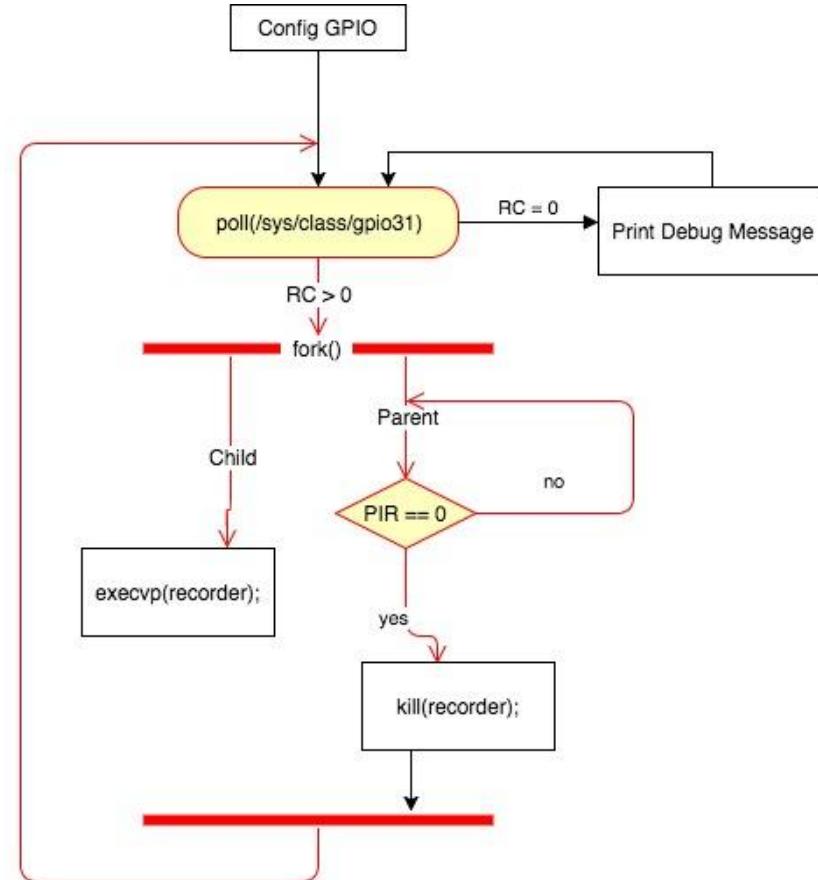
Interrupt Controller (MCU)

- PIR V_out as input to MCU pin PE12
 - Pulse for each beam (square wave)
- MCU C program stably mirrors PE12 sensor to GPIO31
 - GPIO31 reconfigured to push-pull
 - software debouncing
 - feed watchdog when necessary
- Reduced FSM to readily accept PIR wakeup signals
 - “Wave hello to your Helios”



Interrupt Controller (C Program)

- Read GPIO31 through file description and system call
- Prune the SD card filesystem
- Recording remains active while GPIO31 is high



Website and App Support

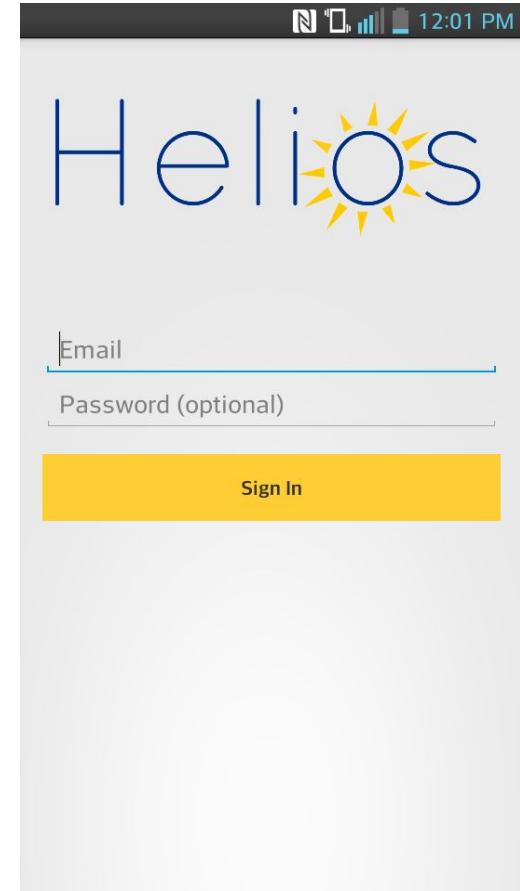
Website

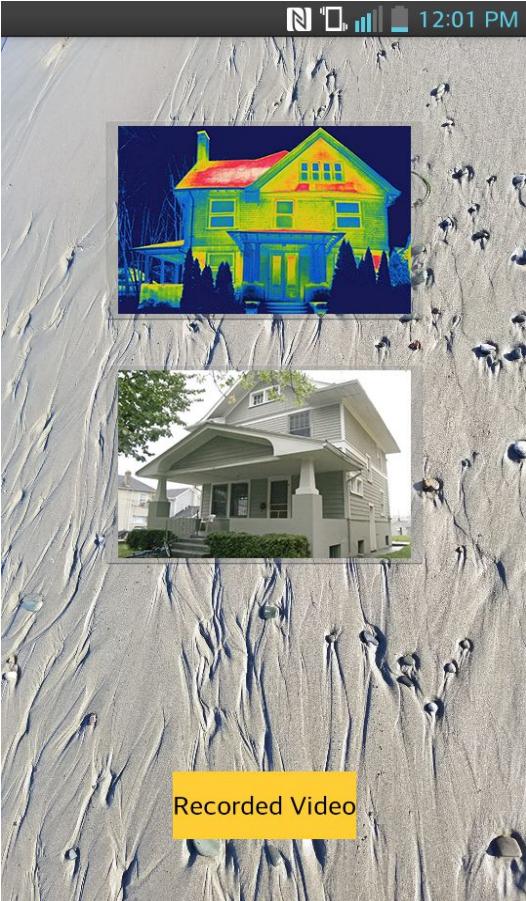
- Javascript and CGI provide a dynamic experience
- Simple and complex features easily accessible
- integrated live view

The screenshot shows a web-based configuration interface for a FLIR camera. The top navigation bar includes links for 'LIVE VIEW', 'GENERAL', 'EDGE', 'NETWORK', 'SECURITY', 'DATE & TIME', 'IMAGE QUALITY', 'VIDEO STREAMS', and 'MOTION DETECTION'. On the left, a sidebar lists 'Camera Actions' such as Reboot, Restore, Reset Factory, and Update Firmware. The main content area is divided into sections: 'Status' (showing Camera Date, Uptime, Code Version, MAC Address, IP Address, Enet Address, Camera Name, Camera Model, and SD card 1 size), 'General Settings' (with dropdown menus for IR Switching and At night use set to 'Black and White', and Status LED set to 'Enabled'), and a bottom row with 'Apply' and 'Cancel' buttons. The footer of the page reads 'UCSB Capstone Website'.

App: Login

- User-friendly Android app integration
- Login for remote security surveillance





App: Stream Selector

- Access livestream feed via WiFi
- Switch Between Visible and Infrared with a press of a button



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Production

Production Steps

THOR board

- Send plans to mass producer
- Removing all prototype pins and debug ports
- Integrated flex cable
- Permanent PIR and ambient light sensor mounts



Unit Cost

Item	Supplier	Single Price	Price Quantity 10,000	Price Quantity 100,000
Housing	Strata-Systems	\$3,298.00	\$206.13	\$103.06
Electronics	Miscellaneous	\$98.60	\$6.16	\$3.08
Sourced Parts	DigiKey/McMaster	\$210.02	\$13.13	\$6.56
THOR Board Assembly		\$3,000.00	\$187.50	\$93.75
Total Raw		\$6,606.62	\$412.91	\$206.46
Net Total Estimated Materials		\$8,588.61	\$536.79	\$268.39
Total with Tooling		\$200,000.00	\$208,588.61	\$556.79
				\$270.39

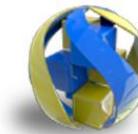
Closing Remarks

Special thanks: Marcel, Kai, Sean, Ian, Andy, and Jim at FLIR

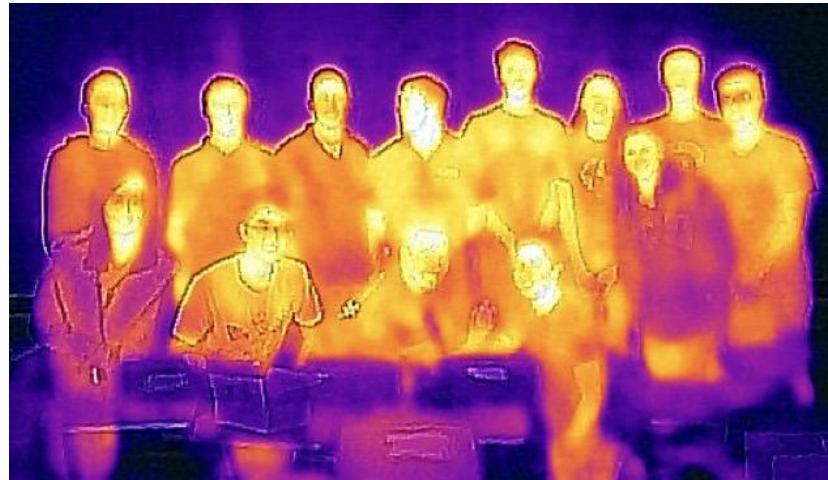
Program Advisors: Professors Johnson, Ben-Yaacov, Susko, and Yoga Isukapalli

On Campus: Celeste Bean, Will Miller, Caio Motta, and Megan Chang

Thank you!



UC SANTA BARBARA
engineering



PC: FLIR ONE