FLIR Helios
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

<table>
<thead>
<tr>
<th>Engineering Characteristic</th>
<th>Target Spec (Minimum requirement)</th>
<th>Tested Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submerged in 1m Water</td>
<td>30 min*</td>
<td>30 min</td>
</tr>
<tr>
<td>Dust tight</td>
<td>8 hours*</td>
<td>8 hours</td>
</tr>
<tr>
<td>Minimum Solar levels</td>
<td>2.9 hours/day</td>
<td>2 hours/day</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-20 to +50 °C</td>
<td>-30 to +60 °C</td>
</tr>
<tr>
<td>Weight</td>
<td>15 pounds</td>
<td>10 pounds</td>
</tr>
<tr>
<td>Connectivity</td>
<td>WiFi</td>
<td>WiFi (large range)</td>
</tr>
<tr>
<td>Battery Life</td>
<td>2.5 hours**</td>
<td>3.7</td>
</tr>
<tr>
<td>Price (in bulk)</td>
<td>$500</td>
<td>$300</td>
</tr>
</tbody>
</table>
Current Design
Inside Camera Housing

IR Lepton

Flex cable

PIR Sensor

Visual Camera

AL Sensor

Proportional - Confidential ©2016 FLIR Systems Inc. Information and equipment described herein may require US Government authorization for export purposes. Disclosure contrary to US law is prohibited.
Electronics and Circuits
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
• 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
- Javascript and CGI provide a dynamic experience
- Simple and complex features easily accessible
- Integrated live view
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
Introducing Helios with FLIR Lepton

A wireless security camera, powered by the sun
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

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

PC: FLIR ONE