# True Sight

## Absolute Vision Systems

# Team Breakdown

CEO : Don Labayo
- Hardware Design
- System Integration

CIO : Tomasz Szajner
- Software Design
- Mechanical Implementation

CTO : Samson Tam
- Hardware Design
- System Architecture Design

# Team Breakdown

CFO :  Curtis Rietchel
- Software Design
- Mechanical Design and Implementation

COO: Jim Tu
- Meeting Minutes , Contact Person, Planning
- Team Management
- Software Troubleshoot

# Outline

- Team Breakdown
- Motivation
- Existing Solutions
- System Design
  - Overview
  - Electrical
  - Software
  - Mechanical
  - Hardware Problems
  - Software Problems
- Budget
- Market Analysis
- Future Improvements
- Reflections
- Lessons Learned
- Project Timeline
- Acknowledgements
- Conclusion
- Q&A Session and Demo

# Motivation

- Solve a problem - Fire related and local

- Project scope aligned with our skills and experience

- Unique idea that has not been done before

# Existing Firefighting Equipment



1. Thermal Imaging Camera
   2 Modes : Thermal Image, Infrared.
2. Pak-Tracker
3. Standard Equipment:
   Full turnout gear
   Self-contained breathing apparatus (SCBA)
   Personal alert safety system (PASS device)
   Portable radio that uses the fireground
   frequency and is available to the incident
   commander
   Hand tools
   Hand light
   Search rope or webbing
        Rapid air transport (RAT) bag
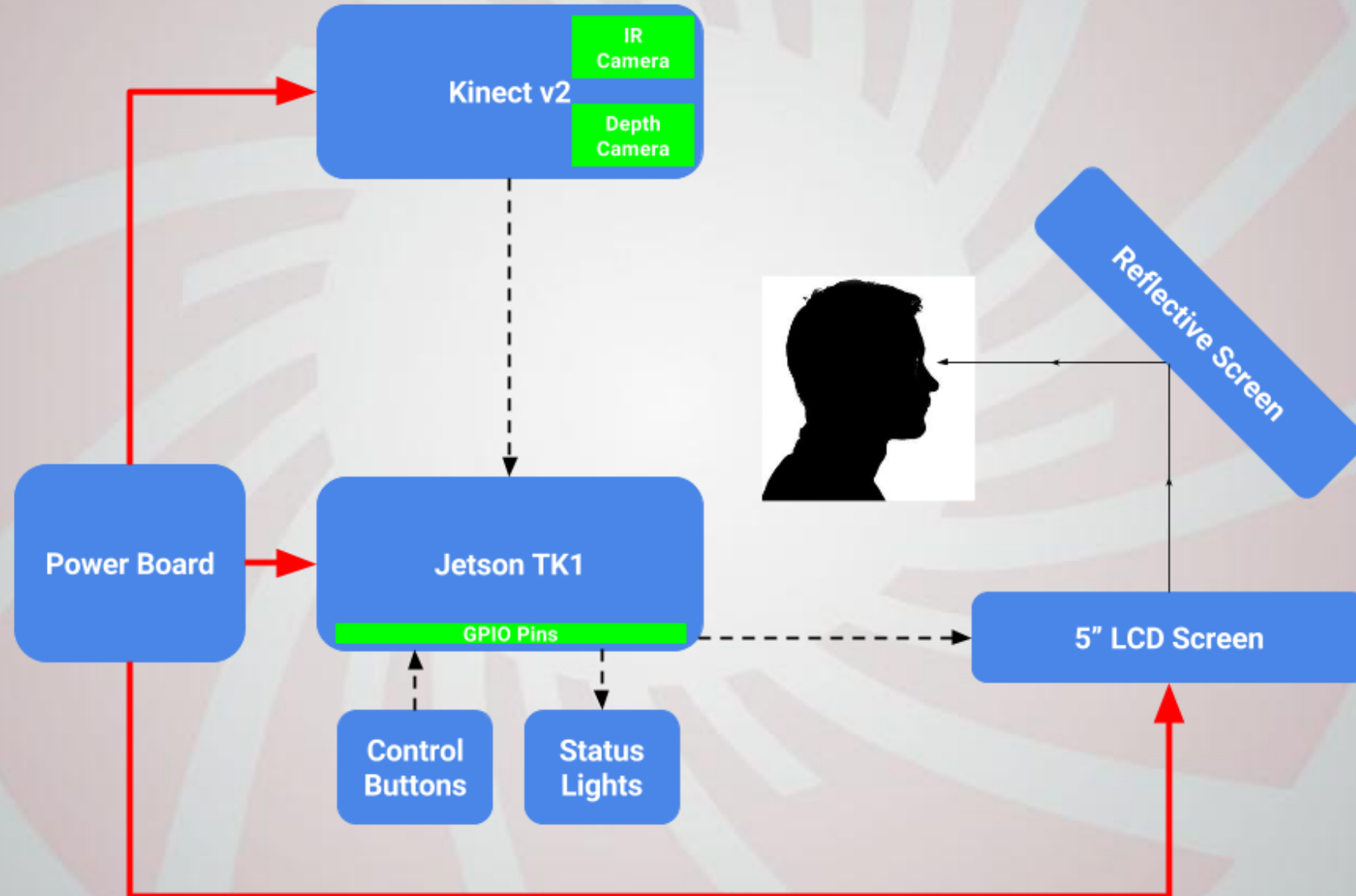
# System Overview

Infrared Camera

HUD

Real time Visual Aid

Portable and Wearable by Firefighters

# High Level System Design

Kinect V2 Module

Display Module

Simulation Air Tank

Jetson TK1 Computing Unit

# Kinect V2

Infrared & Depth

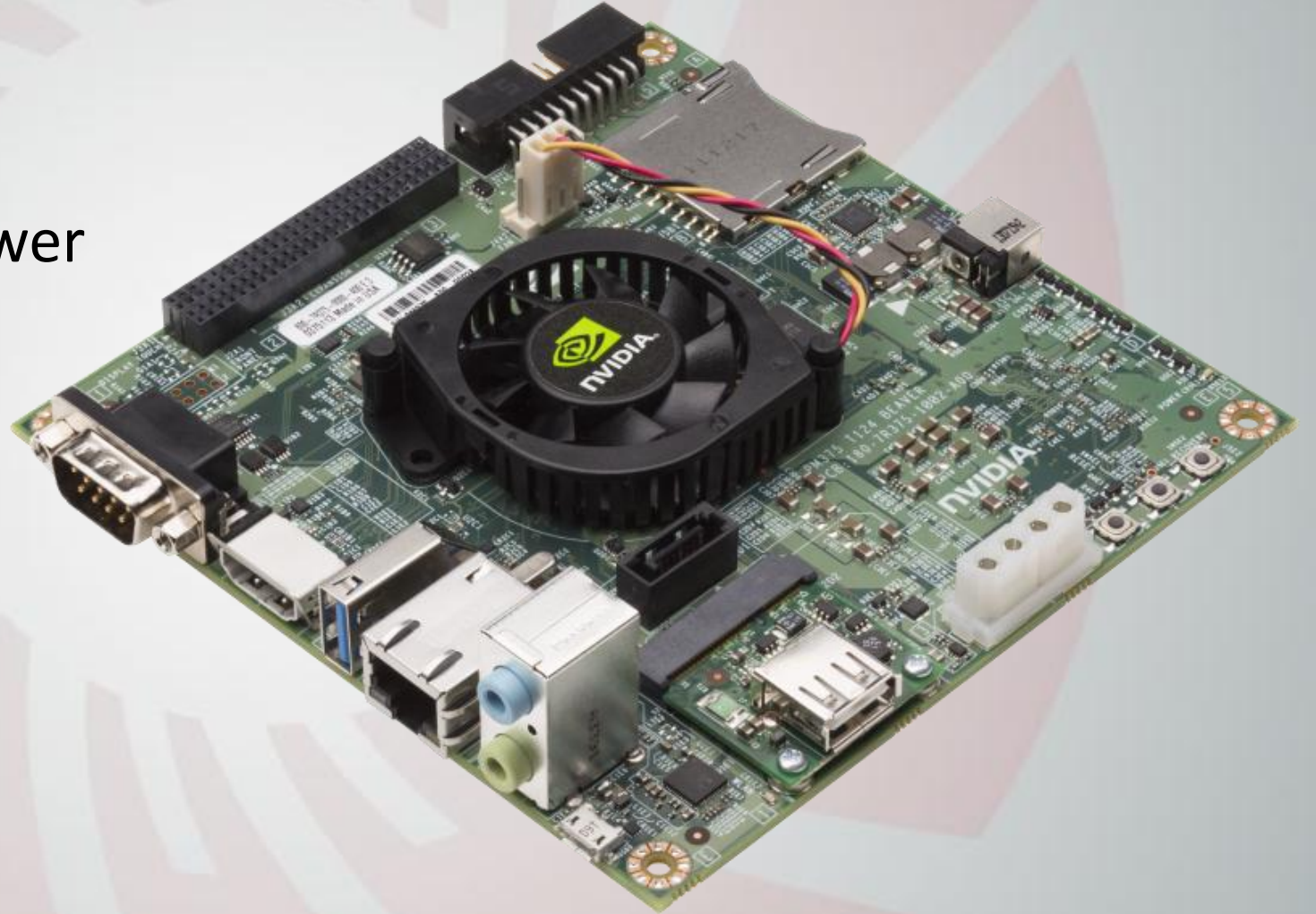Rapid Prototyping & Established Community
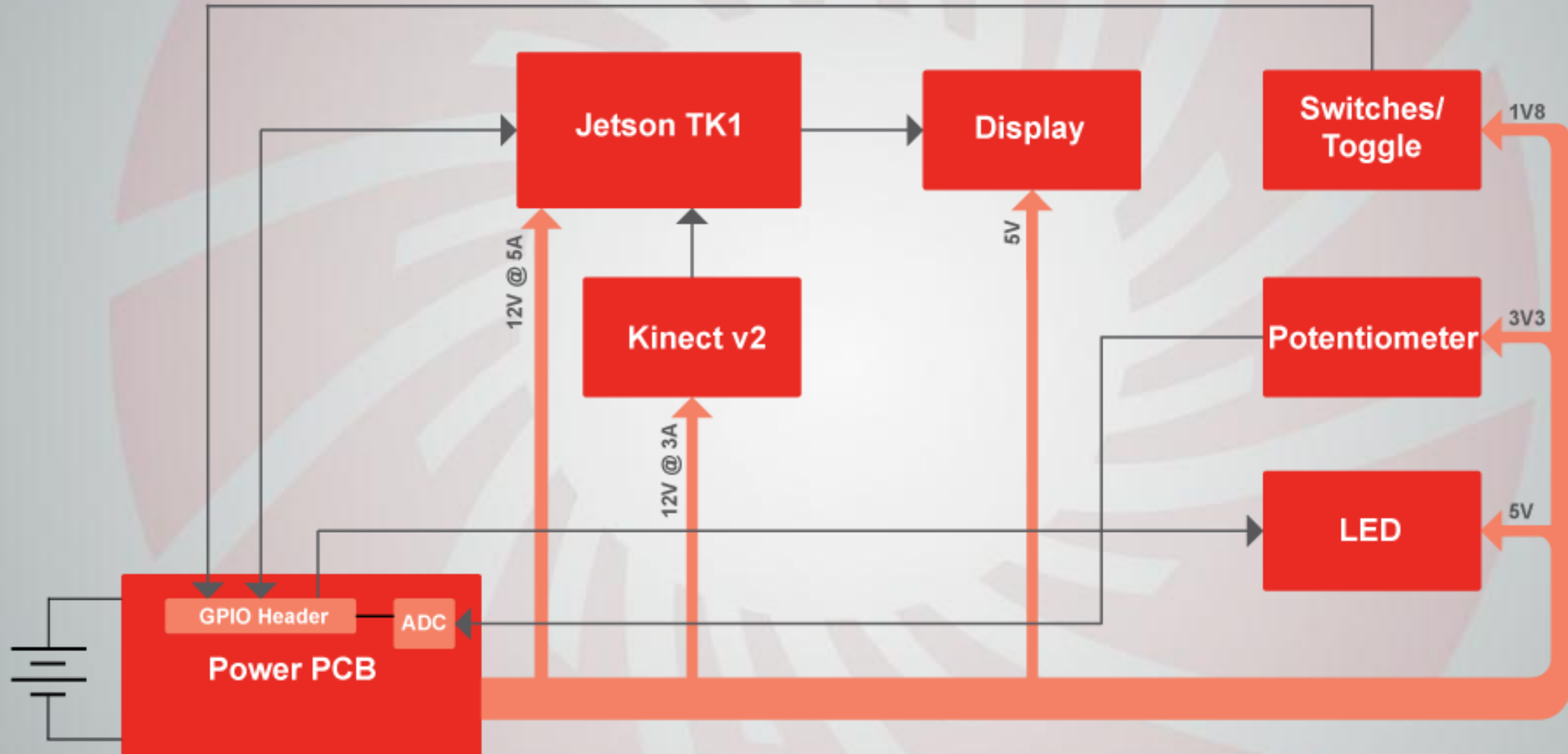
USB 3.0

# Jetson TK1

USB 3.0

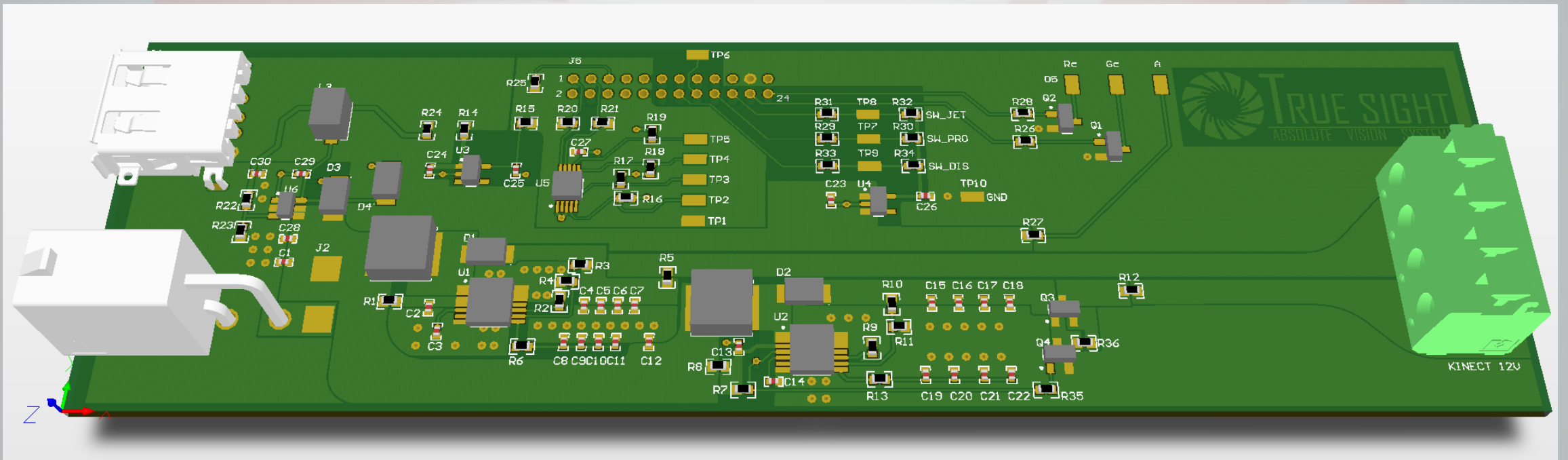Graphical Processing Power

Embedded Interfaces

# Electrical Design

# Electrical Design

# Software

Image Feed

Image Processing

Controls

Linux configuration / scripts

# Software Stack

**Visual**

OpenCV

**Application Layer**

TrueSight Application

libfreenect2

**Low Level**

sysfs

i2c-dev

libusb
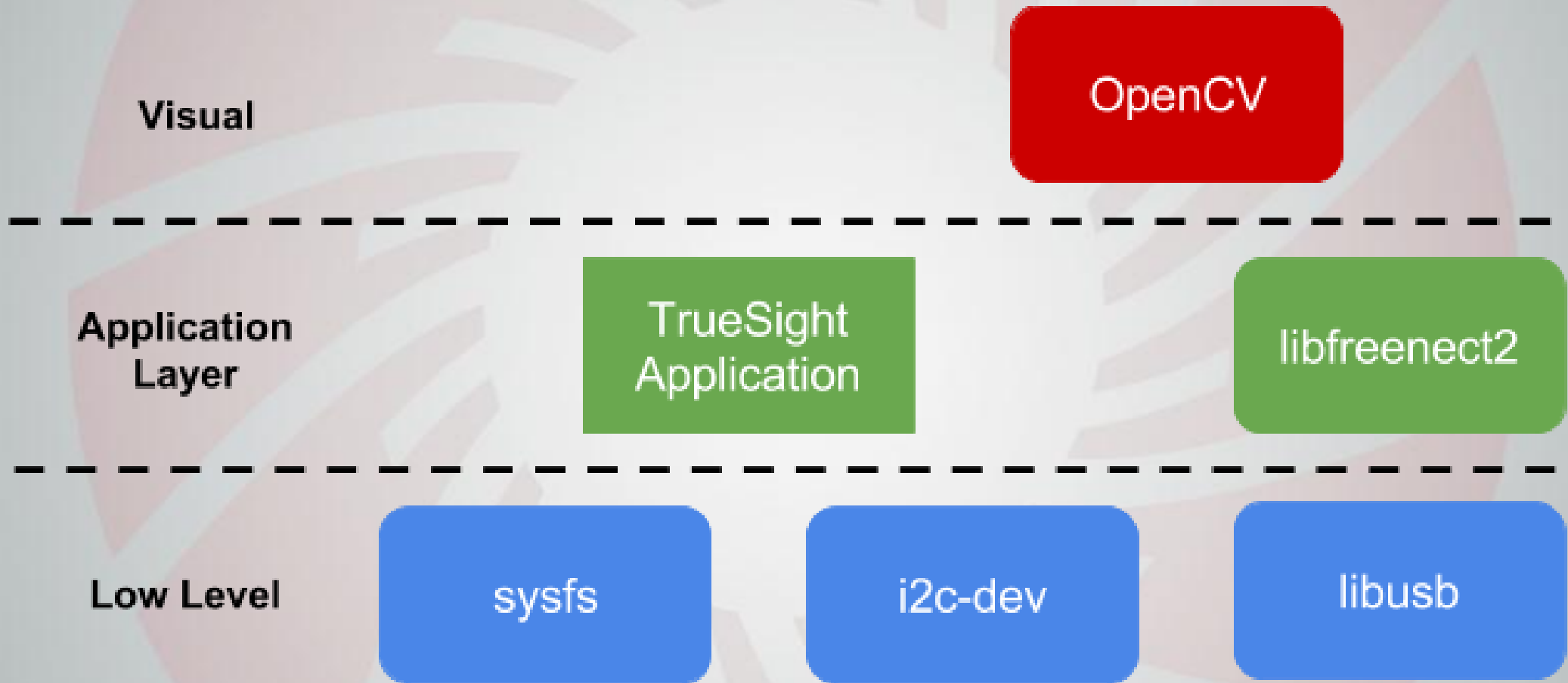
# Software - Image Processing

# Software - Scripts and Bootup

Goal was to create a seamless bootup application

Boot into application and disable linux desktop GUI

Kiosk application

Shutdown and HDMI power gpio run in background

# Mechanical

- Consists of screen mount, helmet mount, kinect mount
- Chose plastic to create mounts
- Used a variety of machining equipment to create the mounts
  - Table Saw
  - Drill Press
  - Dado Cutter
  - Scroll Saw
  - Belt Sander
  - Router
- Also machined main processing enclosure, attached "air tank" to enclosure

# Mechanical

# Mechanical

# Hardware Problems

Package voltage limitation

5V USB

Kinect 12V switch control

$I^2C$

# Software Problems

Image Processing

$I^2C$ interface

Single-application bootup

# Budget

| Equipment | Estimated Cost ($) | Actual Cost ($) |
|---|---|---|
| Kinect V2/Imaging | $150 | $179.19 |
| Nvidia Jetson TK1 Dev. Board [Embedded Processor] | $200 | $271.02 |
| Kinect USB Adapter | $60 | $68.20 |
| HW8G3 Pico-engine | $30 | N/A |
| Projector PCB | $50 | N/A |
| Adafruit LED Screen | - | $167.14 |
| Helmet with Visor | $50 | $0.00 |
| Materials for Mechanical structure | $50 | $101.50 |
| Miscellaneous electrical components | $50 | $38.98 |
| Batteries & charger | $25 | $154.49 |
| Power PCB | - | $141.00 |
| Power PCB Components | - | $229.85 |
| Total Cost | $665 | $1351.37 |

# Market Analysis

1. C3I :  command, control, communications and intelligence

2. The study identifies the key technology needs, trends, and solutions for first responders.

3. Frost & Sullivan said that the emergency response market earned revenues of $50.41 billion in 2012 and estimated this to reach $131.62 billion in 2019[1].

4. Potential for us to enter the subset of the market

# End user feedback

1. Attack Team : Fighting Fires.

2. Rapid Intervention Team: Assist, Search & Rescue.

3. Existing Equipment, Established Procedure, and Training.

4. How TrueSight Adds Value.

5. Positive Response.

# Future Improvements

1.Real Time Communication

2.Optimization : Decrease Bulk,  Miniaturize

3.Energy Efficiency.

4.Improved sensor I.e. thermal camera or short wave infrared camera

5.Real Time Data Storage.

# Timeline

| | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | ▷ **Idea and Proposal** | **12 days** | **Fri 9/11/15** | **Mon 9/28/15** | |
| 6 | ▷ **Define Specs** | **33 days** | **Tue 9/29/15** | **Thu 11/12/15** | **4** |
| 12 | ▷ **Hardware Rev0** | **12 days** | **Wed 11/4/15** | **Thu 11/19/15** | **6** |
| 16 | ▷ **Sofware Implementation** | **16 days** | **Wed 11/4/15** | **Wed 11/25/15** | **6** |
| 21 | ▷ **Mechanical Mounting** | **2 days** | **Fri 11/27/15** | **Mon 11/30/15** | |
| 25 | ▷ **System Integration** | **10 days** | **Tue 12/1/15** | **Mon 12/14/15** | **21** |
| 29 | ▷ **System Testing** | **3 days** | **Tue 12/15/15** | **Thu 12/17/15** | **21,25** |
| 33 | ◢ **Final Report and Presentation** | **2 days** | **Fri 12/18/15** | **Mon 12/21/15** | **29** |
| 34 | Demo Presentation Prep | 2 days | Fri 12/18/15 | Mon 12/21/15 | |
| 35 | Demo Day | 0 days | Mon 12/21/15 | Mon 12/21/15 | 34 |

# Lessons Learned

- Rapid Prototyping

- Team Collaboration

- Values of Planning, Scheduling, and Meeting

- Linux Programming

- Importance of Documentation

- Working towards your own goal is a great motivator

# Closing Remarks

Created a successful project, but can be improved

Most of main functionalities achieved

Good team environment and communication key to success

# Acknowledgements

- Friends & Family

- Fireman Jason (Fire Hall 3)

- Andrew Rawicz

- Steve Whitmore

- TAs

# Questions

# References

[1]Frost & Sullivan, "Frost & Sullivan," 20 June 2013. [Online]. Available: http://www.frost.com/prod/servlet/press-release.pag?docid=280118803. [Accessed December 2015].