# FLIR Automotive Night Vision System

**Team Members**: Robert Abbott, Westley Anastasio, Patrick Zhao
**Mentors**: Ilan Ben-Yaacov, Louis Tremblay
**Sponsor**: FLIR Inc.

NoctIR – Your Eyes at Night

UC SANTA BARBARA engineering

FLIR

## Abstract

The purpose of our Senior Capstone Project '14 is to take an already existing FLIR product and augment its design to make it more affordable and accessible to the public. The original PathfindIR, which is an aftermarket version of thermal imaging cameras in high-end cars, are expensive and requires a substantial amount of installation due to all the wiring components. Our product will eliminate the cost and issues involved in the wiring and installation process by providing the PathfindIR wireless data transferring capabilities.

The existing PathfindIR system includes a thermal camera connected to the ECU board. The ECU board receives serial video data from the camera which it then processes and outputs analog data to a 7 inch LCD Monitor.

## Operation

In our new design for the existing PathfindIR, we will be adding three main components which will be implemented on a PCB (top board) separate from the original ECU board (bottom board). The first component is the video decoder. The video decoder turns the analog video to a basic digital format. The data from the decoder is then transmitted to a DE0-nano FPGA. The FPGA turns the raw digital data into the YUV video format. The YUV video is then sent to the third component; a Redpine Signals WIFI Direct chip. The WiFi chip then transmits the video data to an Android smartphone.

The three additional components are combined on a single printed circuit board which connects to the ECU board to get the analog video data. The board is referred to as the 'WIFI Board' and it goes in the same enclosure as the ECU board that will sit behind the front bumper of a car.

The WiFi board has the video decoder and DE0-nano dev. board on one side, and the WIFI chip on the other side. The WIFI chip is isolated on one side of the WIFI board to allow the board's ground plane to shield it from EMI interference caused by other electronics in the system. The antenna of the WiFi chip is placed below a plastic FLIR logo to allow transmission of the signal outside of the enclosure.

## Powering

Two options of powering the system which is provided by the battery of the car *(Fig. 2)*. Option one is that the WiFi board will be constantly powered which will control the power flow to the ECU board as shown in the designed PCB. Since the WiFi board has miniscule power requirements, leaving it on does not drain the car battery at a significant rate. Option two is that eh WiFi board is connected to the ignition section on the battery, eliminating the battery drain of our device.

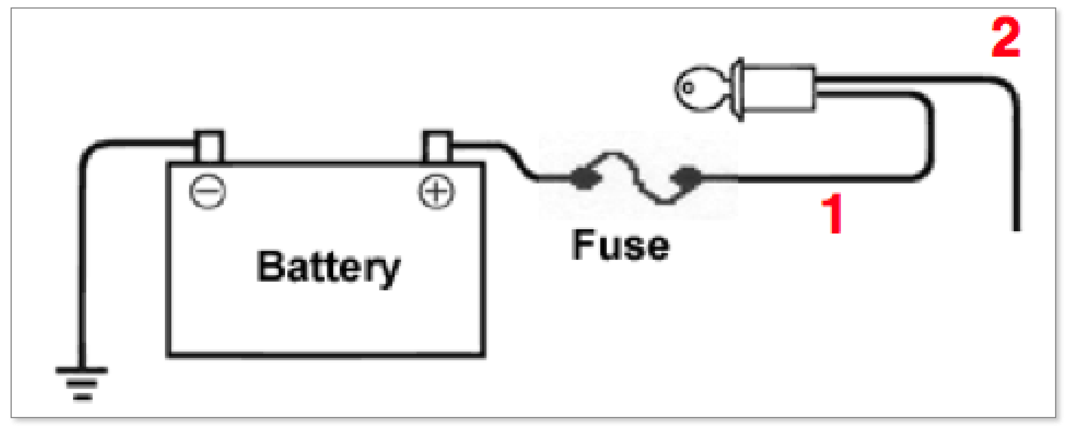



*Figure 2: Power Implementation*

## Existing PathFindIR

*Figure 3: Mounted Product*

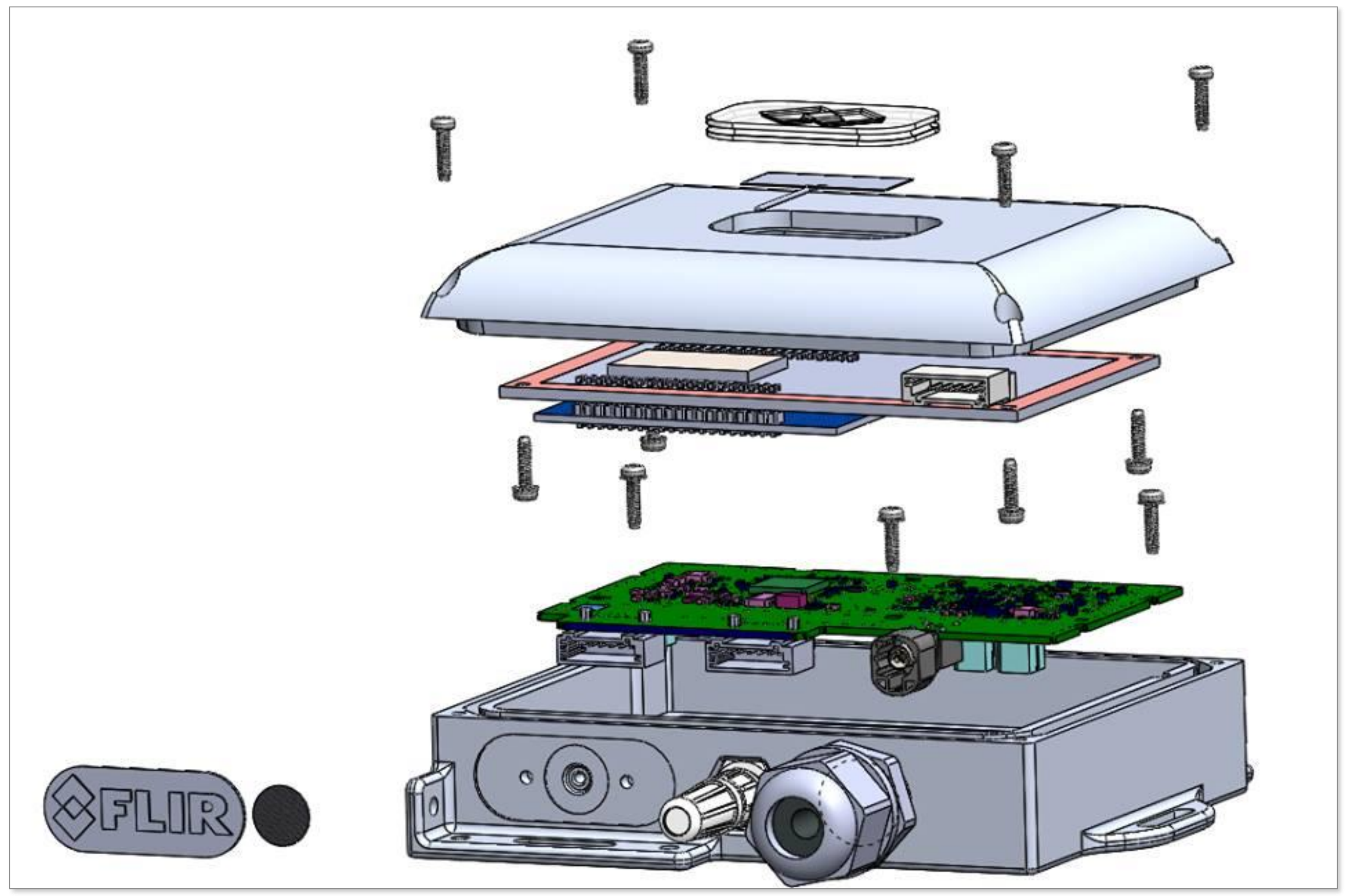
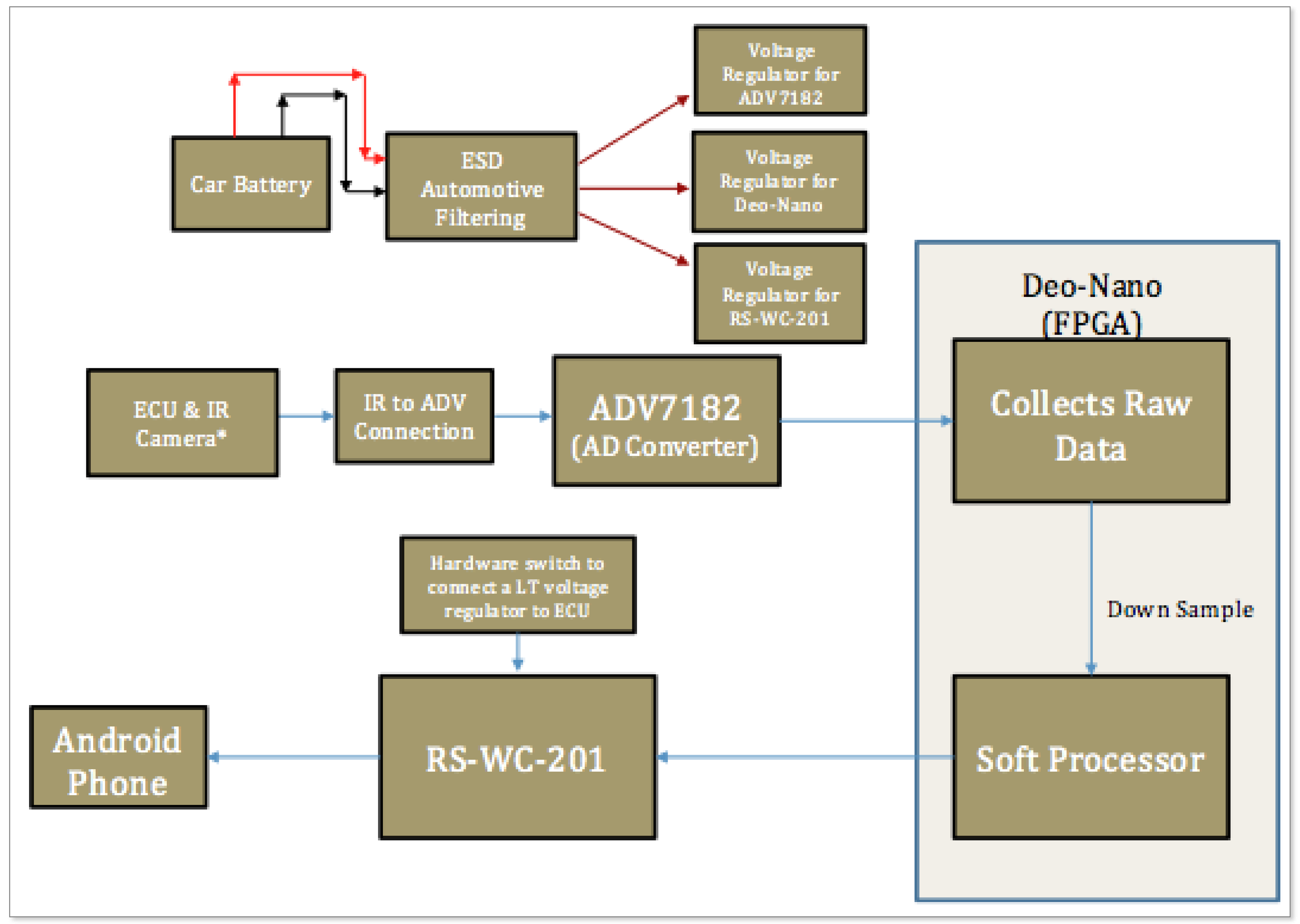


*Figure 1: Exploded View of the Product*

## WiFi Board Layout →



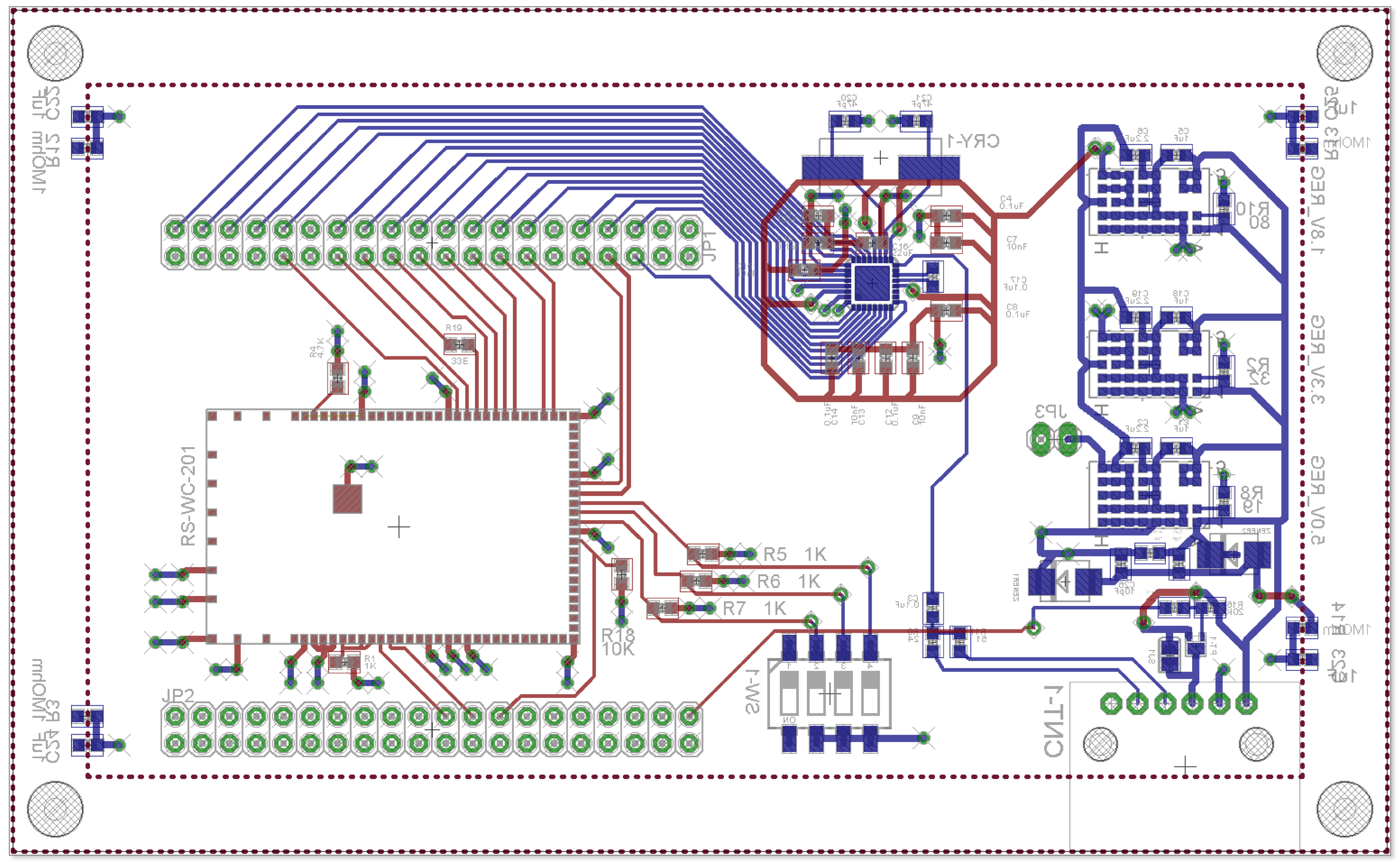

## Design Challenges

- WiFi direct and android video streaming.
- Memory and performance limitations of the FPGA.
- Video decoder and wireless module requires complex firmware and extensive operating procedures.

## Future Improvements

- Increase memory on FPGA. This will allow more of the image to be stored on the FPGA at one time which will help facilitate the streaming process, and make it possible for the stream to function even at lower data rates.
- Develop a software solution that enable the use of an Android app to view the video on a mobile device rather than a laptop. This would require the use of WiFi Direct, which was our original plan.
- Eliminate the ECU board so that the system only converts directly to a compatible streaming video format The current ECU takes the digital data and converts the data to analog. This will decrease system latency and decrease cost of the system.
- Implement a more powerful processor than the FPGA to allow faster image processing, so the stream can be sent without decreasing the resolution of the image provided by the camera.

## 4-Layer PCB Design



## Acknowledgements

- Dr. Ilan Ben-Yaacov
- FLIR Inc.®
- Louis Tremblay
- Vicki Ben-Yaacov
- MyroPCB©
- Redpine Signals, Inc.®