

Team B6 - EyeSPy

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Use Case

- A Camping Perimeter Security System to monitor surroundings
- Current solutions are **costly, internet dependent**, and **not suited** for **wilderness** use cases
- ECE Areas: Signals & Systems, Hardware Systems, Software Systems



Trip Wire Based Security System



Trail Camera Security System

Requirement #1

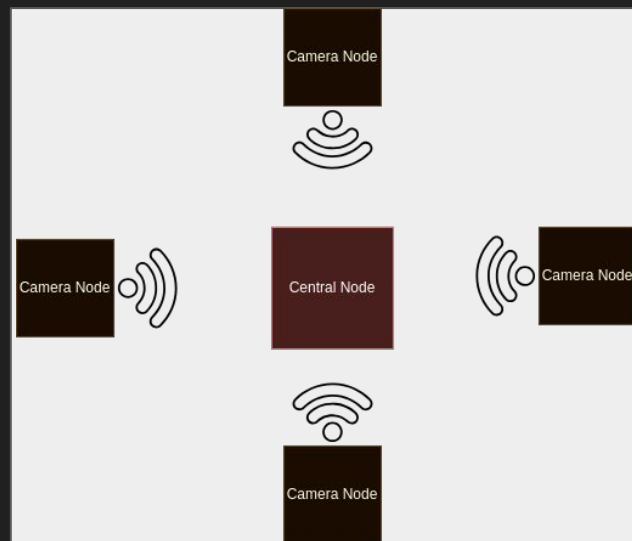
Continuous Streaming from All Cameras

Motivation

Security systems must monitor **all camera streams simultaneously**

Sub Requirements

- Stream 240p - 10Hz streams from 6 cameras
- Drive a 720p - 60Hz display
- Less than 10% dropped frames



Requirement #2

Portable Camera Nodes

Motivation

Outdoor scenarios require an **easy setup** and **quick teardown process**

Sub Requirements

- Wireless communication between camera and receiver
- 24 hours on battery power
- Plug-and-Play operation

Requirement #3

Reduced Costs Compared to Alternatives

Motivation

Existing systems are **expensive** and are **incompatible** for campsite surveillance

Sub Requirements

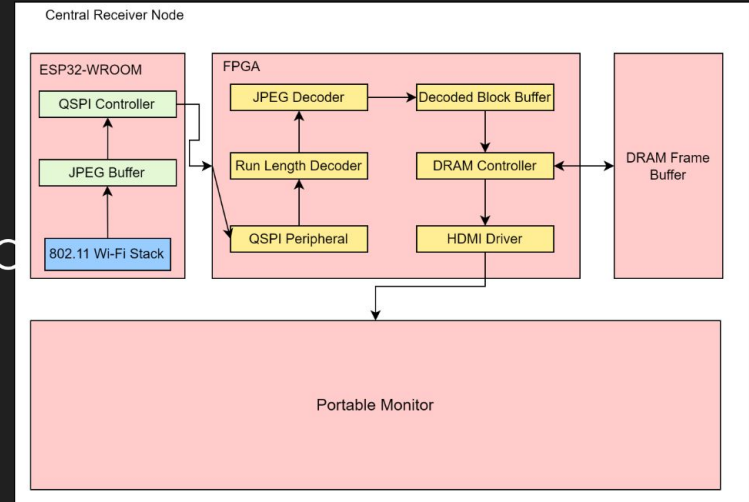
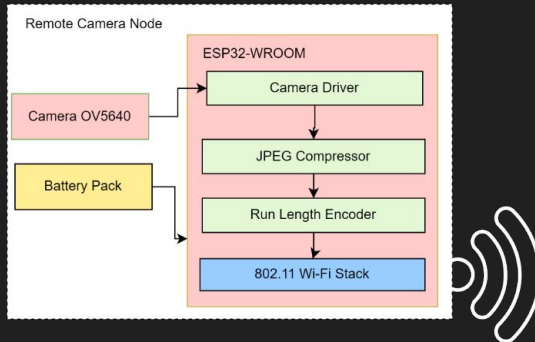
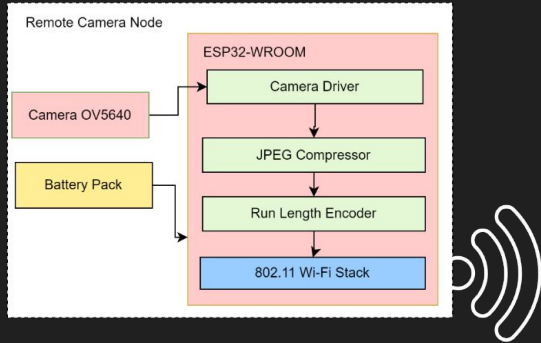
- Cost of prototype camera node < \$50
- Cost of prototype receiver node < \$100
- Use only Open Source Toolchains

Technical Challenges

How do we...

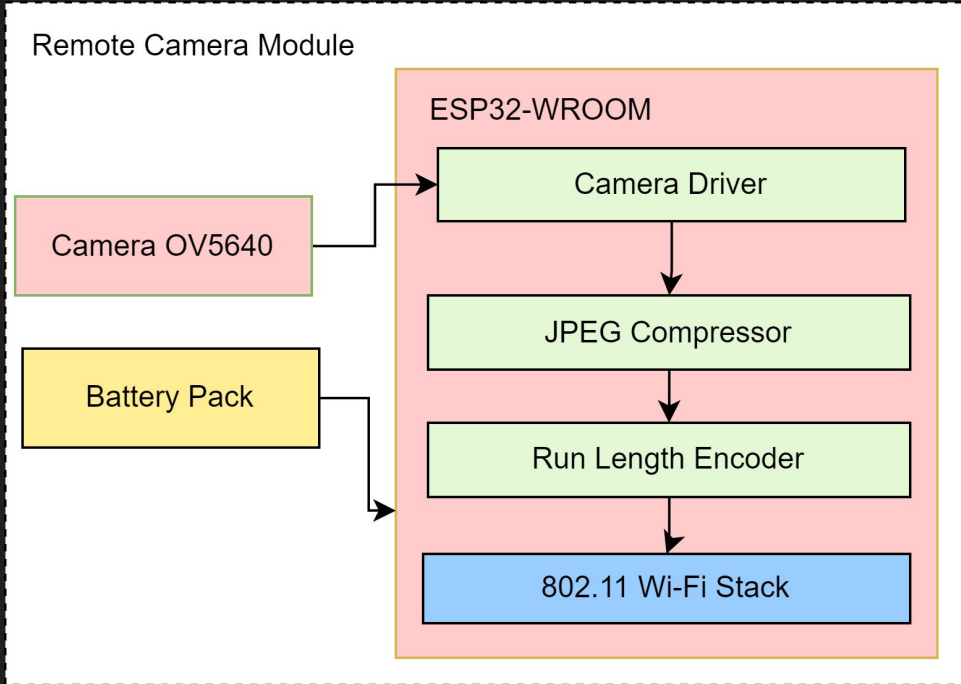
- **Compute** frame compression fast enough
- **Stream** enough data over the wireless connection
- **Decompress** all the incoming frames fast enough
- **Optimize** performance to minimize power consumption

Solution Approach



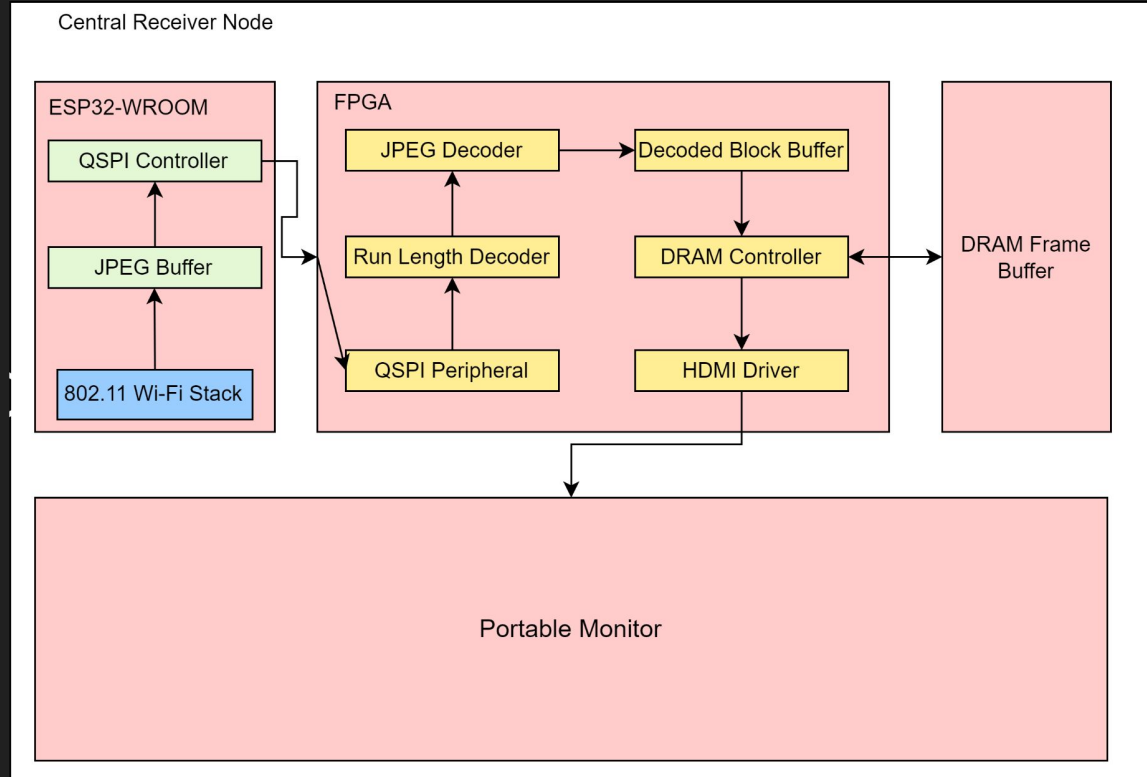
The Camera Node

- 5MP OV5640 Camera
- LiPo Battery Pack
- Wireless ESP32
- Custom software stack for fast JPEG compression



The Receiver Node

- Wireless ESP32 Access Point
- QSPI Interface to Open Source FPGA
- FPGA Accelerated JPEG Decoding
- Portable Monitor to display video streams



Testing & Verification

- **Run Length:** ensure camera nodes can run for 24 hours on battery
- **Wireless Streaming:** measure transmitted and received frame counts
- **Display Driving:** ensure monitor detects stable and clear HDMI input
- **Performance:** measure throughput of compression and decompression
- **Scalability:** ensure above tests pass with at least 6 camera nodes

Division of Labor

- Camera Node - Michael Lang
- Receiver Node ESP32 - Neelansh Kaabra
- Receiver Node FPGA - Varun Rajesh
- Testing and Verification - All
- Deliverables - All

Conclusion

- Proposed a **portable security system**
- **Cost effective** and **easy-to-setup**
- Includes features not commercially available
- An **extensible platform** for future development