

NaSTA Awards 2018

SUSUtv Written Submissions

Technical Achievement

WiFi-Based Camera System for Mid-Range OB

Wireless camera solutions are typically beyond the budgets of student television. We wanted to find an affordable solution with acceptable quality. SUSUtv live broadcasts are 720p on Facebook, hence this was the benchmark, with ideally 1080p in future.

Equipment can be obtained cheaper than commercially. There's a wide range of compatible cards with specific Atheros/Ralink chipsets.

- Transmitter (£68)
 - Raspberry Pi 2/3: £35
 - Compatible WiFi card (2+ antennas): £28
 - Power supply (5V min 2A): £10
- Receiver (£20)
 - Linux-based OS
 - Compatible WiFi card (2+ antennas): £20

This work builds on the EZ-WiFibroadcast system developed and released as open source by borteK. The system allows transmission of HD-video over routerless WiFi connections with 7km line-of-sight. This is achieved via packet injection mode in WiFi cards to increase payload above normal standard. By default, the code is designed for use with a RasPi camera.

Receiver Modifications

How the system could be connected to a switcher/streamer was considered first.

- A Pi, directly outputting video signal to a switcher via HDMI: least control, maximum ease-of-use.
- A Pi acting as a receiver, e.g. high up to receive signal from a distant outdoor camera, then transmitting video over TCP Ethernet, where it can be routed to an ATEM via HDMI or direct to OBS Studio/Facebook.
- Directly to workstations running Linux OS, with video routed to a connected switcher or direct to Facebook/OBS Studio.

The first option is easy to implement in EZ-Wifibroadcast by small script changes on the receiver to forward video. Raw H.264 frames can be decoded by workstations (ffmpeg/gstreamer) and routed to appropriate destinations.

The second required a custom kernel (to incorporate changes to WiFi card system drivers to allow for packet injection). Additional changes are required to build a custom "regulatory

domain” for the drivers to work correctly.

Testing

Broadcast quality was tested on two platforms.

First: a multicopter, range 100m+ even without line-of-sight. This makes it ideally suited to outdoor environments, where 200m cable runs are impractical but wired internet is unavailable or unnecessarily complex. The software also supports multiple WiFi adapters/antennae.

Second: aboard a 2m boat in the HydroContest alongside traditional 5.8ghz systems (maximum 480p). This showed a marked improvement in quality. Reflections from the water caused poor signal quality after 100m so testing will be conducted with larger antennas to work around this.

Conclusion

The system showed good 720p range, and as WiFi quality improves, 1080p will become possible. Operating environment has a significant influence on achievable quality, so line-of-sight areas free of signals allows greatest performance. Pre-configuration allows non-experts to operate just by powering on. Greater understanding is required for single-camera operation.

Non-Pi Cameras

There was no capture card available during testing, but any supported by RasPi would allow use of any HDMI-out broadcast camera. We also added code to send captured frames via the same programme as the native camera. This would improve image quality over official cameras (quite poor by broadcast standards) with no increase in bandwidth.