Live Video Streaming via Stand-Alone Software Defined Radio for the Wright State University High Altitude Balloon

Progress Report II

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1. INTRODUCTION

1.1 PURPOSE

This report documents the up to date progress of Team Live-Video. Digital live video streaming; using a standalone software defined radio (SDR) is the focus for this project.

1.2 Background

Team Real-Time Video submitted a proposal for the digital live video streaming project that involved using standalone software defined radio (SDR). The proposal was accepted on January 16, 2012. The focus for this project is to provide digital live video streaming for a High Altitude Balloon (HIBAL) launch scheduled by the end of this quarter. The E100 purchased from Ettus Research is a standalone SDR does not require a laptop or any computer aided device. It is designed with its own FPGA configuration which the received data will be processed. This project will provide the HIBAL team the capability with a wireless digital live video streaming communication system. The HIBAL team will benefit from the live video streaming for future scheduled HIBAL launches. The primary benefit that the E100 provide is that it can be easily modified for the desired signal to transmit. Parameters, such as, the center frequency, data rate and the type of modulation are examples of some configurations that can be modified.

Our team is the first EE HIBAL team to attempt to transmit digital live video streaming via HIBAL launch. The digital live video streaming will provide the HIBAL team real-time data that will provide the HIBAL team to monitor future launches real-time.

Team Live-Video has expanded Team Radiohead’s project and focused on the ability to create a wireless digital real-time video transmission communication system. Team Radiohead was able
to successfully transmit wireless digital video up to 500ft on the ground. Their wireless system consists of two laptops and USRPs. Our team has modified the system and implemented a standalone SDR operating as the transmitting component for our system, where the receiving component is a USRP1 that is connected to a laptop. The E100 is scheduled to be installed onto one of the HIBAL’s packages. The E100 and battery pack satisfies the weight restriction for the payload and provides a viable solution for a wireless live video streaming communication system for the HIBAL team.

Team Live-Video has made great progress with this project. The E100 has the capability to transmit wireless digital live video streaming to approximately 2/3 frames per sec. The wireless digital streaming system has been tested up to 2800 ft. line-of-sight. We are preparing to implement the wireless digital communication system for a future launch and record real-time digital video streaming. The range of the video transmission and the distance is the main focus for testing the system via the future HIBAL balloon launch. Our goal is to transmit and receive live digital video transmission up to 100,000 ft. A HIBAL launch is scheduled by the end of this quarter and the results will provide us valuable data about the range and distance that our communication system is designed for. Future EE teams will have the foundation for this wireless communication system to improve the frames rate and the overall performance.

1.3 SCOPE
This report provides the status of all tasks described in the project abstract project schedule, This includes the following:

- Purchased the E100 and the equipment that is needed to complete our project.
- Configure the E100 to transmit digital live video transmission.
- Install the webcam with the E100 to provide video the video data for transmission.
- Install the E100 on HIBAL package for a scheduled launch.
2. STATUS

2.1 TASK COMPLETED

2.1 Task completed

Task 1: Purchased the necessary equipment
- Purchased the E100; a standalone Software Defined Radio (SDR). No computer is needed to connect with the E100. It is designed with FPGA technology for processing data. This is the first standalone system that has been implemented for the HIBAL project.

Task 2: A 1.285 GHz Yagi antenna has been designed and built for the receiving USRP
- The antenna for the receiving USRP has been properly matched.
- The operating frequency for the E100 is 1.285 GHz.
- The input gains for the Yagi antenna of 1.285 GHz, 23 cm band and has a gain of 14dB.
- The USRP1/Laptop receiver requires a Yagi antenna that has been designed to receive RF signals transmitted at 1.285 GHz.

Task 3: Established a standalone power supply for the E100
- Lithium-Ion 11.1V 4400mah battery pack provides adequate power to the E100.
- Castle Creations CC-BEC PRO Battery Eliminator Circuit. The lithium-Ion battery provides 11.1V 4.4 amp/hour. The E100 requires 6V. The Pro Battery eliminator regulates the 11.1V 4.4 amp/hour battery pack to the required 6V that is needed to operate the E100.
- The battery pack connected to the CC_BEC PRO Battery Eliminator Circuit was tested for endurance. The battery pack was depleted after 4 hours.

Task 4: Life Cam HD-5000 Web Cam
- Web cam is operational with record capability.

Task 5: Live-Video Streaming
- VLC software installed onto E100 and receiving USRP1.
- Wireless digital live video streaming is operational.
- 2/3 frame per second
- GMSK modulation
- Operating frequency is 1.285 GHz
- Tested live digital video up to 2800 ft.
- Recording digital live video capability

Task 6: Battery Test
- Cold test the 11.1V Lithium –Ion battery pack.
- Endurance test the 11.1V Lithium-Ion battery pack.
Task 7: Antenna design for the E100
- An Omni-directional ¾ wavelength antenna is used on the transmitting SDR.
- 50 ohm impedance and a one to one gain.

Task 8: Designed a platform for the E100
- Hard-wired the cables and connectors from the E100 to a wooden platform.
- Use hot glue to secure cables to the platform.

2.2 Task Remaining
- Install the E100 onto the HIBAL package and launch the balloon to capture live digital video streaming.

3. Conclusion
The Live-Video Team has made great progress with the digital live video streaming. We currently have the ability to transmit and receive digital live video streaming. We are able to record and playback the live video transmission. Live digital video streaming has been tested up to 2800ft and is scheduled to test for longer distances. The Live-Video Team is very optimistic for implementing digital live video transmission via the next HIBAL balloon launch. Our final report will provide details and the process for the project that we have successfully tested and implemented for the HIBAL balloon team.

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