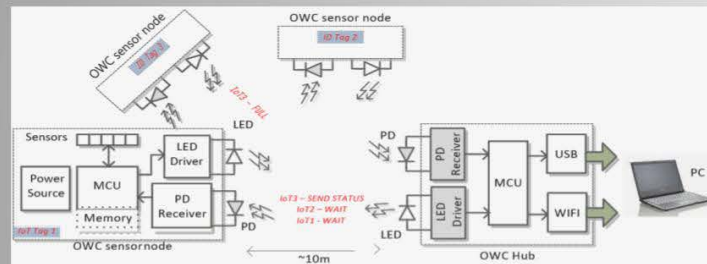


Team Flash-IoT : Wei Hu(EE) Xueren Wang(EE) Zhicai Li(EE) Yuhang Dai(EE) Yanqin Huang(EE)

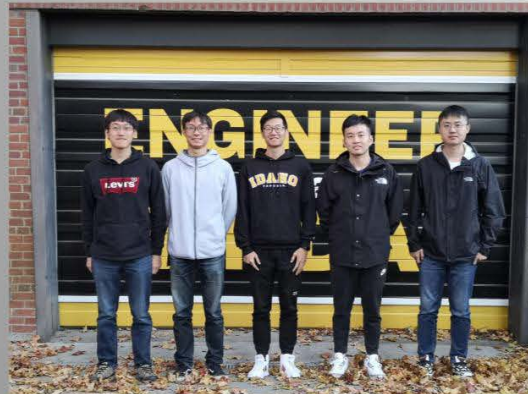
Introduction

Life at the early 21st century takes place simultaneously in physical and cyber space. As the demand for data, heavy wireless applications and services are increasing, the RF spectrum will get more congested resulting in slower wireless browsing or worse. It is expected that massively deployed IoT devices will provide data traffic that would not be met by only RF based wireless technologies.



Project Goal

The project aims to develop a low-power Internet-of-Things (IoT) enabled smart sensor node that is capable of generating, processing, and storing locally generated sensor data (i.e. position, identification, sensory info, etc.) and communicating through visible spectrum to an optical wireless communication (OWC) hub.

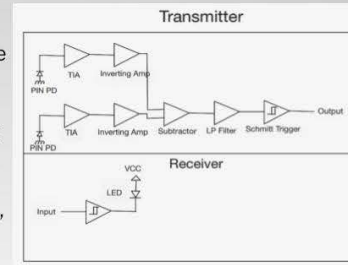


Sponsor: Dr. Suat Ay(UI ECE VSRG)
Instructor: Dr. Feng Li

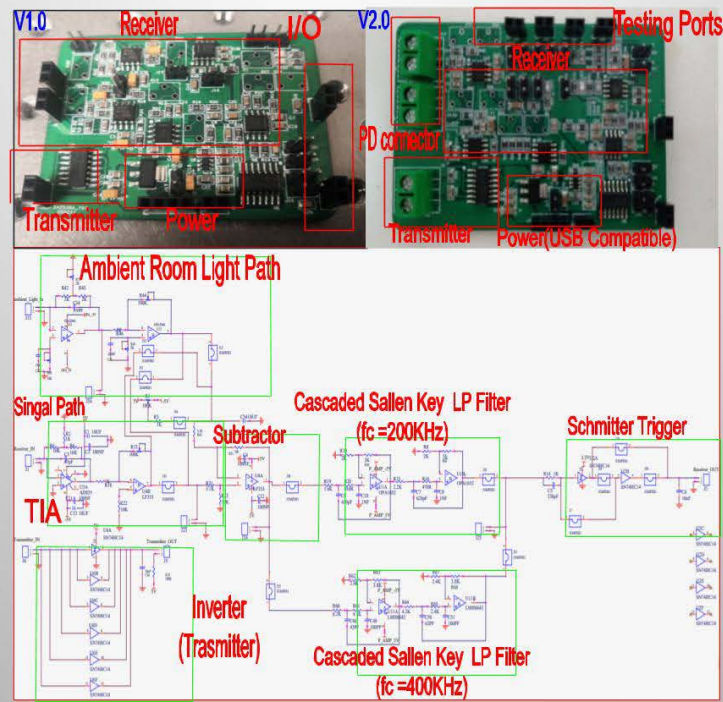
Final Design

The right figure shows the circuits design for our TR module which is the core part of the project.

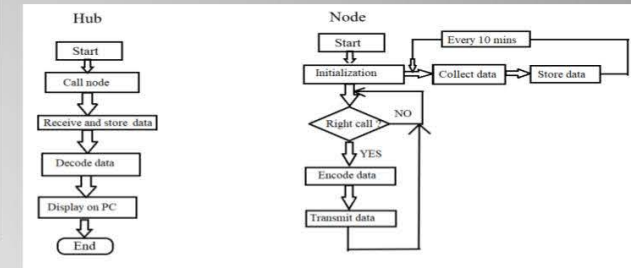
The top PIN PD samples the ambient room light noise and the bottom PIN PD receives the optical signal. Then, the ambient room light noise is subtracted from the signal after both being amplified. The Low Pass Filter is used to remove the aliasing ($f > 400\text{kHz}$) due to the light reflection. The Schmitt trigger works as a single bit ADC. To transmit the signal, multiple schmitt triggers in parallel are used to drive the LED.



The TR module V1.0 was fabricated and tested. To improve the speed performance as well as reduce the complexity of setup and debugging, we had the motivation to design and fabricate the V2.0.



The figure below is our product algorithm design for Hub and node to realize intercommunication by transmitting data.

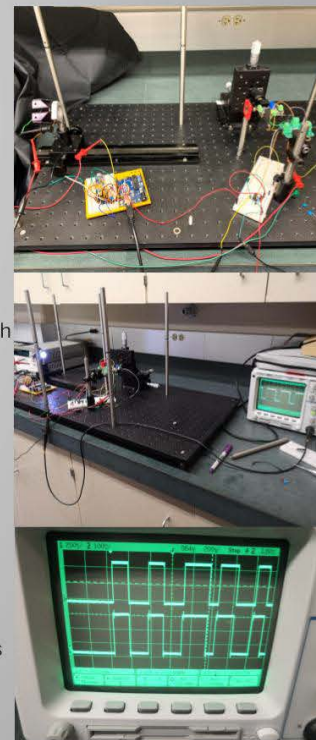


Validation

We verified that our V1.0 can communicate at 77cm at 10kbps with a convex lens. For the V2.0, the bandwidth is greatly improved. In simulation, we estimate the V2.0 can communicate at 1.4m (without optical system) with a data rate $> 200\text{kbps}$ through Pulse Width Modulation.

Conclusion

In this project, our V1.0 achieved a communication distance of 77cm with 10kbps. The power consumption is about 250mW at 50% duty cycle. However, our V2.0 shows the potential to achieve a data rate up to 200 kbps. The distance can be further improved through lens..



Special Thanks: Dr. Zouheir Rezki