Introduction to Embedded Linux and Visible Light Communication

Yigit Suoglu, 17720

Sabanci University, FENS, Electronics Engineering

Abstract

This project was done at AirTies Wireless Networks, a company which specialises in wireless network systems. First part of my internship we learned about Linux and Networks. We build a LAN messenger using what we learned. At second part, first we all come up with an idea and present it. My elevator pitch was about sending data using visible light, which was one of the selected projects. I led a team to build my idea. Our prototype is able to send with the rate of 40 bit/sec without an error. This rate can be increased easily with improvements on hardware, software (UI) and modulation. This type of communication system can be used in extreme environments, such as underwater or space, for transferring huge data in short time.

Part I : Introduction to Linux and Networks

First part of my internship consists seminars about Linux and wireless networks as well as workshops to practise some part of seminars.

Part II : Introduction to Visible Light Communications

Second part of my internship project consists an idea we build. Each 26 of us present an idea to others. We voted for the ones we like and select 6 of them. My project was one selected ones...

Rest of the poster contains some information about our project and VLC.

For more information about our work: github.com/suoglu/RGB_data_transfer

Short History of VLC

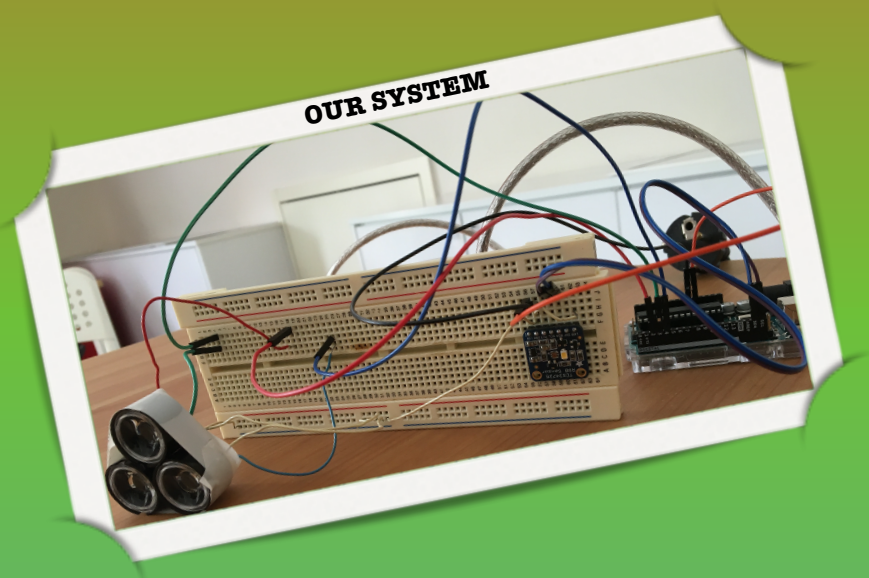
- 1880s in Washington, D.C. Alexander Graham Bell invented the photophone, which transmitted speech on modulated sunlight over several hundred meters.
- A prototype for VLC has been presented by students at Universidad de Buenos Aires in 1995.
- More recent works begin in 2003 at Nakagawa Laboratory, in Keio University.

About VLC

Visible light communication is a type of communication which uses visible light between 400 and 800 THz (780-375 nm) as communications medium. VLC is rising field and I believe in the future it will be important for us. Today there are many working models such as RONJA or Li-Fi.

Why VLC?

- Cheap
- Fast
- Secure



About Our System

Our system uses 1W RGB LEDs. Each colour represents 1 bit of data, thus we send 3 bits each cycle. To detect RGB values we used Adafruit TCS34725 sensor. And to control whole system we used Arduino Uno's. For error correction we used 8-4 hamming code.

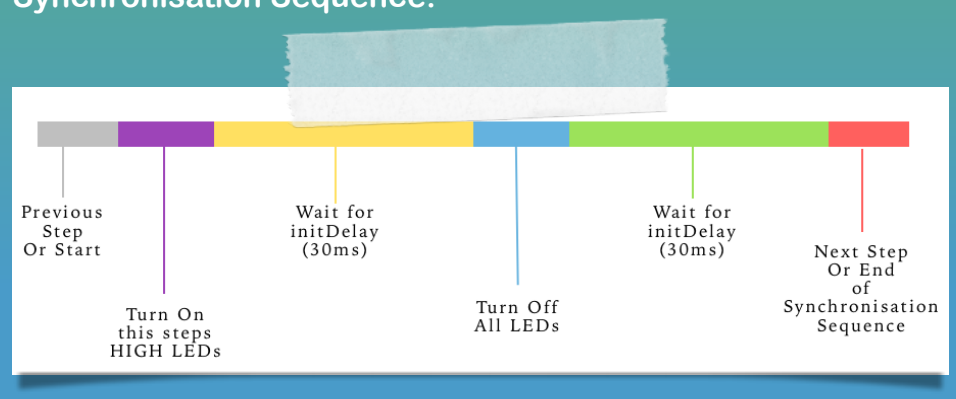
With parity bits our packages are 12 bit, thus we send each package in 4 cycles. Our packages contain ASCII codes for char's. And our system currently sends only text messages.

For our system to understand incoming lights first we show it by our calibration protocol. In this protocol we show all possibilities in order at figure calibration order, values represent RGB. Calibration protocol consist two sequence for each possibility. These sequences are calibration sequence, which saves signals and sync sequence, which provides signals.

For transmitting data we use a transmission protocol. IDLE devices waits for request or input which corresponds first step of Receiving cycle. To send data we enter our text into serial monitor, then transmitting device starts to Transmitting cycle. Other device will see request and starts Receiving cycle.

Calibration Sequence:

Synchronisation Sequence:



Calibration Order: