Proposal:

Application of IR-transmitter/receiver as an IR tripwire

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Abstract

An infrared tripwire is proposed as a novel and useful application for the transmitter and receiver modules of the Optical Uplink project. The importance of efficient and non-intrusive trip wire sensors for both defense and retail applications is outlined, in addition, the background theory for infrared sensors is described. Preliminary measured results of the Optical Uplink are provided as well as their ramifications on the tripwire sensor are discussed. Relevant qualifications of all team members is described and sufficient experience is with required technology is shown. Finally, a cost analysis for design and production of the proposed tripwire is performed.

Electrical and Computer Engineering
University of Maine

ECE - 342
November 30, 2017

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1 Introduction

This proposal is written in reply to a call for proposals for novel applications of the transmitter module of the Optical Uplink project. The overall block diagram of the Optical Uplink can be seen in Figure 1.

Figure 1: Block diagram for optical uplink [1]

The Optical Uplink project was finalized with the implementation of an LED signal transmitter with a separate receiver/amplifier module. The entire device acts as a rudimentary wireless communication device capable of transmission over tens of meters.

An infrared sensor, widely known as a tripwire, is a popular device that has many applications, notably in both military and retail. In this proposal, the use of IR as trigger method for IR will be considered, and the importance of tripwire sensors in both defense and retail will be discussed.

2 Background

In both the defense and retail fields, tracking the movement of people or groups of people is paramount. Whether it is to protect the perimeter of military installation, or to monitor the foot traffic through a grocery store isle, understanding the flow of people through an area is fundamental way of understanding a system. Being able to effectively detect, monitor, and measure the number of people crossing and do so a non intrusive manner is of extreme importance to both the military and retailers.

Literature

3 Proposed Work

4 Preliminary Results

5 Team Qualifications

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7 Conclusion

The design, simulation, and implementation of the LED driver have been explained. Lab specification required that the signal generator have a frequency of approximately 20kHz, a duty-cycle of approximately

50%, and an amplitude of at least 100mA. The LED driver takes a sinuisoidal waveform of variable duty-cycle and outputs a 50% durt-cycle square wave. The waveform is then converted to a suffeciently large driving current by the current driver. The LED driver was constructed using the following parts: a 10kΩ, 100kΩ, 470Ω, 1kΩ, 12Ω and a 10kΩ potentiometer; a MCP6004 quadrature operation amplifier; an IR1503 LED; and finally a 2N3904 BJT. A 9V battery supply is stepped down to 5V with an LM7805 voltage regulator. The frequency was 20.1kHz, with a duty-cycle of 50.1%, and an amplitude of 150mA. An important lesson about the behavior circuits including both op amps and transistors was learned. The meshing of op amps and transistors provide novel solutions to real world problems

References

[1] Doug Richardson. (2002) ”Sensors, Sentry Owls and smart dust: since the summer of 2002, Sentry Owls have been helping guard US units operating in overseas locations close to Afghanistan.” Armada International Dec. 2002: 20+. Business Insights: Essentials. Web. 29 Nov. 2017.

@articleVicaire:2009:ALS:1464420.1464429, author = Vicaire, Pascal and He, Tian and Cao, Qing and Yan, Ting and Zhou, Gang and Gu, Lin and Luo, Liqian and Stoleru, Radu and Stankovic, John A. and Abdelzaher, Tarek F., title = Achieving Long-term Surveillance in VigilNet, journal = ACM Trans. Sen. Netw., issue$_{date} = February 2009, volume = 5, number = 1, month = feb, year = 2009, issn = 1550-4859, pages = 9:1--9:39, articleno = 9, numpages = 39, url = http://doi.acm.org/10.1145/1464420.1464429, doi = 10.1145/1464420.1464429, acmid = 1464429, publisher = ACM, address = NewYork, NY, USA, keywords = Applicationsofsensorandactuatornetworks, andlongevity, connectivity, coverage, energyandresourcemanagement, ene$

[2] NPTEL.(2017) Schmitt Trigger [Online]. Available: http://www.nptel.ac.in/courses/117107094/lecturers/lecture_18/lec

[3] N.W. Emanatoglu.(2017) Lab #4; LED Driver [Online]. Available: http://davidkotecki.com/ECE342/labs/ECE342_2017_Lab4_Briefing.pdf

[4] Everlight Electronics. (2017) 5mm Infrared LED. [Online]. Available: https://media.digikey.com/PDF/Data%20Sheets/Everlight%20PDFs/9-IR1503.pdf

[5] ON Semiconductor. (2017) LM7805 [Online]. Available: https://www.sparkfun.com/datasheets/Components/LM7805.pdf

[6] ON Semiconductor. (2017) 2N3904 [Online]. Available: http://www.onsemi.com/PowerSolutions/supportDoc.do?type=models&rpn=2N3904