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.

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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

The final circuit is shown in Figure **??**.

In order to meet specifications, several minor changes to all circuits were made. The individual changes are discussed in their respective subsection as follows, the signal conditioner then the current driver.

4.1 Signal conditioner

4.2 Current driver

5 Team Qualifications

Ryan, Phil and Joseph have completed, at the time of this proposal, five semesters in the electical and computer engineering discipline. The most relevant skillsets for the purposes of this proposal is from the electronics course, ECE 342, which an optical uplink was simulated and designed by this team. This course focused primarily on microelecronic circuits and in-depth study of MOSFET's, BJT's and their implementation in circuits with operational amplifiers.

Ryan and Phil are double majoring in Computer and Electrical engineering at the University of Maine. Both have relevant skills from coursework in Microcomputer Architecture and Design, ECE 473, which implements Verilog in design of Microprocessors, which is of use when designing hardware for the tripwire. Joseph is an undergraduate majoring in electrical engineering at the University of Maine.

6 Cost Analysis

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

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