Memo

To: Professor Pisano, Professor Alshaykh, Professor Hirsch

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Team: 15

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Subject: Preliminary Testing

1.0 Arduino to Arduino Optical Communication

1.1 Description of Test

We will demonstrate the optical communication aspect of our project by programming an Arduino Leonardo to "talk to itself" using laser communication. The Arduino Leonardo has two serial channels: Serial to communicate with the computer and another connected to pins 0 and 1 of the board (Serial1). This simple program listens for a message on Serial, then sends that message on pin 1 (Tx of Serial1). Serial1 Tx is connected to a laser, which is aimed at the photodiode in the receptor circuit. The receptor circuit's output is connected to Rx of Serial1. When Serial1 hears a message, it is transmitted to the computer's serial console via Serial.

When the circuit is setup and program is loaded, any message sent to the Leonardo should be echoed back to the computer's Serial console. The tester will type the message "Hello World!" into the computer's serial console and verify that it is echoed back to the console. The tester should increase the baud rate on Serial1 (the laser serial port) and re-perform the test until the message echoed back is corrupted.

1.2 Significance of Test

The object of this test is to test the communication aspect of our project. Since the purpose of the project is to maintain laser communication with a moving target, establishing laser communication is an integral part. A successful test will have demonstrated that the receptor circuit and laser modulation mechanism work. Going from one Arduino talking to itself to one Arduino talking to another Arduino is trivial, since it does not involve any hardware or software changes.

Moving forward, two main tasks need to be accomplished to transition from this test to the communication mechanism need for the final product:

1. Rehauling hardware to allow for higher bitrate.
2. Making sure communication distance satisfies our design requirements.

1.3 Equipment and Setup

This test will require a computer, an Arduino Leonardo, and circuit connected according to the figure below:

1.4 Data Collection

The data received by and transmitted by the arduino.

1.5 Measurable Criteria

We will be measuring whether the data we transmit is the same as the data received by the photodiodes.

2.0 Tracking

2.1 Description of Test

In this test we will demonstrate a rudimentary laser tracking mechanism. This test will use a laser (always on) mounted on a stepper motor and two photodiodes as the receiver. As the receptor moves left and right, the stepper motor should be able to follow it.

The stepper motor is programmed to turn at a constant speed. When the laser hits the left photodiode, an interrupt is triggered and the motor changes its direction to move right. When the laser hits the right photodiode, an interrupt is triggered and the motor turns left. Thus, then the receptor assembly is held still, the laser should bounce back and forth between the two photodiodes. When the receptor is moved laterally, the laser should follow it as long as the beam is kept between the two photodiodes. If the receptor is moved too quickly and the beam is no longer between the two photodiodes, the tracking mechanism fails.

2.2 Significance of Test

Tracking is the second of our two main problems in this project, and also the more difficult. While the tracking setup demonstrated during this test is primitive, it is a good base to build more sophisticated tracking mechanisms upon. This test demonstrates our ability to control the laser with a servo and to maintain a feedback loop between the receiver and transmitter using photodiodes.

2.3 Equipment and Setup

Two photodiodes taped together connected to a circuit that sends feedback to an Arduino. Stepper Motor that is currently connected to the same Arduino. Laser glued onto Stepper Motor currently powered by a constant on source from the Raspberry Pi.

2.4 Data Collection

The data would be to verify that a stepper motor changes direction when the appropriate photodiode is hit.

2.5 Measurable Criteria

The metrics we will use for this test are the ability of the laser to follow the receiver which we will move a few cm to the left and right as well as the greatest distance from the laser where tracking will work.