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[DESIGN DOCUMENT: IPOD BARCODE SCANNER]

Contents

Introduction:

I. Technical Terms Definition

Terms	Description
OEM Barcode Scan Engine (MDL 1000)	Original equipment manufacturers needing to add laser scanning capability to smartphones or any other portable devices can utilize this laser scan engine.
TRRS	A four contacts connector typically used for analog signals, primarily audio. Two channels are typically used for stereo sound output and an additional one for microphone input. They all share the same common ground.
RS232	A standard used for serial binary data bi-directional communication.
Barcode	An optical representation of a small piece of data which can be easily read by a machine.
iPod Touch	A small, lightweight, wireless-internet capable mobile device used mainly as a media player, personal digital assistant and game console.

II.

II. Executive Summary

This project's client is Marshalltown Company, a leader in construction tool manufacturing. The goal of this project is to help implement a user friendly and cost effective product for the company's warehouse employees to use. This requires a design that effectively interfaces an inexpensive barcode scanner to an iPod Touch. The obtained barcode data will be fed into the iPod Touch through the TRRS audio jack. Transferring data using the 30-pin connector is a more expensive option and thus avoided. This device will have a hardware button used for initiating a scan which then transfers the barcode data to the iPod Touch automatically. A software library will also be created for iPod Touch so that it is capable of receiving the data through the TRRS audio jack.

III. Project Description

A barcode scanning engine will scan for a barcode when the push button is pressed and will send a serial signal to the microphone input of the iPod touch. The iPod touch will sample the signal provided by the barcode scanner as a stream of bits that can be interpreted into barcode values. The barcode scanning engine will be powered through the 30-pin connector on the iPod touch. The iPod will have an

application that is listening for serial data. The application will convert the stream of serial bits into meaningful barcode values. The application will analyze the serial data sampled and determine if the serial data received is error free. If the serial data is determined to be corrupt the application will produce an error notification. Once a barcode has been successfully read the application will store the barcode information in a library. The library of successfully scanned barcodes will be queried by an existing application developed by Marshalltown Company.

System Overview:

I. Functional Requirements

Upon discussions with our client the following are what we consider functional requirements:

Primary:

- Software designed will act as a utility that must conform to an existing inventory app the client has already made
- The design must use the TRRS audio jack for communication, not the 30 pin connector
- The system must be able to be used for a consecutive 8 hours without being charged
- A physical hardware trigger must be used to initiate a scan
- When charged, the entire system must have a connected source of power (ie the user must be able to charge both the iPod and the power circuitry for the barcode engine together)

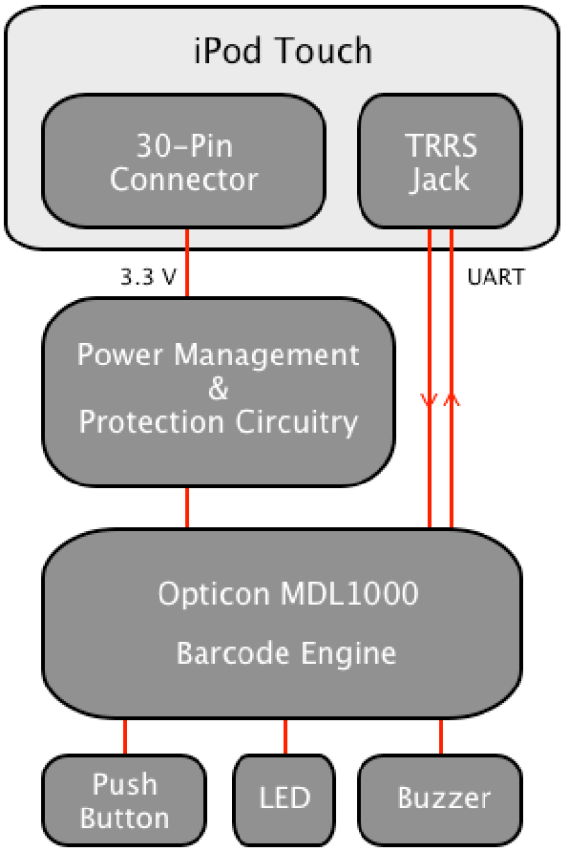
The following non-functional requirements are not deal-breaking. Without the non-functional requirements listed below, our client would still be able to use our design but would like the following considered and explored.

Non-Functional Requirements:

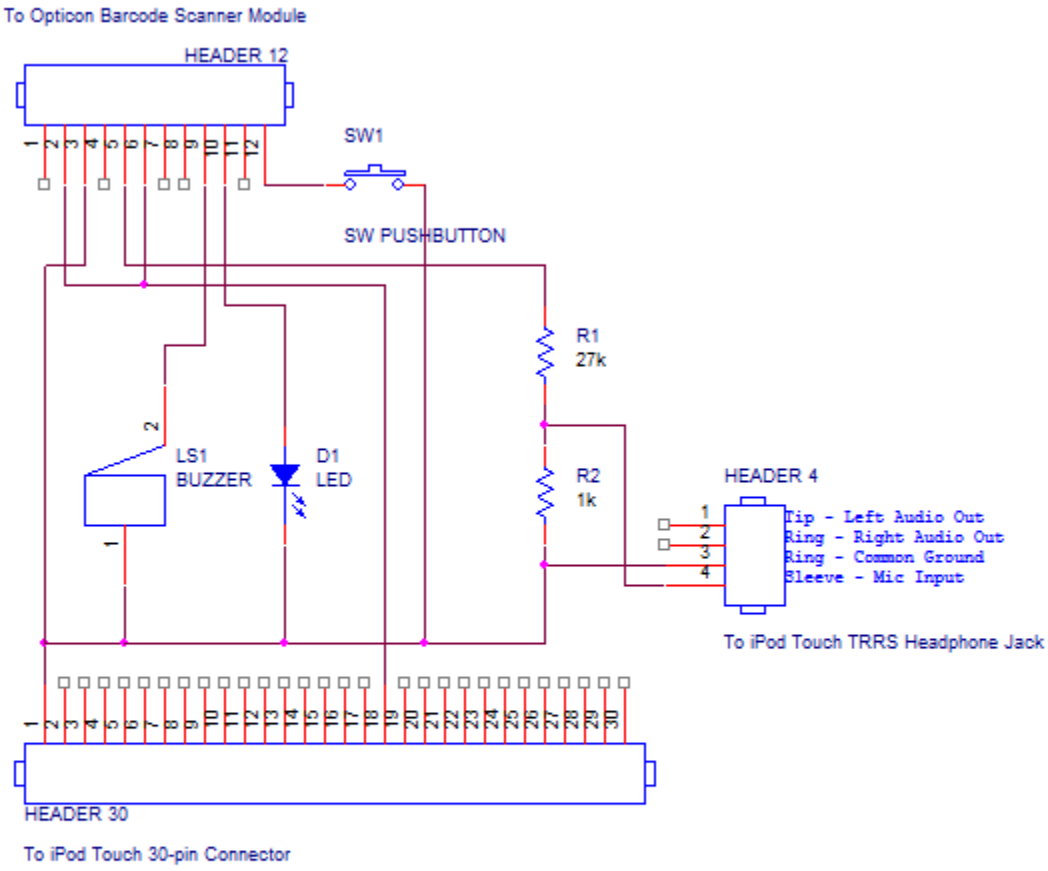
- If an external battery is used, find a way for this battery to charge the iPod when the iPod is not being charged and is running low on power
- Double level trigger for laser aiming followed by scanning
- Bi-directional communication through the TRRS audio jack to have a the iPod button work as a trigger
- Consider options for use with the new Apple portable device connector

II. Hardware Requirements

The MDL 1000 laser scan engine will read a barcode after a pushbutton is pressed. Upon a successful scan, the engine will release RS232 serial data corresponding to the barcode values. The voltage of this serial data will lowered and then sent to a male TRRS audio jack to be mated with an iPod touch. Power will be taken from the 30-pin connector on the iPod Touch. Onboard power management will be implemented to ensure safe power levels are provided to the scanning engine.



III. Schematic Diagram



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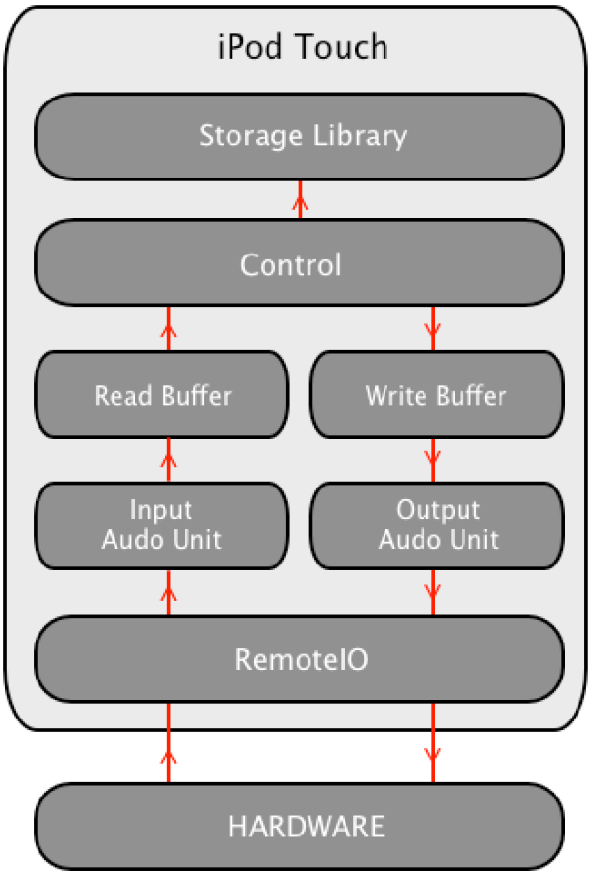
III. Software Requirement



The iPod touch receives serial signal from the barcode scanner engine through the audio jack. The iPod touch software will decode the audio signal and store the barcode value into a library on the iPod touch.

Design Details:

I. User Interface

There will be no user interface for this project. The software for the iPod Touch will be a generic library that will support the functionality to receive communications from the barcode scanner. There will be a test application that will be developed for the iPod Touch. However, this will only consist of a single text box used to display the received barcode.

II. Design Considerations and Tradeoffs

When designing the barcode scanner we had to make several important decisions that would reduce total cost and development time.

- We have eliminated the requirement of a microcontroller. Thus, saving not only the cost of the microcontroller itself but also power it would have consumed. The barcode scanner still remains fully functional without the microcontroller.
- Another consideration that we made was choosing the correct barcode scanner. We needed a scanner that was small enough that an iPod Touch case could be built around it. It also needed to be low in power consumption so that the iPod Touch would have maximum battery life. We decided on the Opticon MDL1000. This scanner fits our requirements and does not have extra functionality that is not required that would increase the cost of the device.

Project Details:

I. Standards

TRRS is a standard for a connector that carries analog signals. It is mainly used in audio devices, such as the iPod Touch. We will be using this standard because that is the connector that the iPod Touch supports. The RS-232 wire that will be connected to the audio and microphone input of the TRRS jack in the iPod Touch. This will allow serial data to be transferred across the TRRS jack so that in can be translated into readable data by the iPod Touch.

RS-232 is a standard for serial communication between devices. The Opticon MDL-1000 will send the data stored in a barcode that is scanned to the iPod Touch using RS-232. The iPod Touch does not have a traditional RS-232 port. Instead we will read the serial data directly from the iPod's microphone input and translate the data into characters that is readable by the iPod Touch.

GS1 Standard for Universal Product Code (UPC) - Barcode symbology used for tracking trade items in stores in the most common form, UPC-A, consisting of 12 numerical digits uniquely assigned to each trade item. This standard defines the formatting and encoding of UPC. This standard is used by the Opticon MDL-1000 module to read barcodes and translate them so that they can be sent via serial communication.

IPC/EIA J-STD-001 -Requirements for Soldering Electronics and Electronics Assemblies - This standard provides requirements and specifications for the manufacture of soldered electronics. When manufacturing our preliminary PCB's, this standard will be used to ensure that components that have been soldered are soldered correctly. This will provide insight and guidance as to insure functional quality and understanding when the hardware is assembled.

II. Expected Deliverables

The expected deliverable to our client, Marshalltown Company, is a complete and functional design that can easily be implemented and manufactured. For software we will be delivering essentially a library that can be used in conjunction with a current inventory iPod app our client has created. From a hardware standpoint, we will deliver at least one working printed circuit board as well as all of the design documents necessary to produce more in the future.

III. Cost

The cost of the components to our device will be under $100. Given that the barcode engine module is $60 this leaves the rest of the design to be less than $40. The current product available to our client is $500 and the main goal is to create product that is cheaper than this.