Tiny Sensor
Overview Document

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OVERVIEW.

This document describes the *Tiny Sensor* from Team Practical Projects. The Tiny Sensor board connects any sensor that varies its resistance in accordance with some physical parameter; e.g. temperature, light intensity, position, force/pressure. The Tiny Sensor alternately flashes a red and green LEDs at a rate that corresponds to the value being sensed.

The Tiny Sensor is intended for education in the following areas:
- DC electronic circuit design
- Printed circuit board design (Fusion 360 Electronics)
- Arduino programming (non-blocking)
- Programming an Attiny85 or similar "bare bones" AVR microcontroller

The figure below shows the assembled Tiny Sensor board.

Figure 1. Tiny Sensor Board.

THEORY OF OPERATION.

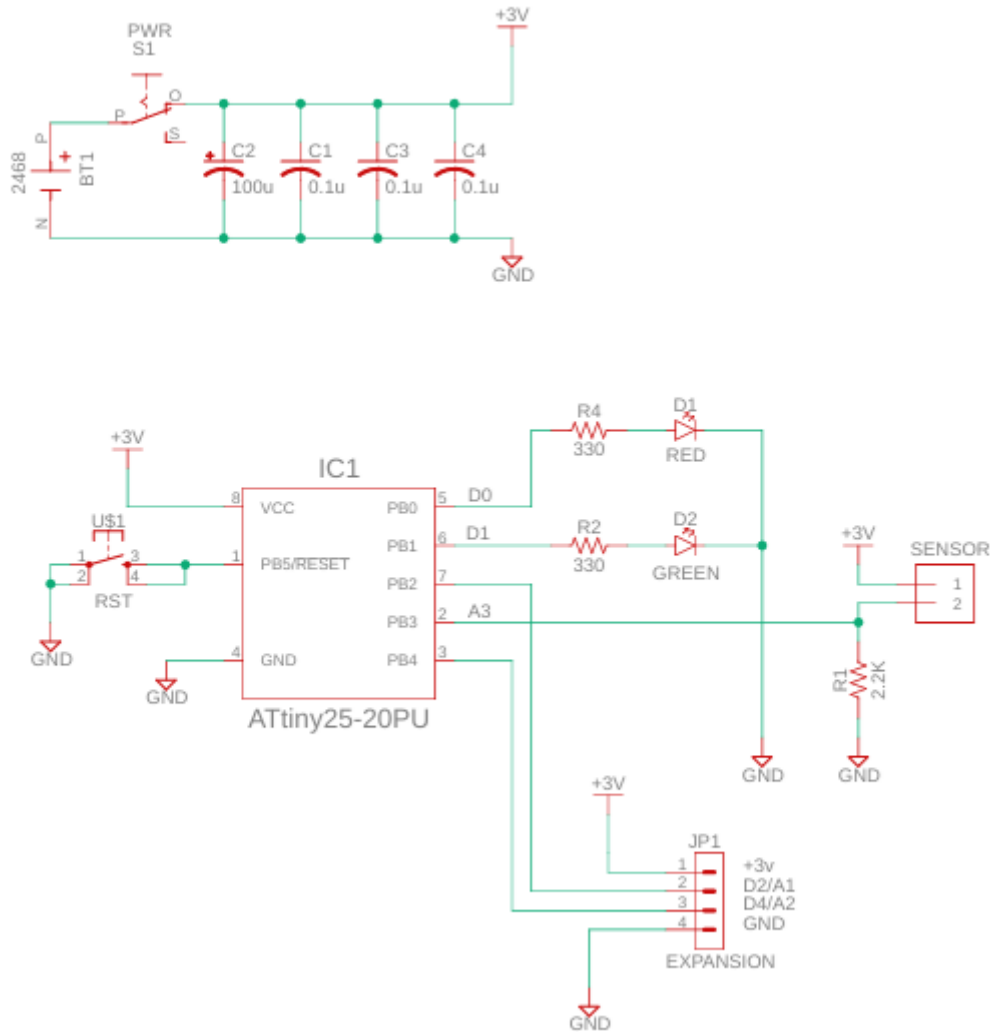Figure 2 is a schematic diagram for the Tiny Sensor Board.

Figure 2. Tiny Sensor Schematic.

The Tiny Sensor Board is powered by 2 AAA batteries. The POWER slide switch above the battery holder turns on and off the battery power to the Board.

A 2 position terminal block at the top of the Board is used to connect a resistive sensor to the Board. A Light Dependent Resistor (LDR) is shown in the photo of figure 1, but any other resistive sensor may be used.

The sensor is connected in series with a 2.2 Kohm resistor (R1) to form a voltage divider. The output from the voltage divider is connected to pin 2 (Arduino A3) of the ATtiny85 microcontroller. The microcontroller software continuously reads this voltage and maps it to a time interval to flash the LEDs on and off.

A red and a green LED are connected to the Attiny85 microcontroller via 330 ohm current limiting resistors. The red LED is driven from Attiny85 pin 5 (Arduino digital 0) and the green LED is driven from Attiny85 pin 6 (Arduino digital 1).

A pushbutton is connected to the Attiny85 !RESET line (pin 1). It resets the Attiny85 when pressed.

The remaining 2 pins of the Attiny85 are connected to a pin header at the bottom of the Board and are available for future expansion.

The Arduino source code for the Attiny85 is in the Software/Tiny_Sensor folder in this repository. The following lines of code define the minimum and maximum LED flashing times (in milliseconds):

```
#define MIN_FLASH_TIME 50  // fastest flash is 50 ms on and 50 ms off
#define MAX_FLASH_TIME 500  // slowest flask is 0.5 second on and 0.5 second off
```

The following lines of code define the expected analog read values from the voltage divider for the maximum and minimum conditions for the sensor:

```
#define MIN_ANALOG_VALUE 150  // sensor is at its highest resistance
#define MAX_ANALOG_VALUE 1000 // sensor is at its lowest resistance
```

These values were determined by experimentation for the particular LDR sensor shown in figure 1. These pre-defined values may be changed to accommodate other types of sensors.

The software is relatively straightforward Arduino code. The map() function is used to map analog values read from the voltage divider to flashing rates for the LEDs. *Loop()* calls the non-blocking function *nbFlashLEDs()* so that the sensor value may be read continuously and without waiting for flashing delays.

CONTENTS OF THIS REPOSITORY.

Top Level.

- *README.md*: the readme document for this repository

- *Terms of Use License and Disclaimer*: terms of use and licensing information for this project. You must agree to these terms in order to use the material in this repository.
- *Overview*: This document.

Documents folder.

- *Programming ATtiny using Uno As A Programmer:* A document that describes how to use an Arduino Uno (R3) to flash code to an ATtiny25/45/85 microcontroller from the Arduino IDE.
- *Tiny Sensor Schematic v1:* schematic diagram in pdf format.

Hardware/PCB folder.

- *Tiny Sensor Schematic.fsch:* Fusion 360 schematic file
- *Tiny Sensor Schematic.fbrd:* Fusion 360 board file
- *Tiny Sensor Board v1.zip:* ZIP file containing manufacturing files from Fusion 360 ("Gerber" files). These may be uploaded to a PC manufacturing company (e.g. JLCPCB) in order to manufacture the printed circuit board for the project.
- *2486 folder:* Fusion 360 library file for the AAA battery holder, from Digikey.

Software/Tiny_Sensor folder.

- *Tiny Sensor.ino*: Arduino source code for the ATtiny85.