EPIC FMS

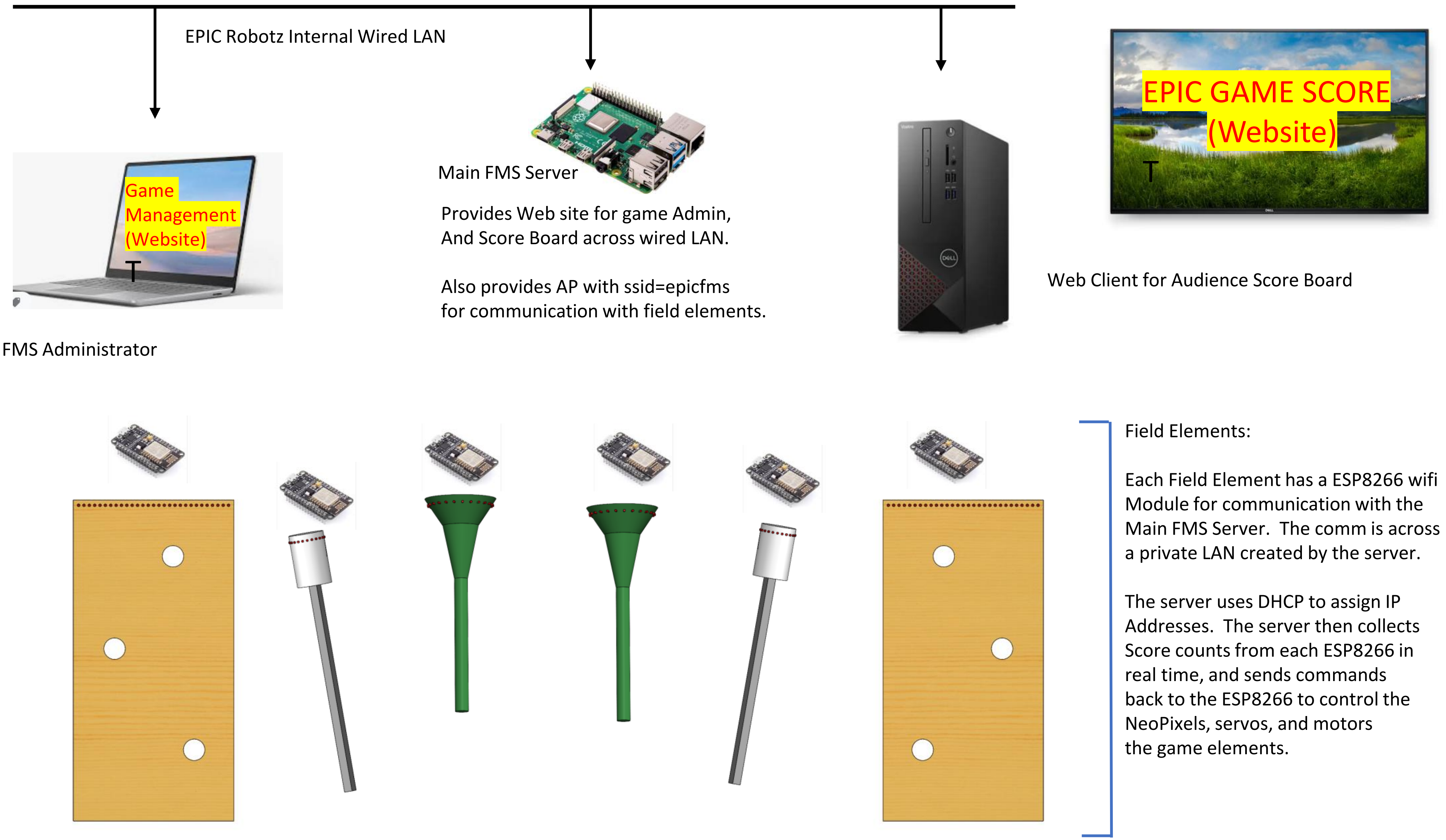
A Field Management System (FMS) for the Fall Game

Epic Robotz

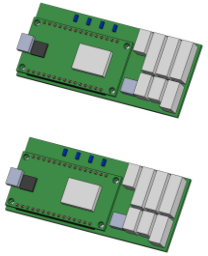
Fall 2021

This stack contains useful info about various parts of EpicFMS.

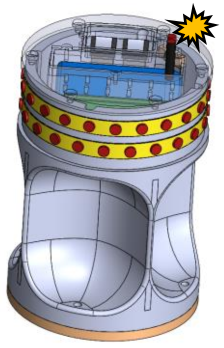
EPIC Robotz FMS System for the Fall 2021 Intramural Game



Overview of Electronics for Field Elements

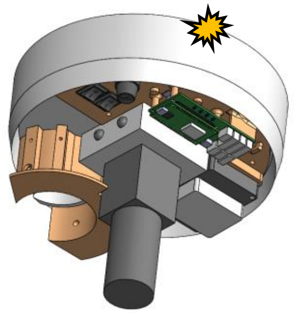


Two versions (V1, V2) of a PCB were manufactured to support EpicFMS. The schematics for these PCBs are named “Moving Target Unit, V4” and “Moving Target Unit, V5”, respectively. These feature an ESP8266 for WiFi.



Moving Target Unit

These units use V2 of the PCB, And are wired according to “Moving Target Wiring Schematic”
Power to this unit is an internal 2S Lipo battery.



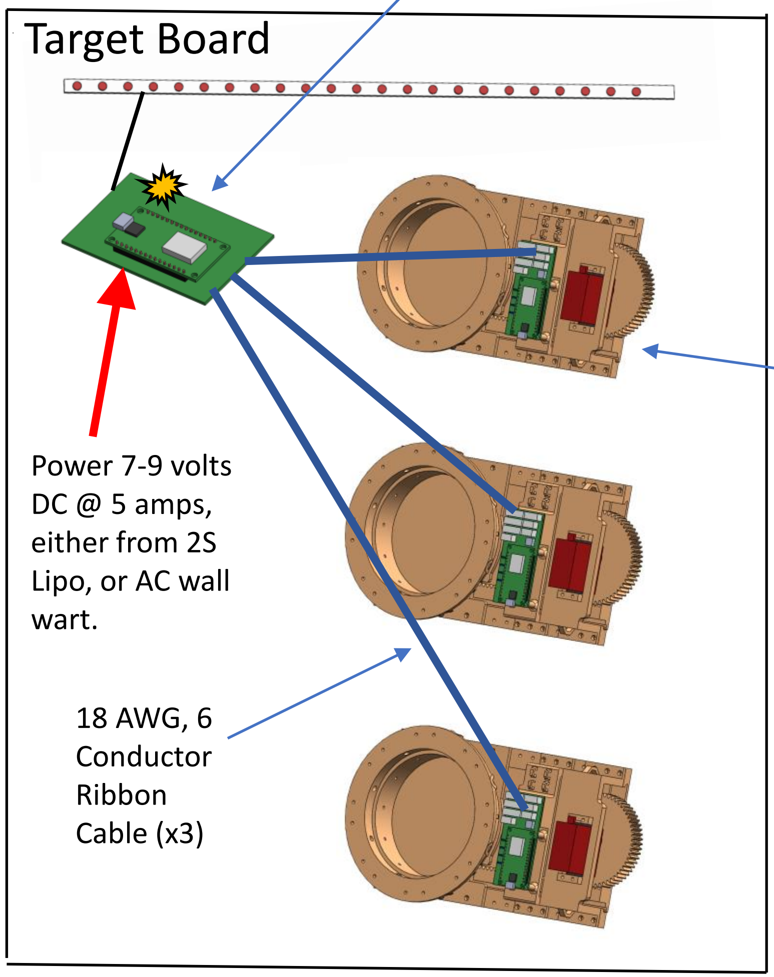
Basket Target Unit

These units use V1 of the PCB, And are wired according to “Basket Wiring Schematic”
Power to this unit is 12 volts DC @ 10 amps, either from a 3S Lipo Battery, or an AC Wall Wart.

 = WiFi Enabled Device

Target Board Conductor Unit

This is a hand soldered circuit board.
See “Target Board Conductor Schematic”



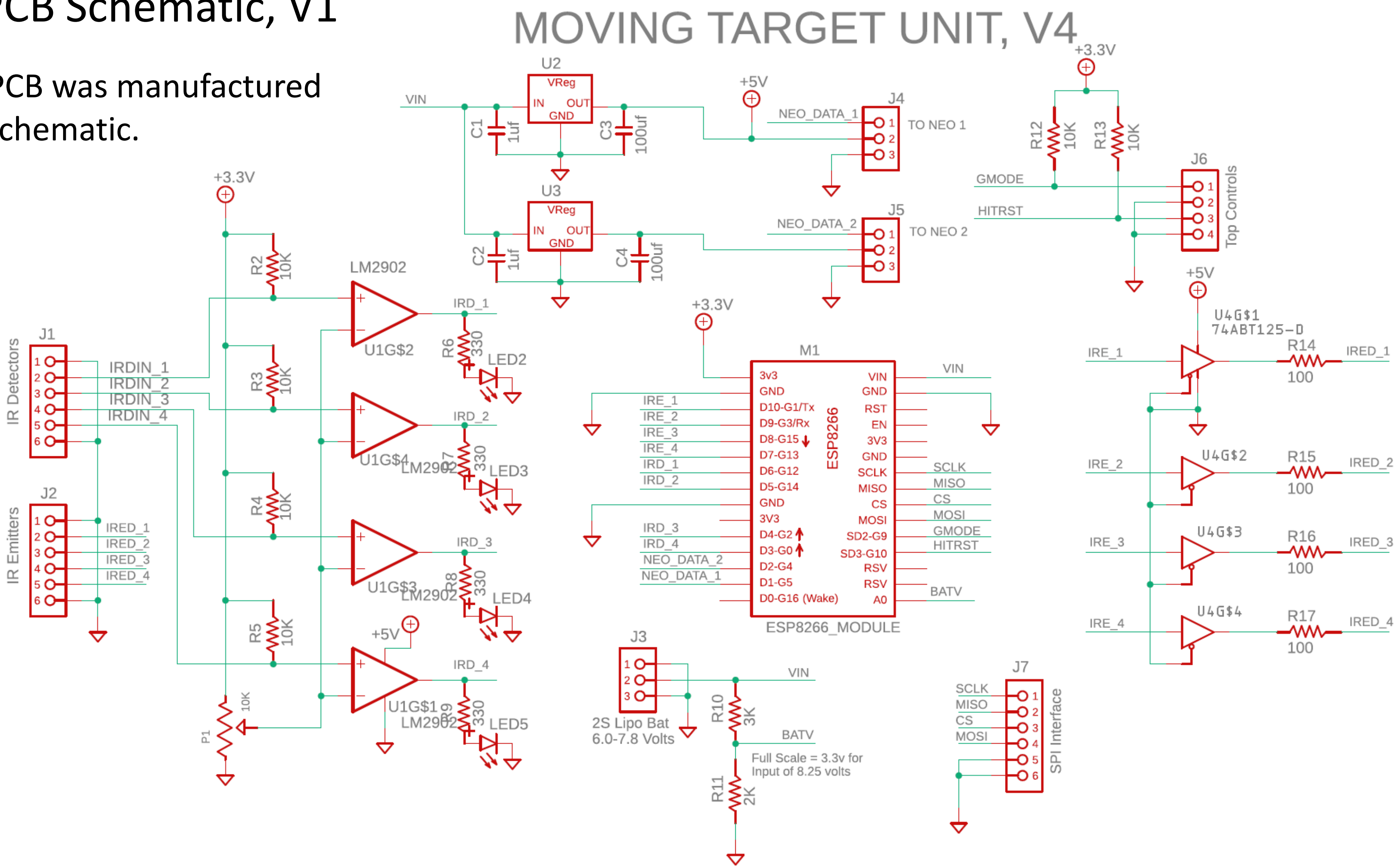
The Target Boards features 3 targets that can open and close on command from the EpicFMS server. In addition, there is a strip of NEO LEDs at the stop, also controlled by the server.

Sliding Target Unit

Each of these uses a V2 PCB, and is wired according to the “Sliding Target Wiring Schematic”
These slider units do not use their WiFi capability, but instead communicate with the Target Board Conductor via SPI over a ribbon cable. The ribbon cable also supplies power to these units.

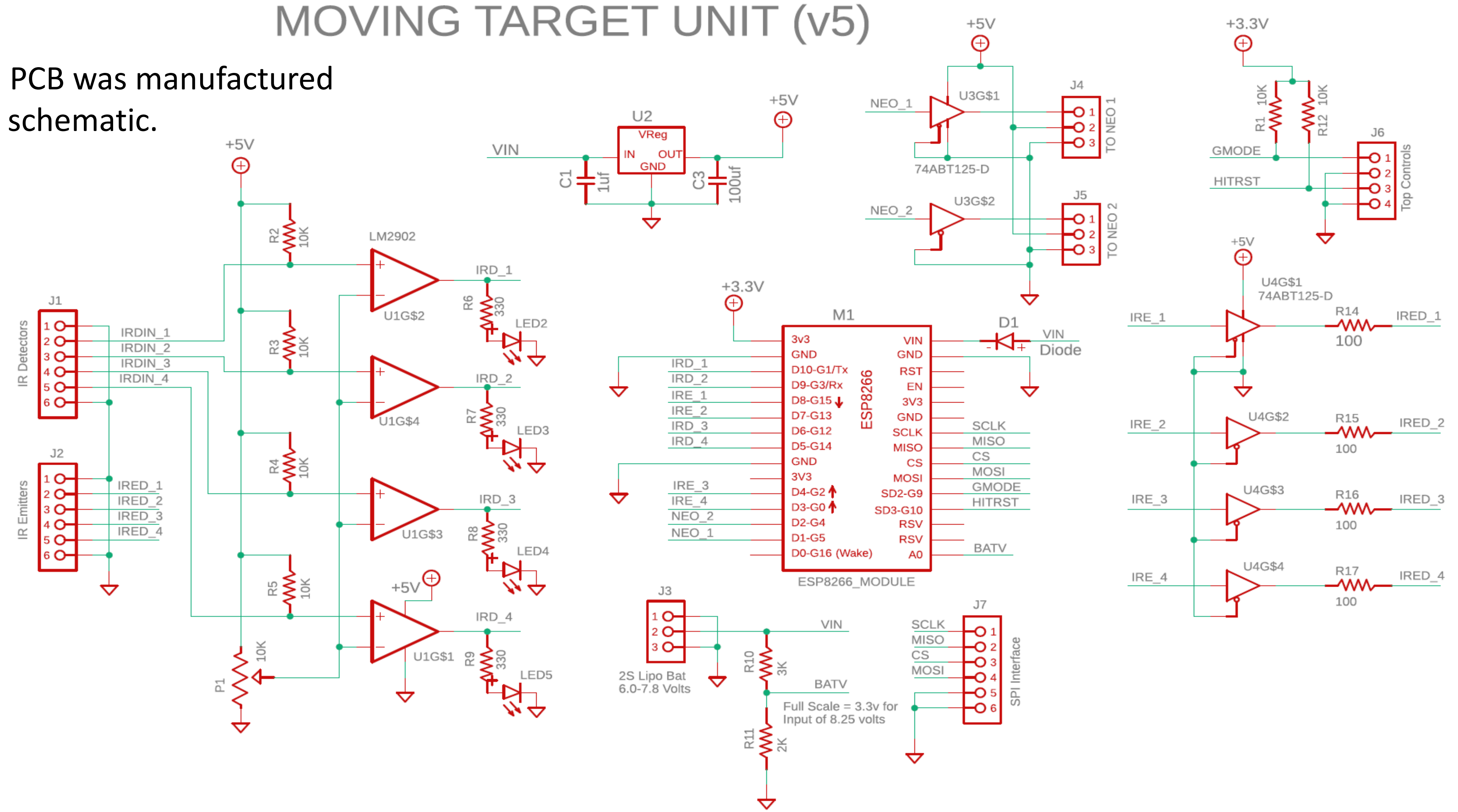
PCB Schematic, V1

V1 of the PCB was manufactured from this schematic.



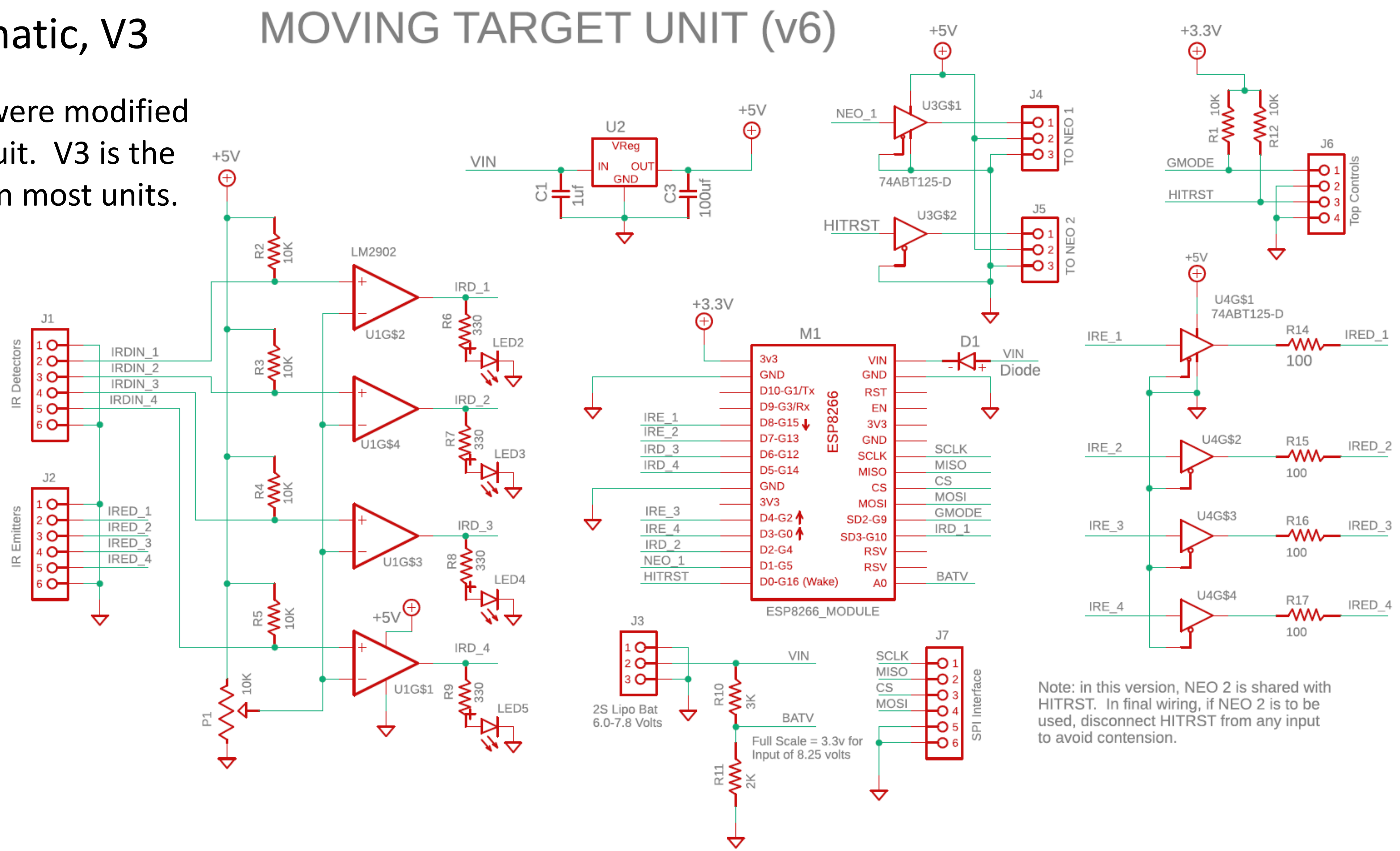
PCB Schematic, V2

V2 of the PCB was manufactured from this schematic.



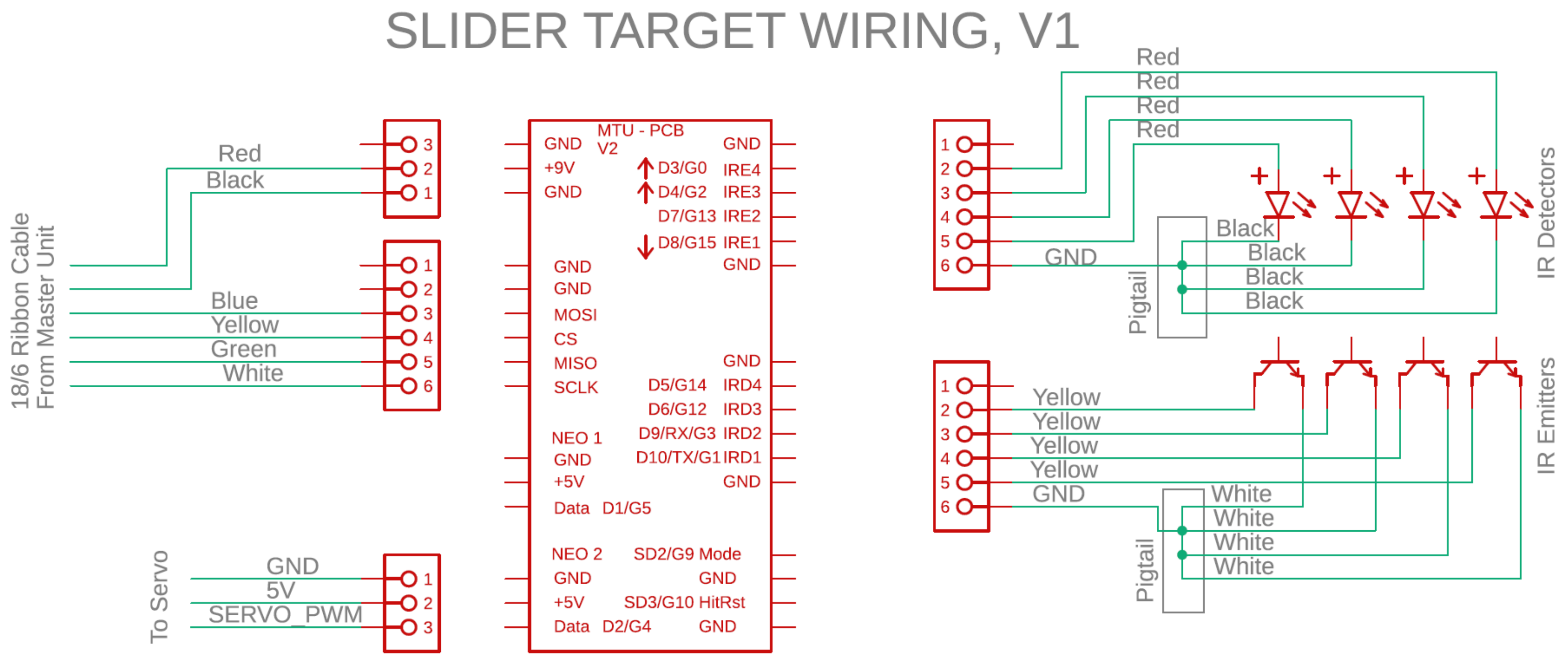
PCB Schematic, V3

The V2 PCBs were modified to be this circuit. V3 is the version used in most units.

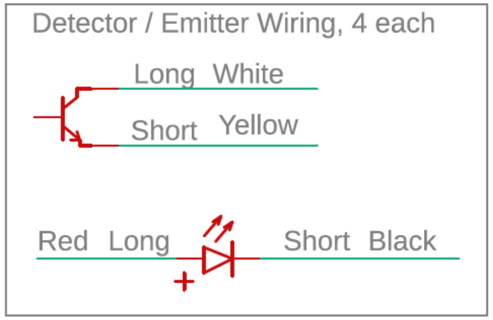


Note: in this version, NEO 2 is shared with HITRST. In final wiring, if NEO 2 is to be used, disconnect HITRST from any input to avoid contension.

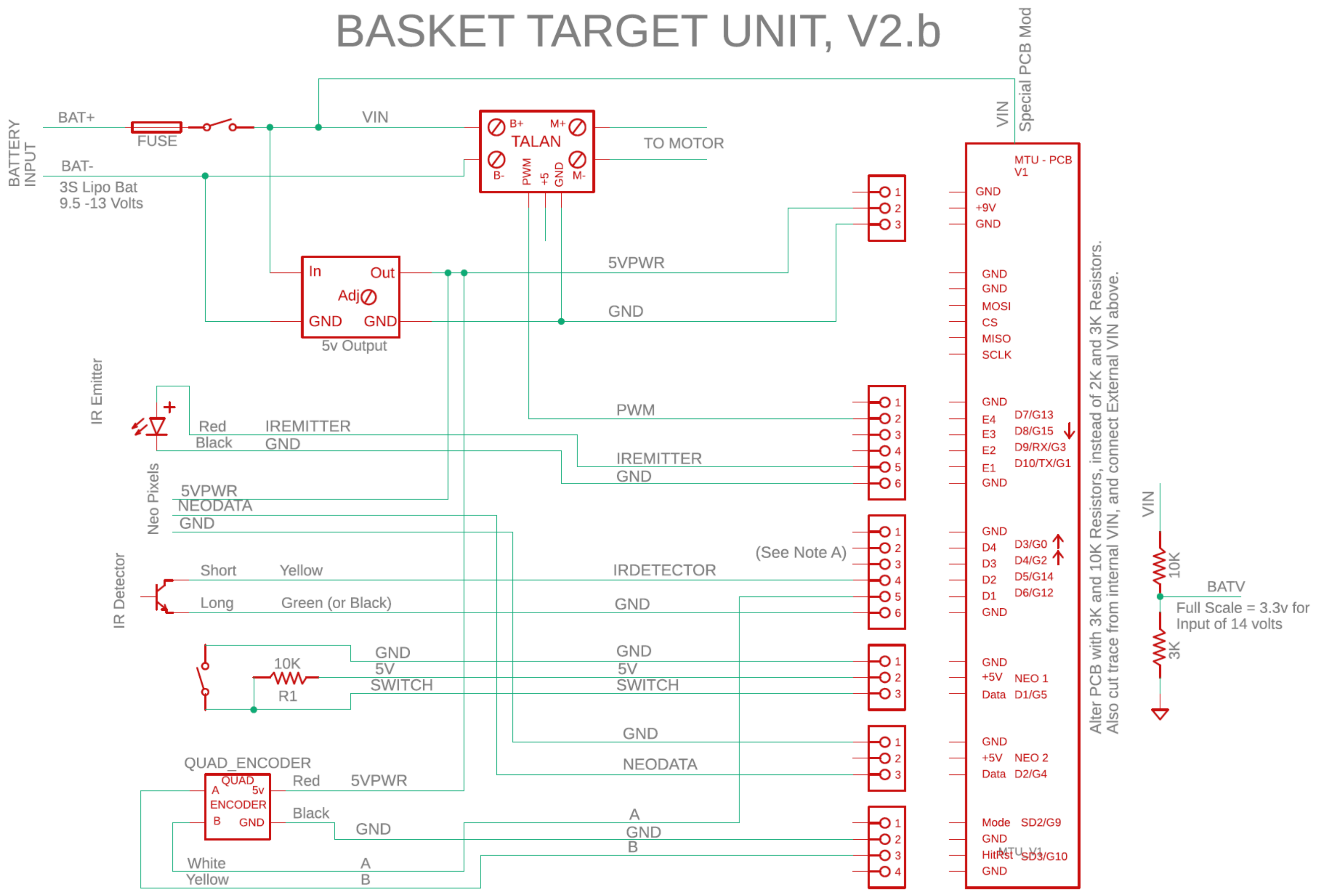
Sliding Target Wiring Schematic



Notes:
1. Rect Blocks are JST connectors, HX series
2. IR Emitter/Detectors are 5mm 940nm from Amazon
3. Wire sizes are 24 AWG, stranded.



Basket Target Wiring Schematic



Note A: for proper boot up D3 and D4 at the ESP8266 module must be held high.
This can be accomplished by leaving them UNCONNECTED even though they are fed by an OpAmp on the PCB.
This allows a V1 Version of the PCB to be used for the basket target -- although for other targets, V1 cannot be used.

Target Board Conductor Unit, Schematic

Coming Soon, I Hope.

Moving Target Wiring Schematic

Coming Soon, I Hope.

KNOWN Issues with the EPS8266

What as been learned through experimenting and study:

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1. DO NOT USE the "D" numbers such as D0, D1, etc when specifying pins.
2. Pins seem to always be specified with the G numbers.
3. If you want a serial port to upload code and debug,
   DO NOT USE D9 and D10 for any circuitry.
4. D0/G16 is connected to the on-board LED.
5. D0/G16 cannot be used for PWM or Interrupts!
6. D0/G16 cannot be used for NEO pixels!
7. D0/G16 can be used to turn on/off a simple LED
8. D1, D2, D3, D4, D5, D6, D7, D8, and SS3 all work with interrupts.
9. Startup problems and upload problems are likely if you use D0.
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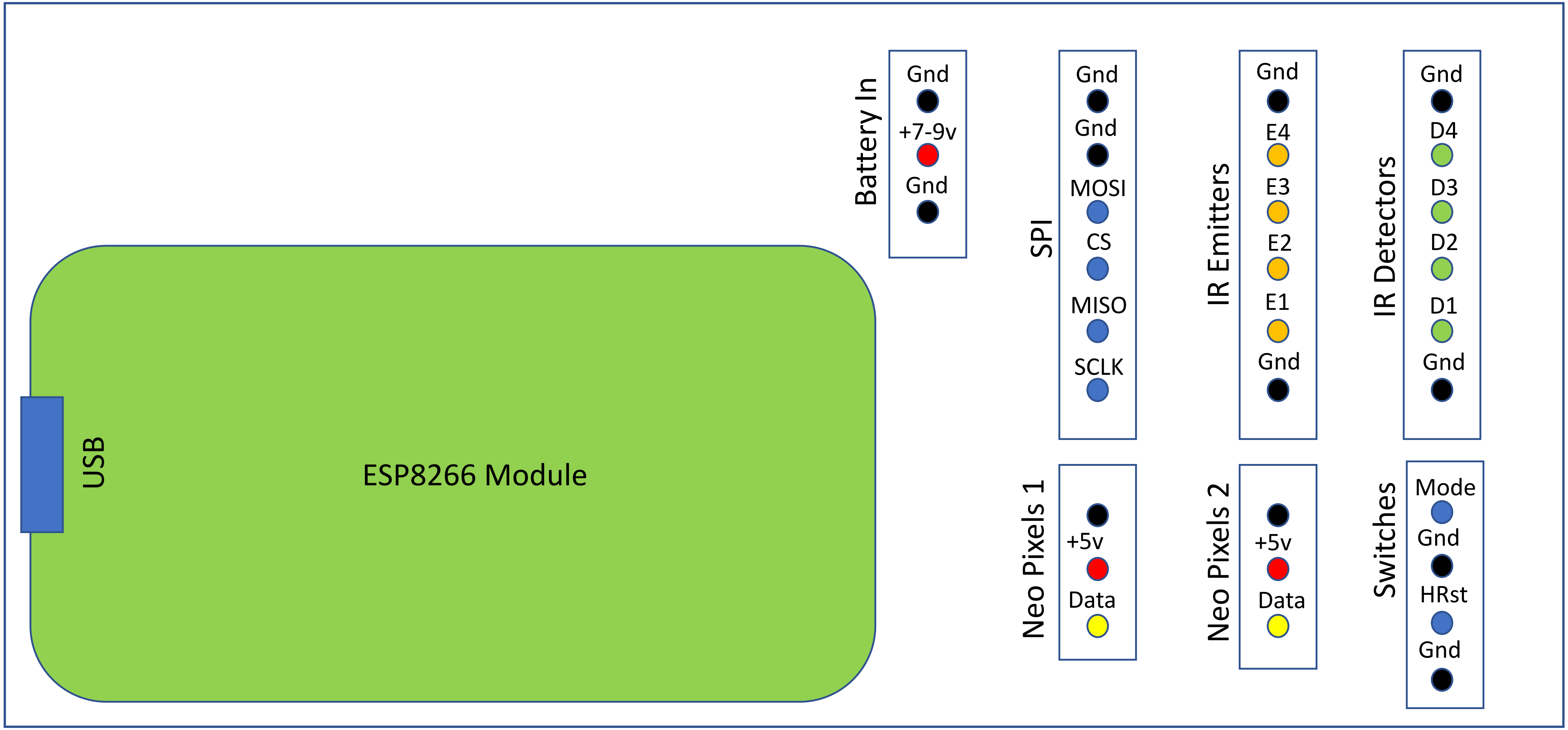
MOVEING TARGET CIRCUIT BOARD CONNECTORS



Wiring IR Emitter/Detectors

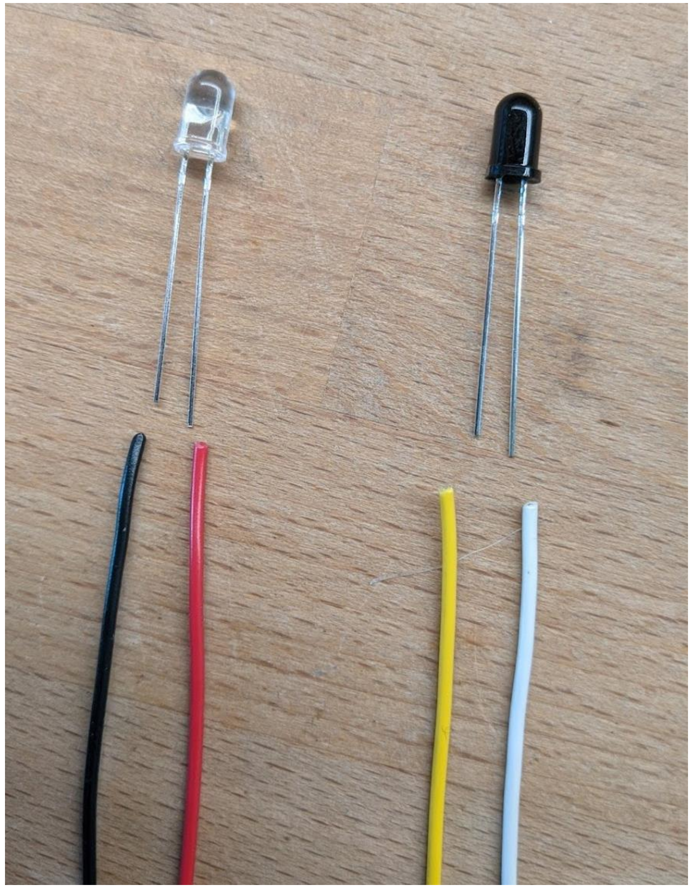
The CLEAR LED is the Emitter.

Our circuit sends about 17ma of current through this device.

The RED wire carries positive voltage and must be connected to the LONG lead.

The BLACK wire should be connected to the SHORT lead.

Use 24-26 AWG stranded wire.



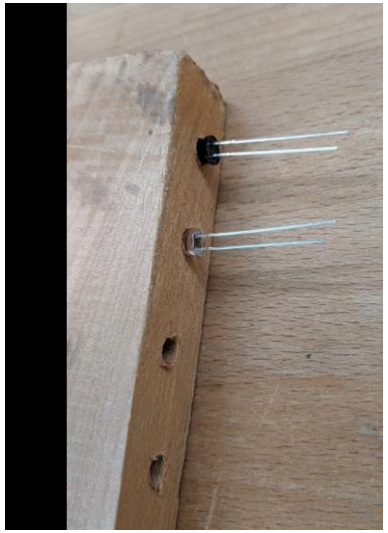
The Dark Component is the Detector.

When it detects IR light, it allows current to flow between it’s leads, but in only one direction: from the short lead to the long lead.

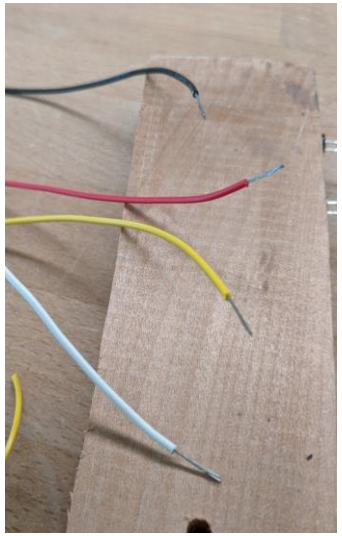
The YELLOW wire is the positive side and Must be connected to the SHORT lead.

The WHITE wire is the negative side and Must be connected to the LONG lead.

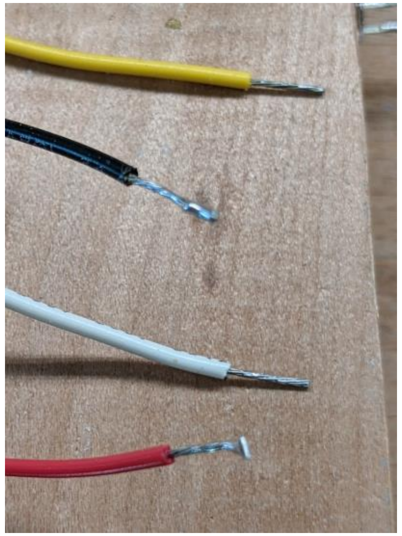
Steps to Solder Wires to the IR Components



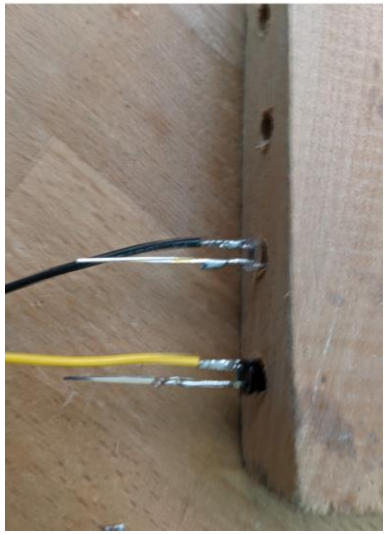
Start with the components in the soldering jig with the long leads nearer the top of the jig.



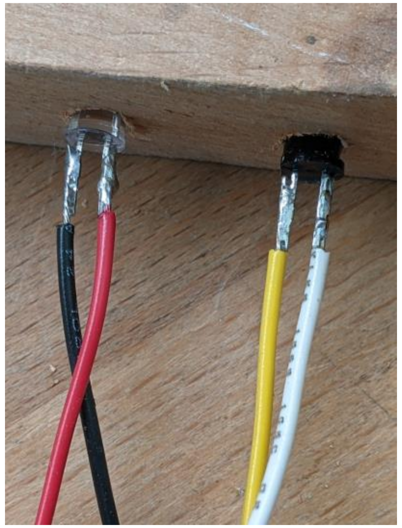
Strip about 0.5 inch of insulation from each wire.



Tin all wires and leads. Then trim the wires so that there is about 3/8 inch of conductor showing.



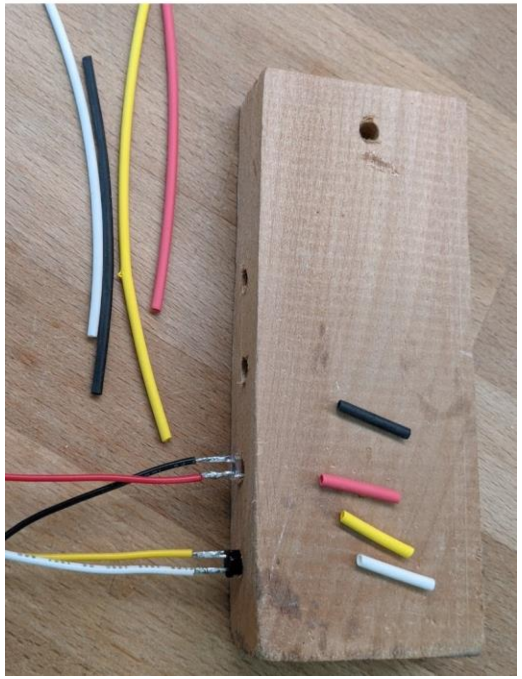
Cut the short leads to about 3/8 inch. And then use the **parallel solder technique** to solder the wires.



Do the same for the long leads.

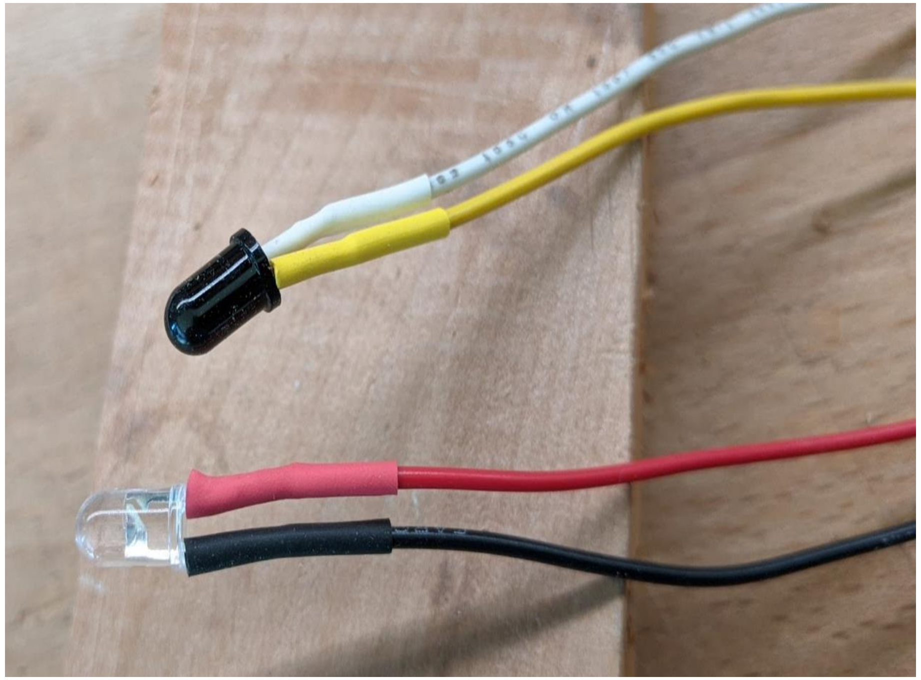
Parallel solder technique: After tinning both wire and lead, bring the wire along side of the lead (i.e., parallel to it), and then heat both with the soldering iron at the same time. Allow the solder to flow between the lead and the wire while holding the wire very steady. Remove the soldering iron while keeping the wire absolutely still until the solder cools.

Steps to Finish the Soldered IR Components



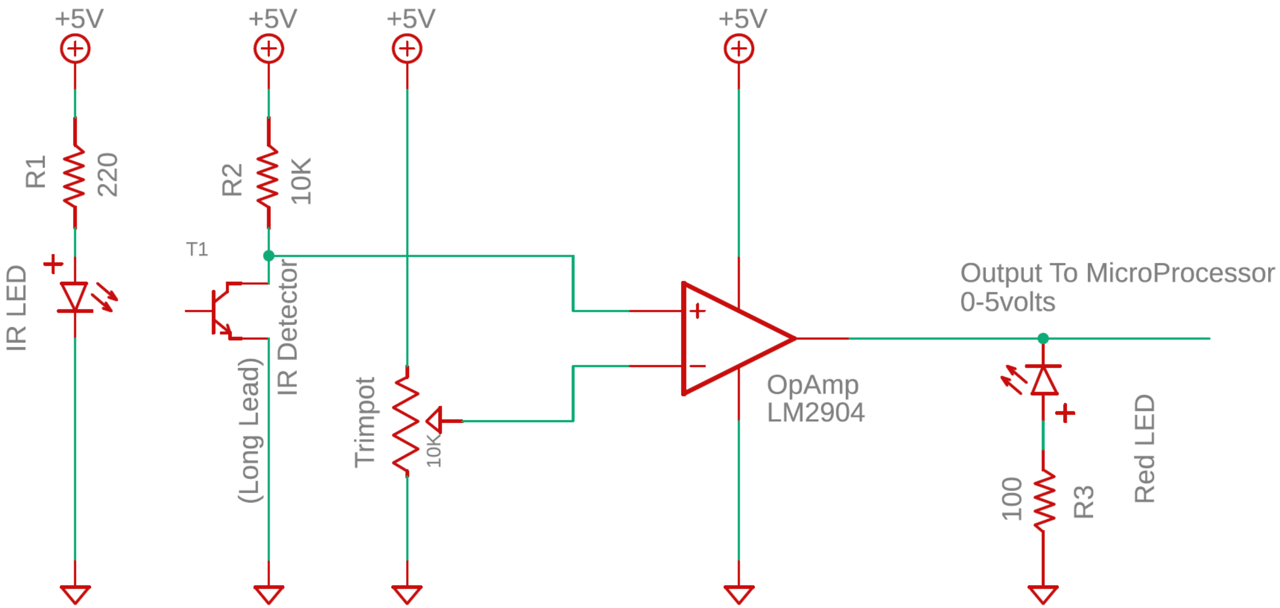
Cut about 5/8” of heat shrink tubing for each wire. Try to use the same color. Use 1/16 “ diameter tubing (measured before heat applied).

Slide the heat shrink tubing on each wire all the way to the component. Apply heat with a heat gun. Don’t use a match!



All Done!

IR Emitter / Detector Test Circuit



Notes:

1. The IR Emitter, as shown with a 220 ohm resistor draws about 17 mA.
2. The voltage at the + terminal on the OpAmp runs between 0.12 volts when the beam is detected, and 3.5 volts when the beam is broken.
3. The OpAmp is wired as a simple comparator. It outputs a hard 0 volts if the beam is detected, and about 3.5 volts if the beam is broken.
4. The Red LED after the OpAmp is included to indicate when the beam is broken.

IR Emitter / Detector Wiring

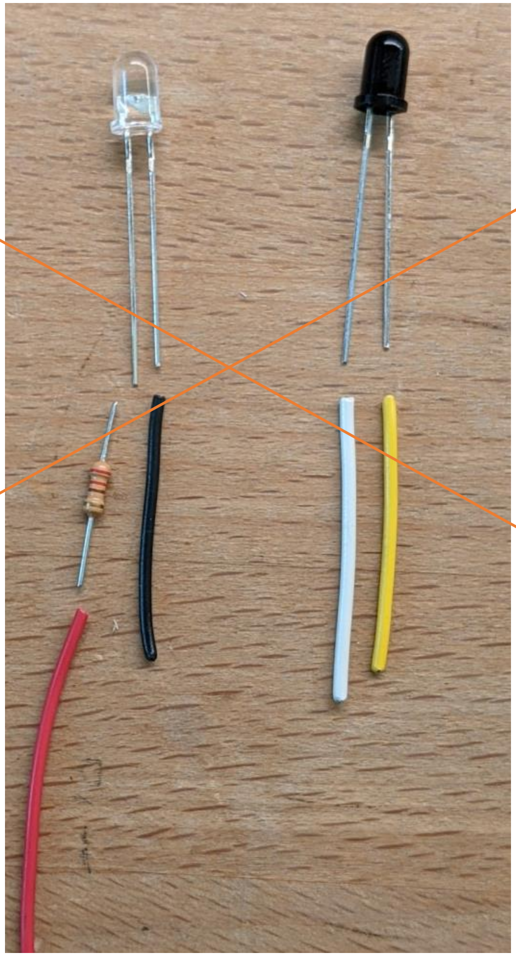
OBSOLETE!! Design Changed.

The Clear LED is the Emitter.

Connect a Red wire to a 220 ohm resister and then to the long lead. On the short lead, connect a black wire.

Use 24-26 AWG stranded wire.

When powered with 5 volts, Each emitter will draw about 14 mA.



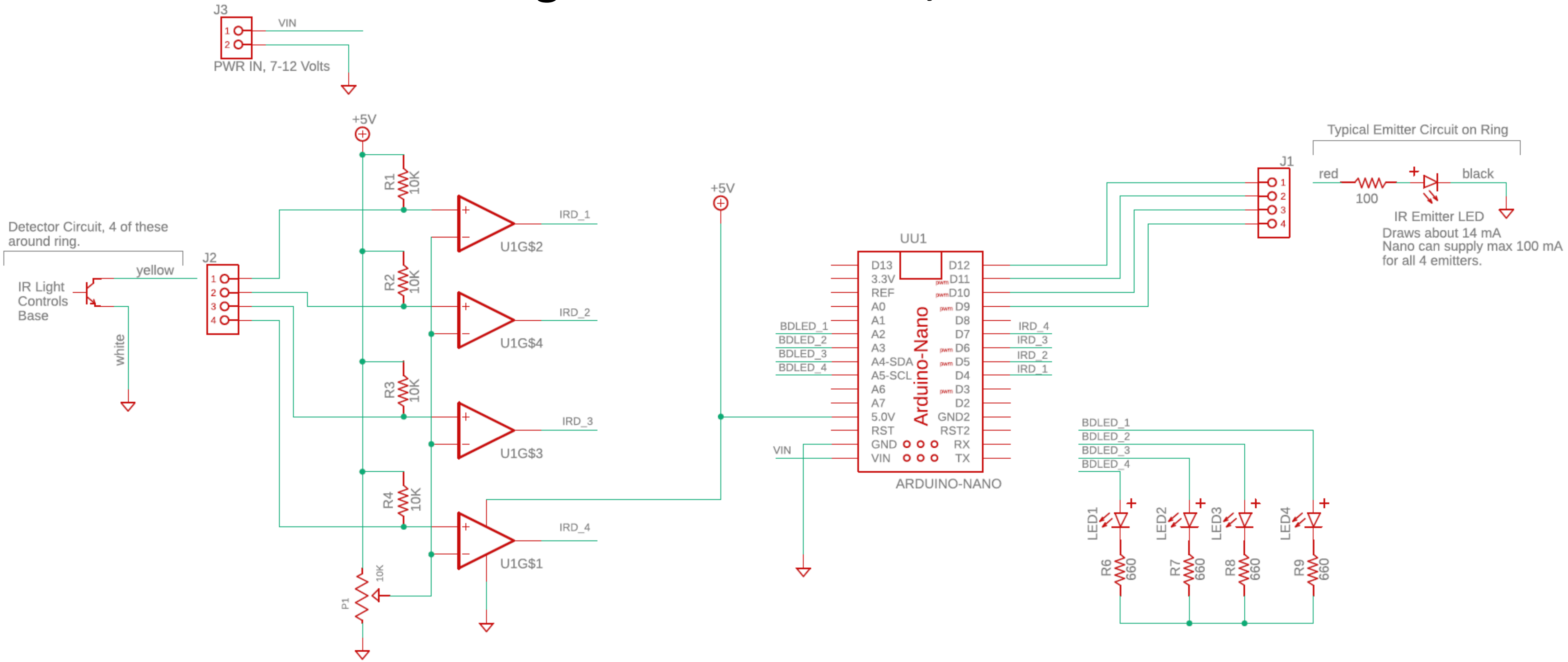
The Dark Blub Component is the Detector.

Connect a white wire to the long lead. Connect a yellow wire to the short lead.

Use 24-26 AWG stranded wire.

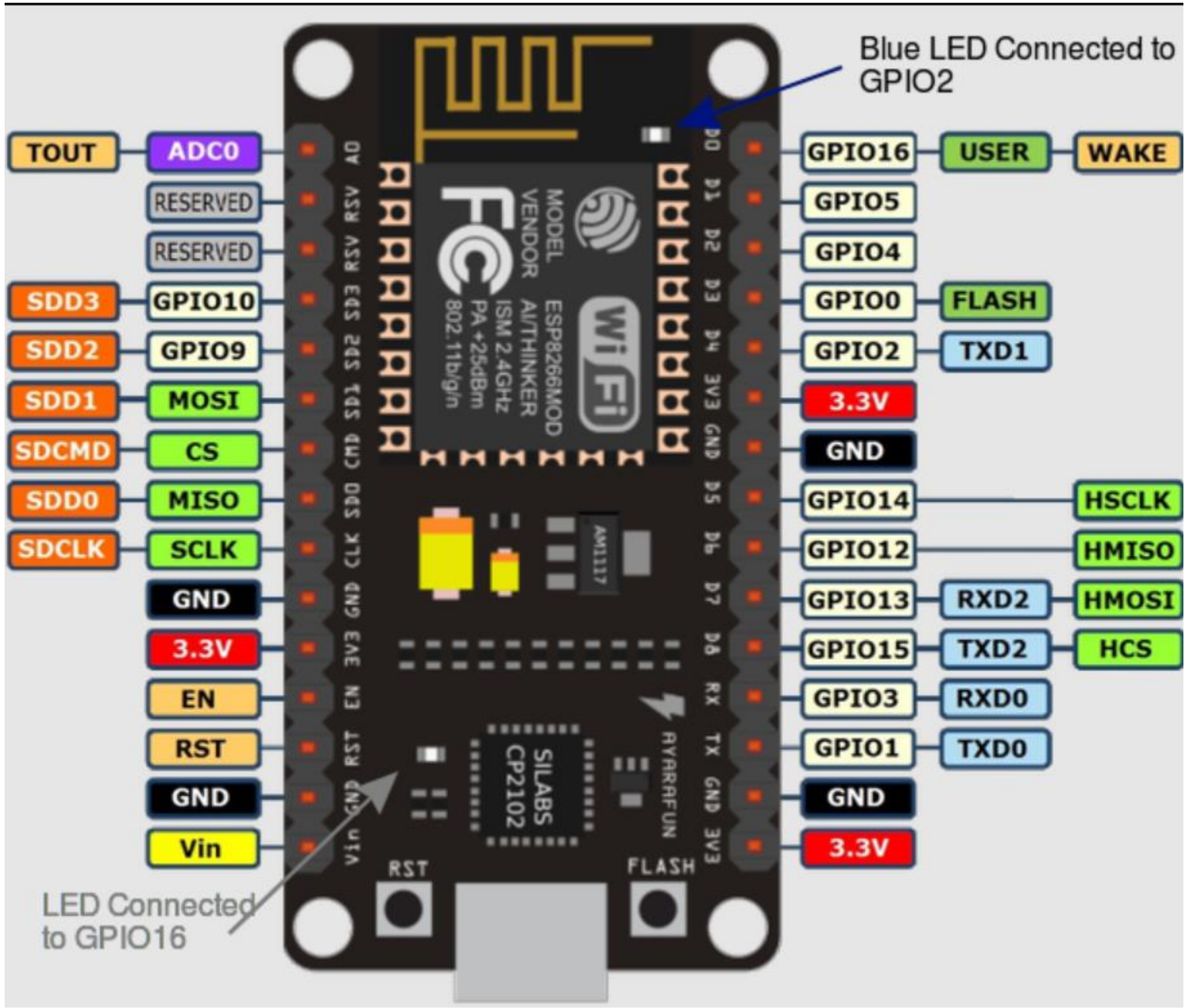
In the circuit, the white lead will be connected to ground. When the detector is “on”, current will flow from the yellow wire though the detector to ground.

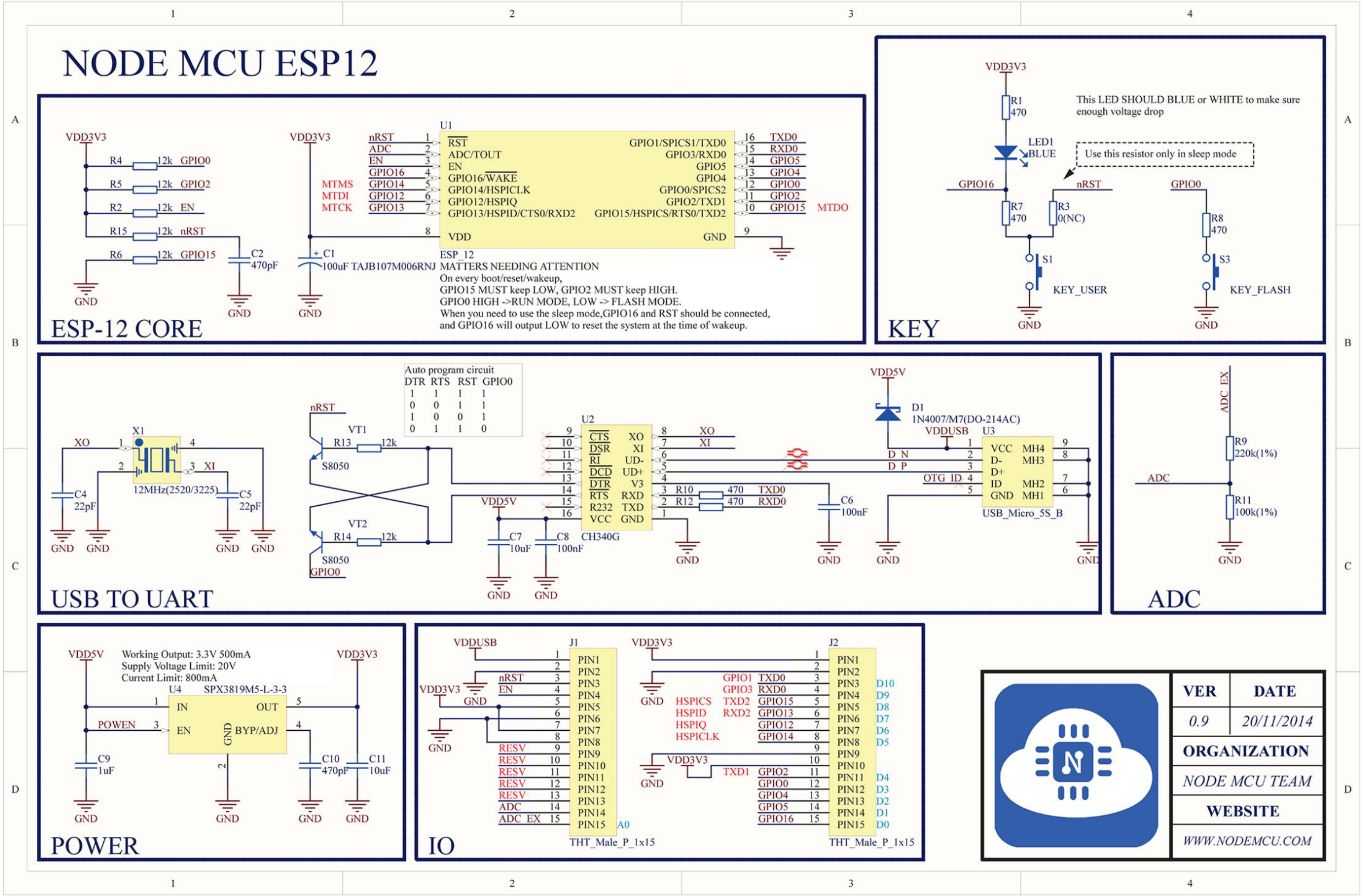
Ring Detection Circuit, Version 1



This circuit was used in early development to test IR detection. It is not part of the final system.

Pinout for nodeMCU




NODE MCU ESP12
ESP-12 CORE
U1
ESP_12
RST
ADC/TOUT
EN
GPIO16/WAKE
GPIO14/HSPICLK
GPIO12/HSPIQ
GPIO13/HSPID/CTS0/RXD2
VDD
GPIO1/SPICS1/TXD0
GPIO3/RXD0
GPIO5
GPIO4
GPIO0/SPICS2
GPIO2/TXD1
GPIO15/HSPICS/RTS0/TXD2
GND
MTMS
MTDI
MTCK
MTDO
C1
100uF TAJB107M006RNJ
C2
470pF
MATTERS NEEDING ATTENTION
On every boot/reset/wakeup,
GPIO15 MUST keep LOW, GPIO2 MUST keep HIGH.
GPIO0 HIGH ->RUN MODE, LOW -> FLASH MODE.
When you need to use the sleep mode,GPIO16 and RST should be connected,
and GPIO16 will output LOW to reset the system at the time of wakeup.
KEY
This LED SHOULD BLUE or WHITE to make sure enough voltage drop
Use this resistor only in sleep mode
LED1
BLUE
R3
0(NC)
KEY_USER
KEY_FLASH
USB TO UART
Auto program circuit
DTR RTS RST GPIO0
1 1 1 1
0 0 1 1
1 0 0 1
0 1 1 0
12MHz(2520/3225)
S8050
CH340G
D1
1N4007/M7(DO-214AC)
USB_Micro_5S_B
ADC
R9
220k(1%)
R11
100k(1%)
POWER
Working Output: 3.3V 500mA
Supply Voltage Limit: 20V
Current Limit: 800mA
U4
SPX3819M5-L-3-3
IO
J1
J2
THT_Male_P_1x15
VER
DATE
0.9
20/11/2014
ORGANIZATION
NODE MCU TEAM
WEBSITE
WWW.NODEMCU.COM

INFO About Arduino NANO – Pin Mappings