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ECE 342 pet door project sub block report

Contents

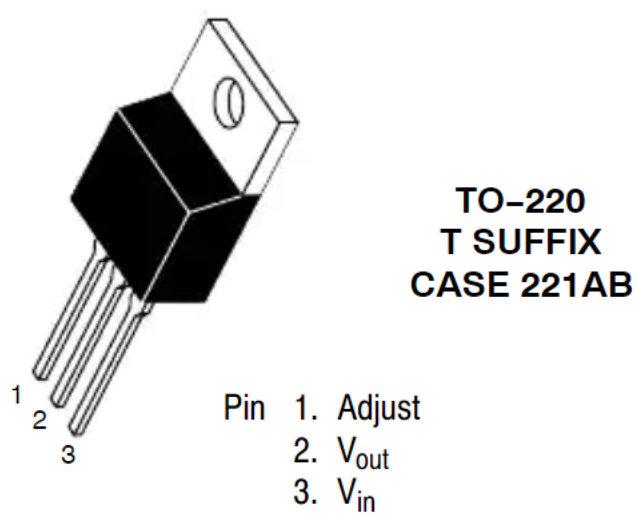
1 Project overview

The pet door project is a group project with several requirements. For the block check off 1. What I have done at first is to create a power controller to control the voltage from 5.1V to 1.2 V.

However, on the group meeting Apr 47th, we have found a mistake on the block diagram. Which the input voltage is not 5v but the output voltage should be 5.1v. In this way the design have to be changed

In this way at first this requirement could be realized by using the **TPS63590**. However, since the input voltage is changed. The **TPS62590** is not correct. What I use to realize is **LM317**. R1 and R2 need to be adjusted due to the requirement. After simulation, the input voltage is 7.5v and R1 and R2 should be 240 and 720. Then the output voltage will be decreased to 5.1V.

The LM317 is an adjustable **3−terminal positive voltage regulator** capable of supplying in excess of 1.5 A over an output voltage range of1.2 V to 37 V. This voltage regulator is exceptionally easy to use and requires only two external resistors to set the output voltage. Further, item ploys internal current limiting, thermal shutdown and safe are a compensation, making it essentially blow−out proof. The LM317 serves a wide variety of applications including local, on card regulation. This device can also be used to make a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the LM317 can be used as a precision current regulator.



In conclusion the LM 317 has following features

•Output Current in Excess of 1.5 A

•Output Adjustable between 1.2 V and 37 V

•Internal Thermal Overload Protection

•Internal Short Circuit Current Limiting Constant with Temperature

•Output Transistor Safe−Area Compensation

•Floating Operation for High Voltage Applications

•Eliminates Stocking many Fixed Voltages

•Available in Surface Mount D2PAK−3, and Standard 3−Lead

Transistor Package

•NCV Prefix for Automotive and Other Applications Requiring

Unique Site and Control Change Requirements; AEC−Q100

Qualified and PPAP Capable

•These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS

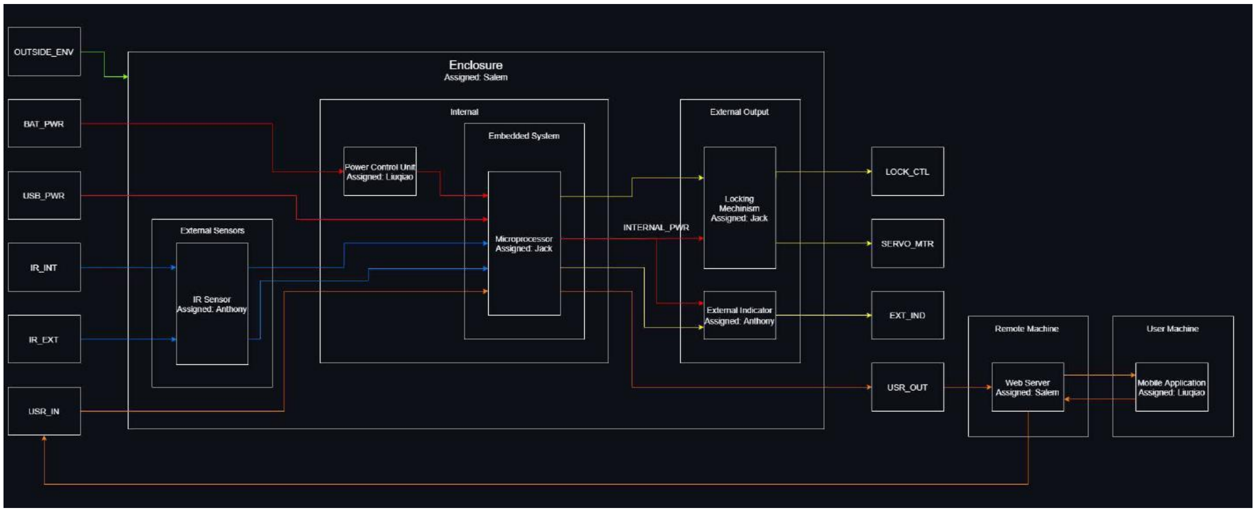
Compliant

2 Project interface

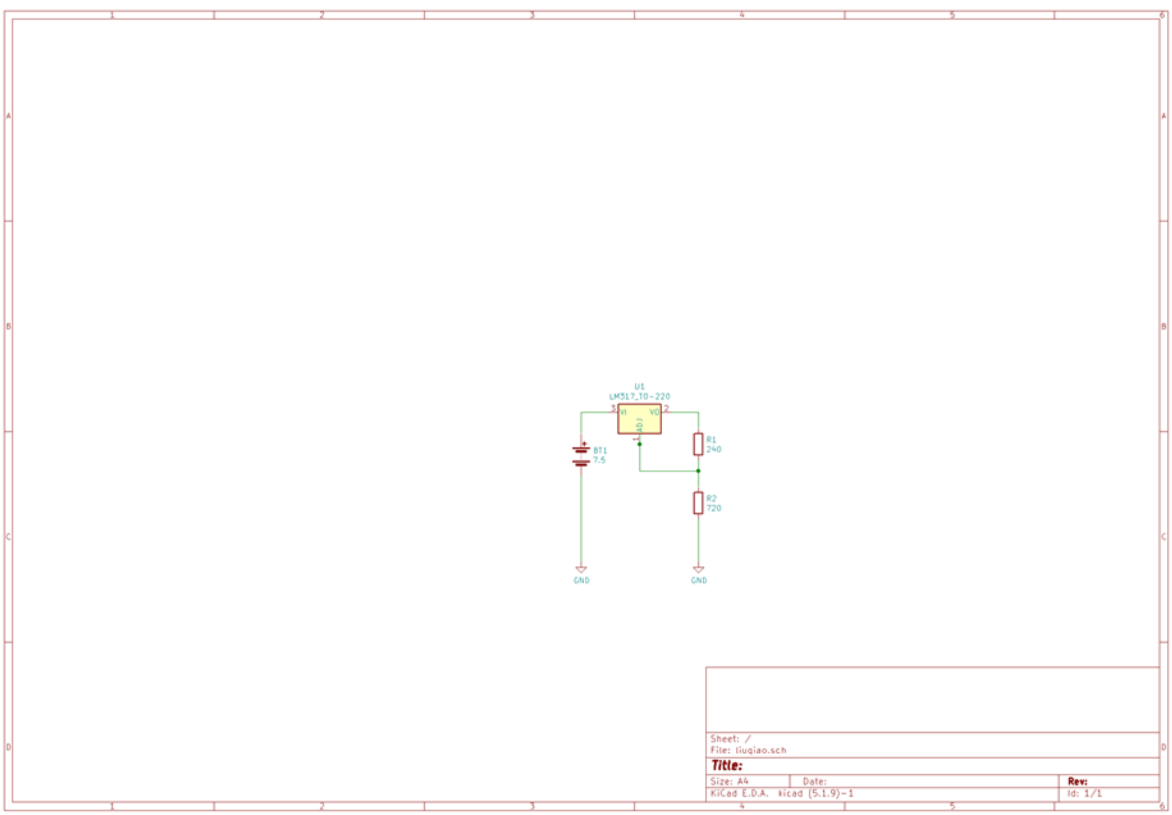
Name	Type	Definition
BAT_PWR	DC Power	• Voltage: 5.1V • Current: 1.2A
USB_PWR	DC Power	• Voltage: 5.1V • Current: 1.2A
IR_INT	Analog Signal	• Voltage: DC 5V • Minimium Range: 1m
IR_EXT	Analog Signal	• Voltage: DC 5V • Minimium Range: 1m
USR_IN	Data	• Standards: 2.4GHz IEEE 802.11b/g/n • Protocol: RESTful API • Format: JSON Object

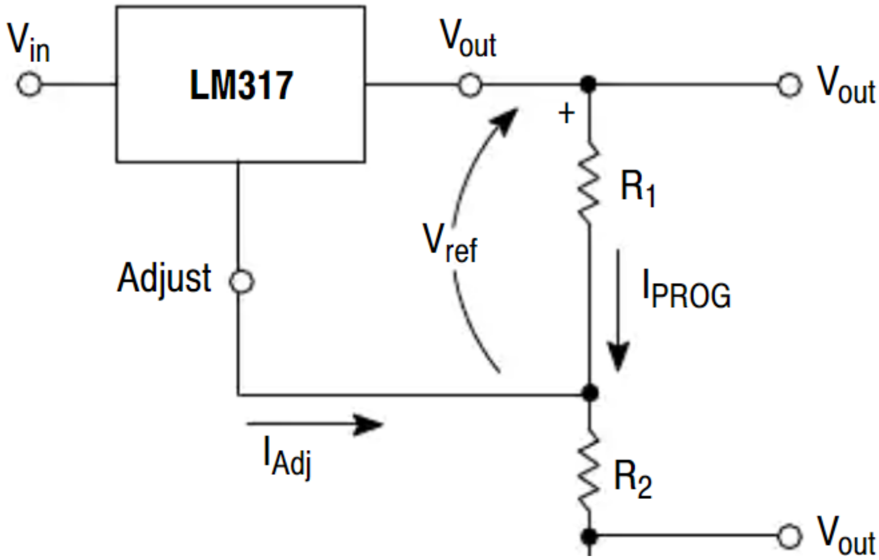
3 Black Box Diagram

4 Block Diagram



5 Power controller schematic



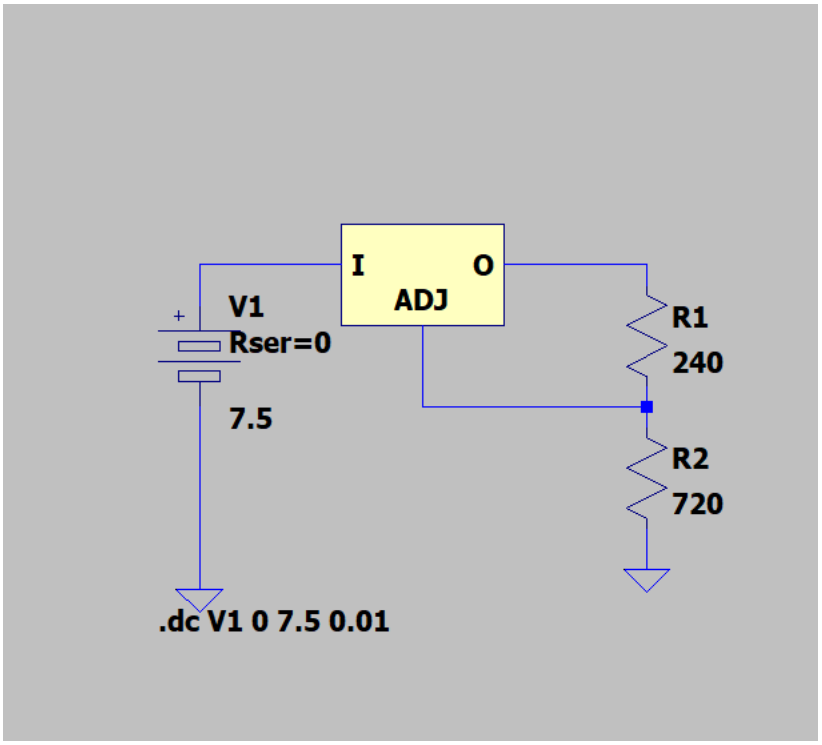


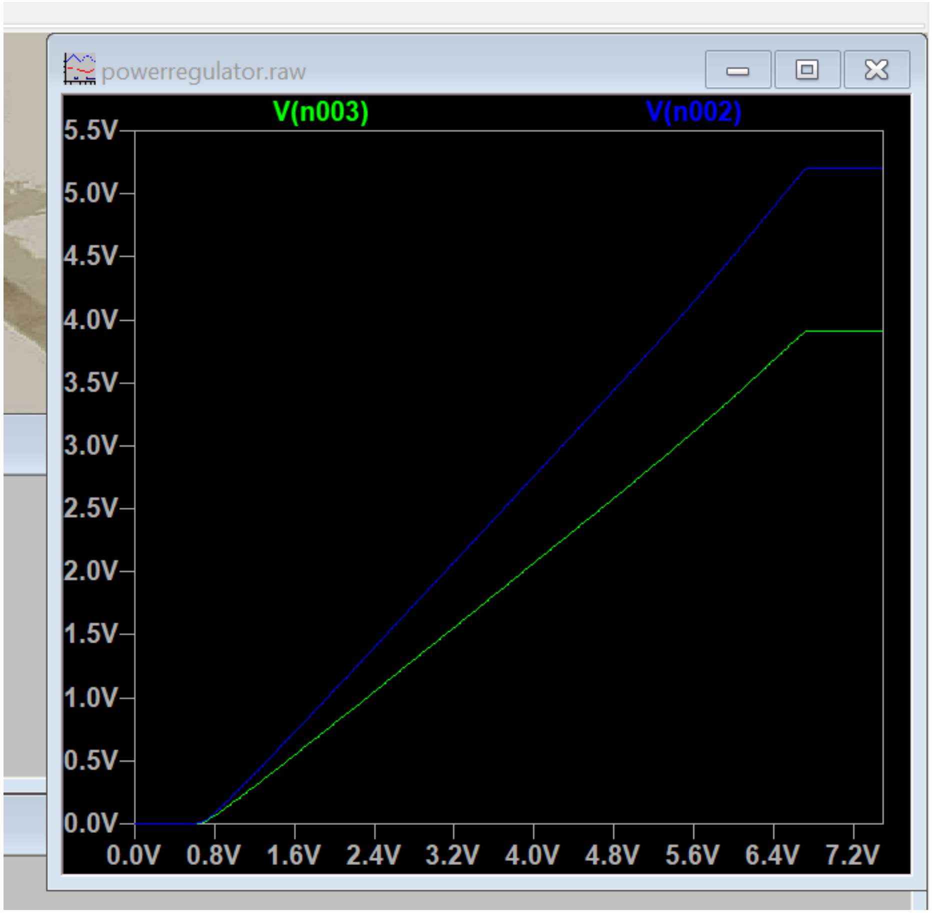
For the design here, due to the input voltage and the output voltage are both DC voltage. In this way, there is no need to use the conductor.

6 PCB Layout

7 Simulation Part

As our group plan, we plan to do the design first and then make the PCB together. In this way I use LTspice to crate the simulation to check if it could realize my request.


I
O
ADJ
V1
Rser=0
7.5
R1
240
R2
720
.dc V1 0 7.5 0.01



From the simulation, we could see that the output voltage is around 5V.

8 Bill of materials

Component Reference	Value	Number
3–terminal positive voltage regulator	LM317	1
Shunt resister R1	240 ohm	1
Adjustable resister R2	720 ohm	1
Battery Pack	5AA 7.5v	5 AA battery

* An AA cell measures 49.2–50.5 mm (1.94–1.99 in) in length, including the button terminal—and 13.5–14.5 mm (0.53–0.57 in) in diameter. The positive terminal button should be a minimum 1 mm high and a maximum 5.5 mm in diameter, the flat negative terminal should be a minimum diameter of 7 mm

9 Calculation Part

To realize how big the resistor should be. We have to calculate the resistor it should be. From the data sheet of LM317 we could find that math connection as follows:

Vout=Vref*(1+R2/R1) + Iadjust* R

Since the current from the adjustment terminal (IAdj) represents an error term in the equation, the LM317 was designed to control IAdj to less than 100 mA and keep it constant. To do this, all quiescent operating current is returned to the output terminal. This imposes the requirement for a minimum load current. If the load current is less than this minimum, the output voltage will rise.

Since the LM317 is a floating regulator, it is only the voltage differential across the circuit which is important to performance, and operation at high voltages with respect to ground is possible.

10 Reference

[1] https://www.digikey.com/htmldatasheets/production/99682/0/0/1/lm317-ncv317-datasheet.html?utm_adgroup=Semiconductor%20Modules&utm_source=google&utm_medium=cpc&utm_campaign=Dynamic%20Search_EN_RLSA_Cart&utm_term=&utm_content=Semiconductor%20Modules&gclid=CjwKCAjwj6SEBhAOEiwAvFRuKEZgIuZv2_BKEu17eaN9O_7jOICQO6OKmNtjiP5Iq1VFLhkwo-BnARoCoBYQAvD_BwE

[2] https://www.advancedenergy.com/globalassets/resources-root/white-papers/what-you-need-to-know-about-scr-power-controllers.pdf

[3] https://www.ti.com/lit/ds/symlink/tps62590.pdf?ts=1619192243982