Requirements and Verification

ECE445

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What is RV table?

- A two-column table with **requirements** on the left, and **verification** on the right
- A checklist for both modular goals and modular debugging
- If all requirements have been verified by your verification for every module, you should have a fully functioning project.

Requirements

A technical definition of what each and every module in your system block diagram must be able to do

- Quantitative (tolerance range)
- Thorough and detailed
- Driven by project goals
- Design requirements ≠ purchase requirements

Verification

A set of procedures that you will use to verify that a requirement has been met

- Equipment
- Test procedures
- Presentation of results
- Explicit

Bad RV Example

Voltage Regulator

Requirements	Verification
1. Step down battery to 3.3VDC	1. Take oscilloscope measurements to make sure that voltage output is 3.3V.

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What is battery voltage?

Bad RV Example

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1. Step down battery to 3.3VDC	1. Take oscilloscope measurements to make sure that voltage output is 3.3V.

Do I fail if the output is 3.25V?

Bad RV Example

Voltage Regulator

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1. Step down battery to 3.3VDC	1. Take oscilloscope measurements to make sure that voltage output is 3.3V.

Do we miss any requirements? e.g, current draw?

Bad RV Example

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1. Step down battery to 3.3VDC	1. Take oscilloscope measurements to make sure that voltage output is 3.3V.

How to measure?

Good RV Example

Voltage Regulator

(adapted from SP16 Wireless IntraNetwork)

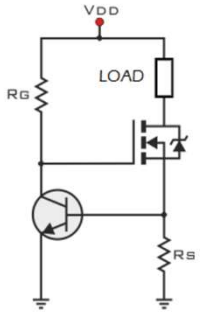

Fig. 3. Constant-current test circuit, I_L=0.7/R_s

Requirements	Verification
1. Provide 3.3V +/- 0.5% from a 3.7V-4.2V source 2. Can operate current within 0 - 300mA 3. Maintain thermal stability below 125°C	1A. Measure the output voltage using an oscilloscope, ensuring that the output voltage stays within 5% of 3.3V. 2A. Connect the output of the voltage regulator to VDD node in the constant-current test circuit in Figure 3. 2B. Adjust Rs in Figure 3 to deliver at most 300mA to the load, measured by a multimeter. 2C. Measure the output voltage using an oscilloscope, ensuring that the output voltage stays within 5% of 3.3V. 3A. During verification for Requirement 1 and 2, use an IR thermometer to ensure the IC stays below 125°C.

Good RV Example

Voltage Regulator

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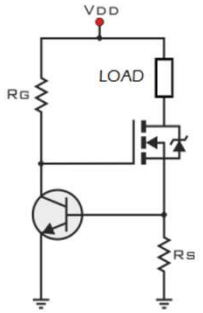

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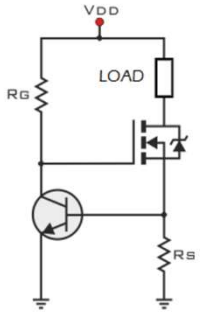

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Requirements	Verification
1. Provide 3.3V +/- 0.5% from a 3.7V-4.2V source 2. Can operate current within 0-300mA 3. Maintain thermal stability below 125°C Very detailed and thorough requirements	1A. Measure the output voltage using an oscilloscope, ensuring that the output voltage stays within 5% of 3.3V. 2A. Connect the output of the voltage regulator to VDD node in the constant-current test circuit in Figure 3. 2B. Adjust Rs in Figure 3 to deliver at most 300mA to the load, measured by a multimeter. 2C. Measure the output voltage using an oscilloscope, ensuring that the output voltage stays within 5% of 3.3V. 3A. During verification for Requirement 1 and 2, use an IR thermometer to ensure the IC stays below 125°C.

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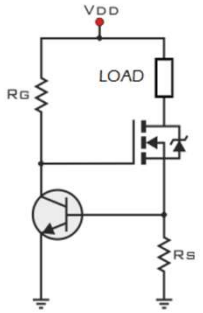

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1. Provide 3.3V +/- 0.5% from a 3.7V-4.2V source 2. Can operate current within 0-300mA 3. Maintain thermal stability below 125°C Step-by-step procedure	1A. Measure the output voltage using an oscilloscope, ensuring that the output voltage stays within 5% of 3.3V. 2A. Connect the output of the voltage regulator to VDD node in the constant-current test circuit in Figure 3. 2B. Adjust Rs in Figure 3 to deliver at most 300mA to the load, measured by a multimeter. 2C. Measure the output voltage using an oscilloscope, ensuring that the output voltage stays within 5% of 3.3V. 3A. During verification for Requirement 1 and 2, use an IR thermometer to ensure the IC stays below 125°C.

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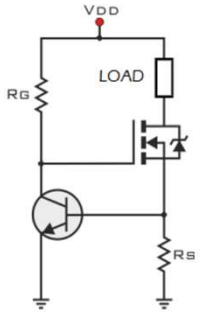

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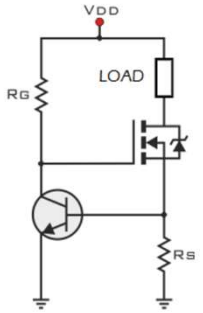

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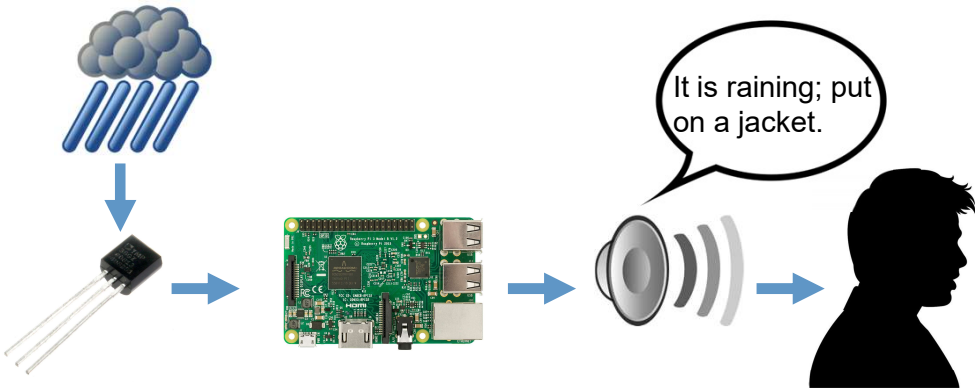
Bad RV Example

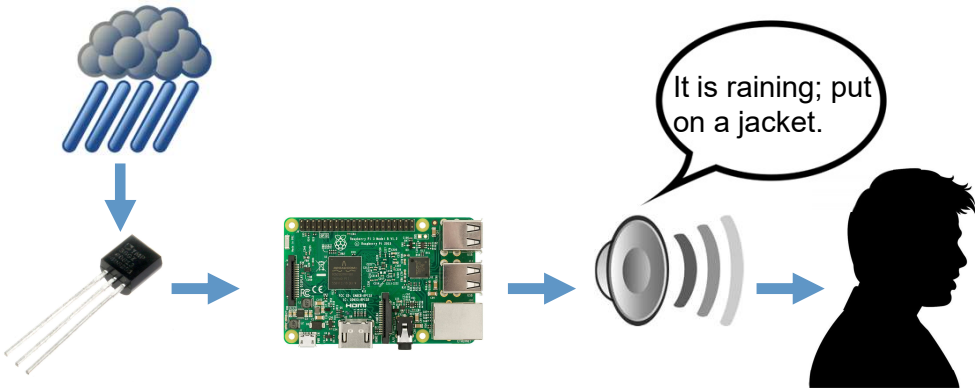
Personal Rain Detector



Requirements	Verification
1. Raspberry Pi is functional.	1A. Provide 5V power to Raspberry Pi. Inspect status lights to ensure it is operating.
2. Raspberry Pi GPIO pins can produce outputs.	2A. Toggle GPIO pins and measure with oscilloscope.
3. Speaker produces sound when powered.	3A. Drive speaker with 9V power supply and listen for sound to ensure it works.
4. Moisture sensor can survive manufacturer-specified weather conditions.	4. Put sensor outside on a rainy day and test that it works after.

Bad RV Example

Personal Rain Detector



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ISSUE: Padding your RV table.

Each of these is "guaranteed" by the manufacturer.
You aren't testing any new designs of your own.

If you have any questions, contact your TA!