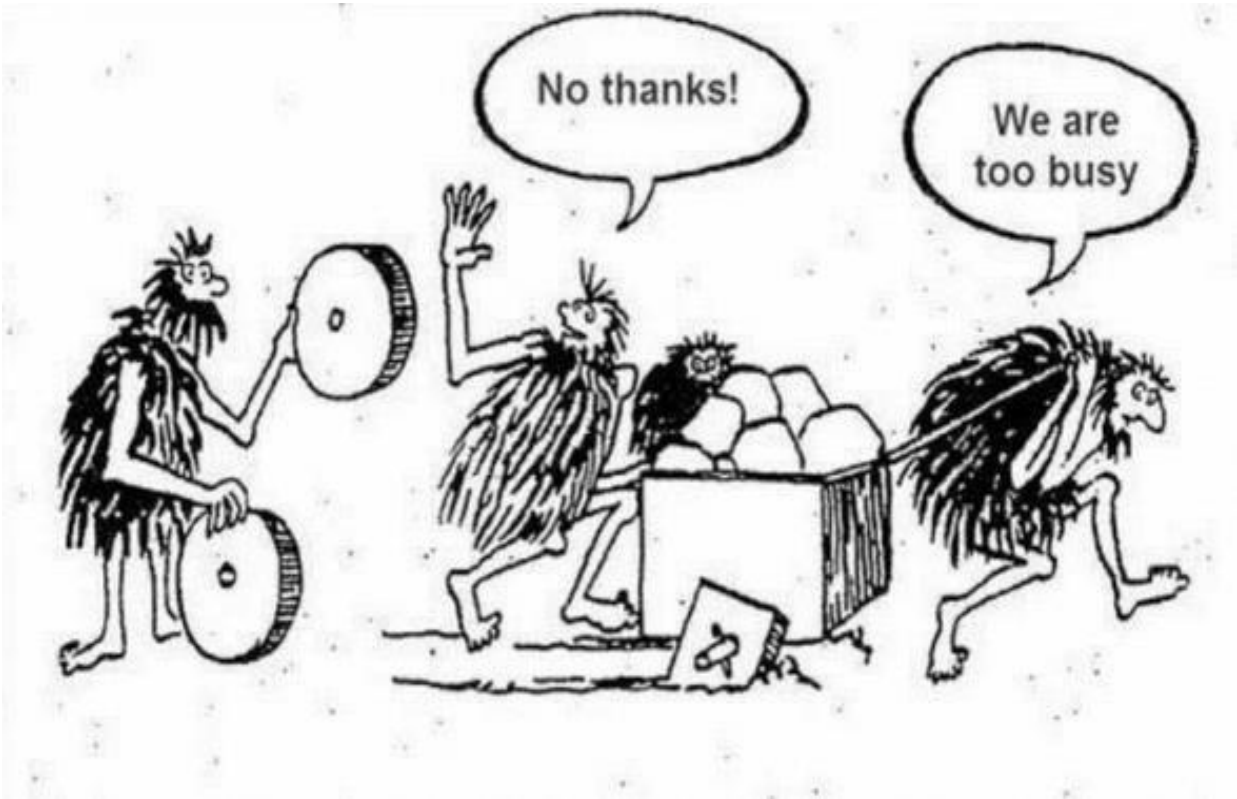
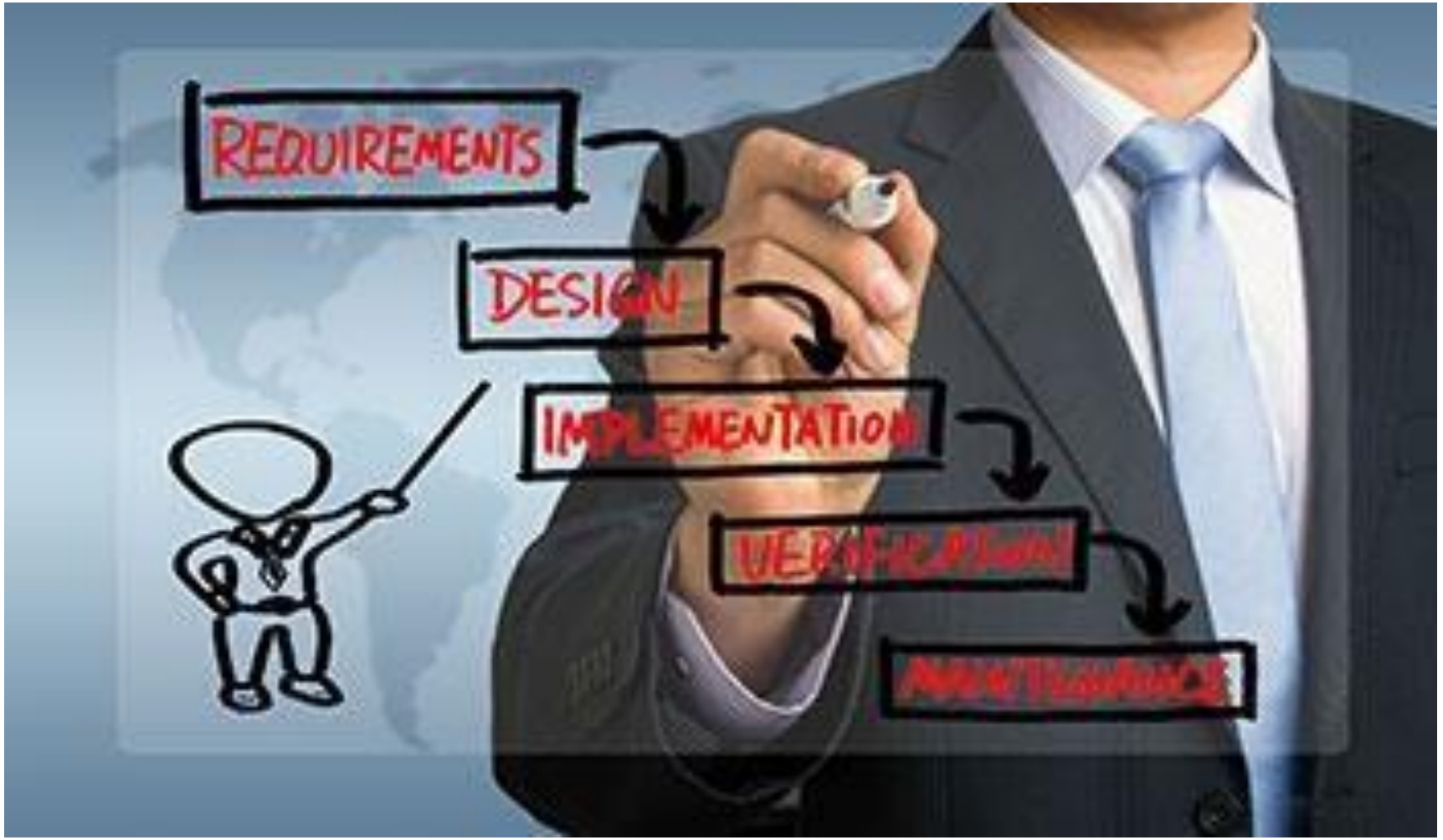
Failed Projects

are because of Poor Requirements

https://www.infotech.com/research/flawed-requirements-trigger-70-of-project-failures



The Embedded System Design Process



WE START WITH A FEW DEFINITIONS OF THE DOCUMENTS

THAT ARE PART OF EVERY GOOD DESIGN

- **General Requirements**
- The general specifications of the operation of a product that must be met by the end product. These specifications should define the characteristics of the product as experienced by the end user.
- Examples might include such topics as number of users, power consumption, size, weight, and speed. Numerical values should be assigned to a requirement whenever possible.
- The Acceptance Testing should verify that the product meets the General Requirements.

Detailed Requirements – Sometimes called Specifications

1. Description of purpose and general operation including a physical description.

2. In normal operation for input and output

Number and type of inputs (i.e. analog inputs, digital inputs, etc.-What do they represent?

Range and resolution of values (i.e. 0-600volts, +- .01 volts)

Frequency range (if required)

Such values determine the following:

Samples per second per channel for analog inputs or data rates for digital data

For outputs, what will the user see (or hear)? How does the user control the productkeyboard, touch screen, etc.

3. Other conditions

Response to over-range or errors of input values- What happens when something goes wrong?

Alarm conditions (if necessary)

“Hard real-time” timing constraints (if any) and overall timing diagram

4. Acceptance Testing Protocol

What will satisfy the “user” that the product performs as described?

5. Special Requirements

Power/safety/environmental considerations

Functional Specifications

1. Block diagram and description of software (SW) and hardware (HW) modules used to meet the Detailed Requirements
2. Description of the interfaces between modules – type of data exchanged, data rates, error conditions, etc. 3. Timing diagram for critical parts of system
4. More detailed description of the output data or signals5. For the software modules and data, estimate the storage requirements.
5. Details of the User interface with the product

Detailed Design (Hardware and Software)

1. Flow charts, circuit diagrams, etc. that describe how the product will be made.

2. Define all the I/O drivers and interrupt service routines. How will these routines be tested?
3. How will the integrated system (HW and SW) be tested?

http://users.ece.utexas.edu/~valvano/Volume1/E-Book/C7_DesignDevelopment.htm

Safety: The risk to humans or the environment

Accuracy: The difference between the expected truth and the actual parameter

Precision: The number of distinguishable measurements

Resolution: The smallest change that can be reliably detected

Response time: The time between a triggering event and the resulting action

Bandwidth: The amount of information processed per time

Maintainability: The flexibility with which the device can be modified

Testability: The ease with which proper operation of the device can be verified

Compatibility: The conformance of the device to existing standards

Valvano I

Mean time between failure: The reliability of the device, the life of a product

Size and weight: The physical space required by the system

Power: The amount of energy it takes to operate the system

Nonrecurring engineering cost (NRE cost): The onetime cost to design and test

Unit cost: The cost required to manufacture one additional product

Time-to-prototype: The time required to design, build, and test an example system

Time-to-market: The time required to deliver the product to the customer

Human factors: The degree to which our customers like/appreciate the product

Valvano II

OTHER CONSIDERATIONS - IF A COMMERCIAL PRODUCT

- MANUFACTURING
- COST OVERALL
- CERTIFICATIONS UL, IEEE, NEC, etc.
- PATENTS

Think during design rather than after the product is built and being tested!!

TRUST ME ON THIS!
TLH