REQUIREMENTS

SOFTWARE PROJECT

formación dual
UNIVERSIDAD AUTÓNOMA DE QUERÉTARO

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MENTOR: CONTINENTAL SUPPORT TEAM

Continental

INTRODUCTION

The requirements contain the behavior, attributes and properties of a future system. Therefore, the main task of the requirements is to ensure that they are understood by all stakeholders. The work with the requirements involves various processes, e.g. identification, analysis, verification and, finally, management.

Requirements are divided in two main classes: functional and non-functional requirements.

Non-functional requirements are the quality attributes, some certain design or realization constraints or external interface that directly relate to the product.

Functional requirements are the product features or its functions that must be designed directly for the users and their convenience. They define the functionality of the software, which the software engineers have to develop so that the users could easily perform their tasks up to the business requirements.

METHODOLOGY

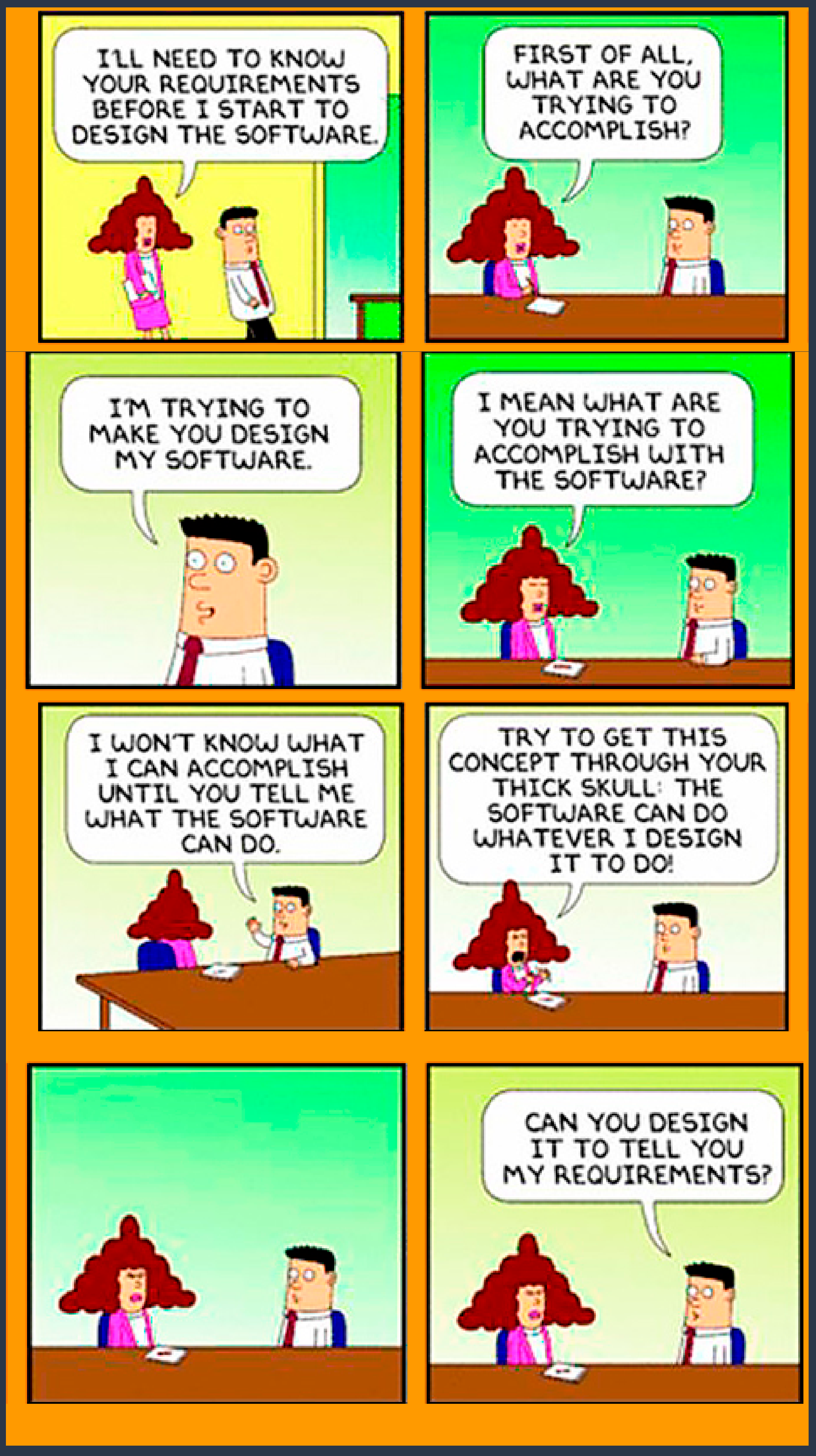
The first step in the development of the requirements was to have an introductory class about how to develop a list of requirements.

Then we had a session with Alejandro Rivera Garay; in this session we established the main functional requirements and the basic functioning of the project.

After had developed our first draft with the help of Juan Luis Garcia we had a revision session with Alejandro Rivera, Juan Luis Garcia and Rommel Garcia to review our progress; with the help and feedback derived from this session we continued working with the requirements. We had continuous feedback with Juan Luis Garcia, we developed the State Machine Diagram and continued working with the requirements with his help.

Our last draft of the requirements was reviewed by Alejandro Rivera, Juan Luis Garcia, Rommel Garcia, Jorge Alvarez, and Angel Guzman.

RESULTS & DISCUSSION



After weeks of development, we ended with 12 Functional Requirements related with our design diagrams, including the diagram of the state machine.

We developed 13 Non-Functional Requirements.

All the requirements are listed below:

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Functional Requirements

	Requirement Description	Test Case
	Components (location and specifications)	
1.	The communication will be established using SPI protocol.	Verification of the configuration in the main code.
2.	The action "WindowUp" will be represented by using a Push Button 1 (PB2). The action "WindowDown" will be represented by using a Push Button 2 (PB1).	Both buttons should be visible and will be represented by the buttons SW1 (for BU) and SW2 (for BD) located in the NXP configured as MASTER.
3.	There will be a set of LEDs (CLED1) which consists of four LEDs external to the card placed in a row. These LEDs will simulate the automatic movement of the window glass of a car. They will be numbered depending on their position in the circuit following the order: (from left to right) D1, D2, D3 and D4.	They will be located externally to the card. They should be visible, blue, ultra bright 5mm type.
4.	The LED marked D11 of the NXP card (D5) will be used. This LED will be used in three different ways: D5 will turn ON RED (D5_R) - using the LED of the DXT card marked as TP30 - depending on the condition indicated in Req. 8* D5 will light GREEN (D5_V) - using the LED of the DXT card marked as TP29 - depending on the condition indicated in Req. 9* D5 will light BLUE (D5_A) - using the LED of the DXT card marked as TP28 - depending on the condition indicated in Req. 13* *See Req. 8, Req. 9 and Req. 13	It will be visible on the NXP card. It will be noted that the color corresponds to what is established in this requirement.
	Component Operation	
5.	Pressing PB1 for more than 50mS with a tolerance of ± 5mS, and holding it; CLED1 will show the sequential activation of the 4 LEDs as follows: D1, D2, D3 and finally D4 (ascending order).	Its operation will be verified when observing the sequential lighting of the 4 LEDs that integrate CLED1.
6.	The lighting sequence of CLED1 (see Ref. 4) will be carried out while PB1 is held down. And it will stop until the total number of LEDs is completed ((if PB1 is still being pressed). This to simulate that the glass is going up (WindowUp). In the event that PB1 is stopped being pressed and if the 4 LEDs were not lit), the CLED1 ignition sequence will stop and the previously lit LEDs will remain active. This to simulate that the glass did not rise completely.	Its operation will be verified when observing the sequential lighting of the 4 LEDs of CLED1, depending on the use of PB1.
7.	Pressing PB2 for more than 50mS with a tolerance of ± 5mS, and holding it; CLED1 will show the sequential deactivation of the 4 LEDs as follows: D1, D2, D3 and finally D4 (descending order).	Its operation will be verified when observing the sequential shutdown of the 4 LEDs that integrate CLED1.
8.	The shutdown sequence of CLED1 (see Ref. 4) will be carried out while PB2 is held down. And it will stop until the total number of LEDs is completed (if PB2 is still being pressed). This to simulate that the glass is going up (WindowUp). If PB2 is stopped pressing (if the 4 LEDs were not turned off), the CLED1 shutdown sequence will stop and the previously lit LEDs will remain active. This to simulate that the glass did not came down completely.	Its operation will be verified when observing the sequential shutdown of the 4 LEDs of CLED1, depending on the use of PB2.
9.	LED D5 (see Req. 3) will turn GREEN when the window is completely up and it is no longer possible to continue going up. This will be based on Req. 5, that is: when the WindowUp action is completed and all CLED1 LEDs are on, D5 will be activated in green: D5_V.	It will be noted that the color of D5 is green when the WindowUp action concludes.
10.	LED D5 (see Req. 3) will turn RED when the window is completely down and it is no longer possible to continue lowering. This will be based on Req. 5, that is: when the WindowDown action is completed and all CLED1 LEDs are off, D5 will be activated in red: D5_R.	It will be noted that the color of D5 is red when the WindowDown action concludes.
11.	In case the two buttons, PB1 and PB2 are pressed at the same time at any time of the execution the system will attempt to read the buttons again until the conditions indicated in the requirements 6 or 8 are accomplish.	It will be noted that the system will remain in the last state of the execution. Meanwhile the system will read the buttons until the condition to change states is fulfilled.
12.	In the event that none of the conditions set forth in Req. 8 and Req. 9 are met, LED D5 will remain deactivated.	The operation of this LED will be observed during execution. And it should not turn on unless the above criteria is met.

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Non-Functional Requirements

	Requirement Description	Test Case
	Communication	
1.	Communication clock speed (SCK pin) at 10 MHz with tolerance ± 5%.	Check SCL line (pin 67) with the logic signal analyzer. Verify that the transmission speed is in the range of the requirement.
2.	Number of bits: 8	Check that the number of bits in the MOSI and MISO line (pin 64 and 65) is met with the logic signal analyzer.
3.	Parity: None	Check MOSI and MISO line (pin 64 and 65) with the logic signal analyzer. And verify that there is no parity bit in the signal.
4.	Phase: 1	Check the MOSI and MISO line (pin 66 and pin 65) with the logic signal analyzer and verify that data sampling is performed when the clock changes state from high to low.
5.	Polarity: 1	Check the SCL line (pin 67) with the logic signal analyzer and verify that the SCL line in the state is low.
	Connections	
6.	SPI serial communication will be from Card 1 (Master) to Card 2 (Slave).	Verification of the configuration of both cards in the code.
7.	PB1 and PB2 will be the Push Buttons integrated in the NXP 1 (Master) card: SW3 and SW2. LED D5 will be the one already integrated to the NXP 1 (Master) card: D11.	It will be verified that both buttons and LED D5 are functional according to the established requirements.
8.	CLED1 will be connected to the outputs of the NXP 2 (Slave) Card. These LEDs will be external to the card and will be connected using the necessary resistors to adapt to them the voltage that the NXP Card delivers in its physical outputs.	It will be verified that all external LEDs that make up CLED1 are functional according to what is established.
9.	5mm diameter blue LEDs, 3.2 voltage will be used at 3.4V and 20mA connected with a protection resistor of 82Ω for a maximum voltage of 5V (+ - 200mV) at the output of the card or without resistance for a minimum voltage of 3.3V (+ - 100mV) at the output of the card.	Check the connection of the LED according to the output voltage of the card.
10.	The PB1 button must be implemented with a pull down circuit.	Check the pull down circuit for button PB1 in the card description.
11.	The PB2 button must be implemented with a pull down circuit.	Check the pull down circuit for button PB2 in the card description.
	Electrical characteristics	
12.	The maximum system input voltage will be 5V and the minimum 3.3V (+ - 200mV) as required.	Check the power input of the pins configured as inputs.
13.	The input voltage and power supply for the system must be supplied by a computer USB port (maximum system input voltage is 5V and 1A).	Check that the cards are connected to a USB port.