System Requirement Documentation

**4 in a row**

*Version: 0.2*

*Date: 24-6-2019*

ALTEN

Jeroen Grollenbeek, Ralph Lentink and Arjan Verboord

Internal document

Draft

Version History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version** | **Date** | **State** | **Author** | **Remark** |
| **0.1** | 16-03-2016 | Draft | AV,JG,RL | *First requirements draft* |
| 0.2 | 24/06/2019 | Draft | Elise van der Wielen | Added 3 user requirements and 2 system requirements |

Acronyms and Abbreviations

|  |  |
| --- | --- |
| **Term** | **Explanation** |
| For the acronyms and abbreviations of the concerned project, see Internal Project Plan (IPP). | |

Referenced documents

*< This table shall list the number, title, revision, and date of all leading documents referenced in this document. >*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Id | Reference | Title | Date | Author |
| 01 |  |  |  |  |

Contents

1. User Requirements 5

1.1 UR must-have 5

1.2 UR nice-to-have 5

2. System Requirements 6

3. Acceptance Criteria 7

Appendix A: About requirements 8

Appendix B: About qualification 12

Appendix X: TODO list for this document 13

# User Requirements

## UR must-have (mandatory)

|  |  |  |  |
| --- | --- | --- | --- |
| **Req ID** | **User Requirement** | **Notes** | **Referenced ID** |
| UR.01 | The user should be able to start and play a game of 4 in a row against the robotized opponent without operator intervention. |  |  |
| UR.02 | The robot should detect a cheating player and respond by resetting the game. |  |  |
| UR.03 | The user shall be notified when the game ends. | The system must communicate somehow who won (sounds, visual, giving a coin). |  |
| UR.04 | The system is able empty the playfield, separate the coins by colour and prepare itself for the next game. |  |  |

Table 1: UR must-have

## UR nice-to-have (optional)

|  |  |  |  |
| --- | --- | --- | --- |
| **Req ID** | **User Requirement** | **Notes** | **Referenced ID** |
| NH.01 | An adjustable robot AI level |  |  |
| NH.02 | Awarding a winning human player with a Alten coin |  |  |
| NH.03 | For extra challenge the robot player should be able to start a game. |  |  |
| NH.04 | The game is easy to set up. | Plug in the power cord, and click a few buttons. |  |

Table 2: UR nice-to-have

# System Requirements

***E:*** *for* ***E****lectrical and electronic requirements, computer resource requirements*

***L:*** *for Data* ***L****ogging*

***M****: for* ***M****echatronical/ mechanical requirements*

***C****: for system* ***C****oncept*

***U****: for* ***U****ser experience*

## System concept

The user starts a game by inserting the first coin. The robot detects the inserting of the coins and starts the game routine. Based on the human move and the AI the robot will react an insert his coin. The user, on his turn, will make a new move. This routine repeats until one of the players has 4 coins in a row, or when the board is full. After a game, the robot has to collect all the game coins from the gameboard and sort them to human and robot base. Finally, the system is reset and a new game can start.

From the SDD document, the robot tasks can be divided in:

* Controlling the XZ table to the referenced height and column.
* Opening the game board closure per column.
* Picking up the coins from sorting base and sort them by color.
* Flipping the sorted human coins to the yellow coin base.
* Rotating the head and inserting the game coins in the game board.
* Detecting where the human player inserts the game coin.

|  |  |  |  |
| --- | --- | --- | --- |
| **Req ID** | **System Requirement** | **Notes** | **Referenced ID** |
| M01 | The working area of the robot must be kept separated from the human environment. |  |  |
| M02 | For easy transport, the dimension of the robot must be kept small. | (Within flight case dimensions) |  |
| M03 | The robot shall operate in the X (width) and Z (height) axes of the coordinate system. |  |  |
| M04 | The robot head will contain a sucker which picks up his game coins from the collecting base and insert them into the game. | A sucking head does not required a fixed position / configuration of the coin. |  |
| M05 | The columns of the gameboard shall be 3mm wider than the coins diameter. | This margin adds flexibility of the XZ table. |  |
| M06 | The sucking head must be rotatable. |  |  |
| M07 | A robot coin should always be transferable out of the container without knowing the state of the container |  |  |
| M08 | During the game, the coins should be kept in line with the game rows. |  |  |
| M09 | After a game, The coins must move to the sorting base, by emptying the game board column by column. | In order to avoid obstruction during clearing the board game and make the coin checking principle easier. |  |
| M10 | From the sorting base, the yellow and red coins shall be sorted and returned to their belonging base. |  |  |
| M11 | A flipper will shoot the human (yellow) coins back to their base. |  | E9 |
| E1 | The robot head shall be controlled to the desired X position within 1.5mm accuracy | Inserting the coins in the desired column is the most sensitive horizontal movement |  |
| E2 | The robot head shall be controlled to the desired Z position within 1.5mm | Picking up gamecoins from the containers is the most critical vertical movement |  |
| E3 | The insertion of a game coin in an arbitrary column shall be detected by dedicated sensors. | Cheating by inserting double coins should also be handled |  |
| E4 | The robot head should suck op gamecoins by actuating the sucker. | Research needs to be done on the sucking power wrt the coins. |  |
| E5 | For insertion of the game coins, the robot head must rotate 90 degrees while holding a coin. |  |  |
| E6 | The robot head sucker can release the coin at a given position to insert the coin into game. |  |  |
| E7 | After finishing a game, the robot should empty the gameboard column by column and move the coins to the sorting base. Therefore the movement of the slider should be accurate within 1.5mm. | The small indentation of the holding pins on the slider makes the control sensitive. |  |
| E8 | Coins shall be identified based on their colour and sorted out. |  |  |
| E9 | The flipper will be activated for shooting the yellow coins to the human base. |  | M11 |
| E10 | The motors are silent when position is kept. |  |  |
| U1 | The system looks professional. | No ductape or loose wiring. The system moves in a controlled manner and the system is stable when the motors move. |  |

Table 3: System requirements