Lab.cafe

Catalogue of requirements

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1. Introduction

1.1. Purpose of requirements document

This document is intended to provide a detailed overview of the specific requirements of the Lab.cafe project, which is being carried out as part of the course Information Systems Development. The aim of the project is to allow students to apply the theoretical knowledge they have gained during their bachelor's studies at the Faculty of Mathematics, Physics, and Informatics at Comenius University during the years 2022–2025. The requirements catalogue serves as a communication tool among all the stakeholders of the project, ensuring that everyone clearly understands the system's functionality, objectives, and value. This document provides a detailed overview of the project scope, its expected features, user requirements, and technical specifications.

1.2. Scope of the product

The developed information system is designed to manage access control and order processing for Lab.cafe and its technical infrastructure.

Its core function is to facilitate communication between the Otello system and various devices, such as 3D printers, locks, and access modules. Through integration with the Fabman database, the system enables the administrator to oversee member access to both the workshop and equipment, while also managing and tracking 3D printing tasks.

Furthermore, the system incorporates POS terminal capabilities to monitor café purchases made by members, utilizing card-based authentication and synchronizing data via platforms like PapayaPOS and Airtable. This solution streamlines member management, access control, and the tracking of equipment usage within Lab.cafe.

1.3. Definitions, acronyms and abbreviations

POS – point of sale

1.4. References

GitHub repository of the project: https://github.com/TIS2024-FMFI/Lab.cafe

Source code of the client: https://github.com/LabCafe

1.5. Overview of the remainder of the document

The second chapter describes the general functionality of the system, its characteristics, dependencies, constraints placed on it and the perspective of the product as a whole. The third chapter provides a detailed specification of the functional requirements for the system under development as well as those requirements that not directly related to its functionality.

2. General description

2.1. Product perspective

The system serves two primary functions: managing a workshop and a café. Members of the Lab.cafe community use a membership card to access both areas. This membership card acts as an authentication method for various services, such as entering the workshop, operating Lab.cafe equipment *(specifically 3D printers)*, and applying membership benefits like café discounts. The card ensures that members can easily verify their identity and gain access to services without manual intervention.

Currently, the system operates in a prototype form but requires optimizations to improve performance, particularly in access speed and control logic.

2.2. Product functions

The system is composed of several key components and integrates various tools and services.

2.2.1. Printer Management and Order Processing

The internal system, Otello, manages the list of printers and processes orders. The system is built on CodeIgniter *(PHP, MySQL)*. Member and machine access data are stored in the Fabman database. Memberships are purchased through WooCommerce *(WordPress)*, with billing handled via the WooCommerce Subscriptions module. Membership information is synchronized with Fabman.io via Make.com.

2.2.2. Access Control for Workshop

When a member taps their card on the access module at the workshop door, the module sends an endpoint request (including the card number) to a central server on the Otello system. The server retrieves access rights from Fabman, determining the member's membership type. For instance, hobby members have access only on Wednesdays, while maker members have daily access. Based on the response, the module signals access approval, denial, or an error through three LED lights. LabCafe uses custom hardware for this access module.

2.2.3. Equipment User Control

The Fabman Bridge controls machine access, verifying if the user has been trained on the machine via their RFID card. If authorized, the Fabman Bridge powers on the equipment. Each 3D printer is equipped with a Raspberry Pi Zero 2W running OctoPrint, which monitors the printer's status and active print jobs. A central server *(running on a Raspberry Pi)* manages these printers and their

status. Users must "Acquire" a print job within five minutes of starting, or the job will be paused. The system tracks print jobs and their authors for billing purposes, with monthly consumption calculated based on usage. Printer management and configuration are handled via the Otello system.

2.2.4. Café Discounts

A POS terminal tracks members' café purchases using their membership card. Custom hardware retrieves the member's details and stores the current valid name on the server. This information is retrieved by PapayaPOS during checkout. Once the transaction is processed in PapayaPOS, the account information is saved in Airtable.

The member presents their card at the bar when paying for a meal. The LabPOS terminal verifies the member’s identity and displays their name. The bartender processes the payment in PapayaPOS, which triggers a call to a predefined endpoint in the Otello system.

2.3. User characteristics

The system distinguishes between two types of users:

Administrator – has full access to the system and can modify or update it as needed.

Regular User – The users of our software will be clients of Lab.cafe, specifically those using their maker space. On the Lab.cafe webshop, users choose between a Hobby membership or Maker membership depending on the times they wish to access the workshop and the activities they want to pursue. Once their membership is set, they freely use the workshop space for tasks like school projects, launching a startup, or experimenting with new ideas.

2.4. General constraints

The system relies on external services such as Fabman, Woocommerce, Make.com, Superfaktura, Airtable, and Octoprint, and any outages or changes to these services can impact its functionality. Hardware devices like Raspberry Pi have limited performance, which could cause issues during more demanding operations. Processes such as machine access or claiming a 3D print job require quick responses from users, which may sometimes be impractical. The system's functionality also depends on the reliable performance of API calls that connect various components.

2.5. Assumptions and dependencies

The system's operation assumes the stable performance of external services like Woocommerce, Fabman, Make.com, and others. The internal Otello system must be reliable since it manages critical functions like access to 3D printers and locks. Fabman Bridge and RDIF technology must reliably verify user access. The system requires a stable internet connection to ensure all devices, including Raspberry Pi and terminals, function properly. Additionally, it is crucial that hardware is well-configured and regularly updated to prevent any issues during operation.

3. Specific requirements

3.1. Workshop requirements

a) Access to machines is only allowed with a valid membership card.
b) The time limit to acquiring the machine is 5 minutes.
c) After the time limit expires, the machine will stop its operation.
d) Machine usage is only possible after presenting a valid membership card.
e) Machine usage is only possible after completing the training for the specific machine.
f) The central server has an overview of all machines.
g) Each machine is connected to a Raspberry Pi running Octoprint, which monitors the machine's status.
h) The central server displays the list and current status of the machines.
i) The central server records each machine's job on the server, specifically:
    - Membership card ID
    - Start of machine usage
    - End of machine usage
    - Machine ID
    - Job performed
j) Machine configuration is done via the internal Otello system.
k) The central server offers the user the option to acquire the machine via a button on the terminal.
l) During active work, the machine is unavailable for acquiring.
m) Once the work is completed, the machine becomes available again for use.
n) A machine requiring supervision during work will request the membership card to be presented at regular intervals of 5 minutes.

3.2. Door access requirements

a) Door opening is only possible with a valid membership card.
b) A lock module is installed on the doors.
c) The membership card is presented to the module.
d) The module indicates the result status with 3 LED lights:
    - Green – access granted
    - Red – access denied
    - Flashing red – an error occurred
e) The module communicates with the Otello system's API.
f) The Otello system determines door access.
g) Access evaluation must be completed within 1 second.
h) Upon successful verification, the doors open for 3 seconds.

i) Two types of membership cards are distinguished according to section (2.3) Regular user.
j) The HOBBY type has access allowed only on Wednesdays.
k) The MAKER type has access allowed every day.
l) Access is granted even if the connection to the module fails.

3.3. Café requirements

a) A membership card reader module, LabPOS, is located at the checkout.
b) During payment, the membership card can be scanned.
c) The module will display the member's name on the screen based on the scanned membership card.
d) The module saves the current member's name on the server using an API call.
e) After the transaction is completed, the PapayaPOS system saves the member’s bill in Airtable.