

Module Interface Specification for Plutos

Team #10, Plutos

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1 Revision History

Date	Version	Notes
01/13/2024	0.1	Sections 2–5
...

2 Symbols, Abbreviations and Acronyms

See Section 1.3 of the [SRS Documentation](#).

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3 Introduction

The following document details the Module Interface Specifications (MIS) for the Plutos project.

Complementary documents include the [System Requirement Specifications \(SRS\)](#) and [Module Guide \(MG\)](#). The full documentation and implementation for the project can be found in the [Plutos repository](#).

4 Notation

The structure of the MIS for modules comes from [Hoffman and Strooper \(1995\)](#), with the addition that template modules have been adapted from [Ghezzi et al. \(2003\)](#). The mathematical notation comes from Chapter 3 of [Hoffman and Strooper \(1995\)](#). For instance, the symbol $:=$ is used for a multiple assignment statement and conditional rules follow the form $(c_1 \Rightarrow r_1 | c_2 \Rightarrow r_2 | \dots | c_n \Rightarrow r_n)$.

The following table summarizes the primitive data types used by Plutos.

Data Type	Notation	Description
character	char	a single symbol or digit
integer	\mathbb{Z}	a number without a fractional component in $(-\infty, \infty)$
natural number	\mathbb{N}	a number without a fractional component in $[1, \infty)$
real	\mathbb{R}	any number in $(-\infty, \infty)$

The specification of Plutos uses some derived data types: sequences, strings, and tuples. Sequences are lists filled with elements of the same data type. Strings are sequences of characters. Tuples contain a list of values, potentially of different types. In addition, Plutos uses functions, which are defined by the data types of their inputs and outputs. Local functions are described by giving their type signature followed by their specification.

5 Module Decomposition

An overview of the module decomposition can be found in Section 5 of the [Module Guide document](#).

6 MIS of OCR Processing Module

6.1 Module

OCR Processing Module

6.2 Uses

This module uses image processing libraries and text parsing utilities. It interacts with the Input Format Module and Machine Learning Module to process data effectively.

6.3 Syntax

6.3.1 Exported Constants

None

6.3.2 Exported Access Programs

Name	In	Out	Exceptions
processImage	Image file (binary)	Text data (structured)	FileError
validateImage	Image file (binary)	Boolean	FormatError

6.4 Semantics

6.4.1 State Variables

None

6.4.2 Environment Variables

This module interacts with the file system to read image files and uses external OCR libraries or APIs to extract text data.

6.4.3 Assumptions

The input image is in a supported format (e.g., JPEG, PNG). The OCR library or API is available and correctly configured.

6.4.4 Access Routine Semantics

processImage():

- transition: Parses the image and converts it into structured text data.
- output: Structured text data extracted from the image.
- exception: Throws a `FileError` if the image cannot be read or an unsupported format is provided.

validateImage():

- transition: Validates the input image format and dimensions.
- output: Returns true if the image is valid; false otherwise.
- exception: Throws a `FormatError` if the image format is invalid.

6.4.5 Local Functions

localImageProcessing():

- This function applies pre-processing steps to the image, such as resizing, noise reduction, or thresholding, before OCR is applied.

localTextExtraction():

- This function uses an OCR library to extract raw text from the pre-processed image.

MIS of Authentication Module

This module manages user authentication, utilizing Firebase Authentication to handle login and registration. It also interacts with React Native components for the user interface.

Module

Authentication Module

Uses

This module uses Firebase for authentication purposes. It interacts with Firebase Authentication to handle user login and registration, as well as React Native components for the user interface.

Syntax

Exported Constants

- **auth**: An instance of Firebase Authentication, initialized using the Firebase app.
- **db**: An instance of Firebase Firestore, initialized using the Firebase app.

Exported Access Programs

Name	In	Out	Exceptions
loginWithEmailPassword	email (string), password (string)	user object	InvalidEmail, MissingPassword, InvalidCredential, GeneralError
createUserWithEmailAndPassword	email (string), password (string)	user object	InvalidEmail, WeakPassword, GeneralError

Semantics

State Variables

The module maintains state for username, password, and credential error messages to support user interactions and error handling.

Environment Variables

The module interacts with the Firebase Authentication API for user management and relies on Firebase configuration to communicate with the backend services.

Assumptions

It is assumed that the Firebase configuration is valid and correctly set up. Network connectivity is also assumed to be available for authentication operations.

Access Routine Semantics

loginWithEmailPassword():

- transition: Authenticates the user with the given email and password, and transitions the application to the "Overview" page if successful.
- output: Returns a user object containing user details upon successful login.
- exception:
 - **InvalidEmail:** The email address is not valid.
 - **MissingPassword:** No password was provided.
 - **InvalidCredential:** Email or password is incorrect.
 - **GeneralError:** A generic error occurred during login.

createUserWithEmailAndPassword():

- transition: Creates a new user account with the provided email and password.
- output: Returns a user object containing user details upon successful registration.
- exception:
 - **InvalidEmail:** The email address is not valid.
 - **WeakPassword:** The password provided is too weak.
 - **GeneralError:** A generic error occurred during registration.

Local Functions

validateCredentials():

- Checks the validity of the entered username and password before attempting login or registration.

handleErrors():

- Maps Firebase error codes to user-friendly error messages displayed on the UI.

MIS of [Module Name —SS]

[Use labels for cross-referencing —SS]

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L^AT_EX for hyperlinks to external documents. —SS]

6.5 Module

[Short name for the module —SS]

6.6 Uses

6.7 Syntax

6.7.1 Exported Constants

6.7.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

6.8 Semantics

6.8.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

6.8.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

6.8.3 Assumptions

[Try to minimize assumptions and anticipate programmer errors via exceptions, but for practical purposes assumptions are sometimes appropriate. —SS]

6.8.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]

- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

6.8.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

References

- Carlo Ghezzi, Mehdi Jazayeri, and Dino Mandrioli. *Fundamentals of Software Engineering*. Prentice Hall, Upper Saddle River, NJ, USA, 2nd edition, 2003.
- Daniel M. Hoffman and Paul A. Strooper. *Software Design, Automated Testing, and Maintenance: A Practical Approach*. International Thomson Computer Press, New York, NY, USA, 1995. URL <http://citeseer.ist.psu.edu/428727.html>.

7 Appendix

[Extra information if required —SS]

Appendix — Reflection

[Not required for CAS 741 projects —SS]

The information in this section will be used to evaluate the team members on the graduate attribute of Problem Analysis and Design.

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing “what you think the evaluator wants to hear.”

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

1. What went well while writing this deliverable?
2. What pain points did you experience during this deliverable, and how did you resolve them?
3. Which of your design decisions stemmed from speaking to your client(s) or a proxy (e.g. your peers, stakeholders, potential users)? For those that were not, why, and where did they come from?
4. While creating the design doc, what parts of your other documents (e.g. requirements, hazard analysis, etc), if any, needed to be changed, and why?
5. What are the limitations of your solution? Put another way, given unlimited resources, what could you do to make the project better? (LO_ProbSolutions)
6. Give a brief overview of other design solutions you considered. What are the benefits and tradeoffs of those other designs compared with the chosen design? From all the potential options, why did you select the documented design? (LO_Explores)