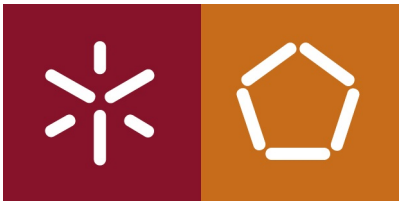
University of Minho

Integrated Master in Informatics Engineering



TuiChain

Projeto em Engenharia Informática

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1 The Purpose of the Project

1.1 Context

The lack of monetary possessions is one of the main obstacles to higher academic education and professional specialization. The cost of higher education in a country like the United States of America is around 100,000 dollars [1]. In view of these exorbitant figures, it is not expected that everyone will be able to bear such a financial burden. In addition, there are several underdeveloped countries that lack social programs to support education, making access to higher education even more difficult. Despite the cost, higher education courses are becoming increasingly important for entering the labor market. Companies are increasingly looking for people who are highly specialized in particular technical and scientific fields.

To cover the costs associated with education, students traditionally resort to loans from banks, to which they will have to pay an associated interest, possibly entering credit spirals (successive loans to pay off previous ones). Finally, many students are unable to borrow from these institutions because they represent a high risk investment, *i.e.*, students are often disregarded.

Currently, there exist institutions that provide education financing through Income Share Agreements (ISAs). An example in Portugal is the *Fundação José Neves* [2], which establishes contracts with students so that their training can be financed. In return, the students, when entering the job market, pay a percentage of their salary for a certain number of years, in order to cover the financed amount. However, in this model, the capital available for student funding is limited to the capital of the institution originally providing the funds.

1.2 Goals of the Project

With this in mind, we propose a platform based on blockchain technology, which brings together lenders and students who need financing. Through this platform, students should be able to publish requests for funding, subject to the usual conditions of an ISA. Any individual may browse the platform for such requests and decide to finance, in part or in full, the tuition costs of one or more students.

The platform must ensure that when funding is raised for the student's entire application, the money is transferred to the student and the lenders receive tokens representing the student's debt (the amount of tokens is proportional to the fraction financed). After the student makes the final payment (as stipulated by the conditions agreed upon at the time of the request's publishing), the full returned amount is transferred to the holders of the tokens corresponding to the debt in question, in proportion to the amount of tokens owned.

These tokens should also be able to be traded between potential stakeholders, thus forming a secondary market where it is possible to announce the intention to

sell/purchase tokens. In this case, the value of the token will be defined by the market, through the existing supply and demand. In addition, revenue may be generated from the application of fees on these transactions. Compared to existing exchanges, the platform should have the advantage of providing specialized search functionalities, in order to enable the identification of more or less attractive offers (+/- risk, +/- reward), according to the desire of each user.

2 The Stakeholders

In this section, we describe the people who have interest in the product, which are commonly called the *stakeholders*. Stakeholders are not only individuals or institutions that intend to invest capital in the product — all those who intend to use or otherwise take advantage of the product can be considered stakeholders.

2.1 The Client

Since the client is defined as someone who makes an investment in the product, there is no one who respects this definition as well as our own working group, in partnership, and with *Subvisual*'s mentoring.

After well defining our motivations, already described in the first section, we decided to invest in the project and create the desired platform.

2.2 The Customer

The customer is defined as someone who pays to acquire the system when it is ready to be used. Given this notion it becomes clear who are the customers of this project, not least because they coincide with the ultimate consumers and users of the product. They are the *students* and the *investors*.

This kind of users, don't necessarily pay to acquire the system, but, by using it, they will be paying because that's how the system works. It needs these two types of users to work properly. Students that need funding, and investors who lend them the money they need.

2.3 Other Stakeholders

All other stakeholders with a direct or indirect interest in the product will be listed below. It will be presented the knowledge they can provide to the team and how they will be affected by the product.

2.3.1 Banks

Banks are the first competitors of our product, since they are the ones we want to replace in the task of lending money to students for their higher education courses. They apply high interest rates, and require monthly payment from the moment the loan is made. The problem is that students do not have the money to pay for the education they need.

They'll be affected by our product because they will lose a portion of their usual student clients to our product, which offers a solution that fits them better.

2.3.2 *Fundação José Neves*

This foundation was created by a portuguese philanthropist, who had the idea of improving the education of the portuguese population. They use ISAs, which are agreed with the students, fighting one of the banks disadvantages. This foundation has a problem, though. They established a ceiling for funding, and they don't fund everyone who need, instead they choose which students to fund. Besides, this foundation is the only investor, not allowing anyone else to invest.

In this way they'll be affected by our product because the students that are not funded will use our product. The people who wants to give a little contribute and invest in some student education will be able to.

2.3.3 Lambda School

This institution also use ISAs, which are agreed with the students, where all have the same value (30,000$). Also, to be able to use this ISAs you have to be either a US citizen, a US permanent resident or a DACA (Deferred Action for Childhood Arrivals) recipient, which by itself is a disadvantage. They only offer courses that exist in the organization (Data Science and Full Stack Web), which is not an accredited institution and does not offer a degree but a certificate of completion.

By expanding this product to other countries, namely the USA, we will be giving a real opportunity to these students that may want to study in a accredited university or get, for example, the PhD that they really want. Consequently, a significant part of these students may want to use our product instead of seeking an ISA through Lambda Schools.

2.3.4 Developers, Software Engineers and Infrastructures

It's expected that the team where these elements are integrated have the skills necessary for the development of the product, such as, know object-oriented programming, manage a project and test software.

The development of the product will promote the creation of new job opportunities in the area of software development.

2.3.5 *Comissão Nacional de Proteção de Dados*

The product that is being developed must comply to the norms of CNPD for the management and use of user data gathered.

3 Nomenclature and definition conventions

Students People who need funding to increase their degrees, including doctorates, MBAs, bachelor's degree, post-graduations and others.

Tuition The needed amount to get a degree.

Investors People who contribute to the debts of students in order to make a profit.

Blockchain Distributed ledger technology that allows data to be stored globally on thousands of peers, while letting anyone on the network see everyone else's entries in near real-time. No one can control or own the data.

Ethereum Decentralised open source blockchain network with smart contracts functionality, allowing users to create their own programs on top of the network infrastructure.

Smart Contract Piece of code that specifies a set of rules to manage transactions in a blockchain environment.

ISA An income share agreement (or ISA) is a financial structure in which an individual or organization provides something of value (often a fixed amount of money) to a recipient who, in exchange, agrees to pay back a percentage of their income for a fixed number of years.

Secondary market A place where investors can resell their tokens to another investor in the hope of making some profit or avoiding losing money.

Token Digital asset that represents a portion of a student's debt. The student has legal obligation to pay each part of his debt to each token owner.

NFT NFT stands for non-fungible token, which is a specific type of token that has different aspects from any other token. It's like a collectable, it hasn't a fixed or stable value, instead it has the value that the owner wants it to have.

4 Functional Requirements

As mentioned before, there are two types of users, each with specific needs and objectives. The functional requirements for students are presented below, followed by the requirements of investors. The Volere Requirements Specification was used to describe each requirement.

Req. nº: **F01** Type: **9**

Description: **As either a student or investor, I want to register on the platform so that I can be identified and have exclusive access to personal data.**

Acceptance Criteria: **Given a register form, when I provide my name, age, address, email, password, ID and a photograph, then I'm registered on the system.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F01-b** Type: **9**

Description: **As either a student or investor, I want to register on the platform via external services (ex: Google), so that I can be identified and have exclusive access to personal data.**

Acceptance Criteria: **Given a service prompt and I successfully login on it, when I provide additional information such as my name, age, address, ID and a photograph, then I'm registered on the system.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F02** Type: **9**

Description: **As either a student or investor, I want to login on the platform so that I can access my personal data.**

Acceptance Criteria: **Given a login form, when I provide my email and password, then I'm authenticated in the system.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F02-b** Type: **9**

Description: **As either a student or investor, I want to login on the platform via external services (ex: Google) if I previously registered with it.**

Acceptance Criteria: **Given a service prompt, when I successfully login on it, then I'm authenticated in the system.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F03** Type: **9**

Description: **As a student I want to register a request for funding so that I can be financed.**

Acceptance Criteria: **Given a funding form and I'm logged in, when I provide my CV, a letter of motivation, the institution I want to study, the course I intend to take and the cost of its tuition, then I can create a request for funding.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F04** Type: **9**

Description: **As a student I need to sign a contract so that the loan can be materialized.**

Acceptance Criteria: **Given a contract issued by the company, when we both sign the contract, then the contract is materialized.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F05** Type: **9**

Description: **As a student I want to be able to change my professional status as well as my income so I can pay or suspend my loan according to those information.**

Acceptance Criteria: **Given that my professional status or income changes, when I'm available to change that information, then I'm able to modify my profile with the correct information**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F06** Type: **9**

Description: **As a student I want to pay back to the various investors who hold parts of my debt so that I can fulfill the contract I signed.**

Acceptance Criteria: **Given that I'm working, then I'm able to pay back my debt, so I can pay off my debt regularly.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F07** Type: **9**

Description: **As an investor, I want to login with my virtual wallet so that I can invest in students.**

Acceptance Criteria: **Given I'm logged in, when I introduce my wallet information, then I can start using my funds.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F08** Type: **9**

Description: **As an investor I want to buy a portion or all of a student's tuition so that I can help her/him get the education (s)he needs, and hope to profit later.**

Acceptance Criteria: **Given my wallet has funds, when I buy student tokens, then I can manage them as I see fit.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F09** Type: **9**

Description: **As an investor, I want to cancel my financing, so that I can get my funds back.**

Acceptance Criteria: **Given a funding is not fulfilled, when I cancel my contribution, then I retrieve the funds I've invested.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F10** Type: **9**

Description: **As an investor, I want to sell tokens I have so that I can have some profit**

Acceptance Criteria: **Given I have tokens, when I sell them, then I receive the corresponding value.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F11** Type: **9**

Description: **As an investor, I want to see all students asking for financing, so that I can fund them.**

Acceptance Criteria: **Given I have money to invest, when I search for students asking for financing, then I can fund them**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F12** Type: **9**

Description: **As an investor, I want to access a student's profile, so that I can evaluate and fund her/him.**

Acceptance Criteria: **Given I want to invest in a student, when I search for students asking for funding, then I can check their profile**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **F13** Type: **9**

Description: **As an investor, I want to manage my portfolio**

Acceptance Criteria: **Given I want to check any of my investments, when I access my profile, then I can check my portfolio**

Originator: **Brainstorming**

Priority: ***Must have***

5 Non-Functional Requirements

5.1 Look and Feel Requirements

Req. nº: **NF01** Type: **10**

Description: **The application shall have a simple and elegant feel, in order to simplify the user experience.**

Fit Criterion: **A sample of representative users shall be able to use the product effectively after 20 minutes of use.**

Originator: **Brainstorming**

Priority: ***Must have***

5.2 Usability and Humanity Requirements

Req. nº: **NF02** Type: **11**

Description: **The application shall be easy to use for people who have basic education and have some e-currency experience**

Fit Criterion: **90% of a test panel should be able to successfully complete given list of tasks within 30 minutes.**

Originator: **Brainstorming**

Priority: ***Must have***

5.3 Performance Requirements

5.3.1 Capacity Requirements

Req. nº: **NF01** Type: **12**

Description: **The application shall be able to handle large customer loads.**

Fit Criterion: **The application will have to handle hundreds of client requests per minute**

Originator: **Brainstorming**

Priority: ***Must have***

5.3.2 Scalability or Extensibility Requirements

Req. nº: **NF01** Type: **12**

Description: **The application shall be able to support an increase in the number of customers.**

Fit Criterion: **If the platform shows a daily/monthly/anual load increase, then it should be prepared to tolerate it.**

Originator: **Brainstorming**

Priority: ***Must have***

5.4 Operational and Environmental Requirements

Req. nº: **NF01** Type: **13**

Description: **The application shall be able to work in any web browser.**

Fit Criterion: **Given any browser, when the website is accessed, then the interfaces load correctly.**

Originator: **Brainstorming**

Priority: ***Must have***

5.5 Maintainability and Support Requirements

Req. nº: **NF01** Type: **14**

Description: **The application shall be modular in order to guarantee a more accessible maintenance.**

Fit Criterion: **The application shall be divided in layers, creating boundaries between interfaces, logic and services.**

Originator: **Brainstorming**

Priority: ***Must have***

Req. nº: **NF01** Type: **14**

Description: **The application source code must be well documented.**

Fit Criterion: **The source code of the application must provide at least 1 comment for each function / method developed that explains the manipulated variables and values.**

Originator: **Brainstorming**

Priority: ***Must have***

References

[1] HSBC Holdings. The Value of Education: The price of success. Technical report, HSBC Holdings, 2018. Retrieved Nov. 8, 2020 from https://www.us.hsbc.com/content/dam/hsbc/us/en_us/value-of-education/HSBC_VOE5_USA_FactSheet_508r2.pdf.

[2] Home – Fundação José Neves. Retrieved Nov. 8, 2020 from https://joseneves.org/.