Prepare Students for Software Industry
A case study on an agile full stack project

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Outline

- Introduction
- Background
- Case Study
- Results and Lessons Learned
- Conclusion

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Abstract

- Reducing the gap between Software Engineering education and the needs of the software industry is a goal for Academia
- The approach presented in this paper has involved the staff of a software company in collaboration with the staff of an academic Institution and resulted in a student's involvement in a full-stack software development project
- Results show that this agile and full-stack approach allows students to develop cutting-edge technical and non-technical skills
- The paper presents the approach, the achieved results, some lessons learned and some guidelines for the future

Introduction

- Nowadays, there is a considerable demand for well-prepared professionals
- There is a need for a well-prepared new generation of engineers using new approaches and a more holistic experience of modern software development activity
- In the software industry, many advances are happening to speed up development
- Another essential aspect nowadays is the great possibility of integration and interconnection between various systems. This makes it increasingly important that the new generation of IT professionals knows the services available and what mechanisms to use to integrate them into their applications. This can be acquired in theory, but nothing is better than consolidating it through developing projects that use this integration and other technologies. Cloud service providers are cases in point
- Full-stack development has changed, with new areas and skill sets becoming important
- Job market needs more technically well-prepared graduates with good soft skills
- Preparing the new generation of engineers requires training not only in the technical subjects that are the knowledge base but also the vision, and more holistic experience about the paths followed today by software companies and the soft skills

Goals

- Prepare students for the software industry reality, still in the academic environment and in close collaboration with partners from the software development industry
- Involvement of a software house company that develops software for the international market
- Training not only in the technical subjects that are the knowledge base but also the vision, and more holistic experience about the paths followed today by software companies and the soft skills
- Contribute to reduce the gap that sometimes exists between what is learned in academia and what is needed in the industry

Background

- Developers often:
  - do not just play a single role in software development
  - should be able to work both in the web platform and mobile application development
  - should be able to use software development tools and techniques that allow the development team to be at its highest level of productivity
- Higher education institutions face a challenging task in preparing students to work proactively in these high-performance teams
  - Many approaches have been proposed to teach and learn Software Engineering subjects
    - Some attempt to motivate students to take a more active role in their training and provide them with more realistic experiences by replicating the settings used in the software development profession
    - Project-based learning, flipped classrooms, and gamification are some of these strategies
    - Some promote a closer involvement of software companies. These approaches are suitable for students because they provide real challenges, more realistic experiences, and recreating industry software development environments. They are also crucial for companies.

Background

- Software engineering teaching has been adapting to new developments and trends, namely the agile methodologies
- Agile practices would positively influence the teaching process
- Besides the good results obtained by several of the strategies, software engineering teaching and learning can still benefit from a more participative and closer involvement of software development companies in the training process
- This can enable students to join distributed teams, enhance their non-technical skills, and engage themselves in the practices used in these companies

Case Study

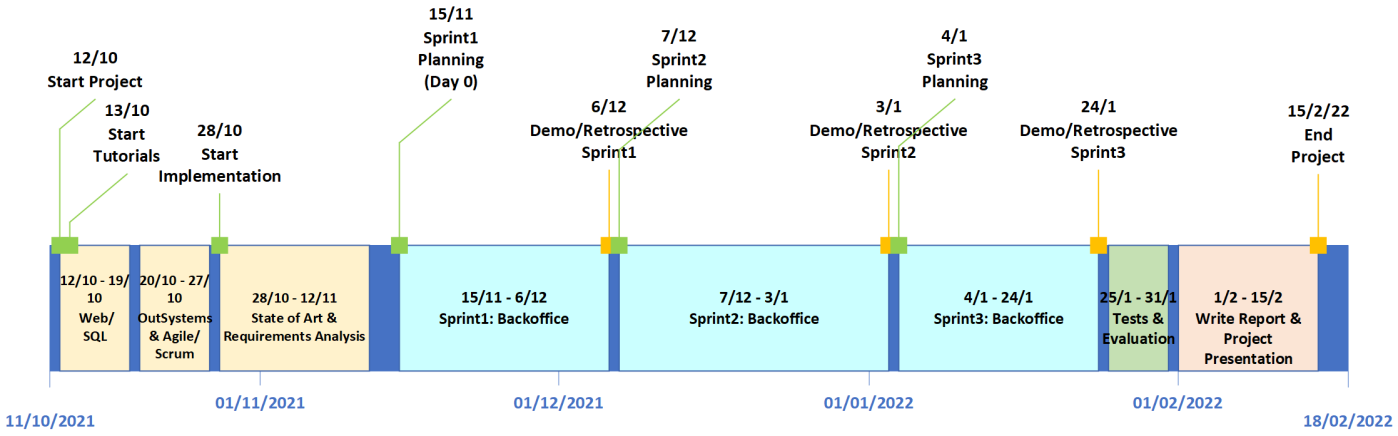
- Develop an application for household accounting

- Team
  - 6 members
    - 1 member of the company acted as product owner
    - 2 members of the company (with vast experience in terms of development using the adopted platforms) acted as coaches/development technical support
    - 1 member was the student that acted as a developer
    - 2 teachers acted as scrum masters and in some tasks as coaching (documentation, timeline, etc.)
  - The student view
    - Besides getting support for the development of the project/product, he also assimilated experience in terms of teamwork (soft skills), realizing the difficulties and aspects that are common in business projects of this type
    - The members' posture was demanding and methodical, continually adopting practices equal to what is done in the day-to-day business activity

Case Study

- Process
  - SCRUM framework
  - Scrum's artefacts were met, such as product backlog, sprint backlog, etc.
  - Jira was used to manage all stages so that details of the evolution and its rhythm could be adequately monitored in an articulated manner

- Timeline of one of the semesters:



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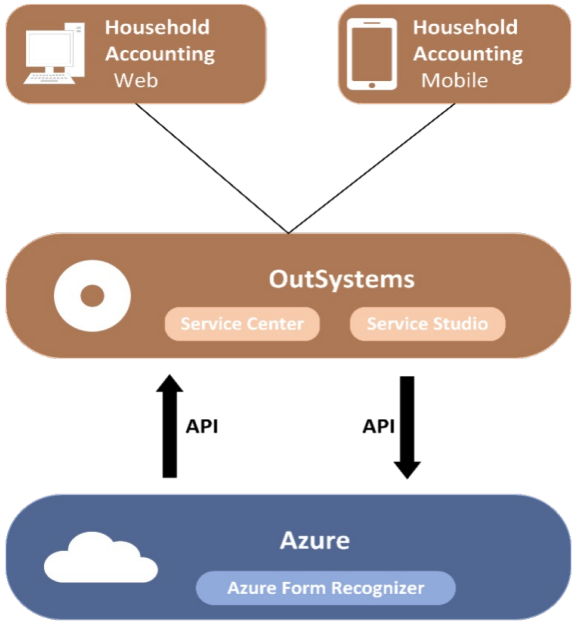
Case Study

- Project
  - User stories, wireframes, ER model
  - For the user stories, the acceptance criteria were defined, which helped to design the test cases and thus contribute to a robust application
  - Research, development, software integration, application synchronisation (web and mobile), security, agile Scrum framework, teamwork, and new tools (low-code platform, integration with cloud azure, cognitive services, Jira, etc.)
  - Report of all phases and details of each aspect covered during the implementation process was also made
  - In the final stage of the project, acceptance tests were done to determine if the implemented features were useful and satisfied the users' needs
  - This work involved full-stack web and mobile development using the OutSystems low-code platform

Case Study

- Project
  - Architecture

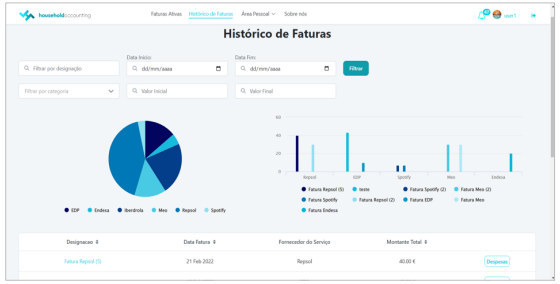


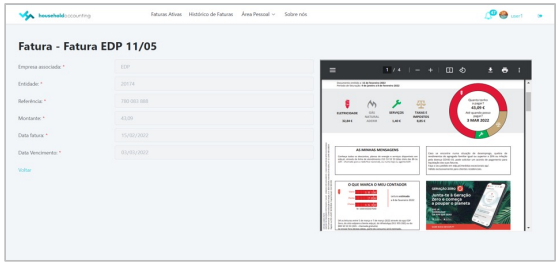
Case Study

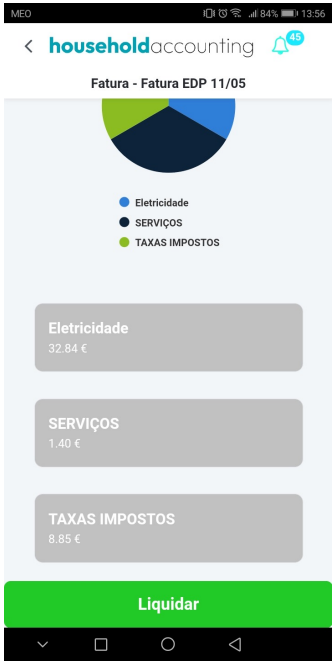
- Product
  - Recognition and automatic data extraction from documents (invoices, receipts, etc.)
  - Mechanisms to recognise and extract data from invoices and store, organise and manage these data
  - OutSystems platform to develop the current project was a requirement from the company
  - Web and mobile applications using the OutSystems low-code platform, allowing users to manage their expenses in a digital format, independently of the users receiving the documents digitally or on paper
  - Resulting product was an application (web and mobile) with the integration of cognitive services that allows (among other functionalities) the user to:
    - Register invoices
    - Process invoices (recognise and extract) data from pdf or an image captured by a smartphone.
    - See spending statistics of a specific type and period
    - …

Case Study

- Product
  - Web & mobile







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Results and Lessons Learned

- Potential users were asked to install and use the application and to respond to a survey.
- The analysis of the responses shows that:
  - 90% of respondents rate the application as useful or very useful
  - 80% of respondents rated the application as easy or very easy to use
  - All the respondents were satisfied or very satisfied with the automatic reading of invoice information
  - Importing invoices in PDF format were considered very important by 80% of respondents.
  - The import of invoices from a photo was considered important or very important by 60% of the respondents
  - In the open-answer question, it was possible to obtain some feedback on usability improvements and the reporting of some bugs
  - After completing the entire system within the planned period of 2 semesters, a high-quality software product was developed (all requirements implemented and good acceptance from potential external end-users)

Results and Lessons Learned

- This approach requires a dedication of at least one hour/week (average) to the teachers and the company's members
- In the case of the coaches (staff from the company), this period was longer due to all the daily meetings
- The dedication paid off because the result (resulting product, preparation of the student's technical and non-technical skills) was very positive
- The fact that everyone was engaged in developing a comprehensive project that involved all stages and components of the proposed architecture was challenging, motivating and clearly beneficial for all parties, that is, for teachers, students, and staff involved from the partner company

Conclusion

- The presented case study shares an agile approach to preparing students for the job market regarding SE practices in the context of final year projects (in the 5th and 6th semesters of the course curricular plan to complete the degree)
- This approach contributes to reduce the gap between SE education and practice in the software industry
- The student was involved in a distributed team with teachers and IT professionals from a software house to develop a product that demands full-stack development and agile best practices
- The case study presented illustrates the work methodology and the resulting product. In other words, the paper described people, the process, the project, and the product
- These industry-academia partnerships help students become better and quickly prepared to work in high-performing teams. They raise students´ employment opportunities by preparing them in cutting-edge fields and improving their soft skills to have better performance in software development teams
- These partnerships are also advantageous for the other involved partners. Hiring qualified human resources is good for the companies, as well as for the participating higher education institutions (contributes to improving their employability rate)