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**Abstract**

The ECOS project is a web-based marketplace developed as a response to the problem of informal waste management and illegal dumping in Puente Alto. Its main objective is to provide citizens with a secure and reliable platform where they can publish, donate, or sell unused items, promoting reuse and the circular economy. The project applies a hybrid agile methodology that combines Scrum and Kanban, structured in four sprints with defined deliverables. The expected outcomes include a functional technological solution that strengthens community waste management, validates the application of competencies from the Computer Engineering program, and demonstrates the feasibility of addressing social and environmental issues through software development.

1. **PART I**

| **1. Personal Information** |
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| The following table presents the requested information to be completed. |

| Student Names | **Camila Hormazabal Quintulen/ Cristóbal Marín Palacios /Rodrigo Montalván Rivera /Annais Romero Díaz.** |
| --- | --- |
| Rut | **21.195.029-3/ 19.920.373-8/20.226.543-K/ 20.538.007-8** |
| Program | **Computer Engineering** |
| Campus | **Puente Alto** |

| **2. Project APT Description** |
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| In this section, briefly indicate the name of your APT project and the competencies from the graduate profile that you will apply. If your program defines specific Areas of practice, also mention the Areas of practice related to the project. |

| Project Name | ECOS |
| --- | --- |
| Areas of practice | Software and web application development  IT project management  Software quality and usability assurance |
| Competencies | * Design and develop innovative and high-quality software solutions, applying the complete life cycle and following industry standards and best practices. * Design and adapt requirements engineering processes through the use of cutting-edge methodologies and industry standards. * Evaluate and manage IT projects, applying agile and hybrid methodologies to meet organizational requirements. * Develop innovative software projects for web platforms, using frameworks, development tools, and coding best practices. * Design secure and sustainable software solutions, considering aspects of quality, security, and scalability. |

| **3. Project APT Justification** |
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| Below are various fields that you must complete with the requested information. This section asks you to describe your project in detail and justify its relevance and significance. |

| Relevance of the APT Project | The ECOS project arises as a response to a social and environmental issue present in the municipality of Puente Alto, due to the accumulation of unused objects that end up in illegal dumping sites or are informally managed through social networks. This situation generates negative impacts on the urban environment, health risks, and the loss of goods that could otherwise be reused.  We chose this topic because it directly links technology with a real community problem, allowing us to apply computer science as a tool for social transformation. For our degree program, this issue is highly relevant since it requires us to design and implement a technological solution that incorporates requirements engineering, software development, project management, and quality control, all key competencies in the graduate profile.  The situation is located in Puente Alto, one of the most populated municipalities in the country, characterized by high waste generation and limited local capacity for waste management. It directly affects residents, especially families without the means to afford private collection services, which typically maintain contracts with large organizations and charge fees that are inaccessible to most households.  The value of this project is primarily social, as it provides the community with a formal platform that facilitates the reuse of goods, contributing to the reduction of illegal dumping sites. |
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| Project APT Description | The project consists of developing a web-based marketplace application that allows users to publish, search, sell, or donate unused items and give them a second life. The system will include user registration, differentiated roles (administrator/end user), a catalog with dynamic filters, secure sandbox transactions, automatic notifications, and report generation.  The goal is to deliver a functional technological solution that addresses the identified need in Puente Alto, promotes reuse, and improves community waste management. The project will be carried out using a hybrid agile methodology (Scrum and Kanban), ensuring iterative deliveries, continuous testing, and full traceability of requirements. |
| Relevance of the Project to the Graduate Profile | Our project is directly linked to the competencies of the graduate profile, as it requires designing and developing innovative, high-quality software solutions, applying the complete life cycle.  It requires us to manage an IT project with defined deadlines and deliverables, applying agile best practices.  It involves adapting requirements engineering processes and translating them into verifiable functionalities.  It demands the application of quality and security testing, ensuring usability and reliability in the developed software. |
| Relation to Professional Interests | The ECOS project connects with our professional interests in three main ways. First, through software development, as we are motivated by creating technological solutions from scratch and structuring them with best practices. Second, in project management, where we enjoy planning and organizing tasks, distributing resources, and coordinating the team. Finally, in software quality assurance, as we are committed to delivering secure, reliable, and user-friendly solutions.  By developing this project, we are confident that we will strengthen both our individual competencies and our ability to work collaboratively as a team, which will contribute significantly to our professional growth. |
| Feasibility of Developing the APT Project | The project is feasible within the semester since the duration is approximately 17 weeks, which allows us to organize the phases into four sprints with clear deliverables for each deadline.  We have scheduled hours and group work, which facilitates the distribution of responsibilities.  We will use open-source technologies (Python/Django, MySQL, Bootstrap, GitHub), which eliminates licensing costs.  External factors that facilitate development include access to free development environments, available bibliography, guidance from the instructor, and agile methodologies already applied in previous semesters.  Potential difficulties include the learning curve with Django/MySQL and the dependence on external services such as SMTP and sandbox payments. These risks will be mitigated through self-training, preliminary integration testing, and modular design that reduces the impact of possible errors on the system as a whole. |

1. **PART II**

| **4. Objectives** |
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| In this section, you must define the general and specific objectives of the APT Project. It is important to clarify that the objectives must be stated clearly and concisely, without further explanation; in other words, they must be self-explanatory. It is recommended that you write them using an infinitive verb, as this requires you to specify concrete actions. |

| General Objective | The objective is to develop a web-based marketplace application, called ECOS, that enables citizens to publish, search, donate, and sell unused items, fostering reuse and the circular economy through a secure, accessible, and reliable system that meets the defined functional and non-functional requirements. |
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| Specific Objectives | Gather and document the functional and non-functional requirements of the system, ensuring traceability and alignment with user needs.  Design the system architecture under a layered approach (Model-View-Controller), considering quality, security, and sustainability standards.  Implement the main modules of the web application, including user authentication, product publishing, catalog with filters, sandbox-based transactions, and exportable reports (PDF/XLS).  Develop the administration module for managing users, roles, categories, and system policies, ensuring effective control of the platform.  Apply unit, integration, and usability tests to validate the proper functioning of the system and achieve at least 90% of successful test cases.  Produce technical and end-user documentation, including manuals, a training plan, and defect records.  Meet the milestones and deadlines established in the project plan. |

| **5. Methodology** |
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| In the following section, you should describe the methodology specific to your discipline that you will use to complete the APT project described above, including the stages and working methods. |

| Description of the Methodology |
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| For the development of this APT project, *ECOS*, a hybrid agile methodology will be implemented, based on the principles of Scrum and complemented with Kanban tools for visual task management. This approach allows us to organize the work in short iterations (sprints), ensure continuous feedback, and maintain traceability of each deliverable.  The project will be divided into four main sprints, with clearly defined deliverables for each phase:   * **Sprint 1:** Initial documentation, requirements gathering, use cases, mockups, and WBS (Work Breakdown Structure). * **Sprint 2:** Architecture document, data dictionary, risk and RACI matrices, and development of core modules (login, registration, and initial maintainers). * **Sprint 3:** Implementation of main functionalities (publications, catalog, sandbox transactions, notifications, and reports). * **Sprint 4:** Execution of functional and integration tests, user manual, training plan, and project closure.   **Work Methods**   * Sprint planning meetings to define tasks, estimate effort, and prioritize deliverables. * Short daily meetings (15 minutes) to review progress, blockers, and next steps. * Sprint reviews to present progress and validate partial deliverables. * Retrospectives to identify improvements in collaboration and project management. * A digital Kanban board (Notion) will be used to manage and visualize task progress.   **Roles and Responsibilities**   * **Project Manager (Annais Romero):** Coordinates deadlines, scope, and costs; manages communication with stakeholders; and supervises documentation. **Rodrigo Montalván (PMO and QA/Tester):** Ensures methodological compliance and project traceability, and designs and executes quality tests (both manual and automated). * **Software Analyst/Developer (Cristóbal Marín):** Implements functional modules, manages the database, and develops unit tests. * **Designer (Camila Hormazabal):** Creates mockups and prototypes, and ensures user experience and platform usability. |

| **6. Evidences** |
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| Next, describe what evidence will be evaluated in the progress report and final report for your APT project. This evidence must be agreed upon with your teacher. Evidence refers to the products developed during the project whose purpose is to highlight or document how the work has been implemented. |

| **Type of Evidence (progress or final)** | **Name of Evidence** | **Description** | **Justification** |
| --- | --- | --- | --- |
| **Progress** | ERS Document (Software Requirements Specification) | Document detailing the functional and non-functional requirements of the ECOS system, including use cases and diagrams. | Validates that the system addresses clear and verifiable needs from the beginning. |
| **Progress** | Project Charter | Formal document that establishes the project’s objectives, scope, roles, and initial constraints. | Provides an official framework to start the project and aligns the team with its guidelines. |
| **Progress** | Requirements Spreadsheet | Detailed record of functional and non-functional requirements in a structured format. | Facilitates traceability and control of requirements during development. |
| **Progress** | Extended Use Case Document | Describes in detail the interaction flows between users and the system for each key functionality. | Ensures clarity on expected system behavior and reduces ambiguities in development. |
| **Progress** | Complete System Mockups | Visual representations of the main screens and navigation flow of the system. | Allows validation of usability and user experience before technical implementation. |
| **Progress** | WBS - Costs | Work Breakdown Structure along with cost estimation. | Helps organize project effort and estimate the required investment. |
| **Progress** | Roadmap | Visual plan of milestones and deliverables distributed over time. | Serves as a guide for planning and monitoring project progress. |
| **Progress** | Business Process Document (TO-BE) | Definition of improved processes to be supported by the technological solution. | Ensures alignment of the system with projected business processes. |
| **Progress** | RACI Matrix | Matrix defining responsibilities (Responsible, Accountable, Consulted, Informed) for each task. | Prevents role ambiguities and ensures clarity in project management. |
| **Progress** | Risk Matrix | Initial identification and analysis of project risks. | Facilitates anticipation of problems and definition of mitigation strategies. |
| **Progress** | Data Dictionary | Document describing attributes, data types, and main relationships of the database. | Ensures consistency in information modeling and facilitates technical implementation. |
| **Progress** | Meeting Minutes | Formal record of agreements, commitments, and topics discussed in each project meeting. | Maintains traceability of decisions and facilitates team communication. |
| **Progress** | Sprint Progress Report | Report of activities and results obtained in each sprint (if using agile methodology). | Allows assessment of partial objectives and adjustments to planning. |
| **Final** | Test Plan | Document defining test cases, scenarios, and criteria. | Ensures software quality through systematic validation. |
| **Final** | Database Test Matrix | Document evaluating consistency, integrity, and performance of the database. | Confirms that the database properly supports system operations. |
| **Final** | Defect Log | Record of errors found during testing and their resolution status. | Enables tracking and management of the defect correction process. |
| **Final** | Scope Verification | Document comparing final deliverables with initial requirements. | Ensures that the product meets the committed scope and quality. |
| **Final** | Training Plan | Materials and schedule to train users on system use. | Facilitates system adoption and ensures proper user operation. |
| **Final** | User Manual | Practical document guiding users on system functionalities. | Provides user autonomy and reduces need for constant support. |
| **Final** | Change Control Matrix | Formal record of changes in requirements, scope, or schedule. | Ensures change management and decision traceability. |
| **Final** | Project Closure Report | Document compiling results, lessons learned, and project evaluation. | Serves as evidence of completion and final reflection. |
| **Final** | APT Final Report | Comprehensive academic document in Spanish and English summarizing the process and results. | Represents the formal submission to be evaluated by the institution. |
| **Final** | PowerPoint Presentations (Progress and Final) | Presentations to communicate project progress and final results. | Facilitates delivery to the instructor, evaluation committee, and stakeholders. |

| **7. Work Plan** |
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| In the following table, define the planning for your APT Project as required. |

| **APT Project Work Plan** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Competence or Units of Competence** | **Name of Activities/Tasks** | **Description Activities/Tasks** | **Resources** | **Duration of the activity** | **Responsible** | **Observations** |
| Manage IT projects | **Project Charter** | Document that formalizes the beginning of the project, defining framework, roles, and objectives. | Word, team meetings | Sprint 1. | Annais Romero  Rodrigo Montalván | Foundational document, dependent on initial team agreements and context. |
| Design and adapt requirements processes | **Requirements (FR/NFR)** | Elicitation and documentation of functional and non-functional requirements. | Requirements spreadsheet, Excel | Sprint 1. | Annais Romero  Rodrigo Montalván.  Cristóbal Marín. | May require adjustments after validation with instructor. |
| Design software solutions | **Initial SRS** | Document with software requirements specification, use cases, and NFRs. | Word, ERS guide, Excel | Sprint 1. | Annais Romero  Cristóbal Marín | Highly iterative document, to be refined in later phases. |
| Design software solutions | **Extended Use Cases** | Detailed modeling of interactions between actors and the system. | Word | Sprint 1. | Rodrigo Montalván | Must be validated together with functional requirements. |
| Design software solutions / Develop technical documentation | **System Mockups** | Visual prototypes of main screens and flows. | Balsamiq | Sprint 1. | Cristóbal Marín  Camila Hormazabal | Facilitates early validation of usability. |
| Manage IT projects | **WBS - Costs** | Work Breakdown Structure with cost estimation. | Excel | Sprint 1. | Annais Romero | Basis for financial planning. |
| Design innovative and high-quality software solutions | **Architecture Document (DAS - Part 1)** | Definition of the system’s technical architecture (layers, DB, integrations). | Word, UML, Lucidchart/Draw.io | Sprint 2. | Cristóbal Marín  Annais Romero | Must be approved before development. |
| Design and adapt requirements engineering processes | **TO-BE Processes** | Modeling of future processes describing the ideal operation of the system. | Bizagi | Sprint 2. | Rodrigo Montalván  Annais Romero  Cristóbal Marín  Camila Hormazabal | Must be validated with instructor and team feedback. |
| Design and generate information solutions | **Data Dictionary** | Definition of entities, attributes, and rules for the database. | MySQL, Excel | Sprint 2. | Cristóbal Marín | Essential for consistency in later software development. |
| Evaluate and manage IT projects | **RACI Matrix** | Assignment of responsibilities (Responsible, Accountable, Consulted, Informed). | Excel | Sprint 2. | Annais Romero | Requires team consensus. |
| Evaluate and manage IT projects | **Risk Matrix** | Identification, analysis, and categorization of initial risks. | Excel | Sprint 2. | Rodrigo Montalván | Living document, to be updated during the project. |
| Develop software solutions using coding best practices | **Login/Registration + Initial CRUD (users, roles, categories)** | Development of basic modules for authentication and initial management. | Django, MySQL, Bootstrap, GitHub | Sprint 2. | Cristóbal Marín | Critical base for the rest of the functionalities. |
| Evaluate and manage IT projects | **Change Control Matrix** | Formal record of changes in requirements, scope, and design. | Excel | Sprint 2. | Cristóbal Marín  Camila Hormazabal | Ensures project traceability. |
| Develop innovative web software solutions | **Product Publishing and Management** | Module to create, edit, pause, and reactivate product listings with photos and attributes. | Django, MySQL, Bootstrap | Sprint 3. | Cristóbal Marín  Camila Hormazabal | Must validate business rules. |
| Design and generate high-quality software solutions | **Catalog with Filters and Search** | Development of the catalog with dynamic filters (category, location, price, status). | Django, MySQL, Bootstrap | Sprint 3. | Cristóbal Marín | NFR: Response time must be < 3 seconds. |
| Build programs and routines of varied complexity | **Transactions (Sales/Donations with Sandbox)** | Implementation of the purchase/donation flow with sandbox payment integration. | Django, API Sandbox (MercadoPago) | Sprint 3. | Cristóbal Marín | Risk of dependency on external service. |
| Design secure and reliable software solutions | **Email Notifications** | Setup of automatic emails for key events (registration, transactions, status changes). | Django, SMTP, mail server | Sprint 3. | Cristóbal Marín | Validate delivery only to registered accounts. |
| Design and generate innovative high-quality solutions | **Secondary CRUDs (statuses, payment methods, policies)** | CRUD modules for payment methods, product statuses, and policies. | Django, MySQL | Sprint 3. | Cristóbal Marín  Camila Hormazabal | Must maintain consistency with DB and prior FRs. |
| Design data-driven software solutions | **Reports (sold products, transactions per period)** | Exportable reports (PDF/XLS) of listings and transactions. | Django, ReportLab/XlsxWriter libraries | Sprint 3. | Cristóbal Marín  Rodrigo Montalván | Must validate filters and data consistency. |
| Design and generate information solutions | **Database Script** | SQL script creation to load initial data and ensure DB integrity. | MySQL | Sprint 3. | Cristóbal Marín | Requires integrity and relational tests. |
| Evaluate and manage IT projects | **Scope Verification** | Validation that implemented modules aligned with the roadmap and defined requirements. | Checklist, meeting minutes | Sprint 3. | Annais Romero  Rodrigo Montalván | Precondition for QA in Sprint 4. |
| Perform software certification testing | **Functional and Integration Tests** | Validation of overall system performance across different scenarios. | Selenium, Unittest, checklist | Sprint 4. | Rodrigo Montalván. | At least 90% of test cases must pass. |
| Build programs and routines of varied complexity | **Database Test Matrix** | Document recording DB query and routine test results. | Excel, MySQL | Sprint 4. | Cristóbal Marín.  Rodrigo Montalván. | Ensures DB consistency and performance. |
| Perform software certification testing | **Defect Log** | Control document recording errors found during QA. | Excel, defect log sheet | Sprint 4. | Rodrigo Montalvan.  Cristóbal Marín.  Camila Hormazabal. | Ensures traceability and quality control. |
| Develop technical and user documentation | **User Manual + Training Plan** | Final documentation to guide users and training plan. | Word, PowerPoint | Sprint 4. | Annais Romero.  Camila Hormazabal. | Ensures proper user adoption. |
| Evaluate and manage IT projects | **Final APT Report 2.0 (Spanish/English)** | Formal document consolidating results, methodology, evidence, and lessons learned. | Word | Sprint 4. | Annais Romero.  Rodrigo Montalván. | Requires team review before submission. |
| Evaluate and manage IT projects  Effective Communication | **Final Presentation PPT** | Executive presentation of the project for defense before committee. | PowerPoint, Canva | Sprint 4. | Annais Romero.  Cristóbal Marín.  Rodrigo Montalván.  Camila Hormazabal. | Requires rehearsals and team coordination. |

| **8. Gantt chart** |
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| Find a Gantt chart format that suits you and organize the activities planned in the previous point, taking into account the period assigned for the development of your APT Project. You must maintain the academic period timeline in the development of the three phases covered by the Degree Portfolio Course. |

| **Activities** | **Sprint 1** | | | | **Sprint 2** | | | | **Sprint 3** | | | | | | | **Sprint 4** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **w 1** | **w 2** | **w 3** | **w 4** | **w 5** | **w 6** | **w 7** | **w 8** | **w 9** | **w 10** | **w 11** | **w 12** | **w 13** | **w 14** | **w 15** | **w 16** | **w 17** |
| Project Charter | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Requirements (FR/NFR) |  | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Initial SRS (Software Requirements Specification) |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Extended Use Cases |  |  | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| System Mockups |  |  | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| WBS - Costs (Work Breakdown Structure - Costs) |  |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Architecture Document (DAS - Part 1) |  |  |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| TO-BE Processes |  |  |  |  | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |
| Data Dictionary |  |  |  |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |
| RACI Matrix |  |  |  |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |
| Risk Matrix |  |  |  |  |  | **X** |  |  |  |  |  |  |  |  |  |  |  |
| Login/Registration + Initial CRUD (users, roles, categories) |  |  |  |  |  |  | **X** | **X** |  |  |  |  |  |  |  |  |  |
| Change Control Matrix |  |  |  |  |  |  |  | **X** |  |  |  |  |  |  |  |  |  |
| Product Publishing and Management |  |  |  |  |  |  |  |  | **X** |  |  |  |  |  |  |  |  |
| Catalog with Filters and Search |  |  |  |  |  |  |  |  |  | **X** |  |  |  |  |  |  |  |
| Transactions (sales/donations with sandbox) |  |  |  |  |  |  |  |  |  |  | **X** | **X** |  |  |  |  |  |
| Email Notifications |  |  |  |  |  |  |  |  |  |  |  | **X** |  |  |  |  |  |
| Secondary CRUD (statuses, payment methods, policies) |  |  |  |  |  |  |  |  |  |  |  | **X** | **X** |  |  |  |  |
| Reports (sold products, transactions by period) |  |  |  |  |  |  |  |  |  |  |  |  | **X** | **X** |  |  |  |
| Database Script |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |  |  |  |
| Scope Verification |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |  |  |
| Functional and Integration Testing |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |  |
| Database Testing Matrix |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |  |
| Defect Log |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |  |
| User Manual and Training Plan |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** | **X** |
| Final APT Report 2.0 (Spanish/English) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |
| Final Presentation PPT |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** |

**8. Conclusions**

The ECOS project represents a concrete response to a social and environmental problem in Puente Alto, where informal waste management has led to health risks and the accumulation of unmanaged waste in public spaces. By designing a web marketplace, our team has demonstrated the ability to integrate professional competencies such as software development, requirements engineering, and project management. This phase has allowed us to validate the feasibility, confirming that the objectives, methodology, and work plan are coherent with the resources available. In addition, the project has proven to be relevant for our professional field, since it not only applies technical knowledge but also addresses real community needs.

**9. Reflection**

During the development of this first phase, we recognized both strengths and areas for improvement. As strengths, we highlight the collaborative effort of the team, the clarity of the objectives, and the structured methodology chosen, which ensures traceability and organization. We also value the social impact of the project, which motivates us to deliver a solution that goes beyond an academic exercise. However, we identified some challenges, such as the need to reinforce our technical skills in Django and database integration, and to improve the precision of our English writing to meet academic standards. This reflection allows us to set clear actions for the following stages: continuous training, periodic reviews of quality indicators, and reinforcement of communication within the team. We believe that these improvements will strengthen the ECOS project and our professional growth.