



POLITECNICO
MILANO 1863

Project Plan

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Contents

1	Introduction	1
1.1	Purpose and scope	1
1.2	Acronyms	2
2	Project size, cost estimation and effort estimation	3
2.1	Size estimation: Function Points	3
2.1.1	Internal Logic Files (ILFs)	4
2.1.2	External Interface Files (EIFs)	5
2.1.3	External Inputs (EIs)	5
2.1.4	External Inquiries (EQs)	6
2.1.5	External Outputs (EOs)	6
2.2	Overall estimation	7
3	COCOMO II analysis	8
3.1	Software scale drivers analysis	8
3.2	Software cost drivers analysis	9
3.2.1	Product factors analysis	9
3.2.2	Platform factors analysis	9
3.2.3	Personnel factors analysis	10
3.2.4	Project factors analysis	11
4	Effort estimation	12
4.1	Screen view	12
4.2	Effort (average) estimation	13
4.3	Effort (over) estimation	13
5	Scheduling	14
5.1	RASD	15
5.2	DD	16
5.3	Development	17
5.4	Deployment and Start Up	18
6	Resource allocation	19
6.1	Resource allocation - Lo Bianco Riccardo	20
6.2	Resource allocation - Manzoni Mirco	21
6.3	Resource allocation - Mascellaro Giuseppe	22
7	Risk analysis	23
8	References	24
9	Hours of work	24

1 Introduction

1.1 Purpose and scope

This document represents the Project Plan Document for the PowerEnJoy project. Its main purpose is to analyze the expected complexity of PowerEnJoy and assist the project leader in the phase of cost and effort estimation. This information can be subsequently used as a guidance to define the required budget, the resources allocation and the schedule of the activities, as well as a compedium for stakeholders to decide wether to invest in the project.

In the first section, we use the approach based on Function Points, in order to provide an estimate of the expected size of PowerEnJoy both in terms of lines of code and of the cost/effort required to actually develop it.

In the first part we use the Function Points approach to define the size of the system to be developed in terms of number of functionalities to be provided. Then we use the results to perform an appropriate analysis through the use of COCOMO II, a tool capable of providing an accurate estimation of the cost of the project in terms of time and money.

In the second section we explore the possible flow of the developing through its different phases, in order to allocate the resources in an optimal way along the time necessary to complete the job.

Finally, we discuss on the possible risks that PowerEnJoy could face during the various phases of the project and elaborate general conclusions.

1.2 Acronyms

- FP: Function Points.
- ILF: Internal Logic File.
- EIF: External Interface File.
- EI: External Input.
- EO: External Output.
- EQ: External Inquiry.
- DBMS: Database Management System.
- API: Application Programming Interface.

2 Project size, cost estimation and effort estimation

In this paragraph we provide our estimation regarding the expected size, cost and required effort for the development of PowerEnJoy application.

For what concerns the size estimation we used function points approach, taking into account a realistic amount of lines of code for each of the major functionalities of the application. All the analysis is brought on from the point of view of the business logic, without taking into account the user interface.

2.1 Size estimation: Function Points

Through the following chapter, we present considerations related to the different software elements composing the system. Here we resume their role one by one, reporting the pre-defined set of weights used to compute the function points:

- **ILFs**: files used to store persistent information necessary for the functions of the logic.
- **EIFs**: files used to store persistent information necessary for the functions that manage the interaction with the external components (ex. APIs).

For Internal Logic Files and External Interface Files

	Data Elements		
<i>Record Elements</i>	<i>1-19</i>	<i>20-50</i>	<i>51+</i>
1	Low	Low	Avg
2-5	Low	Avg	High
6+	Avg	High	High

- **EIs**: elementary external input activities

For External Inputs

	Data Elements		
<i>File Types</i>	<i>1-4</i>	<i>5-15</i>	<i>16+</i>
0-1	Low	Low	Avg
2-3	Low	Avg	High
4+	Avg	High	High

- **EOs**: elementary external output activities
- **EQs**: elementary external output activities

For External Outputs and External Inquiries

	Data Elements		
<i>File Types</i>	<i>1-5</i>	<i>6-19</i>	<i>20+</i>
0-1	Low	Low	Avg
2-3	Low	Avg	High
4+	Avg	High	High

So we can resume the weights we will use along the discussion as follows.

UFP Complexity Weights

	Complexity Weight		
<i>Function Type</i>	<i>Low</i>	<i>Average</i>	<i>High</i>
Internal Logic Files	7	10	15
External Interfaces Files	5	7	10
External Inputs	3	4	6
External Outputs	4	5	7
External Inquiries	3	4	6

2.1.1 Internal Logic Files (ILFs)

Here we report the ILFs used by PowerEnJoy to store the information it needs to offer the required functionalities. The ILFs presented below reflects the entities designed for the DB of the application (refer to the DD for a complete description of the DB structure).

ILF	Complexity	FPS
PaymentInfo	Low	7
Users	Average	10
Operators	Average	10
Invoices	Low	7
Notifications	Low	7
Rides	Low	7
Cars	Average	10
MinorIssues	Low	7
SafeParkingAreas	Average	10
SpecialParkingAreas	Average	10
Total		85

2.1.2 External Interface Files (EIFs)

Our system manages some operations with the aid of external APIs. We need to interact with Maps API and Navigation API in order to show the map and to guide the user during his trip. Similarly, we use the Payment Manager API in order to process our clients' payments and Driving License Authority API to elaborate information about the driving licence of a new user that join our service, and lastly we use an e-mail API to send mail to users.

EIF	Complexity	FPs
Maps API	Low	7
Navigation API	Average	10
Payment Information API	Average	10
Driving License Authority API	Low	7
E-Mail API	Low	7
Total		34

2.1.3 External Inputs (EIs)

In this paragraph we take into account the transactional function point, allowing users to maintain Internal Logical Files (ILFs) through the ability to add, change and delete the data.

Between the functional requirements listed in the RASD, we have identified the following functionalities, labelled as External Input.

EI	Complexity	FPs
Sign up	Average	4
Log in	Low	3
Reservation request	Low	3
Cancel a reservation	Low	3
Search for cars located nearby or by specifying an address	Low	3
Navigation to a car	Low	3
Navigation to a place	Low	3
Enable money saving option	Low	3
Make a report about a car	Average	4
Unlock reserved car	Low	3
Request a new password	Low	3
Request a new password	Low	3
Show last rides' invoices	Low	3
Insertion of password in order to ignite the engine	Low	3
Total		42

2.1.4 External Inquiries (EQs)

External Inquiries represent data retrieval requests performed by a user that don't require complex computations.

PowerEnJoy offers to the user information about invoices, reservations, safe and special parking areas and cars. It also offers to our operators information about minor issues and rides.

EQ	Complexity	FPs
Retrieve last invoices	Average	4
Retrieve reservation info	Low	3
Retrieve safe parking area	Low	3
Retrieve special parking area	High	6
Retrieve car's information	Average	4
Retrieve minor issue	Average	4
Retrieve rides	Average	4
Total		28

2.1.5 External Outputs (EOs)

This Transactional Function point gives the user the ability to produce outputs. The results displayed are derived using data that is maintained and data that is referenced. In function point terminology the resulting display is called an External Output (EO). In accordance to the RASD documents, we have identified these points:

EO	Complexity	FPs
Send password to user	Low	4
Sign up confirmation	Low	4
Show current reservation time	Low	4
Show reservation confirmation	Low	4
Show last rides' invoices	Average	5
Show canceling reservation	Low	4
Show navigation tips	Average	5
Show cars located nearby or by specifying an address	Average	5
Show money saving option navigation tips	Average	5
Show almost empty battery notification	Low	4
Show non-uniform cars' distribution notification	High	7
Show technical issue notification	High	7
Show driver recognition confirmation	Low	4
Show engine deactivation notification	Low	4
Show 8 hours' driving time exceeded notification	Low	4
Total		70

2.2 Overall estimation

Here we present the summation of the total FP calculated in the previous steps:

Function Type	Value
Internal Logic Files	85
External Interface Files	34
External Inputs	42
External Inquiries	28
External Outputs	70
Total	259

With regard to the FP method, the total value is correlated to the expected effort to be put into the deployment of the system. We use the constant values reported in <http://www.qsm.com/resources/function-point-languages-table> MODIFICA for calculating the lower and upper bounds in the number of lines of code deployed in J2EE language: in particular, we chose the *average* multiplier value (46 for J2EE) for calculating the lower bound and the *high* multiplier (67 for J2EE) for calculating the upper bound.

Depending on the conversion rate, we have a lower bound of:

$$\text{SLOC} = 259 * 46 = 11914$$

and an upper bound of

$$\text{SLOC} = 259 * 67 = 19684$$

3 COCOMO II analysis

3.1 Software scale drivers analysis

In the following lines we present a brief description of the software scale drivers taken into consideration by the COCOMO II software, with:

- **Precedentedness (PREC)**: it reflects the previous experience of the team with the development of projects similar to the current one. Since we are not expert in the field, we chose to set the value to *very low*.
- **Development flexibility (FLEX)**: it reflects the degree of flexibility in the development process with respect to the external specification and requirements. Since there are very strict requirements on the functionalities but we were left with relative freedom in the choice of the technology to be used, this value is set to *low*.
- **Risk resolution (RESL)**: it reflects the level of awareness and reactivity with respect to risks threatening the system. The risk analysis we performed covered the majority of possible bounds, so the value is set to *very high*.
- **Team cohesion (TEAM)**: it's an indicator of how well the team members work together in a cooperative way. For our team, the value is set to *very high*.
- **Process maturity (PMAT)**: the level reached in the creation of the system. On the 18 values scale, we reached the 11th level, so the value is set to *high*, coherently with the prescriptions of CSSE.

3.2 Software cost drivers analysis

In the following lines we present a brief description of the software cost drivers taken into consideration by the COCOMO II software. The cost drivers were evaluated using a post-architecture perspective to obtain an accurate analysis of the costs implied by the project. Cost drivers can be divided into four different subsections: product factors, platform factors, personnel factors and project factors.

3.2.1 Product factors analysis

- **Required software reliability (RELY)**: it represents the measure of the extent to which the software must perform its function over a period of time. We chose to set the value to *low*.
- **Data base size (DATA)**: it represents the effective size of our database. We estimated the fraction D/P and the result was around the value of 11, so we chose to set the value to *nominal*.
- **Product complexity (CPLX)**: it is the evaluated complexity of the produced software. The value is set to *nominal*, due to a complete analysis of device-dependent operations, data management operations, and user interface management operations.
- **Required reusability (RUSE)**: it represents the possibility to reuse the components in different environment. The value is set to *nominal*.
- **Documentation match to life-cycle needs (DOCU)**: it represents the suitability of the project's documentation to its life-cycle needs. This value is set to *nominal*, following the prescriptions of CSSE.

3.2.2 Platform factors analysis

- **Time constraint (TIME)**: it is a measure of the execution time constraint imposed upon a software system. This value is set to *high*, since we plan to use 70% of the execution time resource.
- **Main storage constraint (STOR)**: it is a measure of the degree of main storage constraint imposed on a software system or subsystem. This value is set to *nominal*, since we plan to use up to 50% of the main storage resources.
- **Platform volatility (PVOL)**: it is a measure of the amount of time that should pass before minor/major changes. This value is set to *low*, since we plan to make minor changes every month and major changes every year once the software is fully deployed.

3.2.3 Personnel factors analysis

- **Analyst capability (ACAP):** it represents the Analysis and Design ability, efficiency and thoroughness, and the ability to communicate and cooperate of the analysts. This value is set to *high*.
- **Programmer capability (PCAP):** it represents the ability of the programmers employed in the project. This value is set to *high*.
- **Personnel continuity (PCON):** it represents the percentage of personnel that does the turnover. This value is set to *very high*.
- **Applications experience (AEXP):** it represents the previous experience of the project team in development on the same applications used in the current software. This value is set to *very low* (2 months previous experience).
- **Platform experience (PEXP):** it represents the prevision for the necessity of a post-architecture. This value is set to *nominal* (1 year).
- **Language and tool experience (LTEX):** it represents the previous experience of the project team in development in the same language used in the current project. This value is set to *very low*.

3.2.4 Project factors analysis

- **Use of software tools (TOOL):** it represents the level of maturity of the software used. This value is set to *high*.
- **Multisite development (SITE):** it represents the level of the communication when the team worked in separated location. This value is set to *extra-high* (interactive multimedia used).
- **Requirement development schedule (SCED):** it represents the schedule constraint imposed on the project team developing the software. This value is set to *high*.

4 Effort estimation

We represent below the result of the analysis operated by the official online tool of COCOMO II. The results presented refers to the upper and lower bounds pointed out in the first chapter and to the drivers' values set in the previous chapter. For computing the estimated cost of the project we referred to an average wage of 3000 dollars per month for every employee.

4.1 Screen view

Software Scale Drivers

Precedentedness	Very Low ▾	Architecture / Risk Resolution	Very High ▾	Process Maturity	High ▾
Development Flexibility	Low ▾	Team Cohesion	Very High ▾		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Low ▾	Analyst Capability	Very High ▾	Time Constraint	High ▾
Data Base Size	Nominal ▾	Programmer Capability	Very High ▾	Storage Constraint	Nominal ▾
Product Complexity	Nominal ▾	Personnel Continuity	Very High ▾	Platform Volatility	Low ▾
Developed for Reusability	High ▾	Application Experience	Low ▾	Project	
Documentation Match to Lifecycle Needs	Nominal ▾	Platform Experience	High ▾	Use of Software Tools	High ▾
		Language and Toolset Experience	Very Low ▾	Multisite Development	Very High ▾
				Required Development Schedule	High ▾

4.2 Effort (average) estimation

Results

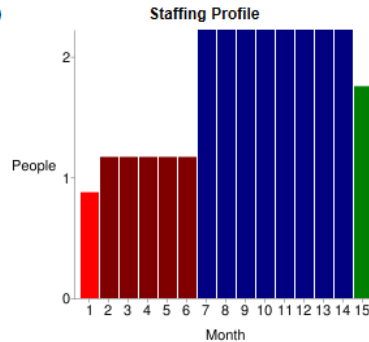
Software Development (Elaboration and Construction)

Effort = 25.3 Person-months
Schedule = 13.9 Months
Cost = \$76007

Total Equivalent Size = 11914 SLOC

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	1.5	1.7	0.9	\$4560
Elaboration	6.1	5.2	1.2	\$18242
Construction	19.3	8.7	2.2	\$57766
Transition	3.0	1.7	1.8	\$9121



Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.2	0.7	1.9	0.4
Environment/CM	0.2	0.5	1.0	0.2
Requirements	0.6	1.1	1.5	0.1
Design	0.3	2.2	3.1	0.1
Implementation	0.1	0.8	6.5	0.6
Assessment	0.1	0.6	4.6	0.7
Deployment	0.0	0.2	0.6	0.9

4.3 Effort (over) estimation

Results

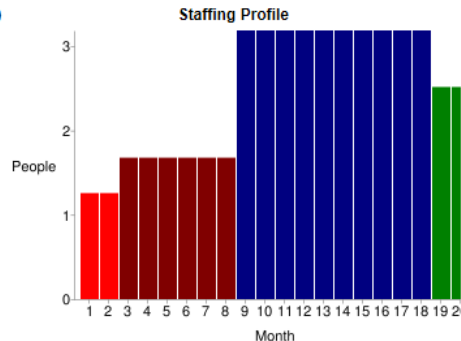
Software Development (Elaboration and Construction)

Effort = 43.3 Person-months
Schedule = 16.5 Months
Cost = \$129991

Total Equivalent Size = 19684 SLOC

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	2.6	2.1	1.3	\$7800
Elaboration	10.4	6.2	1.7	\$31198
Construction	32.9	10.3	3.2	\$98794
Transition	5.2	2.1	2.5	\$15599



Software Effort Distribution for RUP/MBASE (Person-Months)

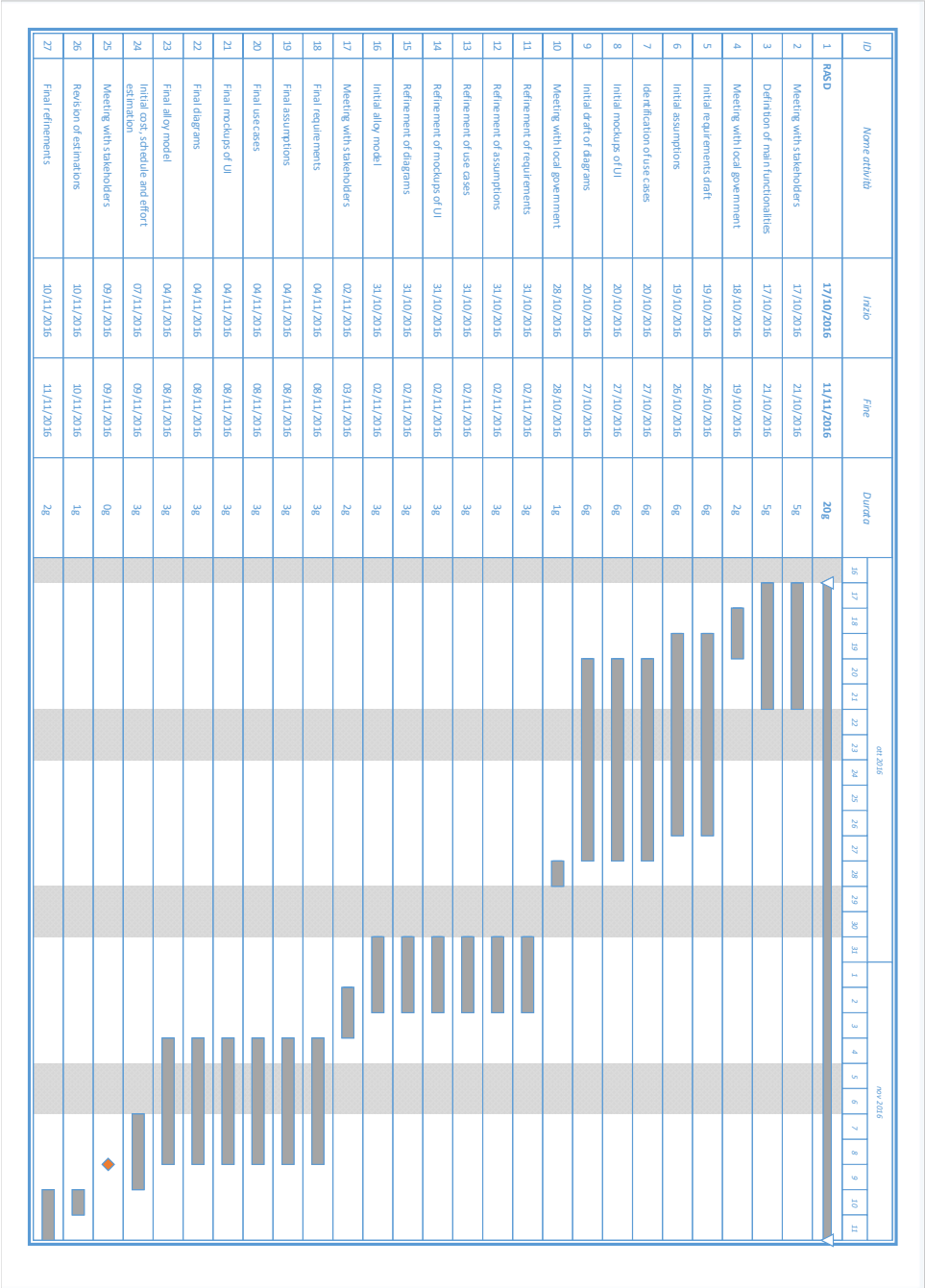
Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.4	1.2	3.3	0.7
Environment/CM	0.3	0.8	1.6	0.3
Requirements	1.0	1.9	2.6	0.2
Design	0.5	3.7	5.3	0.2
Implementation	0.2	1.4	11.2	1.0
Assessment	0.2	1.0	7.9	1.2
Deployment	0.1	0.3	1.0	1.6

5 Scheduling

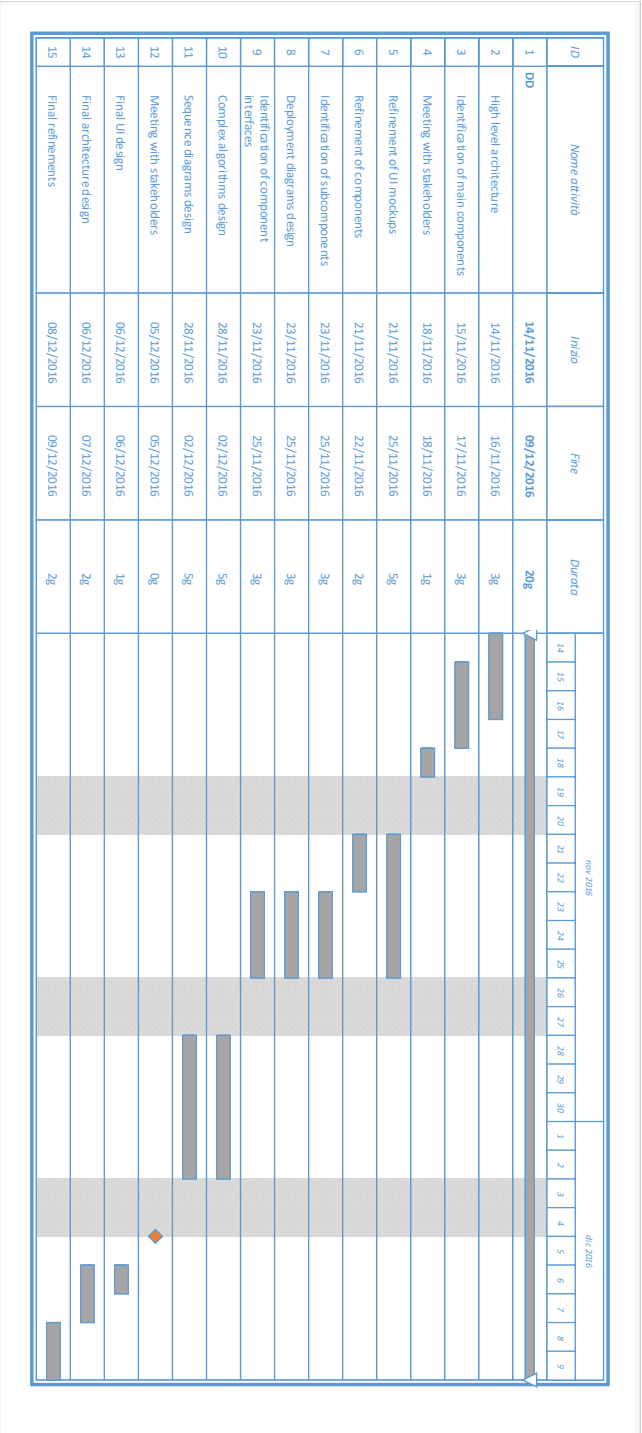
In this chapter provide a general, high-level project schedule. More accurate schedules will be defined during the project development to manage the internal organization of the single development phases, referring to the average evaluation made in the previous chapter. It is important to notice that, while this project is made for didactic purposes and no implementation, testing, deployment and start-up will be performed, we have nevertheless considered these steps as part of our schedule. This was made to try to take into account what could be the full development of this project, should it be entirely completed. As COCOMO II modeling pointed out that for our project the lower bound work effort's prevision is worth 25.3 person-months. Since we are a three people group, we would need $25.3 / 3 = 8.43$ months for developing our project entirely. We assumed to start our project (as it really happened) on October 17th and predicted to complete it within July 7th.

We used Gantt diagrams to highlight tasks duration, useful to schedule, coordinate and track each task providing a clear illustration of project's progress. In order to maintain readability, we have split the schedule in four main parts, each related to its main milestones. The first covers a time period which goes from October 17th to November 11th and concerns the RASD as actually happened. The second time period goes from November 13th to December 9th and concerns the DD as actually happened. The third is about the development phase and it is extended in a time period which goes from December 12th to June 2nd. The last is composed of two phases: deployment (June 5th – June 23rd) and start-up (June 26th – July 7th). All of these dates are designed considering that all the three members would have worked eight hour per day, five days per week.

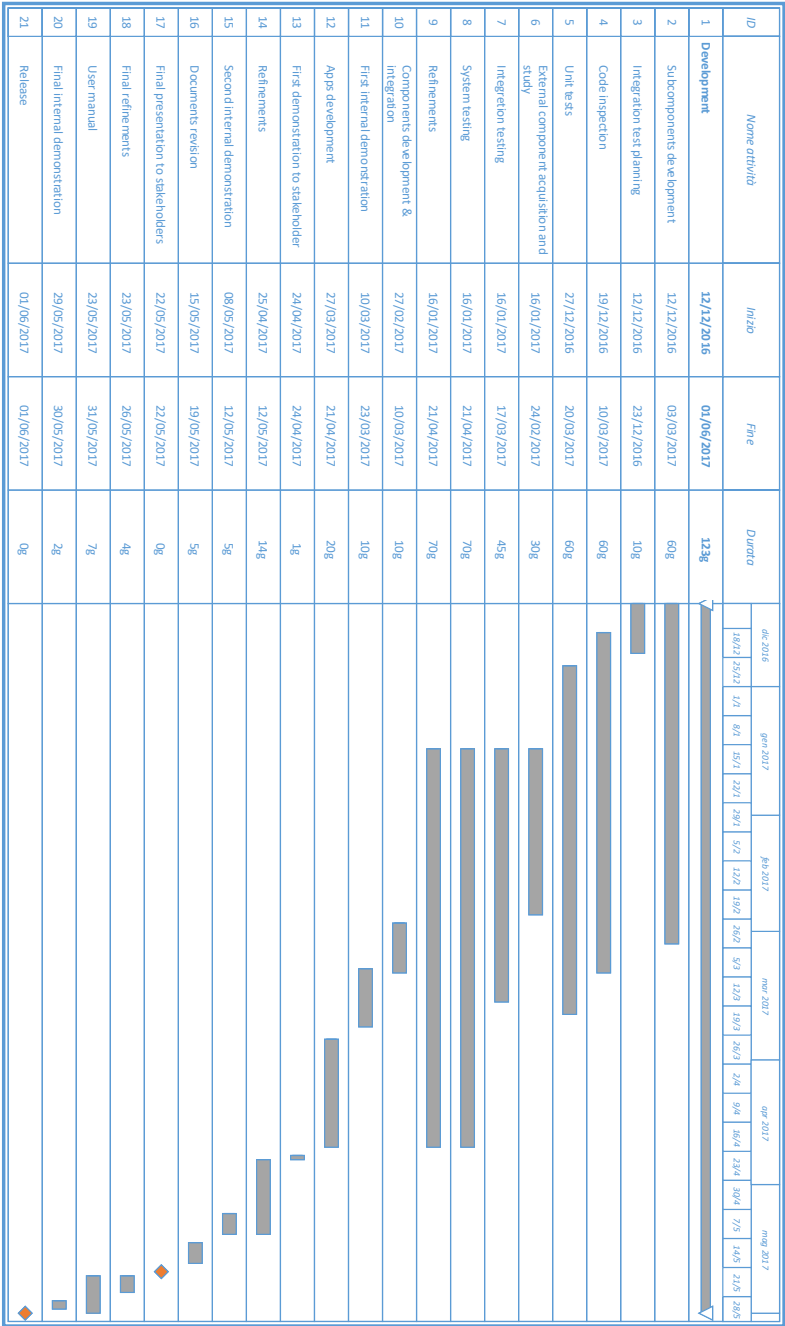
5.1 RASD



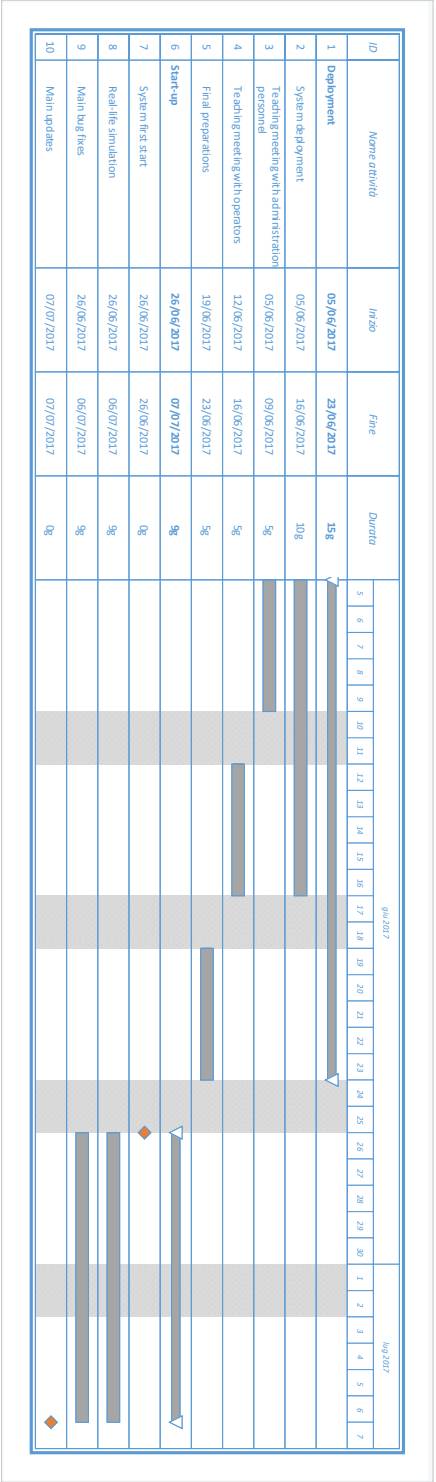
5.2 DD



5.3 Development



5.4 Deployment and Start Up



6 Resource allocation

In this chapter we're going to provide a general overview of how the tasks defined in the schedule in the previous section will be divided among the three members of the development team. More accurate schedules will be defined during the project development itself to manage the internal organization of each development phase.

As we already mentioned in the previous section, we have also included activities in the requirement analysis and design phases that won't actually take place, like the stakeholder's meetings, as well as the implementation, the deployment and the start-up phases. This has been purposefully done to have a more realistic depiction of how the development process should actually be brought on.

In order to maintain a good level of readability, we have split the document in three parts, one for each team member.

6.1 Resource allocation - Lo Bianco Riccardo

ID	Name/Activity	Start	End	Duration	2016												2017															
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1	Record-10 items	17/10/2016	06/07/2017	18M																												
2	Meeting with stakeholders	17/10/2016	21/10/2016	5d																												
3	Definition of main functionalities	17/10/2016	21/10/2016	5d																												
4	Meeting with local government	18/10/2016	19/10/2016	2d																												
5	Initial requirements draft	19/10/2016	26/10/2016	6d																												
6	Initial assumptions	19/10/2016	26/10/2016	6d																												
7	Initial mockup of UI	20/10/2016	27/10/2016	6d																												
8	Meeting with local government	28/10/2016	29/10/2016	1d																												
9	Refinement of requirements	31/10/2016	02/11/2016	3d																												
10	Refinement of assumptions	31/10/2016	02/11/2016	3d																												
11	Refinement of mockup of UI	31/10/2016	02/11/2016	3d																												
12	Meeting with stakeholders	02/11/2016	03/11/2016	2d																												
13	Final requirements	04/11/2016	08/11/2016	5d																												
14	Final assumptions	04/11/2016	08/11/2016	5d																												
15	Final mockup of UI	04/11/2016	08/11/2016	5d																												
16	Final diagrams	04/11/2016	08/11/2016	5d																												
18	Initial cost, schedule and effort estimation	07/11/2016	09/11/2016	3d																												
19	Meeting with stakeholders	09/11/2016	09/11/2016	1d																												
20	Revision of assumptions	10/11/2016	10/11/2016	1d																												
21	Final refinements	10/11/2016	11/11/2016	2d																												
22	High level architecture	14/11/2016	16/11/2016	3d																												
23	Validation of main components	15/11/2016	17/11/2016	3d																												
24	Meeting with stakeholders	18/11/2016	18/11/2016	1d																												
25	Refinement of mockups	21/11/2016	25/11/2016	5d																												
26	Refinement of components	21/11/2016	22/11/2016	2d																												
27	Complete algorithm design	28/11/2016	02/12/2016	5d																												
28	Meeting with stakeholders	06/12/2016	06/12/2016	1d																												
29	Final UI design	06/12/2016	06/12/2016	1d																												
30	Final architecture design	06/12/2016	07/12/2016	2d																												
31	Final refinements	08/12/2016	09/12/2016	2d																												
32	Development	12/12/2016	01/06/2017	124d																												
33	Deployment	05/06/2017	23/06/2017	15d																												
34	Start-up	26/06/2017	06/07/2017	9d																												

6.2 Resource allocation - Manzoni Mirco

ID	Name activity	From	To	Duration	2016												2017															
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1	Meetings	17/02/2016	06/07/2017	18 Mo																												
2	Meeting with stakeholders	17/02/2016	21/02/2016	5d																												
3	Definition of main functionalities	17/02/2016	21/02/2016	5d																												
4	Meeting with local government	18/02/2016	19/02/2016	2d																												
5	Initial requirements draft	19/02/2016	26/02/2016	6d																												
6	Initial assumptions	19/02/2016	26/02/2016	6d																												
7	Verification of use cases	20/02/2016	27/02/2016	6d																												
8	Initial draft of diagrams	20/02/2016	27/02/2016	6d																												
9	Meeting with local government	20/02/2016	28/02/2016	1d																												
10	Refinement of requirements	21/02/2016	02/03/2016	3d																												
11	Refinement of assumptions	21/02/2016	02/03/2016	3d																												
12	Refinement of use cases	21/02/2016	02/03/2016	3d																												
13	Refinement of diagrams	21/02/2016	02/03/2016	3d																												
14	Initial Alloy model	21/02/2016	02/03/2016	3d																												
15	Meeting with stakeholders	02/03/2016	09/03/2016	2d																												
16	Final requirements	04/03/2016	09/03/2016	3d																												
17	Final assumptions	04/03/2016	09/03/2016	3d																												
18	Final use cases	04/03/2016	09/03/2016	3d																												
19	Final diagrams	04/03/2016	09/03/2016	3d																												
20	Final Alloy model	04/03/2016	09/03/2016	3d																												
21	Cost and schedule and effort estimation	07/03/2016	09/03/2016	3d																												
22	Meeting with stakeholders	08/03/2016	09/03/2016	0d																												
23	Revision of assumptions	20/03/2016	30/03/2016	1d																												
24	Final refinements	20/03/2016	11/04/2016	2d																												
25	High level architecture	24/03/2016	16/04/2016	3d																												
26	Verification of main components	15/04/2016	17/04/2016	3d																												
27	Meeting with stakeholders	20/04/2016	16/04/2016	1d																												
28	Refinement of components	21/04/2016	22/04/2016	2d																												
29	Verification of subcomponents	22/04/2016	25/04/2016	3d																												
30	Deployment diagrams design	29/04/2016	29/04/2016	3d																												
31	Verification of component interfaces	29/04/2016	29/04/2016	3d																												
32	Sequence diagrams design	29/04/2016	02/05/2016	5d																												
33	Meeting with stakeholders	06/05/2016	09/05/2016	0d																												
34	Final architecture design	06/05/2016	07/05/2016	2d																												
35	Final refinements	08/05/2016	09/05/2016	2d																												
36	Development	12/05/2016	01/06/2017	12.4d																												
37	Deployment	05/06/2017	23/06/2017	1.5d																												
38	Start-up	26/06/2017	06/07/2017	5d																												

6.3 Resource allocation - Mascellaro Giuseppe

ID	Nome attività	Inizio	Fine	Durata	Gantt chart											
					01/01/2016	01/02/2016	01/03/2016	01/04/2016	01/05/2016	01/06/2016	01/07/2016	01/08/2016	01/09/2016	01/10/2016	01/11/2016	01/12/2016
1	Giuseppe Mascellaro	17/02/2016	06/07/2017	348h												
2	Meeting with stakeholders	17/02/2016	21/02/2016	3h												
3	Definition of main functionalities	17/02/2016	21/02/2016	3h												
4	Meeting with local government	20/02/2016	30/02/2016	2h												
5	Initial requirements draft	20/02/2016	26/02/2016	6h												
6	Initial assumptions	09/02/2016	26/02/2016	6h												
7	Verification of use cases	20/02/2016	27/02/2016	6h												
8	Initial draft of diagrams	20/02/2016	27/02/2016	6h												
9	Meeting with local government	20/02/2016	29/02/2016	1h												
10	Refinement of requirements	21/02/2016	02/03/2016	3h												
11	Refinement of assumptions	21/02/2016	02/03/2016	3h												
12	Refinement of use cases	21/02/2016	02/03/2016	3h												
13	Refinement of diagrams	21/02/2016	02/03/2016	3h												
14	Initial UML model	21/02/2016	02/03/2016	3h												
15	Meeting with stakeholders	02/03/2016	03/03/2016	2h												
16	Final requirements	04/03/2016	04/03/2016	3h												
17	Final assumptions	04/03/2016	04/03/2016	3h												
18	Final use cases	04/03/2016	04/03/2016	3h												
19	Final diagrams	04/03/2016	04/03/2016	3h												
20	Final UML model	04/03/2016	04/03/2016	3h												
21	Initial cost, schedule and effort	07/03/2016	09/03/2016	3h												
22	Meeting with stakeholders	09/03/2016	09/03/2016	6h												
23	Revision of estimations	20/03/2016	20/03/2016	1h												
24	Final refinements	20/03/2016	21/03/2016	2h												
25	High level architecture	24/03/2016	24/03/2016	3h												
26	Verification of main components	15/03/2016	17/03/2016	3h												
27	Meeting with stakeholders	20/03/2016	24/03/2016	1h												
28	Refinement of components	21/03/2016	22/03/2016	2h												
29	Verification of subcomponents	22/03/2016	22/03/2016	3h												
30	Deployment diagrams design	29/03/2016	29/03/2016	3h												
31	Verification of component interfaces	29/03/2016	29/03/2016	3h												
32	Sequence diagrams design	29/03/2016	02/04/2016	6h												
33	Meeting with stakeholders	06/04/2016	06/04/2016	6h												
34	Final architecture design	06/04/2016	07/04/2016	2h												
35	Final refinements	08/04/2016	09/04/2016	2h												
36	Development	12/04/2016	01/06/2017	124h												
37	Deployment	05/06/2017	23/06/2017	15h												
38	Start-up	26/06/2017	06/07/2017	9h												

7 Risk analysis

Through this chapter we take into account the risks the team may face through the development of the project. These risks may come from different sources, such as political and economical factors and environmental needs, but also related to the possible technical issues that may happen.

One possible risk that must be taken into account is the adversion of pre-existing companies that are directly or indirectly in competition with the services offered by PowerEnJoy, such as the "classical" car sharing services and the taxi drivers association. Of course these categories will try to prevent PowerEnJoy from entering the market by pushing on legal factors.

Another issue concerning this field is the fact that the city administration is one of the main stakeholders in a project like PowerEnJoy but, being a public entity, it must undergo strict dictates from the high level public authority.

These problems brings up the necessity of a phase of accurate research in the field of law as a starting point for the entire project, as well as the integration of the stakeholders as active elements in the management of the project along all its steps. In particular the times of the project plan must be modeled in order to take into account the need of several revisions with the stakeholders themselves. The process of legal revision of the project must be iterative and it should take place at least once every six months, plus every time a big change in national laws takes place (of course, in advance with the approval of the changes).

The environmental issues can concern the dismission of exhaust batteries and broken pieces, which requires a special contract for the dismission in stocks. Consulting an expert in this field is fundamental in the first phase of the project, and all the operators must undergo a special training provided by the company in order to be well aware of their role and tasks.

For what concerns the risks that may arise in the development phase, we must consider that the evaluation regarding the ability of our programmers with the language and the tools used may not match the previsions and lead to delay in the date of the deployment. To face this eventuality, the deadlines we planned are highly flexible and incremental, so that eventual issues can be faced with recurrent analysis of the code and with minor changes to the planning. It must be noticed that, regardless of the issues we may encounter during the coding phase, no other programmers will be hired. This is a common behaviour when developing huge projects, since the time necessary to introduce new team members in the environment most of times leads to additional delays.

Possible problems regarding the loss of parts of code due to issues in communication are handled by defining a strict schedule of backups, that the programmers must follow no matter what.

Problems can also arise during the design of the interactions with the external elements, such as APIs. This problem can be partially overcome trying to develop a code as portable as possible, so that eventual changes in the contracts with the partners can be handled in a not disruptive way, just by modifying a few lines of code, thus exploiting the information hiding principle to the fullest.

8 References

- **RASD** (RASD.pdf)
- **DD** (DD.pdf)
- **CSSE** (www.csse.usd.edu)
- **Wikipedia** (www.wikipedia.org)
- **Sunset COCOMO II Guide** (www.sunset.usc.edu)
- **Project Management Basics + Advanced** (Slides of the course)

9 Hours of work

The team divided the work into equivalent parts, even when modeling different parts of the document. In the following table we present a resume of the work division.

Lo Bianco Riccardo	12h
Manzoni Mirco	12h
Mascellaro Giuseppe	12h