Project Plan Document

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POLITECNICO
DI MILANO

Version 1.0

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1 Introduction

1.1 Purpose and Scope

1.1.1 Purpose

The purpose of the Presentation Plan Document is to document planning assumptions and decisions, facilitate communication among project stakeholders, and document approved scope, cost and schedule baselines. We will focus on the COCOMO II approach to estimate the cost required to develop the system, we will refer to some tables for the different parameters used.

1.1.2 Scope

The project PowerEnjoy will provide a service based on mobile application and web application, and the only target of this service is the clients.
All the clients of the service must be registered into the system.
The system allows the client to reserve a car, not already reserved, among the ones available. The client could make a reservation via the mobile application or web application selecting the car from a map that shows all the car of the company. After the client makes a reservation, he has a limited time to reach the selected car. If the reservation expires a penalty is subtracted from the user bill.
When the client turns on the engine of the car, the ride starts. At the end of the ride the system subtract the cost of the ride from the user's bill.
This system could be very useful for all the people that would like to reach places not covered by public transportation. This service is attainable everyday and at any time of the day. This project has also as purpose the decrease of the pollution in the city using electric car instead petrol-based car.
The system will track in each moment car's position with a GPS system located inside the car.
So the main purpose of the system is offering a car rent service simple to use that takes care about the environment.

1.2 Definition, Acronyms, Abbreviation

- COCOMO: COnstructive COst MOdel.
- RASD: Requirements analysis and specifications documents.
- DD: design document.
- CD: cost driver.
- ITPD: Integration Test Plan Document.
- PPD: Project Plan Document.
- EI: External Inputs.

- EIF: External Interface Files.
- EO: External Output.
- EQ: External Inquiries.
- FP: Function Point.
- FPA: Function Point Analysis.
- ILF: Internal Logic Files.
- ITPD: Integration Test Plan Document.
- LDF: Language-Dependent Factor.
- SLOC/KSLOC: Source Lines Of Code / Kilo Source Lines Of Code

1.3 Reference Documents

This PPD document is based on the previous DD, RASD, ITP documents.

2 Project size, cost and effort estimation

2.1 Function Points Weights

The FP estimation approach is based on the amount of functionality in a software and their complexity. Given the FP computation of the previous sections, the analysis can continue with the final estimate of the number of UFPs.

Function Type	Weight		
	Low	Average	High
External Input	3	4	6
External Inquiry	3	4	6
External Output	4	5	7
External Interface File	5	7	10
Internal Logic File	7	10	15

Table 1: Each FP type has a different weights. The weight differs on the complexity level of the single FP.

2.1.1 Internal Logic Files

The PowerEnjoy service platform relies on a number of ILF (Internal Logic Files) essentials for the system to work properly. In this section we are going to analyze them, providing a brief description of what kind of data we expect to store. Some informations are populated by system and they are contained in every ILF. These are the **timestamp**, **created by**, **updated by** and active fields.

- **Client**
  Every user taking advantage of our service is registered and personal data is stored in this table (prior authorization confirmed by him about company personal data treatment policies). This informations are name, surname, email, phone number, account number, nickname, password. System automatically fill the sys_id field using a counter algorithm that guarantee uniqueness of record and the pair <latitude, longitude> when tracking GPS position of the user.

- **SSO**
  Registered users avoid to authenticate on different part of our system multiple times if they are already logged in the platform. Information stored in this table are the user sys_id and the session_id saved for the user.

- **Technician**
  Most of technicians personal informations are stored in the ServiceNow platform and we record only fundamental ones in our system as ID, name, surname, competence groups and roles assigned.

- **Car** Every single car is registered in the database. We store information about license plate, brand, model, matriculation, revision date, insurance deadline payment, battery level, used/reserved status, kilometres amount, GPS coordinate (as pair <latitude, longitude>) and cost per minute.
- **Reservation** This table contains information about the status of all the reservations made by users in system lifetime. It has foreign keys on client and car, record reservation time, start time, end time, total cost sustained, discount earned and status (whose value could be awaiting user, pending, intermediate stop, closed). System scripts calculate time elapsed since field valorization and store data into a separate table called **Metrics**. This is a strumental table as we want to monitor, for example, the amount of time passed from user reservation inquiry to effective trip start, in order to apply overdue and total payments correctly.
- **Incident**
  This table tracks all the incidents opened on cars by both clients and technicians. it contains foreign keys on the user issuing the request, the technician working on the incident, and the car whose incident is about. Proper informations about status, categorization and amount of work are received via SOAP message from ServiceNow platform and transformed properly from the table **TemporaryTransformation** into our **Incident** table.
- **Problem**
  A problem is generated by a technician working on an incident if during incident handling has been found an issue deserving a separated treatment. Foreign keys are related to the technician opening the problem and the incident which is related to. Other informations are retrieved from the ServiceNow platform in the same way as for the Incidents.
- **SafeArea**
  Safe area informations are radius and the pair <latitude, longitude> of a point from which calculate circle area and retrieve cars included in it. Other informations listed are number of car present, number of recharging turrets, number of turrets in use.

The following table shows the complexity about developing these files:

2.1.2 External Logic Files

The external source our platform relies on, is the ServiceNow platform and the Geolocalization and Mapping service. Interactions are possible through SOAP communication and data must be processed before adding it to our database.
The feature we want to implement using external sources are:

- GPS geolocalization of devices;
- Incident and problem management.

Client	Low	7
SSO	Low	7
Technician	Low	7
Car	Low	7
Reservation	Average	10
Incident	Average	10
Problem	Average	10
SafeArea	Low	7
Total	65	

The following table shows estimated complexity of these files:

GPS geolocation	Average	7
GPS SafeArea tracking	High	10
Incident and Problem handling	High	10
Total	27	

Table 2: Feature implemented with external sources.

2.1.3 External Inputs

Our platform will receive several inputs from external sources. We will try to list them along with the estimated complexity of the features introduced in the system to handle these cases.
All users functionalities:

- **Login/Logout**: simple operations handled bySSO.
- **Password retrieval**: operation requiring some interactions between instances due to security constraints - average complexity.
- **Open an incident on a car**: basic process handled by IncidentController. No different impact if the incident is opened from car computer, mobile application or webservice.

Client:

- **Register**: straight-forward simple operation.
- **Change settings**: operation requiring some interaction between instances, as a change can impact in various scenarios.
- **Reserve a car**:operation requiring some interaction between instances. Some controls have to be performed from the system, such as fields correctness and information integrity.
- **Reservation details request**:basic operation handled by the ReservationManager.
- **Delete reservation**: basic operation handled by the ReservationManager.
- **Request a temporary stop**: average complex operation involving some components of the system to work properly.
- **Find by adress**: average complex operation as manage and translate data coming from external sources.
- **Find my position**: as for the previous point, it requires an average effort to work properly.
- **Find safe areas**: average impact operation, it requires some effort to work properly.
- **See car info**: straight-forward simple operation.

Technician:

- **Add, edit, close problems**: this is a quite complex operation, requiring considerable effort to work properly.

- **Add, edit, remove cars**: this is a quite complex operation, requiring considerable effort to work properly.
- **Edit client accounts**: this is an average impact operation handled by both the ClientController and the TechnicianController and could be done by an high-privileges user who needs to manage accounts of company clients.
- **Reporting activities**: average complexity operation, useful to extract data for statistics and issue detection. Involve several queries to database and medium interaction between components.
- **Privilege granting/revoking**: average complexity operation handled by high-privileges technicians.

The following table shows the overall complexity of this development:

Login/Logout	Low	2*3
Password retrieval	Average	4
Open an incidetn on a car handling	Low	3
Login/Logout	Low	2*3
Register	Low	3
Change settings	Average	4
Reserve a car	Average	4
Reservation detail request	Low	3
Delete reservation	Low	3
Request a temporary stop	Average	4
Find by adress	Average	4
Find my position	Average	4
Find safe areas	Average	4
See car info	Low	3
Add/edit/close problems	High	3*6
Add/edit/remove cars	High	3*6
Edit client accounts	Average	4
Reporting activities	high	6
Privilege granting/revoking	Average	2*4
Total	91	

Table 3: External inputs

2.1.4 External Inquiries

As follows in this section, we will provide a list of operation regarding extraction of data from the database:

- Reservation details request - basic effort;
- Incident/problem inquiry from a technician - average effort;
- General table record list request - basic effort;
- Report extraction - elevated effort;

The following table shows the overall complexity of this development:

Reservation details inquiry	Low	3
Incident/problem inquiry	Average	2*4
All tables list request	Low	8*3
Report extraction	High	6
Total	41	

Table 4: External inquiries FPs

2.1.5 External Outputs

As follows in this section, we will list all the operations generating an external output. Basically it means that we are going to show all the ways our system sends a notification to stakeholders:

- Notify client that his reservation has been registered in the DB;
- Notify client that his reservation is going to expire soon;
- Notify user that his smartphone is inside car unlock range;
- Notify a technician that an incident/problem has been assigned to his workgroup;
- Notify clients that money in the account is about to end;
- Warn user that his current position is not inside 3G coverage area;
- Warn user that his stop position is outside a Safe Area.

The following table shows the overall complexity of this development:

Reservation Registered	Low	4
Reservation Expiring	Low	4
Inside car unlock range	Average	5
Assigned to workgroup	Low	4
Money is about to end	Low	4
Area is not covered	Average	5
Stop outside safe area	Average	5
Total	31	

Table 5: External Outputs FPs

2.1.6 Overall Effort Estimated

In the following table we are going to summarize the complexity showed in details in the previous paragraph:

ILF	65
ELF	27
EInput	91
EInquiries	41
EO	31
Total	255

Table 6: Overall effort Estimation.

Given that we will use Java EE for development, from values above we estimate a **line code** lower bound of:

$$255 * 46 = 11730 \tag{1}$$

And an upper bound of:

$$255 * 67 = 17085 \tag{2}$$

2.2 COCOMO Effort Estimation and Cost

In this section we will estimate the cost and needed effort to develop PowerEnjoy.

2.2.1 Scale Driver

To evalutate the value of the scale drivers, we refer to the following table taken from the official COCOMO II manual:

Scale Factors	**Very Low**	**Low**	**Nominal**	**High**	**Very High**	**Extra High**
PREC	thoroughly unprecedented	largely unprecedented	somewhat unprecedented	generally familiar	largely familiar	thorought familiar
$\mathbf{SF}_{[j]}$	6.20	4.96	3.72	2.48	1.24	0.00
FLEX	rigorous	occasional relaxation	some relaxation	general conformity	some conformity	general goals
$\mathbf{SF}_{[j]}$	5.07	4.05	3.04	2.03	1.01	0.00
RESL	little (20%)	some (40%)	often (60%)	generally (75%)	mostly (90%)	full (100%)
$\mathbf{SF}_{[j]}$	7.07	5.65	4.24	2.83	1.41	0.00
TEAM	very difficult interaction	some difficult interaction	basically cooperative interaction	largely cooperative	highly cooperative	seamless interactions
$\mathbf{SF}_{[j]}$	5.48	4.38	3.29	2.19	1.10	0.00
PMAT	SW-CMM Level 1 Lower	SW-CMM Level 1 Upper	SW-CMM Level 2	SW-CMM Level 3	SW-CMM Level 4	SW-CMM Level 5
$\mathbf{SF}_{[j]}$	7.80	6.24	4.68	3.12	1.56	0.00

Table 7: Scale Factor value, $\mathrm{SF}_{[j]}$, for COCOMO II Models.

A short description for all the scale driver listed above:

- **PREC:** Precedentedness, the precedent experience in working in large project, in our case would be very low.
- **RESL:** Risk resolution, the level of consciousness about the risks found in the project.
- **FLEX:** Flexibility, the flexibility in the development process respecting the specifications and the requirements.

- **TEAM:** Team cohesion, how well the team collaborate toghether in a cooperative way.
- **PMAT:** Process maturity, the level of project maturaty.

In our case the result of the evaluation is shown in this table:

Scale Driver	Factor	Value
PREC	Nominal	3.72
FLEX	Low	4.05
RESL	High	2.83
TEAM	Very high	1.10
PMAT	Level 3	3.12
Total	14.82	

Table 8: PowerEnjoy evaluation.

2.3 Cost Driver

A cost driver (CD) is the unit of an activity that causes the change in activity's cost. There are some parameters that we have to consider:

- **RELY** Required Software Reliability,

Could be find very specific table about each of this parameters with the level of knowledge value in the official COCOMO II manual. The result of our project is shown in the table below.

Cost Driver	Factor	Value
Required Software Reliability (RELY)	High	1.10
Database size (DATA)	High	1.14
Product complexity (CPLX)	High	1.17
Required Reusability (RUSE)	High	1.10
Documentation match to life-cycle needs (DOCU)	Nominal	1.00
Execution Time Constraint (TIME)	Very high	1.29
Main storage constraint (STOR)	Nominal	1.00
Platform volatility (PVOL)	Nominal	1.00
Analyst capability (ACAP)	High	0.85
Programmer capability (PCAP)	High	0.88
Application Experience (APEX)	Low	1.10
Platform Experience (PLEX)	Nominal	1.00
Language and Tool Experience (LTEX)	Low	1.09
Personnel continuity (PCON)	Very low	1.12
Usage of Software Tools (TOOL)	High	0.90
Multisite development (SITE)	Very high	0.86
Required development schedule (SCED)	High	1.00
Total	1.61862244377836	

Table 9: Cost Driver table.

2.4 Effort Equation

The effort estimation, measured in Person-Month, is given by the equation below:

$$Effort = A * EAF * KSLOC^F \tag{3}$$

The parameters means:

A = 2.94 (standard value for COCOMO II)

EAF = 1.61862244377836 (product of all cost driver)

E = exponent derived from the scale drivers.

E = B + 0.01 * $\sum_i SF[i]$ = B + 0.01 * 14.82 = 0.91 + 0.1464 = 1.0582

B = 0.91 (standard value for COCOMO II)

We can calculate the estimable effort value in two ways.
The lower bound is given by the formula:

$$Effort = A*EAF*KSLOC^E = 2.94*1.0582*11.730^{1.0582} = 42.107955PM \approx 42PM \tag{4}$$

The upper bound instead:

$$Effort = A*EAF*KSLOC^E = 2.94*1.0582*17.085^{1.0582} = 62.68825PM \approx 63PM \tag{5}$$

2.5 Schedule Estimation

We can calculate the an estimation of the duration using the following formula:

$$Duration = 3.67 * Effort^F \tag{6}$$

The lower bound is given by the formula:

$$F = 0.28 + 0.2 * (E - B) = 0.28 + 0.2 * 0.1464 = 0.30928 \tag{7}$$

$$Effort = 42.107955PM \tag{8}$$

$$Duration = 3.67 * (42.107955)^{0.309228} = 11.6664726 \text{ month} \tag{9}$$

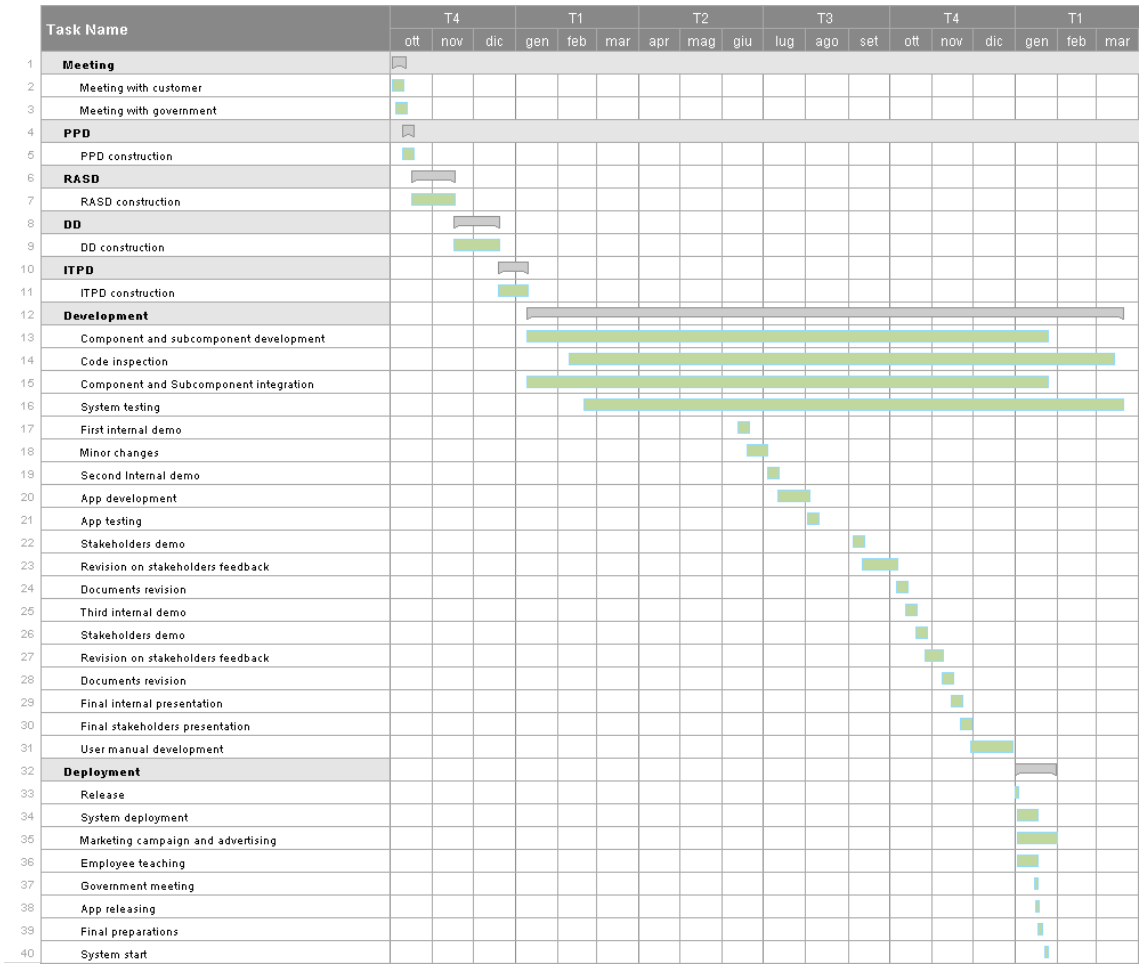
The upper case estimation is:

$$Duration = 3.67 * (62.68825)^{0.30928} = 13.1949 \text{ month} \tag{10}$$

3 Schedule

In this section we are going to provide a general high level schedule divided for tasks.
The main tasks that composed the PowerEnjoy project are:

- **Meeting with customer**, the meeting with the customer to define the project requirements and goals.
- **Requirements Analysis and Specification Document (RASD)** completion, the document containing an accurate description about the goals, assumption and requirement.
- **Design Document (DD)** completion, written description of the product, in order to give a software development team overall guidance to the architecture of the software project.
- **Integration Test Plan Document (ITPD)** completion, written description of the strategy to make testing on the integration between the system components.
- **Project Plan Document (PPD)** completion, document about the effort project estimation.
- **Implementation**, the development of the proper project.
- **Integration testing**, phase in software testing in which individual software modules are combined and tested as a group.
- **Deployment**,the activities that make a software system available for use.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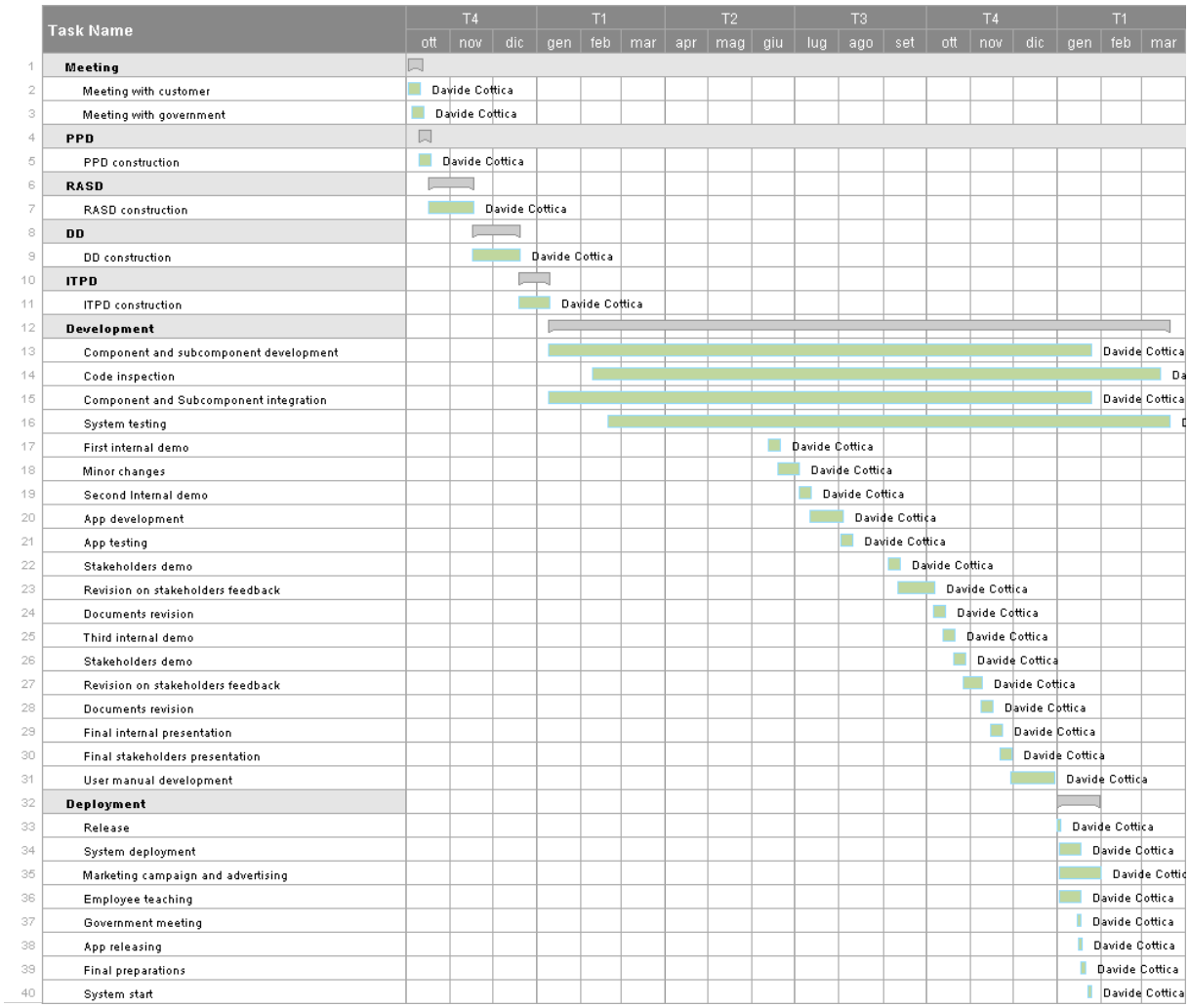
3 Meeting with government
4 PPD
5 PPD construction
6 RASD
7 RASD construction
8 DD
9 DD construction
10 ITPD
11 ITPD construction
12 Development
13 Component and subcomponent development
14 Code inspection
15 Component and Subcomponent integration
16 System testing
17 First internal demo
18 Minor changes
19 Second Internal demo
20 App development
21 App testing
22 Stakeholders demo
23 Revision on stakeholders feedback
24 Documents revision
25 Third internal demo
26 Stakeholders demo
27 Revision on stakeholders feedback
28 Documents revision
29 Final internal presentation
30 Final stakeholders presentation
31 User manual development
32 Deployment
33 Release
34 System deployment
35 Marketing campaign and advertising
36 Employee teaching
37 Government meeting
38 App releasing
39 Final preparations
40 System start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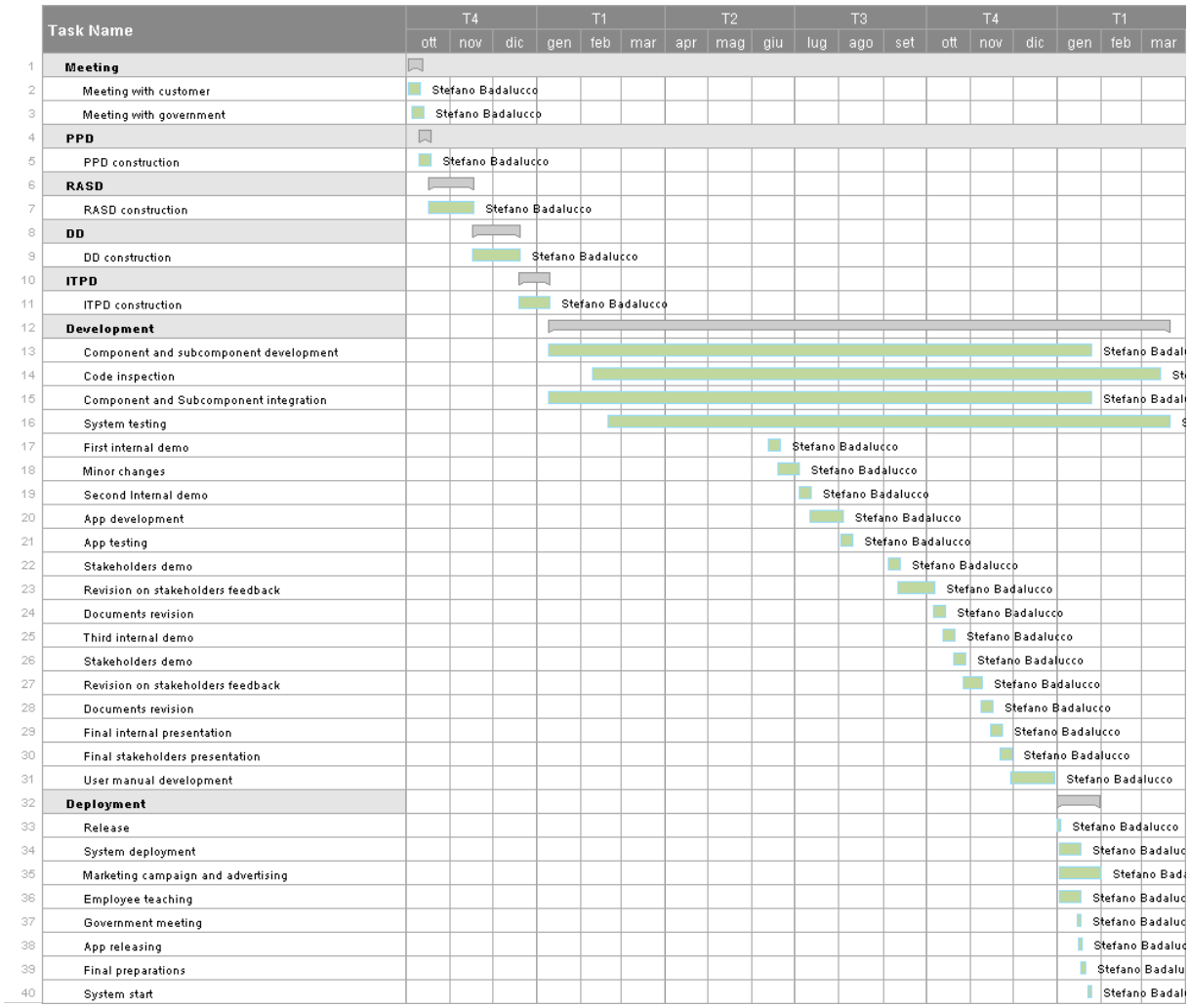
Davide Cottica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Stefano Badalucco

4 Risk Management

In this paragraph we are going to analyze all the threats and obstacles this project could encounter during development and implementation.

Taxi drivers' worker union and car rent companies
The major threat this project should face could be a strong opposition from both worker unions and car rent companies. The implementation of our service constitutes a new way of rivalry towards them, who could state a substantial decrease in revenues. We must schedule meetings with deputies in order to find an agreement and guarantee the being of all the realities.

Petroleum companies
Petroleum lobbies have strong influence in the country and they could arise some complaints about revenue decrease. As for the previous point we should schedule meetings and find an agreement.

Vandalism
Every car inhabilitated is a potential loss of revenue. We must solicit city administration about police inspection enforcing and public park camera coverage increasing, at least in the areas marked as Safe Areas from our company (see following topics for more details).

Safe Area Grant
One of the feature granted by our service is the possibility to park cars in areas called 'safe' with the promise to obtain a discount. This is a strategic choice as areas we mark as 'safe' are the ones with the lower crime rate, this way we reduce car failures and we can grant a better service. We must find an agreement with city administration and schedule some meetings.

Power line failures
If the city is experiencing a blackout period, recharging turrets aren't operational and users could complain about it. Even if it could be considered a rare event potentially caused by natural disaster, we should consider a way to guarantee cars operational, for example equipping the company with portable power generators suitable for emergency cases.

Cars left outside city range
The only way we could defend from this threat is to promote heavy penalties against users leaving city range in order to discourage the behaviour. Obviously users are advised about this penalty in the initial agreement policies in the act of registration.

Cyber attacks
This is a rising threat and we should consider the possibility of implement modern IDS and firewalls to protect ourselves.

Other external threats

The previous points cover almost all possible known cases. Other risks and threat considered extremely rare could be satellite failures and radical changes in governmental law, whose countermeasures taken company level cannot be substantial.

5 Hours of work

The amount of working hours:

- Davide Cottica: 16 hours
- Stefano Badalucco: 16 hours