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Software Engineering 2 Project
"myTaxiService"
Project **P**lan

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1 Introduction

The aim of this document is to provide an estimation of the cost that the project will take in terms of time, required lines of code and effort.

The process to do this consists in analyzing all the required functionalities of the system to be developed and evaluating, one by one, the complexity of that operations basing on the number of required data inputs and outputs. After doing this a first evaluation of the required number of code lines can be made using specific tools, while the estimated time and effort required will be provided using the COCOMO solution.

After the cost estimation can be found an identification of the tasks to accomplish in order to develop the system, and the project plan that identifies the tasks execution order. The definition of the tasks allows to do an initial allocation of the human resources composing the working team.

Finally a risk analysis is made in order to identify the principal problems that can rise up during the project development: such analysis made a priori allows the formulation of a contingency plan that will lead to a risk avoidance and will help to solve problems in the eventuality of their appearance.

2 Function Points

Function points can be divided into five categories, basing on the type of considered data:

- **ILF - Internal Logic File:** homogeneous set of data used and managed by the application;
- **ELF - External Logic File:** homogeneous set of data used by the application but generated and maintained by other applications;
- **External Input:** elementary operation to elaborate data coming form the external environment;
- **External Output:** elementary operation that generates data for the external environment. Also includes the elaboration of data from logic files;
- **External Inquiry:** elementary operation that involves input and output. No significant elaboration of data from logic files is needed.

For every type of function point the estimation will take into acount the complexity of the operation, using the following weight table:

Function Type	***Complexity***		
	Simple	*Medium*	*Complex*
Internal Logic File	7	10	15
External Logic File	5	7	10
External Input	3	4	6
External Output	4	5	7
External Inquiry	3	4	6

2.1 Function Points Estimation

2.1.1 Internal Logic Files

The application includes several internal logic files that are used to store information about Customer, Taxi Driver, Generic Call, Ride and Notification. Each of these entities has a simple structure as it is composed by a small number of fields except for the Generic Call that has a more complex structure and needs more operations during the computation (path calculation, search for an available taxi driver, ride matching for the shared ones, notification to the selected taxi driver and so on). Therefore it is adopted a complex weight for Generic Call and a simple weight for all other entities. The total amount of function points concerning internal logic files is: (1x15) + (4x7)=43

2.1.2 External Logic Files

The application has to use ELFs for execute several operations:

- acquisition of the city map and the positions of both Taxi driver and customer. These data are obtained using the chosen GPS APIs;
- interaction with an external banking service. Such service sends to the system all the information about the validity of the customers payment information and the data related to a specific payment.

Due to the complexity of these interactions (acquire city map, retrieve a position, interface with the banking system) and the structure of the received data , it's reasonable to choose a medium weight. 3x7=21

2.1.3 External Inputs

- *Login/Logout:* these are simple operations, so it is adopted the simple weight for them. 2x3=6

1. Customer
    - *Registration:* the guest fills the resistration form, this is a simple operation, so it is adopted the simple weight for it. 1x3=3
    - *Rate a Taxi Driver:* this is a simple operation, so we can adopt the simple weight for it. 1x3=3
    - *Make an Immediate Call:* this is not a simple operation. It involves several components: ImmediateCallSystem, TaxiDriver, DataManager, PaymentManager. For this reason it is adopted the medium weight for it. 1x4=4
    - *Make a Reservation Call:* it is an operation that involves the same components of the immediate call operation, so it is adopted the medium weight for it as before. 1x4=4

- *Make a Shared Call:* this operation involves the same components involved in the other "Call" operation but it is more complex, so it is adopted the complex weight for it. 1x6=6
- *Update personal informations:* it is a simple operation, so it is adopted the simple weight. 1x3=3
- *Insert/Update payment method:* these are simple operations, it is adopted the simple weight for them. 2x3=6

2. Taxi Driver

   - *Assistance Call:* this is a simple operation because involves only the "AssistanceCallManager" component, for this reason it is adopted the simple weight for it. 1x3=3
   - *Update personal informations:* it is a simple operation, so it is adopted the simple weight for it. 1x3=3
   - *Accept/Decline a call request:* these are simple operation, so it is adopted the simple weight for them. 2x3=6

3. Admin

   - *Add new taxi driver:* this is not a simple operation. It is adopted a medium weight for it. 1x4=4
   - *Manage User Data:* this is a not simple operation, it is adopted a medium weight for it. 1x4=4

2.1.4 External Outputs

- *Request of payment to the banking system and Notify the success or the failure of the operation to the Customer:* for this operation it is adopted a medium weight. 1x5=5
- *Notify the confirmation or the rejection of a Call request:* this is a simple operation, it is adopted a simple weight. 1x4=4
- *Compute the path of a specific ride and communicate it to the Taxi Driver:* this is a complex operation for this reason is adopted a complex weight. 1x7=7
- *Searching for an available taxi Driver and sending a notification to him:* this is not a simple operation, it is adopted a medium weight. 1x5=5
- *After registration the success or the failure of the operation is notified to the user:* this is a simple operation, so it is adopted a simple weight. 1x4=4
- *After an Assistance Call, the system sends a notification to the correspondent technical service:* this is a simple operation, so it is adopted a simple weight. 1x4=4

2.1.5 External Inquiries

- *Request to consult rides history:* the system allows both taxi driver and Customer to consult the Ride History, it is a simple operation, so it is adopted a simple weight. 1x3=3
- *Consult personal information:* the system allows every type of user to consult his personal information. This is a simple operation, for this reason it is adopted a simple weight. 1x3=3
- *Request to consult payments history:* it is a simple operation, so it is adopted a simple weight. 1x3=3

2.2 Function Points Summary

The analysis made in the previous section can be summed up in the following table:

Function Type	***Value***
Internal Logic File	43
External Logic File	21
External Input	55
External Output	29
External Inquiry	9
Total	157

The total value can be used as the basis to estimate, using the Average Variable Cost (AVC) corresponding to the Java language in the tables[1], which corresponds to 53.

The resulting number of lines in this case is:

$$157\ FPs\ *\ 53 = 8321\ SLOC = 8.321\ KSLOC\ (1)$$

[1] `http://www.qsm.com/resources/function-point-languages-table/`

3 COCOMO II Approach

The COCOMO II tool has been used in order to compute effort and duration of the project development, starting from the number of identified FPs.

In the first step of the estimation all the Cost and Scale Drivers have been considered as "Nominal", so the resulting EAF and exponent value E are:

- Effort Adjustment Factor, derived from Cost Drivers: $EAF = 1.00$;
- Exponent, derived from Scale Drivers: $E = 1.0997$;

At this point, following the related formula of the model

$$\textit{effort} = 2.94{*}EAF{*}(KSLOC)^{\mathrm{E}} \quad \textit{(2)}$$

substituting the values obtained with the formula *(1)* and the parameters described above, the resulting *effort* value is

$$\textit{effort} = 2.94{*}(1.0){*}(8.321)^{1.0997} = 30.21791 \ \textit{Person-Months}$$

Through the found effort value, it's possible to calculate the value of the duration (in months) of the project, using an exponent E' = 0.3179 with the formula

$$\textit{Duration} = 3.67{*}\textit{(effort)}^{\mathrm{E'}} \quad \textit{(3)}$$

obtaining

$$\textit{Duration} = 3.67{*}30.21791^{0.3179} = 10.84 \ \textit{Months}$$

At this point the number of people needed, N, is easy to find

$$N = \frac{effort}{Duration} \quad \textit{(4)}$$

obtaining, substituting the values

$$N = \frac{30.21791 \, PM}{10.84 \, Months} = 2.79 \simeq 3 \text{ Persons}$$

which, in first approximation, it's consistent with the number of people involved in this project (see *Section 4* of this document for further information).

At this point of the evaluation it's good practice to adjust some Cost and Scale Drivers, in order to give a more precise evaluation of the parameters; in order to do so the COCOMO II tool[2] is used, in order to comfortably select the value for each value and automatically change the equations parameters. The results of the execution of the tool are shown in the screenshots above.

[2] `http://csse.usc.edu/tools/COCOMOII.php`

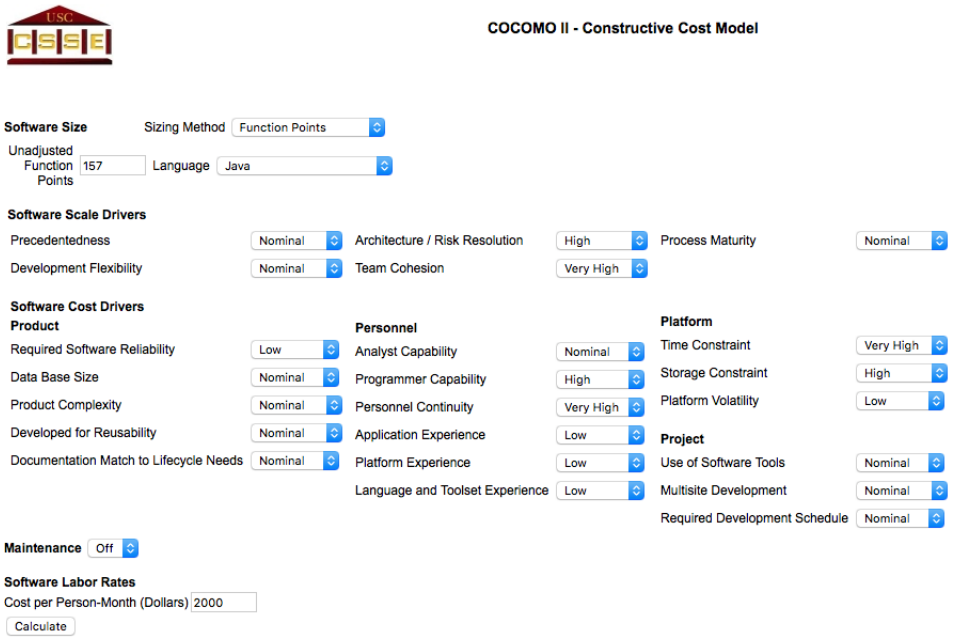


Figure 3.1: COCOMO 2 drivers screen

Results

Software Development (Elaboration and Construction)

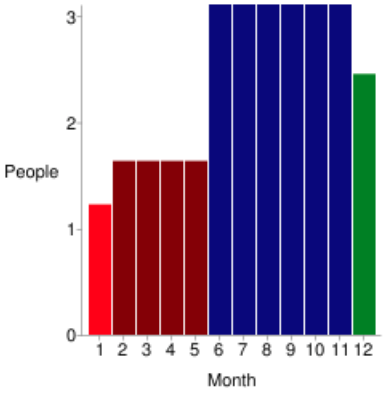
Effort = 28.3 Person-months
Schedule = 11.1 Months
Cost = $56554

Total Equivalent Size = 8321 SLOC

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	1.7	1.4	1.2	$3393
Elaboration	6.8	4.1	1.6	$13573
Construction	21.5	6.9	3.1	$42981
Transition	3.4	1.4	2.5	$6787

Staffing Profile



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

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.2	0.8	2.1	0.5
Environment/CM	0.2	0.5	1.1	0.2
Requirements	0.6	1.2	1.7	0.1
Design	0.3	2.4	3.4	0.1
Implementation	0.1	0.9	7.3	0.6
Assessment	0.1	0.7	5.2	0.8
Deployment	0.1	0.2	0.6	1.0

Figure 3.2: COCOMO 2 results screen

According to the COCOMO 2 results

$$effort = 28.3\ PM$$

$$Duration = 11.1\ Months$$

$$N = \frac{effort}{Duration} = \frac{28.3\,PM}{11.1\,Months} = 2.54 \simeq 3 \text{ Persons}$$

The results are similar as in the case of Nominal Drivers, obviously for the balancement of the values of certain drivers.

4 Tasks and Schedule

This section defines the tasks to be accomplished in order to fulfill the goal of the project and the schedule that will define the work that every team component will have to perform.

The team is composed of three members,

4.1 Identified Tasks

4.2 Project Schedule

5 Resources Allocation

6 Risks

7 Used Tools