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PowerEnjoy

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Chapter 1

1 Function Points estimation

Function Points are units of measure for functional size and it is the major global functional sizing methodology. Function Points is a standard method for quantifying the software deliverable based upon the user view. In this document we are going to consider Internal Logical Files (ILF), External Logical Files (ELF), External Inquiries (EQ), External Outputs (EO) and Unadjusted Function Points (UFP). We apply Function Points to estimate the size and then COCOMO to estimate effort and cost.

Table 1: Internal Logical Files (ILF)

	Data Elements (DET)		
Record element types (RET)	1-19	20-50	51 or more
1	Low (7)	Low (7)	Average (10)
2 to 5	Low (7)	Average (10)	High (15)
6 or more	Average (10)	High (15)	High (15)

Table 2: External Logical Files (ELF)

	Data Elements (DET)		
Record element types (RET)	1-19	20-50	51 or more
1	Low (5)	Low (5)	Average (7)
2 to 5	Low (5)	Average (7)	High (10)
6 or more	Average (7)	High (10)	High (10)

Table 3: External Inputs (EI)

	Data Elements (DET)		
File Type Referenced (FTR)	1-4	5-15	Greater than 15
Less than 2	Low (3)	Low (3)	Average (4)
2	Low (3)	Average (4)	High (6)
Greater than 2	Average (4)	High (6)	High (6)

Table 4: External Inquiries (EQ)

File Type Referenced (FTR)	Data Elements (DET)		
	6-19	5-15	Greater than 19
Less than 2	Low (3)	Low (3)	Average (4)
2	Low (3)	Average (4)	High (6)
Greater than 2	Average (4)	High (6)	High (6)

Table 5: External Outputs (EO)

File Type Referenced (FTR)	Data Elements (DET)		
	6-19	5-15	Greater than 19
Less than 2	Low (4)	Low (4)	Average (5)
2	Low (4)	Average (5)	High (7)
Greater than 2	Average (5)	High (7)	High (7)

Table 6: Unadjusted Function Points (UFP)

Function Types	Simple	Medium	High
Internal Logic Files	7	10	15
External Logic Files	5	7	10
External Inputs	3	4	6
External Inquiries	3	4	6
External Outputs	4	5	7

1.1 Internal Logical Files (ILF)

ILFs (Internal Logical Files) are containers of logically related data maintained within an application boundary. In the case of the PowerEnjoy App we are developing at the moment we identify as such business data to be stored in our relational database tables such as:

- **(1)User**

- **(2)Car**

- **(3)Search**

- **(4)Reservation**

- **(5)Payment**

- **(6)Ride**

- **(7)Safe Area**

and rules/ control data expressed in a **(8)Server Configuration** file, an **(9)API usage details** file and a **(10)Terms Of Service** file. The function points associated to each of them are calculated taking into account their respective DETs and RETs, a shown in table 1.2; the number of DETs and RETs for the business data was inferred from the UML class diagram provided in the referenced DD, whereas in the case of the control data they were based on a generic estimation.

Table 7: Internal Logical Files

Record element types (RET)	Data Elements (DET)		
	1-19	20-50	51 or more
1	Low (7) **(1 - 7)**	Low (7)	Average (10)
2 to 5	Low (7)	Average (10)	High (15) **(8, 9, 10)**
6 or more	Average (10)	High (15)	High (15)

ILF= 2*7+3*15=59 FPs

1.2 External Logical Files (ELFs)

We classify external logical files as containers of logically related data referenced by the application yet maintained outside the application boundary. As stated in the referenced DD the project team plans to use Google Maps API to perform multiple tasks such as reverse geocoding or map marking, processes that will require a certain degree of interaction between our system and remote service provider when maps will have to be generated on the client side. According to the amount of data associated to such objects (consisting of many RETs and few DETs we classify maps files as mildly complex ones.

Table 8: External Logical Files

File Type Referenced (FTR)	Data Elements (DET)		
	1-19	20-50	51 or more
1	Low (5)	Low (5)	Average (7)
2 to 5	Low (5)	Average (7)	High (10)
6 or more	Average (7) **(Map Generation)**	High (10)	High (10)

External Logical Files=1*7=7 FPs

1.3 External Inputs

An external input is to be understood as the result of the processing of data coming from an external environment. Were gonna distinguish between information sent from the users to the system and information sent by the cars belonging to the service to the system, providing some degree of explanation for the less intuitive ones. We identified as members of the first group:

- **(1)User Registration**

- **(2)User Login**

- **(3)Password Retrieval**

- **(4)Reservation Request**

- **(5)Reservation Deletion**

- **(6)Car Opening Request**

- **(7)Damage Info Message**,

whereas

- **(8)RideBeginning Signal** (this signal gets sent when the engine is started: its purpose is to trigger the procedure managing of the beginning of a new ride)

- **(9)MSO Activation**

- **(10)Ride End Signal** (this signal encloses the basic price of the ride, that is, the one calculated on a time basis, the weight perceived by the sensors at the beginning of the ride, data regarding how many belts were fastened, info telling whether the car was left to charge at the end of the ride or not, its position, its battery level: its purpose is to trigger the payment calculation procedure)

belong to the second group.

User Login, Password Retrieval, Car Opening Request, Reservation Request and Reservation Deletion , Ride Beginning Signal and MSO Activation, all have a low level of complexity as they are all uniquely determined by a few fields (few DETs) and reference only text files. The complexity slightly increases in the case of the Damage Info Message as it references image format files as well, becoming average, and it further increases being describable as high in the case of User Registration and Ride End Signal as they contain lots of data elements and reference files of different type (in

the case of the registration this happens because of the driving license photo attached to the form).

Table 9: External Inputs

File Type Referenced (FTR)	Data Elements (DET)		
	1-4	5-15	Greater than 15
Less than 2	Low (3)	Low (3) **(2, 3, 4, 5, 6, 8, 9)**	Average (4)
2	Low (3)	Average (4) **(7)**	High (6) **(1, 10)**
Greater than 2	Average (4)	High (6)	High (6)

External Inputs=7*3+1*4+2*6=37 FPs

1.4 External Inquiries

External Inquiries are elementary processes aimed to retrieve data from ILFs and ELFs. Within our project we classify as such:

- **(1)Payment Details Queries**

- **(2)Ride Histories Queries**

- **(3)Search Queries**

- **(4)Car Details Queries**

The third and the fourth being actually operations performed each time the user wishes to send certain external inputs. The complexity of the four of them is low for obvious reasons, with the exception of the third, and occasionally of the second, whose complexity can be considered average due to the high amount of DETs (sometimes, in the case of the second) involved.

Table 10: External Inquiries

File Type Referenced (FTR)	Data Elements (DET)		
	6-19	5-15	Greater than 19
Less than 2	Low (3) **(1, 4)**	Low (3)	Average (4) **(2, 3)**
2	Low (3)	Average (4)	High (6)
Greater than 2	Average (4)	High (6)	High (6)

External Inquiries=2*3+2*4=14 FPs

1.5 External Outputs

The external outputs can be conceived as the opposite of an external input, being the result of a communication of derived data from the inside to the outside. We counted among them:

- **(1)Notifications to user through app**

- **(2)Notifications to car**

- **(3)Registration confirmation mail**

We grouped the somewhat diverse notifications to the user in a single group as the complexity of them is homogeneously fairly low, since all of them are characterized by few DETs and a number of FTR equal to 1. The same goes for the notifications to car and the registration confirmation mail.

Table 11: External Outputs

File Type Referenced (FTR)	Data Elements (DET)		
	6-19	5-15	Greater than 19
Less than 2	Low (4) **(1,2,3)**	Low (4)	Average (5)
2	Low (4)	Average (5)	High (7)
Greater than 2	Average (5)	High (7)	High (7)

External Outputs =3*4=12 FPs

1.6 Overall Estimation

ILF + ELF + External Inputs + External Inquiries + External Output = 59 + 7 + 37 + 14 + 12 = 129

1.6.1 Lower Bound

SLOC = 129 * 46 = 5934

1.6.2 Upper Bound

SLOC = 129 * 67 = 8643

1.6.3 Average

SLOC = 7288

Chapter 2

2 Cocomo II estimation

Chapter 3

3   Task and schedule

Chapter 4

4 Resource allocation to tasks

Chapter 5

5   Risks associated with the project