1. Project size, cost and effort estimation

2.1. Overview

In this section, we will provide an estimation of the cost and the size of PowerEnJoy project.

This chapter will be divide into two parts. The first part belongs to the estimation of the size of the project. This estimation is done with a function points approach.

The second part belongs to estimation of the cost. This estimation is done with the COCOMO approach.

2.2. Size estimation: Function Points

The function points method provides an estimation of the size of the project, using the amount of functionalities that the project provides to the client.

The estimation is done using the following tables. The tables belong to a statistical analysis.

For Internal Logic Files and External Logic Files

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data elements | | |
| Record elements | 1-19 | 20-50 | 51+ |
| 1 | Low | Low | Avg |
| 2-5 | Low | Avg | High |
| 6+ | Avg | High | High |

For External Output and External Inquiry

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data elements | | |
| File Types | 1-5 | 6-19 | 20+ |
| 0-1 | Low | Low | Avg |
| 2-4 | Low | Avg | High |
| 4+ | Avg | High | High |

For External Input

|  |  |  |  |
| --- | --- | --- | --- |
|  | Data elements | | |
| File Types | 1-4 | 5-15 | 16+ |
| 0-1 | Low | Low | Avg |
| 2-3 | Low | Avg | High |
| 3+ | Avg | High | High |

UFP Complexity Weights

|  |  |  |  |
| --- | --- | --- | --- |
|  | Complexity Weights | | |
| Function Types | Low | Average | High |
| Internal Logic Files | 7 | 10 | 15 |
| External Logic Files | 5 | 7 | 10 |
| External Inputs  External Outputs  External Inquiries | 3  4  3 | 4  5  4 | 6  7  6 |

2.3. Internal Logic Files(ILFs)

PowerEnJoy must store a lot of users because we think that a lot of people will use this service, and the information of the users are lots such as name, surname, password, e-mail, address, bank code. So, complexity is high.

For the car, we must store the availability and the actual position, because that two continue to change we deduce an average complexity.

We must store the reservation that is quite simple because there is only to store the car, the user and the date, so complexity is low.

Finally, we must store the bill of the use of the car. We need to store the possibly charge or discount, and the total amount of the ride so we deduce an average complexity.

This is the final table for the internal logic files:

|  |  |  |
| --- | --- | --- |
| ILFs | Complexity | FPs |
| User information | High | 15 |
| Car information | Avg | 10 |
| Reservation | Low | 7 |
| Bill | Avg | 10 |
| Total |  | 42 |

2.4. External Logic Files(ELFs)

For the External Logic Files, we should store only the information that the external agency for the payment give to us about the last nonpayment of the ride. So, the complexity is quite easy but on average because we need to store and change only a boolean but every user has a different one.

This is the final table for the external logic files:

|  |  |  |
| --- | --- | --- |
| ELFs | Complexity | FPs |
| Payment information | Avg | 15 |
| Total |  | 15 |

2.5. External inputs(EIs)

There are a lot of input that arrive from the different type of client of the application.

* **Registration:** is a complex operation, because involve a lot of information and so we need to do a lot of query.
* **Login:** is a simple operation because needs only the control of the e-mail and the password.
* **Password recovery:** we need to control the existence of the user and we will send again the password, so we need to do not simple operation and we deduce an average complexity.
* **Reserve car:** Complex input indeed we need to pass in a lot of component, so is a high complexity.
* **Unlock car:** Simple operation because we need only to control the user and the relative car reserved.
* **View reservation and payment history:** Simple operation that involve only the database of the application.
* **Send data sensor of the car:** Simple operation because is only a sending of the sensor that are in the car.

This is the final table for the External inputs:

|  |  |  |
| --- | --- | --- |
| EIs | Complexity | FPs |
| Registration  Login  Password recovery  Reserve car  Unlock car  Send data sensor  Payment/reservation history | High  Low  Avg  High  Low  Low  Low | 6  3  4  6  3  3  3 |
| Total |  | 28 |

2.6. External Outputs(EOs)

The application must provide these outputs for the client

* Send the bill to the client, this operation is quite simple because have only to send an e-mail to the correspondent user, so complexity is low.
* Send the fee for the reservation lost. This operation is like the send bill one so complexity is low.
* Open the car. This operation is on average complexity because the system must control the reservation information, the position of the car and the mobile that want to open the car, and control also if the time of the reservation is finish.
* Notify the user if he hasn`t paid the last ride so, until he doesn`t pay it, he can`t reserve another one car. This action is only a notification via e-mail, so is a low complexity action.
* Notify the user if the he has paid the last ride, and so he can restart to reserve a new car, like the before one, is a low complexity action for the same reason.
* Notify the bill to the external agency. The external agency for the payment and the application has a direct link to each other, so the complexity for this action is low.

This is the final table for the External input:

|  |  |  |
| --- | --- | --- |
| EOs | Complexity | FPs |
| Send bill  Fee lost reservation  Open car  Notify not pay  Notify restart reserve  Bill to external agency | Low  Avg  Low  Low  Low  Low | 4  5  4  4  4  4 |
| Total |  | 25 |

2.7. External Inquiries(EQs)

The only external inquiries that the client can perform, is a request for the payment and reservation history. This action is quite simple to do, because have only to perform a query to the database of the user that asks for his history. So, complexity is low.

|  |  |  |
| --- | --- | --- |
| EQs | Complexity | FPs |
| Payment history | Low | 3 |
| Total |  | 3 |

2.8. Overall estimation

The following table summarizes the results of our estimation activity:

|  |  |
| --- | --- |
| Function Types | Value |
| Internal Logic Files | 42 |
| External Logic Files | 15 |
| External Inputs  External Outputs  External Inquiries | 28  25  3 |