

# Post project review

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## Status

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## PROJECT IDENTITY

2014/HT, Invenire Periculosa

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Document history

Version	Date	Changes	Sign	Reviewed
0.1		First draft		



# 1 Time consumption

In general the time consumed has gone according to plans - some activities have been removed and some have been added to clarify the tasks.

## 1.1 Work distribution

No extreme work load - little work during weekends and evenings, as a consequence of careful planning.

Some persons experienced more work load compared to others (or got more things done at least) since their knowledge was highly appreciated and needed for smooth continuation of project. This was mostly regarding GitHub experience and similar software.

The work was divided into three main groups, with 2-3 persons in each. Their respective areas were

- SLAM - Obstacle detection, Filter and Route planning
- Map structure and logic
- Communication, GUI and Sampling

Since the majority of all header files were written in the design phase, the communication and synchronisation between the groups worked agreeably. In this way, you already had the knowledge of what the others were up to and what data structures they were using.

## 1.2 Time consumption compared to time plan

About 10% of total project time was dedicated for the general buffer as to compensate for any delays. Atop of this a buffer for fault corrections after test was added.

Since the deadline for the design phase was postponed the work load of this phase was a bit higher than expected. The project group reasoned that we during this time could evolve the design implementation and thus facilitate the implementation phase.

The implementation phase also took more time than expected. Much of the code base was not of such a quality that it could be understood and, consequently, used in this year's Balrog project. This lack of structure that was needed to be able to pick up where last year's project group left off, gave reason for putting more emphasis on code structure and commenting this year.

In Table 1.1, the planned time versus spent time can be studied, where the 'Before' phase consists of both pre-phase and design phase.

Table 1.1: Time consumption compared to time plan.

Phase	Planned time [hours]	Used time [hours]
Before	684	721.5
During	809.5	994
After	287.5	≈ 200



## 2 Analysis of work and problems

### 2.1 What happened during the different phases (good/bad/-cause)?

During the pre-phase, the decision to write a thorough design specification was taken. This resulted in extensive documentational work the following weeks, which had the advantage of making every group member aware of what was to be implemented. This helped communication and cooperation. On the other hand, the prolonged design phase resulted in less time for implementation, which was not enough for all the initial requirements.

### 2.2 How did we cooperate (responsibilities, decisions, communication etc.)?

The cooperation and communication was largely done by software tools - todos in L<sup>A</sup>T<sub>E</sub>X and Doxygen, GitHub issues and of course regular e-mails and text messages. Weekly meetings of one hour were held, where group members could bring up problems and ask for help if they were stuck. This allowed for redistribution of work if necessary.

No major decision problems occurred during the project, most decisions were taken as a group but often as a consequence of preparatory work and drafts done by individual group members.

### 2.3 How did we use the project model?

The LIPS model was followed very closely in general during this project, the documents relevant for this project were chosen and written. A main advantage has been the accessibility of well-written documents that group members could consult if they needed a quick answer regarding any subsystem.

### 2.4 How did the relation with the client work?

The documents have been quickly reviewed with clear feedback by the client, which was appreciated by *Invenire Periculosa*.

Overall relation worked fine, client was easy to get in touch with and was flexible and able to reason with. One thing that could be improved when reviewing documents would be to always give a time when the review should be complete, to enable accurate planning.

### 2.5 How did the relation with the adviser work?

The adviser has been present at the majority of the weekly meetings, commenting on issues and difficulties in decisions that the group has experienced. He has also responded via e-mail on questions and given hints upon how to solve certain technical problems.



## 2.6 Technical success and problems

The new threading system, mainly regarding sensor sampling is seen as a great improvement by the group. We have made a modular, well documented and well commented code, and hope it will be used as a base for the future. Another technical success is the new hardware, e.g. the rack protecting the laser sensor. The sensor suffered no damage, even when the vehicle tipped over.

Technical difficulties have been experienced with the ARM processor controlling the track motion, since it automatically activates by random contact with metal. Once it starts it cannot be turned off, except via the hardware shutdown button, which in turn may cause the problem of putting the computer in fail-safe mode. The group has looked into the problem, but it is probably a hardware issue.



### 3 Objective completion

The renegotiated requirements were completed, however the initial ones proved too time consuming to fully implement as little code could be reused. That is why the project shifted focus from making a complete product to making a modular one, not forcing the next group to redo everything from scratch.

#### 3.1 What has been accomplished?

A great base for further development:

- Hardware mounting
- Sensor sampling
- Communication
- Line extraction
- Map structure
- Route planning
- Marginalized particle filter
- Hand controller of the vehicle

#### 3.2 How did the delivery work?

During the delivery, a presentation was held, which seemed appreciated by both corporate and academic staff. Also a demo of the system was held, initially inhibited by the ARM processor problem, which was soon solved. Manual control of the vehicle was shown, and the output values of the marginalized particle filter were demonstrated. Our wish was to also demonstrate the obstacle detection on the map of the GUI, but this was not fully implemented.

#### 3.3 How was the study situation influencing the project?

Some of the group members were unevenly charged with work load outside the project which led to a slight unevenness in total work distribution. A certain liberty was given, making it possible to compensate for missed hours later, or working in advance to prepare for a period with heavy work load.





## 4 Summary

In summary, it can be hard to find a suitable equilibrium between planning/design and implementation, since both are crucial for finishing the product.

### 4.1 The three most important experiences

1. Working in small teams of 2-3 persons where every person has a main responsibility works great. You know what the others are doing and you can ask them when necessary. If you need help you have team mates who are ready to save you.
2. Planning the classes and writing their header files early saves you blood, sweat and tears.
3. Using GitHub gives a good overview of the project's progress and facilitates pointing out problems and asking for help.

### 4.2 Advice to those who will perform a similar project

We are curious whether an agile project method is more suitable for a project so dense in code such as this would improve the outcome. Less planning and documenting at start would give the disadvantage of not everyone knowing what to do and what the others are doing. However, by starting to implement earlier you would get a feeling of how everything works and what doesn't, and the integration can begin earlier. One of the drawbacks of the LIPS model used is the strict order of different phases. In an agile project it would theoretically be possible to end the project after any randomly chosen sprint and always have a functioning product which contributes greatly to the overall flexibility of the project.

Invenire Periculosa believes that documentation is essential for a smooth transition between different project groups working consecutively on the same project. These kinds of projects seem unavoidable in a future career and it would therefore be of great value to go through how good documentation is done. The importance and production of documentation of the overall project is considered to be sufficiently covered by the LIPS model, but the documentation of code could be more emphasised in the programme. A project can lose its value fully if the next group isn't able to understand it. This also rhymes with the issue that the focus of the projects are very oriented towards one semester and not over all the years the project is ongoing. It could merit from lifting the point of view to focus more on taking smaller steps in terms of technology but where all of the additions made can be reused by the following group.