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Best Practice Report

Vlatacom Document Reader–Handheld

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Everybody please state revision index and short description of what has been done + partners involved and date.

Final approval	Name	Partner
Reviewer		

1. Best Practice Title

Vlatacom Document Reader-Handheld (short names: VDR-Handheld, VDR-H)

2. Location of Best Practice

Country, region, town

Serbia, Belgrade

3. Best Practice Executive Summary

Describe briefly (min 10 lines) the GP context (partnership, funding, objectives, approach followed, results)

After the market demand for handheld document readers has been recognized and analyzed, the VDR-Handheld project has been started and run with Vlatacom's own resources and finances with objective to keep a competitive edge and stay ahead of competition, as a recognized designer and manufacturer of machine-readable travel document (MRTD) readers.

The aim was to develop and offer to the market, in shortest possible timeframe, a handheld, battery operated, ruggedized device for verification of travel and personal documents, reading of biometric data and identification of persons holding these documents, including the specialized optical scanner for e-Passport full page scanning with white, infrared and ultraviolet illumination, suitable for integration in such handheld device.

The process involved four stages: first stage was research based on existing components and modules, second stage was research which included HW, SW and algorithm test environment development, next stage was feasibility study ending with successful functional model, and finally fourth stage was final product development stage ending with successful device prototype.

In terms of project management there was continuity between the stages, but each stage was managed as a separate sub-project in terms of Vlatacom defined project process QM-730-101.01E, which is given in Appendix A of this document. The deliverables of each sub-project were inputs for the next stage (sub-project). Each stage was conditional milestone for further project execution.

4. Best Practice Classification

Best Practice Theme

X Research Transformed to Innovative Product

- Research Transformed to Innovative Service*
- Research Transformed to Innovative Methodology*
- Research Transformed to Innovative Production Process*
- Financial Mechanism for Transformation of Research to Innovation*
- Support Mechanism for Transformation of Research to Innovation*
- Other (describe)*

Best Practice Research / Application Areas

- Industrial / Manufacturing Systems*
 - Industrial Informatics and Communications*
 - Intelligent Devices*
 - Distributed Control Systems*
 - Flexible Manufacturing Systems*

- Embedded Systems*
 - Industrial Embedded Systems*
 - Nomadic Environments*
 - Private Spaces*
 - Public Infrastructures**

5. Description of Best Practice

5.1 Best Practice Context

Overall background of the Best Practice. Location, socio-economic, technical & policy background of the BP (min 10 lines)

As a document reader solution provider, Vlatacom is researching the market and trying to improve its products in accordance with the requirements imposed by the market. Vlatacom recognized need for portable biometric verification device which would help reducing delays at border crossings and which would not reduce quality of document reading. Since handheld document reader with full page scanning, have not been existing on the market yet, the estimation is the VDR-Handheld will be great innovation in field of biometric verification devices.

Company decided to invest in research and development of handheld device with full page scanning with white, infrared and ultraviolet illumination which would make this device unique among the similar biometric portable devices. Vlatacom uses its own funds to finance the research, feasibility study (including functional model), and new product development when possibility of innovation is recognized. Since Vlatacom has already developed document readers, this product would expand company's target market and help it get ahead of the competition.

5.1.1 Policy Elements

What are the policy initiatives that have influenced the contextual environment of BP: innovation promotion policies, research funding policies, certification ect as well as relevant tools (min 10 lines)

Vlatacom is turn-key solution provider in the field of information, communication and biometric technologies and therefore is present on the document reader market. Vlatacom has already delivered solutions which included handheld document readers of other manufacturers, with its own SW applications. The market presence helped to identify the market opportunity for the innovative device with functionalities that are not yet met on existing devices.

Company uses its own funds to finance the research, feasibility study (including functional model), and new product development when possibility of innovation is recognized. Since Vlatacom research team has already developed desktop document readers, Vlatacom management considered this research not just as good investment since the risks were reduced, but also as a chance to get ahead of the competition. Vlatacom is using its presence on the exhibitions and conferences to promote its products to the potential customers.

5.1.2 Socio-economic & Other factors

Other contextual factors such as customer / target market addressed, international validity, customer density, economic conditions, customer values, research area addressed (min 10 lines)

Target market for VDR-Handheld are the governments and companies which are buying turnkey solutions from Vlatacom as system integration company. The second target market are the companies which are buying this product as a part of their integrated system.

The main use of this device is for border control management. Since VDR-Handheld is a handheld, portable, battery operated device, it is suitable for use at border crossings in buses, trains, at the airports, and similar environments. VDR-Handheld, as a global solution for verification of latest e-

Passports and chip based ID cards, is valid worldwide. Considering the increasing mobility and new lifestyle, the necessity for portable biometric verification device is increased. Given the fact that this kind of device, a handheld document reader with full page scanning with white, infrared and ultraviolet illumination, have not been existing on the market yet, the estimation is the VDR-Handheld will be great innovation in field of biometric verification devices.

Research area were handheld devices, as well as the field of optical scanning. Full page scanning with white, infrared and ultraviolet illumination in VDR-Handheld is the feature which makes this device unique among the similar biometric portable devices.

5.2 Objectives

Aim of the project, specific objectives & strategies to achieve these objectives (min 10 lines)

The aim of the project was to develop a handheld, battery operated, rugged device for verification of travel and personal documents. The main features are reading of biometric data and identification of persons holding these documents, including the specialized optical scanner for e-Passport full page scanning.

One of the main objectives was to keep a competitive edge and stay ahead of competition, as a recognized designer and manufacturer of the machine-readable travel document (MRTD) readers.

Strategies to achieve these objectives were:

- Dividing the project into phases, first research stage based on existing components and modules, second research phase which included HW, SW and algorithm test environment development, feasibility study stage which should end with successful functional model, and finally product development stage which should end with successful device prototype.
- Identifying risks and addressing them appropriately.
- Using Vlatacom's own funds to finance the research, feasibility study (including functional model), and new product development.

6. Process

Describe the project including key concepts and the overall approach followed. Indicate project end users, target market, main project phases, problems encountered and solutions, problem resolution (min 10 lines)

Vlatacom has already had experience on the handheld document readers market, offering devices produced by other companies, for several years. The existing devices on the market were not satisfying the needs of end users, in terms of functionality and performance. Thus, the market opportunity has been recognized and analyzed. The demand for such devices has been significant and enlarging in time.

The aim was to develop and offer to the market, in shortest possible timeframe, a handheld, battery operated, ruggedized device for verification of travel and personal documents, reading of biometric data and identification of persons holding these documents, including the development of specialized optical scanner for e-Passport full page scanning with white, infrared and ultraviolet illumination, suitable for integration in such handheld device. Such device should supersede the present handheld document readers in all aspects, and offer the end users completely new user friendly experience, while exceeding the efficiency and security.

The device has meant to be used in public safety sector, mainly for security and border control authorities of governments around the world. Border crossing officers checking passengers on the first line of control, especially on the buses and trains, are the main target group of end users.

In most cases the equipment for the border control including the handheld document readers are procured within the public tender procedures. The government authorities responsible for border

control, immigration control and similar, are usually entitled for procurement of these equipment.

There have been identified many technology challenges and risks associated with this project. Decision was made to realize the project in several stages. Each stage was conditional milestone for further project execution. The process involved four stages: first stage was research based on existing components and modules, second stage was research which included HW, SW and algorithm test environment development, next stage was feasibility study ending with successful functional model, and finally fourth stage was final product development stage ending with successful device prototype. In terms of project management there was continuity between the stages, but each stage was managed as a separate sub-project in terms of Vlatacom defined project process. The deliverables of each sub-project have been inputs for the next stage (sub-project). Vlatacom project process QM-730-101.01E (shown in Appendix A) comprises of six phases: Pre-Concept phase, Concept phase, Product Definition and Project Planning phase, Design phase, Integration & Test phase and Delivery, Support & Improvement phase. In line with Vlatacom project process QM-730-101.01E, every project phase has involved corresponding reviews namely, Pre-Concept Review, Concept Review, Plans Review, Preliminary Design Review, Critical Design Review, Unit Acceptance Review. These reviews have been very helpful in identifying omissions, mistakes and failures in early phase, which led to more efficient and more effective project implementation.

The VDR-Handheld project has been started and run with Vlatacom's own resources and finances with objective to keep a competitive edge and stay ahead of competition, as a recognized designer, manufacturer and marketer of machine-readable travel document (MRTD) readers.

6.1 Project Design

Project design based on targeted market complete understanding, project structure, policies and procedures, management and implementation actions (min 10 lines)

After the market opportunity has been recognized and analyzed, the conclusion has been made that there exist significant demand for handheld document readers. Furthermore, it has been concluded that if we could develop device with functionalities and performance that have been needed but not met at the market yet, we could overtake substantial market share.

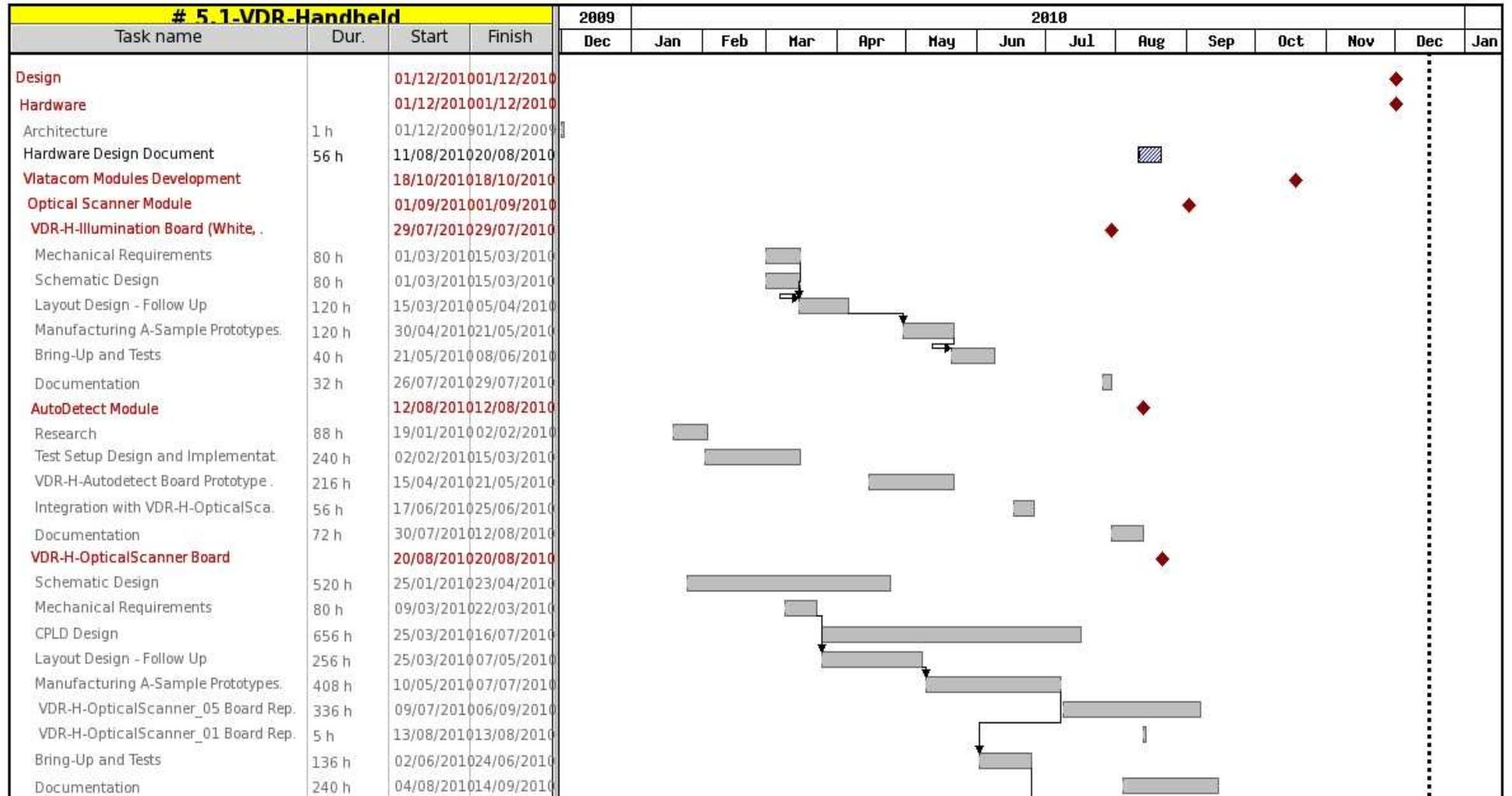
After the market opportunity has been recognized and thoroughly analyzed, the next step was to analyze the technology challenges and risks associated with this new product development project. There were identified several technology challenges and risks. All this was documented in New project proposal document, and afterwards a Project charter document have been released, confirming the decision for starting the project and defining the objectives, deliverables and responsibilities.

For each project stage clear objectives and verification criteria have been defined. Initial research activities confirmed possibility of document optical scanning from the very short distance, which led us to the next research stage. Second research stage confirmed that we have been able to realize the optical scanner with defined requirements and that there are products and technologies available on the market needed for completing this new product development project. In this stage we have identified a new technology risk related to the very small dimensional tolerances that should be reached in order to achieve the successful image processing. This imposed additional mechanical requirements for product development.

Even if we have been able to define the product requirements in the earlier stage, we have been not releasing the Product requirements document till the research stages have been successfully accomplished. Product requirements document in this stage have defined the requirements for the functional model that should have been developed first, not for the final product. Hardware requirements document, Mechanical requirements document and Software requirements document have been based on the same Product requirement document, defining the functional model. After requirements have been defined the design and implementation have been done ending with extensive tests and successfully verified functional model. During this stage the intellectual property rights related with this innovation have been officially protected through the national and international patent registrations.

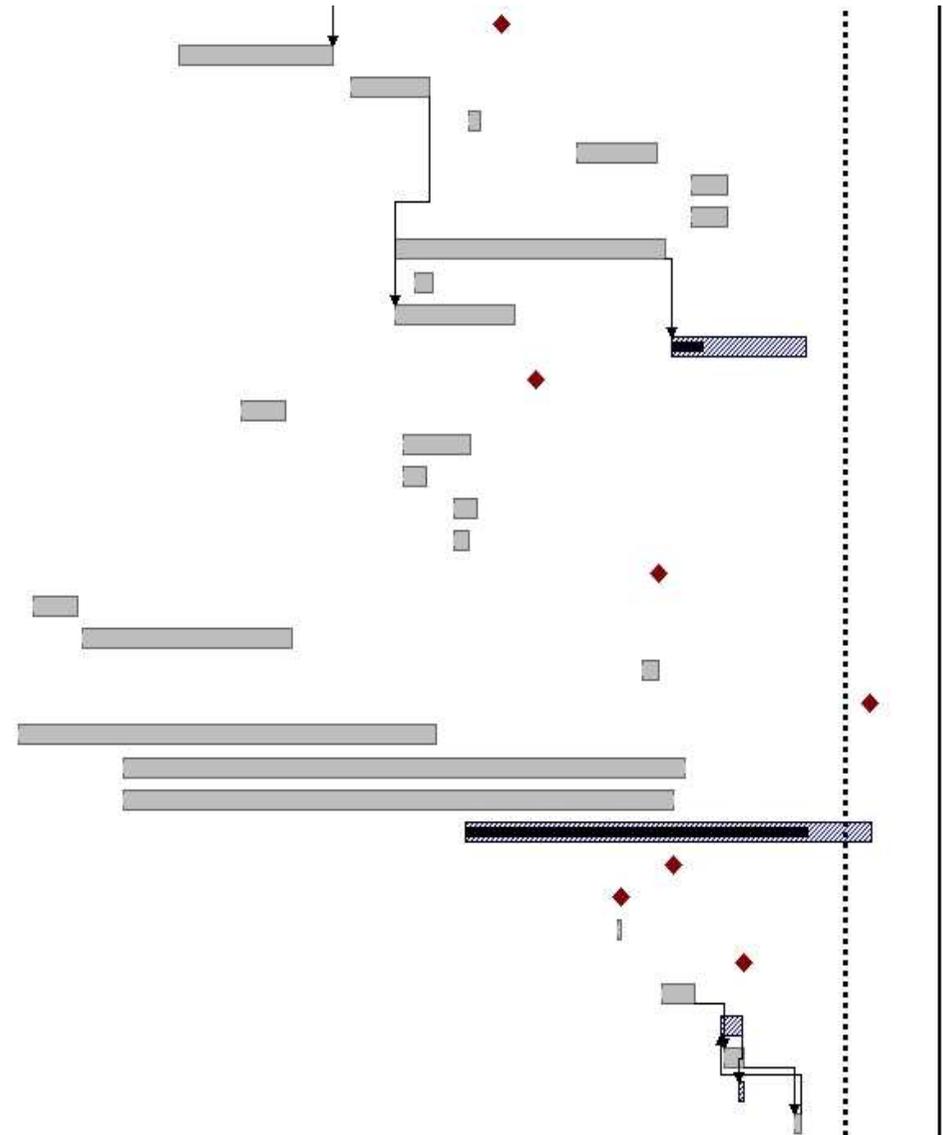
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Gantt chart for the VDR-Handheld project

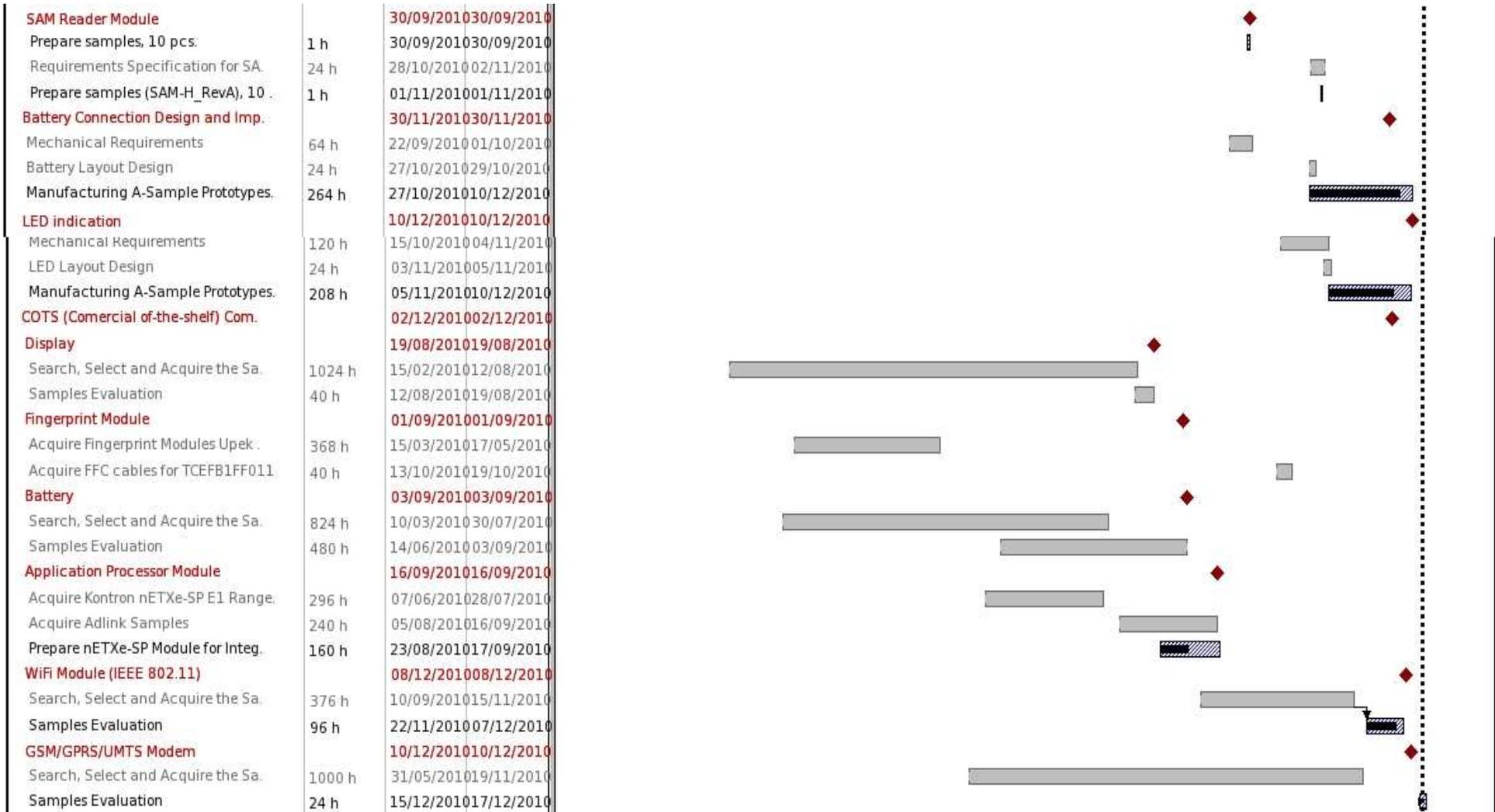


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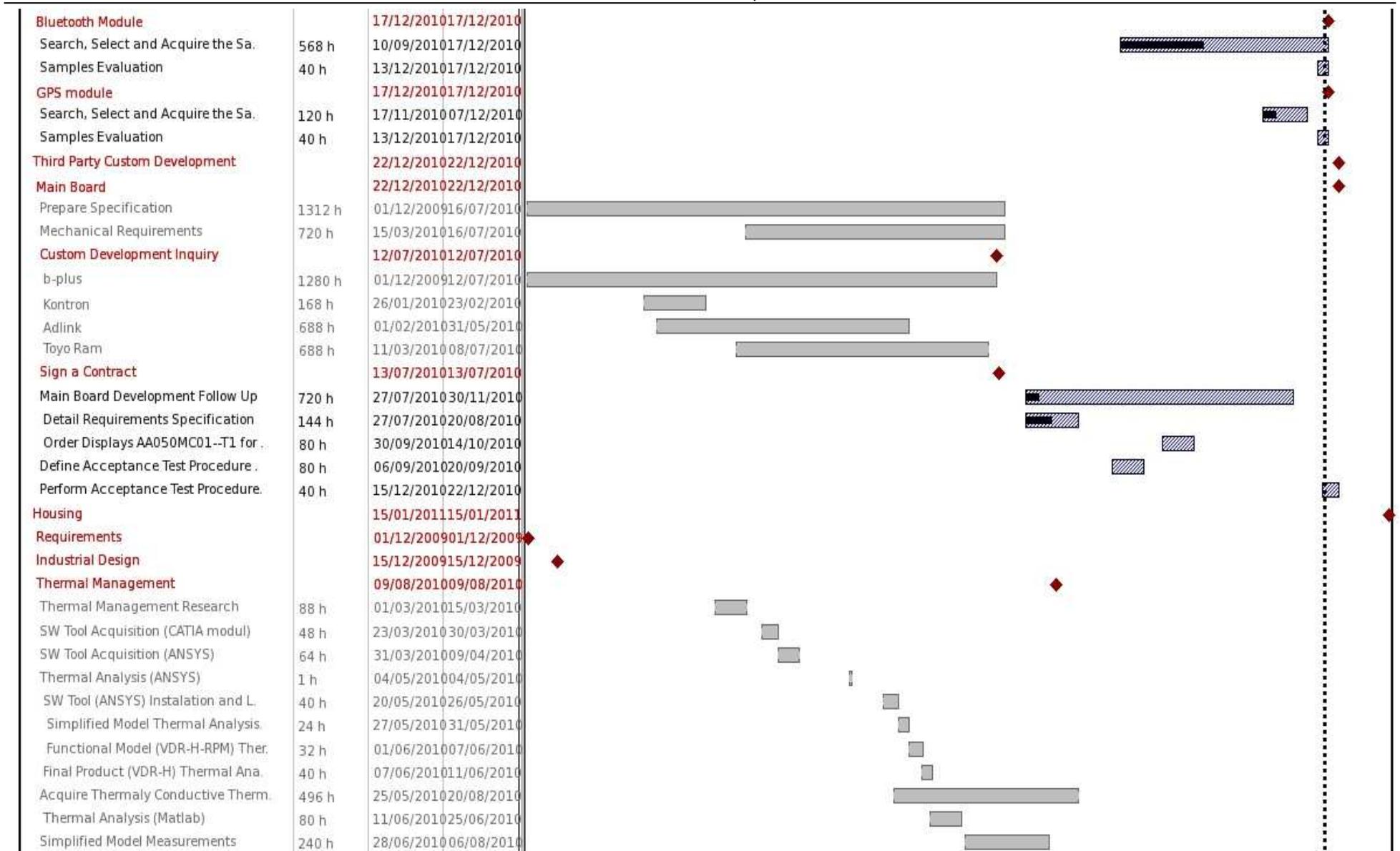
Optical Scanner Module Tests		20/08/2010	20/08/2010
Opto-Mechanical Components Integr.	80 h	25/06/2010	03/05/2010
Prepare test setup	152 h	01/07/2010	27/07/2010
Prepare test setup 2	32 h	10/08/2010	13/08/2010
Prepare test setup 4	152 h	16/09/2010	12/10/2010
Prepare test setup 3	80 h	25/10/2010	05/11/2010
Prepare test setup 5	80 h	25/10/2010	05/11/2010
Focus Calibration	528 h	16/07/2010	15/10/2010
Design and Make a New Focus Image.	24 h	23/07/2010	28/07/2010
Individual image tests	232 h	16/07/2010	25/08/2010
Integral image tests	368 h	18/10/2010	02/12/2010
Mechanical Parts		01/09/2010	01/09/2010
Prepare lens holders (M7x0.35), 1.	80 h	25/05/2010	08/06/2010
Prepare VDR-H-Illumination_RevB H.	128 h	19/07/2010	10/08/2010
Prepare illumination masks and ma.	40 h	19/07/2010	26/07/2010
Prepare AutoDetect Module Holder	40 h	05/08/2010	12/08/2010
Prepare illumination masks and ma.	16 h	05/08/2010	09/08/2010
Document Window		13/10/2010	13/10/2010
Window Material Search and Select.	80 h	15/03/2010	29/03/2010
Window Material Samples Acquisiti.	400 h	01/04/2010	10/06/2010
Window Material Quick Check Evalu.	32 h	08/10/2010	13/10/2010
Lenses		24/12/2010	24/12/2010
Lenses Search and Selection	816 h	10/03/2010	29/07/2010
Lenses Quick Check Evaluation and.	1096 h	15/04/2010	22/10/2010
Lenses Samples Acquisition	1064 h	15/04/2010	18/10/2010
Short List Lenses Detail Tests	800 h	09/08/2010	24/12/2010
Smart Card Reader Modules		18/10/2010	18/10/2010
Dual Interface (Contact and C-les.		30/09/2010	30/09/2010
Prepare samples, 5 pcs.	1 h	30/09/2010	30/09/2010
Antenna		11/11/2010	11/11/2010
Mechanical Requirements	56 h	15/10/2010	25/10/2010
Matching		04/11/2010	10/11/2010
Antenna Layout Design	40 h	05/11/2010	11/11/2010
Prepare samples, 5 pcs.	8 h	10/11/2010	11/11/2010
Manufacturing A-Sample Prototypes.	16 h	29/11/2010	30/11/2010



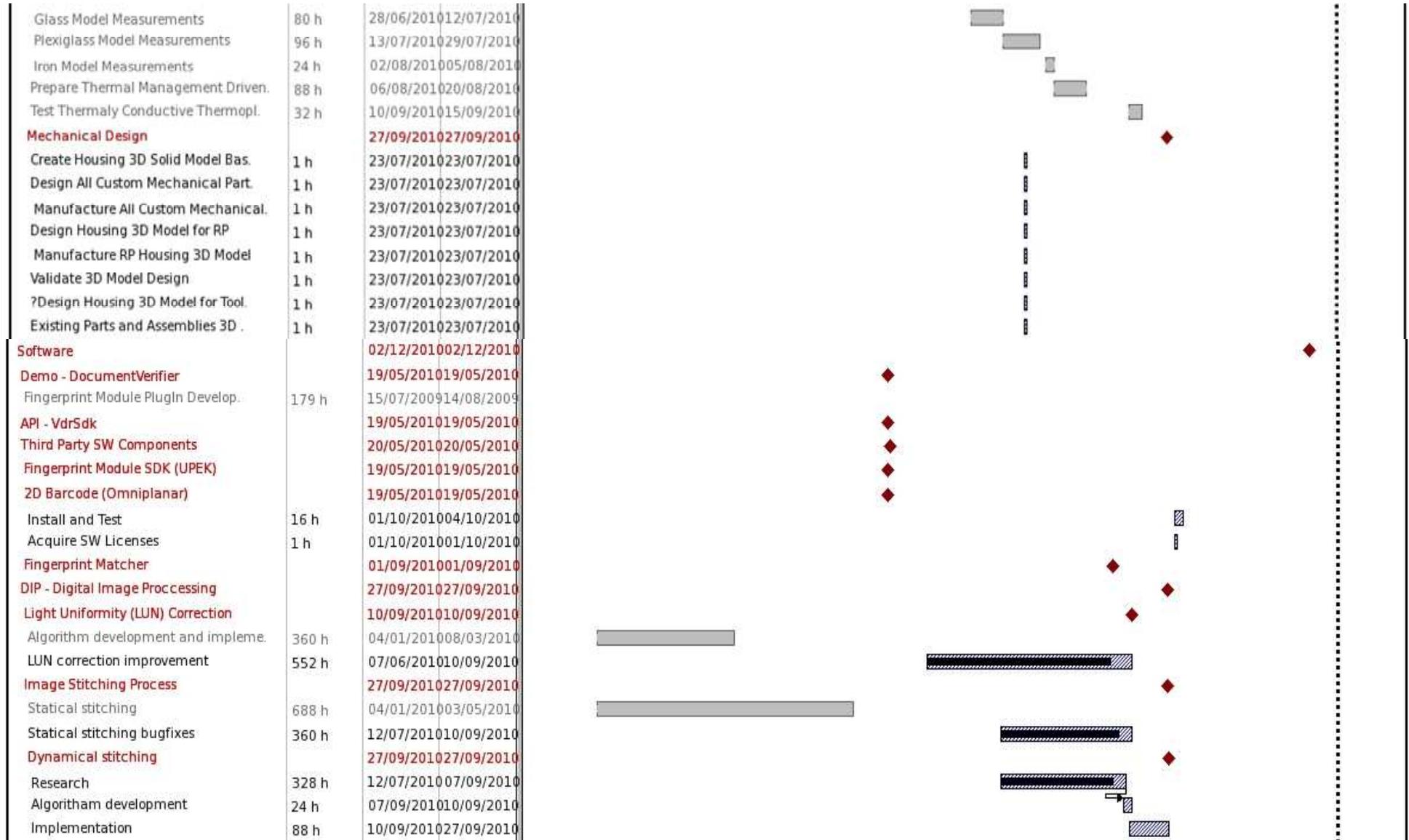
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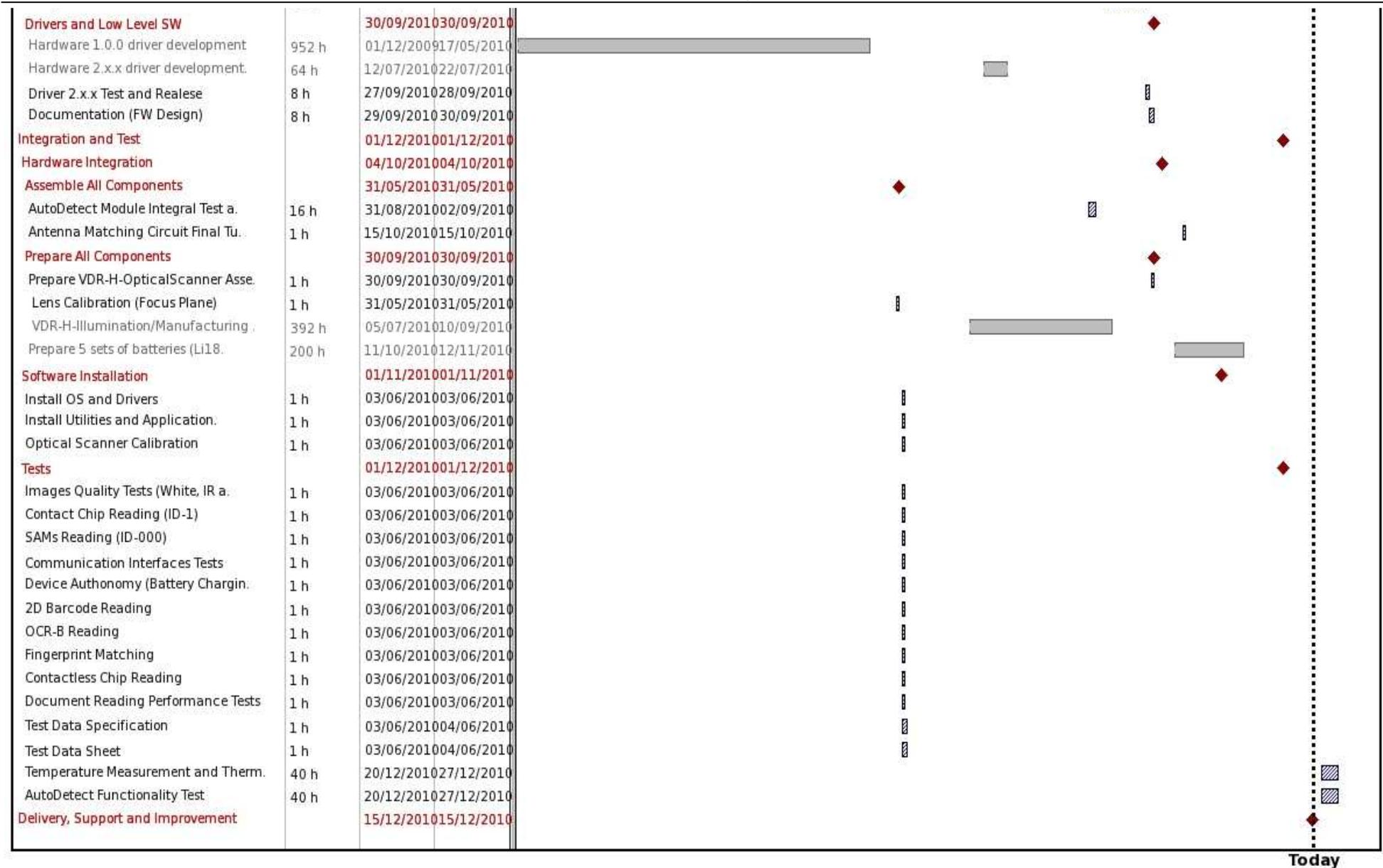
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The fourth stage, final product development, started with new requirements documents which included all device prototype characteristics. Verification criteria have been also redefined. Design and implementation have been done again, but reusing and relying on the results achieved in previous project stages whenever possible.

Since the time to market on this project has been top priority, during the fourth stage we have been reducing some requirements in order to meet defined schedule. Removed requirements have been moved to the roadmap document along with other requirements for the future product improvements.

6.2 Project Management

Activities relevant to project coordination and management, project documentation and reporting, quality control, validation and verification (min 10 lines)

Project manager has been assigned to this project at the very beginning of the project and officially promoted through the Project charter document. The project manager has been responsible for complete project workflow. In this project the project manager at the same time has been design lead and has been working on ensuring that project run on time, within the specification, within the budget.

Project manager has been working on determining project scope and project plan, including the schedule and resources management, and also on product requirements. The Gantt chart of project activities is given in Appendix B of this document. Project documentation, reviews and reports were written by project manager and team members with full responsibility of project manager, to have them on time.

This project has involved some outsourcing activities which has also been responsibilities of project manager. These activities included specifications, coordination, contract, communication and deliverables verification.

6.3 Project Implementation

Main elements associated with the project implementation. Realization of new idea, or new technological realization or improvement / novelty to known technology and means to achieve this. Innovation associated with the project realization in terms of new products, services, methodologies. Marketing, advertising and customer service. (min 10 lines)

At the beginning of process, there were identified many technology challenges and risks associated with this project:

1. Optical scanning of quite large surface (full data page of e-Passport) from very small distance. There was risk of getting document image of poor quality in which case the data processing would not be possible in some or all aspects.
2. Processing power needed for intensive image processing requirements. There was risk to have too long document (person) processing time.
3. Power management of many components with significant power consumption and with requirement for long device autonomy. There was risk to have too short device autonomy (or large battery).
4. Thermal management for device without ventilation openings, with extensive processing power and lot of integrated peripheral devices. There was risk of overheating.

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5. Mechanical design with constraints for harsh environment conditions. There was risk to make a device for lower environment constraints.
6. Third party modules integration. There are many third party modules on which depends the device design. The risk was to have difficulties in modules integration (hardware, software or mechanical), or in meeting required specifications with the chosen modules which would have prolonged the project implementation.
7. Mechanical design with constraints for compact size. There was risk to make too large device in order to meet aforementioned challenges.
8. Standards. Since the scope of the project is within the biometric document field which is not mature yet, there was risk of failing to implement some emerged requirement, which is not known to us at the moment (this was actually marketing risk).

The project has been implemented in four stages. In first stage, research was done, based on existing components and modules. This research addressed some of the risks imposed in optical scanner requirements and also processing power requirements. The results of this research have confirmed that the optical scanner with requested functionalities and handheld device based on such scanner, with requested functionalities, could be realized mostly with components available of the shelf, namely optical imagers, lenses, illumination sources and processing modules. In this stage we have also identified a new technology risk related to the very small dimensional tolerances that should be reached in order to achieve the successful image processing. This imposed additional mechanical requirements for product development.

Second stage was research which included HW, SW and algorithm test environment development. In this stage we have used existing processing platforms and confirmed that optical scanner based on matrix of optical imagers could be successfully realized. At the end of this stage we have produced the integral images of the scanned passports with satisfying quality. Also in this stage processing power estimation was done with positive results. At that time we have identified all limitations and concluded how to address them in the next stage.

Next stage was feasibility study ending with successful functional model. During this phase reviews that have been done have proved to be very useful. For example in this stage in Concept Review we have concluded that some functionalities should be omitted in order to achieve the results minimize risks. Functional model included device with integrated electronics, mechanics and software. This device included processing platform, LCD display, optical scanner, smart card readers with contact and contactless , communication interfaces, battery, housing and demonstration software. Housing was realized in rapid prototyping technology. Furthermore, after the Plans Review we have concluded that additional resources should be planned in order to achieve the planned schedule. In the Preliminary Design Review we have concluded that preliminary design should be changed in order to meet all requested functionalities. The similar result has been drawn after the Critical Design Review. During the tests in this stage a major issue with thermal management has occurred. The cooling solution used in functional model has been of the shelf solution which has not been adequate to provide needed cooling. This issue could not be resolved in functional model, therefore the special attention has been paid on this during the next development stage. Images below show the VDR-Handheld functional model photos.

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The result of project third stage: VDR-Handheld functional model, top view



The result of project third stage: VDR-Handheld functional model, bottom view

Finally, fourth stage was final product development stage ending with successful device prototype. During the realization of this project stage, we have been reviewing each project phase as defined in Vlatacom project process QM-730-101.01E. In design review we have had many issues arised and resolved which helped us to meet the defined deadline with all requested functionalities. Prototype included industrial design, size reduction and optimization of all internal modules, power and thermal management improvements, design for manufacturing and design for test considerations, environmental considerations in terms of integrated modules and housing design. First prototypes are realized with housing in rapid prototype technology. Images below show the VDR-Handheld device prototype photos.

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VDR-Handheld – first prototype, top view



VDR-Handheld – first prototype, bottom view

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6.4 Project Evaluation

Project feedback mechanisms and evaluation mechanisms. (min 10 lines)

Vlatacom runs projects in line with its defined project process, which is in line with latest ISO 9001 standard. Each project phase is started and ended with records and documents, including tests and reports. All issues are reported to the project manager, and are addressed either in the same, or in the next project phase, depending on the type of the issue.

The reviews have had important role in obtaining optimal project process implementation. Thanks to the reviews we have been able to implement project phase after phase with minimal recurrences.

For each product requirement there has been defined verification criterion that has to be met during the product development. In cases when the verification criterion has not been met, the situation has been analyzed and documented. The issue has been reported and addressed either in the same stage, or in the next stage, depending on the type of issue. Sometimes the verification criteria are too complicated, or not representative for the corresponding requirement. In that cases the verification criteria have been changed, as part of validation process.

7. Description of Research team/Institution

Short description of R&D team and institution (min. 10 lines)

R&D team working on this project has been growing together with spreading of project activities. During the project there were involved four electronics engineers, two PCB layout designer, two mechanical engineers, industrial designer, technician for electronics and mechanics, FW/driver and image processing algorithm developer, two SW developers, design lead and project manager.

Vlatacom d.o.o. is a turnkey solution provider in the areas of information, communication and biometric technologies. Vlatacom designs, develops, manufactures and delivers its hardware and software solutions to leading international players in these fields of business. Vlatacom is the authorized distributor of Motorola in Serbia since 1998, as well as its business partner in the fields of biometrics and digital radio systems.

Most of the Vlatacom's employees are young people with two to five years of work experience in the fields of telecommunications, surveillance and control, automated vehicle tracking and location, software development etc. The older employees possess vast experience gathered while working in Serbia's most prominent civil, police and army institutions. Project managers and executives have a vast international technical, marketing and management experience.

Vlatacom d.o.o has been certified as meeting the requirements of ISO 9001:2000 for the following activities: development, engineering and production in the fields of information, communication and biometric technologies and provision of related support services.

8. Applied Financial Mechanism

Describe financial mechanisms applied in transformation of research into innovation within BP, as well as means of connecting scientific research team and financiers (min. 1000 char.)

Vlatacom used its own funds to finance the research, feasibility study (including functional model), and new product development.

Company is present on document readers market for the last five years. Also, as a system integrator and turnkey solution provider in the field of border control management Vlatacom has already

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delivered solutions which included handheld document readers produced by other manufacturers, with its own SW applications. The market presence helped to identify the market opportunity for the innovative device with functionalities that are not yet met on existing devices. Therefore Vlatacom management invested, first in research and after positive results in further development of this revolutionary product.

9. Impact and benefits

Describe achieved benefits of R&D team and/or enterprise implemented innovation, as well as impacts on institutional and policy levels. (min. 1000 char.)

R&D team has developed a new optical scanning technology, based on matrix of imagers. This technology offers high-speed, accurate, document scanning, with white, infrared and ultraviolet illumination, in low profile form factor.

R&D team has developed a new handheld document reader with functionalities and performance not seen on the market yet.

The intellectual properties rights related with this innovation have been officially protected through the national and international patent registrations.

During this development significant new know-how has been adopted. The results of this project could easily be reused for other similar projects.

After this project, Vlatacom is able to better evaluate, plan and implement complex, new product development projects.

The product itself will help countries around the world to protect borders more efficiently with better security, and their governments to have more benefits of next generation ePassports and National ID cards. Citizens will further benefit from the faster border crossings, and reduction of identity theft and fraud. In general it will help to have more comfortable and safer traveling worldwide.

10. Sustainability

Provide information on sustainability of innovation after financial aid within implemented financial mechanisms, and some multiplier effects as replication and extension of the action performed in BP. Expected use of Best Practice and lifecycle considerations. (min. 1000 char.)

The facts that this product of Vlatacom is only part of family of similar products (such as desktop document reader VDR-1, Portable biometric station, Handheld biometric authenticator, etc.), and that for this product there exist proven need on the market, are guarantee of success, especially if it is known that the most countries in the World are in the process of the complete modernization of documents and document verification infrastructure, and that this product has functionalities and performance not seen on the market yet.

Therefore, it is expected that most of the countries that have not finished procurement of handheld document readers will choose our product, due to its superior characteristics.

Furthermore, it is expected that this product is only the first one in a series of Vlatacom handheld document readers.

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11. Repeatability and transferability

Lessons learned from the project implementation team. Repeatability and transferability of the project. (min. 1000 char.)

The project process described herein, was successfully accomplished due to the responsibility and professionalism of project implementation team. The personal and team motivation is exceptionally important when complex project, as this one, has to be implemented. The good communication within the team members is also very important. If possible, the focus on one project should be maintained and every team member should know exactly what are her/his responsibilities. It is necessary to define in detail project scope and exact product requirements, and to evaluate the implications of eventual changes before they are accepted. Feasible timeline should be defined and maintained during the project process implementation.

The results of project itself shall be reused in future product improvements and similar products development. Some of the results will be easily transferred to improve existing Vlatacom products.

Furthermore, this project process could be easily repeated for other product development with different requirements, especially if complex and includes lot of technology challenges and risks. Such projects could benefit on experiences received on this BP example. Similarly, the project process could be transferred to other department or institution.

12. Evaluation

Describe reasons and evaluation criteria why the described example is a best practice. (min. 1000 char.)

The presented project is, in our opinion, a good example of a BP because it represents a very complex engineering project, started after market demand has been spotted, analyzed, and market opportunity recognized, then decision was made to investe time, money and resources in research and development, all splitted in several stages so that project could be stopped if some conditional milestone would not be riched. Before each stage the verification criteria were defined and after each stage the results were evaluated and decision for further research and development was made. That way we have been able to successfully accomplish this very complex project very efficiently, effectivly and with minimal risks and investments.

13. Contact of research team/institution

Name, address, tel., fax, e-mail, URL

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14. Contact of financial mechanism facilitator

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