Giggle Project Plan:
Internet Search Engine for Kids

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1 Introduction

1.1 Preface

The intent of this chapter is to provide information about the "Giggle: Search Engine for Kids" project, a search engine for kids, including a global description, justification, deliverables, and schedules.

This plan will provide a general product description and identifies the activities to be performed in order to create it. Furthermore it establishes schedule baselines and provides a basis for tracking and control.

1.2 Background

"Giggle: Internet Search Engine for Kids" is a management and technology (MT) master's thesis project by two graduate computer science students at the University of Nijmegen. The project will be done in assignment of IBM, Amsterdam.

2 Current Environment

2.1 The problem

A search engine is a piece of computer software that is used to search data for specified information. The most common are Internet search engines, particularly useful because the Internet is comprised of millions of documents in an unstructured matter, and finding data by just looking around is a rather impossible task. However, current search engines have their deficiencies.

Search engines are either too difficult to work with, or retrieve documents and information which are not relevant to the information need. Investigation into search patterns with adults has shown that most users conduct multiple searches, on average 22% of all searches return no results and the average success rate in a search session is 59% [18]. The average person uses a query length of 1.7 terms [18], such a general query formulation results in a low precision retrieval, yielding many documents that are irrelevant to the information need. That such a large percentage of the retrieved sites, using the most general search engines, are irrelevant to the knowledge gap we are trying to satisfy, shows that even adults have trouble finding the information they are looking for on Internet, let alone children. Due to a smaller vocabulary and less global knowledge of the world around them, children are less capable of formulating their information.

There are various dangers facing children on the Internet, ranging from those that victimize the child, such as being unwillingly exposed to pornographic material; to those that enable children to conduct activities such as downloading patents for bombs, or easily purchasing drugs [21].

Children may unintentionally attain access to irrelevant or unappropriate by typing innocent but imprecise queries resulting in misdirected searches. Many popular search engines can lead an unsuspecting child to numerous porn sites. In an effort to increase traffic to their sites, many web-sites have misleading titles or terms, using popular terms, spelling variations or errors, to abuse the manner in which search engines retrieve documents. An estimated 25% of porn sites misuse popular brand names such as Disney, Barbie, and Nintendo [22] resulting in retrieval of web-sites or documents irrelevant to the user query. To emphasize

the scale of the problem we did a short investigation. Using "Google" approximately one quarter of the sites retrieved for the search query "Pokemon" contain adult material. Other examples with similar alarming results include words such as toys, boys, Britney Spears and dogs, query terms likely to be typed in by a child not interested in pornographic images [17] [27]. Another example are misleading URLs. For example, `www.whitehouse.com` does not lead to the official site of the White House (`www.whitehouse.gov`) as possibly expected, but rather to a pornographic site.

Furthermore, children are much more likely to click on advertising banners and icons than adults, not being able to distinguish between editorial content and advertising [36]. Research has shown that advertising ranks surprisingly high as a tool to discover new websites [30]. The result is that children are likely to be attracted away from a sites' editorial content by web advertising and popup windows, and towards unappropriate (including adult content) sites. Furthermore, children are more vulnerable to the commercial promotions and e-commerce, tempting them to actions with serious consequences including making purchases that exceed their pocket money, using up their savings on frivolous purchases, or buying prohibited products or products that are too expensive. Young people often have trouble understanding the real value of money. They may even let themselves be deceived by a promising ad that does not correspond at all to the product delivered.

Children should be capable of independently finding information which adheres to their interests and level of knowledge and development. This is currently not the case; classic tools do not adequately associate with the way in which children think or work. Not only are many of the sites retrieved not relevant to the information need, a rather large percentage contain information not suitable for a general audience. The retrieval of a large number of irrelevant documents is undesired by the users, also parents, teachers, librarians are disturbed by the content of some web-sites retrieved on simple children's queries.

Obviously, when someone intends to do so, many unappropriate documents and web-sites can be freely attained. Using "Google" it took me under a minute to find a recipe for building a Napalm bomb. However, where there is a will there is a way. Protecting children from intentionally trying to access particular information goes beyond the scope of this thesis. This thesis concentrates on a more precise retrieval of relevant documents in relation to the search query and thereby leaving out irrelevant and unintended documents. Whether an additional filtering on particular themes and terms is to be done, to partially restrict intentional unappropriate searches, is left open for discussion with the stakeholders and will become clear during requirement analysis.

The problem as depicted is two-faced. The largest problem is that the many docs retrieved do not satisfy the information need of the user. A side-effect thereof is that, for the sakes of parents, teachers and carers, we must often protect our children from those irrelevant sites that are retrieved.

2.2 Project Objectives

A feasible manner of improving a child's access to relevant documents on the Internet is by offering a search engine suitable to the requirements of children and their guardians, designed specifically for children ages 8 to 12. **The aim of this project is to successfully design and implement an easy to use tool which supports children in their search for information on the Internet.** The fundamental notion is to make searching easy, fun and meaningful in order to improve information accessibility.

The primary focus is on offering documents which better satisfy a child's need, with emphasis on appropriateness of content level. Not only should retrieval result more adequately meet their information need, but irrelevant documents should not be retrieved, and as such, protect children from unwanted and unappropriate web-sites.

The secondary focus is on designing and implementing a user interface that better adheres to the manner in which children think and work. The accent lies on simplification of the query formulation process and navigation, while offering a fun and easy interface to work with.

Furthermore, because we strive for worldwide applicability, the tertiary focus is on language applicability. The program will be made multilingual with target languages being Dutch, English and Spanish for both the user interface and retrieval documents.

3 Justification

3.1 Social Relevance

World

The large media coverage and amount of attention that the dangers of Internet for children is getting [28] [24] [29] [26], shows the demand for advancements in this area, yet the tools momentarily offered, restrict the informative capabilities of the Internet so dramatically that they are often not used, hinting that the public is still waiting for a tool that better adheres to their requirements.

The age group (ages 8 to 12) has been chosen due to the fact that these children often use Internet to find information (for example, to make a report for school or play games), are familiar with using word based search engines (capable of typing and familiar with using words to formalize needs) but have difficulties formalizing their information need accurately which often results in retrieval of many irrelevant web-sites. Furthermore, this age group is easily influenceable, on a social level, increasing the need to protect them.

IBM

Originating as an American company and now prominent world-wide, IBM has always invested in corporate community relations, paying close attention to their societal responsibilities. While making an active effort to promote human welfare, enhancing relationships with customers and employees, IBM hopes to be seen as a great employer, a trusted corporate citizen and a valued member of the community. Their efforts have shown incredible results, scoring in the top 15 per cent of the 50 most prestigious consulting firms [5], Market Cap's top 100 companies [3], and Business Ethics' 100 Best Corporate Citizens every year since the list's initiation [1], based on social analysis profiles.

With IBM's philanthropic programs, it has become one of the largest corporate contributors to nonprofit organizations and educational institutions across the world. IBM's efforts are focused on helping people use information technology to improve the quality of life; using IBM's expertise in technology and demonstrating their reputation as a solutions provider.

IBM believes that their role in social, human, and legacy issues is not all that different from their role in technical fields or financial markets. "Corporations thrive only in communities that thrive" [6]. Since their main competitive strength lies in technology, they offer programs in which employees help children of low-income families learn the use of technology or advise

public schools on information systems [2]. IBM contributes their resources, skills and technical innovations into helping individuals, schools and entire communities thrive.

To give an impression of ways in which IBM is momentarily striving to achieve these goals, only a handful of all the existing programs are mentioned below:

- Reinventing Education:
  Using technology as a leverage for change, it was designed to raise the quality of teaching and learning for all children. [9]

- IBM KidSmart Early Learning Program:
  This program is aimed at giving pre-kindergartens the tools they need to enrich teaching and learning, making children all over the world prepared and excited to learn by increasing their communication skills before they learn to read and write. [10] [8]

- TryScience:
  A worldwide online science and technology center, stimulating interest in science both on-line (www.tryscience.org) and off-line (IBM kiosk in NEMO in Amsterdam [8]) aimed at children ages 8 to 14. TryScience offers a new way for people everywhere to discover the science presented by museums around the world by means of interactive exhibits, adventures, live camera "field trips" and experiments. [12]

- MentorPlace:
  An online mentoring initiative in which IBM employee-volunteers work together with students and teachers to provide students with academic assistance and career counseling, giving them role-models and interpretations of working and working in ICT. [11] [8]

- Webschool:
  An electronic learning environment in the Wilhelmina children's hospital available to children, parents and teachers. It is an initiative to prevent chronically-ill children from complete isolation and falling behind in their education. [8] [13]

As the above list of existing programs shows, IBM is all over the place, actively participating in the education and well-being of children in schools, children's hospitals, family restaurants [25], and children's science centers, only to name a few.

IBM has a strong overall commitment to public education and raising student achievement, promoting the notion of technology access and utilization by all citizens. Using technology as a leverage to make children capable of independently finding information which adheres to their interests and level of knowledge and development clearly fits into IBM's philanthropic efforts. The fundamental notion of improving information accessibility on the Internet by making navigation and search easy, fun, and the results meaningful connects with IBM's efforts in triggering curiosity and stimulating children all over the world to learn. Furthermore, a multilingual solution corresponds strongly to IBM's global approach and philosophy. The goal is thus to develop a tool which encourages children to independently search information on Internet in a safe manner. Such a tool can be which can be advised to children, parents, schools, family restaurants and businesses, children's hospitals and libraries to make the Internet a safe haven for children while providing academic assistance and allowing children to fulfill their curiosity.

3.2 Scientific Relevance

Management and Technology

Most software projects fail because the tools devised do not adhere to the users' demands. In the United States, about 80% of software projects are restarted, mostly because they failed to deliver the value expected by their customers [16]. The most important success criteria of successful projects were user involvement (35.1%), requirements management (24.1%) and planning (9.6%) [15].

Before making a specification of a product, one must be sure that it adheres to both the end-user requirements and the requirements of the company funding its production. The product will be brought on the market free of charge with the company's intention of goodwill for society. Decision makers which influence whether or not the product will be used are the user themselves (children), but also parents and teachers, making success of the product (and thus also the company's image) lie heavily on compatibility with these groups.

An interesting aspect is that of the user group. Momentarily research is being done into usability aspects and software requirements of children [23] indicating awareness of the subject. However, extensive models describing how to systematically research and test user aspects related to learning and independently acquiring information is very sparse [38] [34] [37]. Until recently, software testing for this user group has always been done by adults, yet publications are appearing in which the need to include the user in the design process of children's computer products are addressed [35]. We know little about the service requirements that children pose on a search engine, the manner in which they search on the Internet, and the types of information or documents they search for. Determining a method for an adequate user requirements analysis is a difficult task; traditional methods of surveying and invoicing will most probably not yield appropriate results, while other methods such as watching how the users work and the think-aloud-protocol probably will. A model will be devised to research this topic, including a systematic method of defining and describing the problems that each stakeholder involved may encounter and how to come to these conclusions. The method or model used will be evaluated along with its results.

An extensive requirements analysis and marketing research must be completed to model the requirements of all the stakeholders involved in the project. Contributing to a requirements definition are not only the user requirements, but also the parents, teachers and IBM's corporate strategy. Furthermore law enforced requirements such as those posed on children's toys must be researched for applicability.

Who are the different stakeholders involved when making an application to aid children in their search for information on the Internet? Which problems are encountered, to which extent and under which circumstances do they consider it to be a problem? Which requirements do the different stakeholders involved place on a tool to help deal with these problems?

Computer Science

The computer science aspect of this project is two-faced, with specific requirements in both the information retrieval process and the user-interface (formulation input and result output).

User profiling research must be completed to determine the overall characteristics of the types of documents that must be retrieved, and those that must absolutely not be retrieved. Furthermore, a strategy must be devised and implemented to retrieve these documents from

the Internet and filter out undesired documents. Needed is to find an appropriate balance between a high precision and high recall. Recall and precision are the fundamental parameters defining the behavior of an information retrieval system. Precision is a measure of accuracy describing the proportion of returned documents being useful, in this case reflecting the probability of filtering out all unwanted documents. Recall describes the proportion of retrieved relevant documents in comparison to all relevant documents on the Internet. A high recall reflects the usefulness of the retrieved documents as described by the users themselves, and is necessary to ensure that the product will be used at all. Unfortunately, precision and recall are inversely proportional.

Many current search engines allow query input by means of a text box, making search initiation difficult when the information need is not clearly defined and ineffective if the user does not understand the search method. Other search engines restrict the user to a selection of predefined categories to choose out of, with the advantage that the hierarchical nature reduces the number of irrelevant documents but are restrictive because they often only contain a relatively small number of documents and the categories can be ambiguous [32]. Challenging is the creation of an alternative graphical user interface which aids in the search through hyperspace, simplifies query formulation and furthermore adequately adheres to the users' characteristics such as age group and cultural backgrounds while remaining intuitive, easy to use and easy to learn.

Yet another challenge is the multilingual aspect. Because retrieval models are language dependent, research must be done towards application of the devised tool for retrieval of documents in other languages.

System requirements must be established and the client made aware of these. Issues such as hosting and minimal system requirements will be determined.

In accordance to the requirements specification, a full working program must be delivered with an adequate user-interface verified against the users' needs. Research must be done into the types of algorithms and techniques which can be used to create the desired product, both behind the scene as on the screen. These do not merely include the graphical user-interface, but also methods for retrieving and filtering documents from the Internet. Furthermore, the application must be able to run online and be responsive, retrieving results real-time.

Which relevant problems can be solved by the implementation of a tool, what are the origins of these problems and how can they be solved? Is it possible to adhere to their needs by increasing retrieval precision, delivering relevant documents and filtering irrelevant documents? What are the specifications of an on-line multilingual application which is intuitive enough for children to work with yet strong enough to aid them in their search for information on the Internet?

4 Project Activities and Products

4.1 Process

Doing good research means collecting and analyzing data in a structured manner and working towards a well-defined goal. Making an appropriate software tool to solve a problem can only be done if the software delivers the required functionality and performance to the user while also being maintainable, dependable and usable [14]. This section gives an overview of the process with which we plan to achieve good research and a good software tool.

Our software development is based on the waterfall approach, consisting of separate process phases such as requirements specification, software design, implementation and verification. Only after completion of each phase does the development go onto the following phase. See section 4.3 for more details.

The preliminary research includes investigating and analyzing the issues corresponding to the information need of children and possible solutions for dealing with this need (see section 3.2). In order to distill all the information required during the implementation process, this process is roughly broken down into two aspects, the child-related aspect and the tool-related aspect. The first involves research into the user group and other stakeholders involved. This includes researching cognitive characteristics, capabilities, knowledge levels, and information needs of children in order to create a specification that adheres to the needs of all stakeholders. The second aspect involves investigating the existing state-of-the-art products and solutions for these types of applications, in order to model modern capabilities, in products and research, and the problems and issues associated with them.

To deliver the required functionality and performance to the user, a user requirements analysis will be completed. This is necessary to determine the product requirements and to ensure the quality of the product. In the initial stage a plan will be drawn out, including which questions are to be answered about the users (and other stakeholders) and their environment, how to find an approach to answering these questions, and how to analyze the results and thereby distilling the requirements of all stakeholders. Investigation will also be done into different manners of distilling these requirements. The requirements will partially be based on the results of the preliminary research, and partially based on own experiments and interviews with users and stakeholders (parents, teachers, and customer).

Subsequently we will translate the user requirements into a design. As discussed in [14] the following aspects are of importance for the successful development of a software product:

- Maintainability: ensuring that the software is capable of evolving with changing needs of the users.
- Dependability: including aspects such as reliability, security and safety.
- Efficiency: including aspects such as responsiveness and memory requirements.
- Usability: ensuring an appropriate user interface and adequate documentation for the user for whom it is designed.

The resulting design will describe functional and non functional requirements, and also system and hardware requirements for the tool.

The design will incrementally be translated leading to the implementation of a working program. Implementation and testing will be done incrementally and repeatedly interleave each other, continuously verifying if the program's behavior corresponds to the user and design specification.

After verification, the program will be turned over for acceptance and embedded in an environment for use in the real world.

4.2 Project Schedule

The project has been broken down into 7 subsequent phases, each constituting its own activities, milestones and deliverables with each phase (see section 4.3 for more details). The

following stages of development and their deliverables can be distinguished:

Project phase	Deliverable
1. Orientation	Project Proposal, Project Plan
2. Preliminary Research	Literary Research
3. Research & Definition	Requirements Analysis
4. Design	Architectural design
5. Implementation	Program prototype
6. Testing	Tested program
7. Acceptance & Finalization	End product, Thesis, Presentation

The thesis project comprises 21 work weeks, however will be spread out over a longer period of time. The thesis will be written throughout the entire project. A long-term planning that has been made to give an impression about the duration of each phase and when each of the deliverables can be expected (See Figure 1).

4.3 Project Phases

The proces has been set up as a simple waterfall model. Every phase is followed by a subsequent phase with its own deliverable constituting the results of the milestones.

This section gives a more extensive description of the phases and their deliverables.

Orientation

This is the initialization phase of the project in which a Project Proposal and Project Plan will be produced. The main deliverable, the project plan (this document), can be seen as a manual for the entire project.

Preliminary Research

During Preliminary Research phase a literary research will be completed, including investigation into user group characteristics and existing technologies. The following aspects will be investigated and analyzed:

- Literary research and interviews with IBM employees to investigate IBM's corporate strategy, existing projects, and their criteria on the product and process.
- Stakeholder and user group research:
  - Interviews to distinguish between different stakeholder groups and their roles.
  - Literary research and interviews with experts to devise an appropriate plan and method for acquiring stakeholder and user requirements.
  - Literary research into previous research on the user group.
  - Literary research, interviews with stakeholders, and viewing user group (using methods such as the think aloud protocol[33] and post task interview) at work to complete user group requirements analysis. Subgoals are determining cognitive

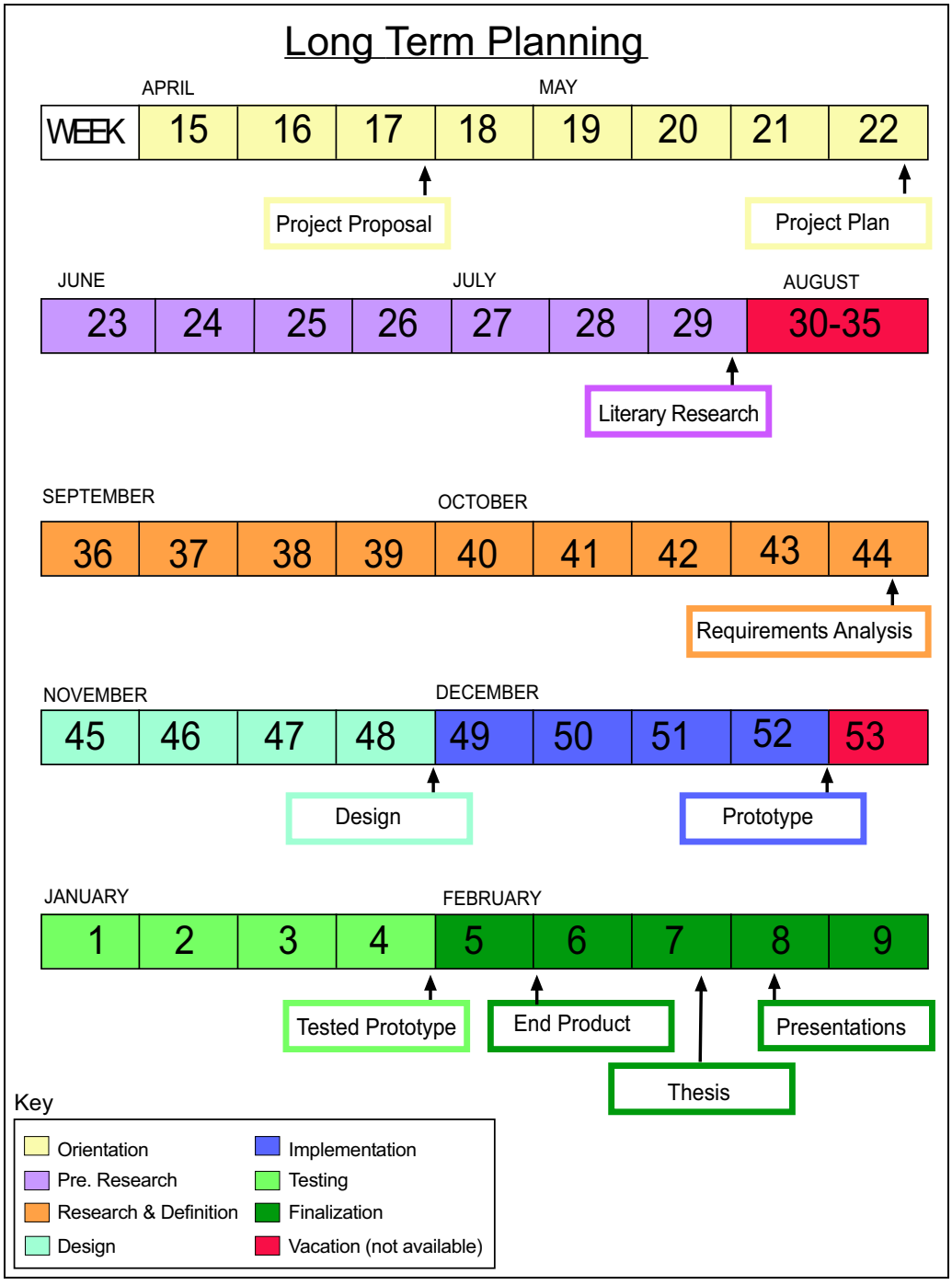

Figure 1: Long-Term Planning

characteristics of children, see how they think and work using existing tools and systems, determine deficits of current tools and possible improvements, yielding a sketch of user group's knowledge about existing systems, verbal competence, and extroversion levels.
  - Interviews with stakeholders and users must yield information and language knowledge level, and determination of types of documents of interest, yielding information for parental and filtering requirements analysis, their standards and expectations.

- Investigation into existing means, technology, tools and solutions and the problems that are encountered with respect to requirements related to the same user group.

This activity will result in a report describing the results of the preliminary literary research.

Research and Definition

During this activity an definition study analysis will be completed. All stakeholder requirements must be distilled during this phase, resulting in the product requirements. Here, the boundaries on the project will be defined more precisely. Where necessary, an appropriate compromise between conflicting requirements must be made. The literary research (see section 4.3) will be used as a foundation for this activity.

This activity will result in a Requirements Analysis document describing the product requirements and defining the boundaries of the project.

Design

The goal of this activity is to create a complete architectural design of the final product according to the requirements described in the Requirements Analysis document (see section 4.3).

Literary research and user group viewing will be done to determine effectiveness of different types of user interfaces, and visual representations of document content. Furthermore, literary research into effective information retrieval and filtering algorithms and multi-linguistic information retrieval will be completed as also the possible technical capabilities available to answer stakeholder requirements. Furthermore, research will be done into existing state-of-the-art tools and programming languages which could be used to create the desired application.

The design activities will result in an architectural design including an interface design and system requirements. The design plan will describe and divide the subsequent activities into several disjunct parts in order to maintain overview during the implementation phase. The system and other technical requirements will be discussed with the client.

This activity will result in a Design Plan describing the final product, how this is to be made, and the considerations made along the way.

Implementation

A complete and working prototype will be built during this phase. The product will be built according to the Design Plan described in section [35]. After the prototype has been built, it will be shown to the client for approval. Furthermore, the stakeholder groups will be asked to give an impression of the program and any ideas, suggestions or improvements.

Testing & Validation

When the implementation has been completed, thorough testing will take place to see if the product adheres to the specifications. The program will be tested by us, several user group members and involved stakeholders. The functionalities of the product will also be tested and verified, to ensure that it does what the customer and users expect and want. Faults or deviations to the specifications will be reported in the product specification. Product faults must be recovered and fixed in order to guarantee an adequately working product.

Acceptance & Finalization

During the Acceptance & Finalization phase the product will be turned over to the client for acceptance. Steps for acceptance will be devised. Together with the client the steps in the acceptance plan will be completed to make sure that the product is embedded and can be fully used, building awareness for the tool among all stakeholders involved – users, parents, teachers and IBM.

Furthermore, during this stage the thesis will be finalized and presentations will be held at the KUN and IBM describing the project. The thesis describes both the method and the results of the requirements research as also the computer science techniques used during development of the application. Furthermore, a final evaluation of both the tool and process approach will be described in the thesis.

5 Project organization

This chapter gives general information about the project and those people involved.

5.1 Project Tracking, Monitoring and Control

To monitor progress, milestones will be tracked against what was planned. If problems are encountered in the development of the project, they will be reported to the supervisors. Meetings with each supervisor will be set up on a regular basis to monitor the overall progress of the project.

5.2 Involvement, Roles and Responsibilities

The following defines the roles and responsibilities of the members involved in the support and approvement of the project and its development:

- Renske Weeda: project owner
  Responsible for setting up, executing and completing the project, and also guarding progress and quality of the project as a whole. Will be involved in each phase of execution.

  Primarily responsible for process (devising a plan for) and progress of execution of the orientation, preliminary research, research and definition (requirements analysis), and product design phases. During design phase, focus will be on interface aspects of program.

- Jolanda van Gendt: project owner
  Responsible for setting up, executing and completing the project, and also controlling progress and quality of the project as a whole. Will be involved in each phase of execution.

  Primarily responsible for process (devising a plan for) and progress of execution of implementation, testing and acceptation phases, with emphasis on quality control. During design phase, focus will be on technical aspects of program.

- Franc Grootjen: supervisor KUN (computer science)
  Provides overall support and guidance throughout the project, with emphasis on progress control. Supervises daily planning, progress will be monitored in weekly meetings problems encountered and milestones achieved will be discussed. Strong involvement throughout the entire project, with more emphasis during the second half in which the computer science aspects of information retrieval, design, implementation and testing play a larger role.

- Pepijn Vos: supervisor KUN (management and technology)
  Provides support and guidance on management and technology aspects throughout the project. Involvement throughout the entire project, however more emphasis lies on the first half and finalization stages of the project during which requirements analysis and acceptance play a dominant role in his field of expertise.

- Warner Dijkhuizen: supervisor IBM:
  Acts as the client's single point of contact for reviewing and approving project deliverables and changes. Evaluates the application for overall operability at acceptance. Responsible for aiding in the acceptance of the product, aspects of embedding the product and increasing awareness of its existence. Guidance is expected within the organizational structure of IBM, and also introduction to contacts (both within IBM and with similar projects) for interviews, experiments and testing of stakeholders.

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6 Final Result

6.1 Deliverables

The following final products will be yielded as a result of the project:

- Requirements Analysis (including literary research)
- Design Plan

- Final Application
- Thesis
- Presentations at the KUN and IBM
- Evaluation and reflection

6.2 Evaluation

Final evaluation will be done according to the deliverables mentioned above. Because this is an academic master's thesis, the grade will primarily be determined by the academic supervisors at the KUN. The computer science aspect of the project comprises about two-thirds of the whole, while the management and technology aspect comprises about one-third of the whole. The final grade will be determined in accordance to these weights. The supervisor at IBM will also deliver a grade, capable of rounding the final grade up or down by a maximum of one point.

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