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Implementing a Model of Virtual Collaborative Planning System

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ABSTRACT

This paper described our research experiences with supporting national planning with information technology through the development of a High Level Model for collaborative planning. The techniques of the Structured Systems Analysis and Design Methodology (SSADM) were adopted for the systematic study and design of a virtual collaborative planning system for a National Planning Commission. Thereafter, we deployed the Macromedia Dreamweaver and photoshop applications development tools to implement the designed system. The result is a virtual collaborative planning software which was tested at the National Planning Commission, Abuja, Nigeria. The system assisted the organisation to plan Federation budgets and projects in teams thereby, allowing exchange of views and ideas from team players before implementation.

Keywords: *Collaboration, Groupware, CSCW, CVGE*

I. INTRODUCTION

Planning is an activity devoted to clearly identifying, defining, and determining courses of action, before their initiation, necessary to achieve predetermined goals and objectives. It is a process for accomplishing purposes. It is a blueprint of business growth and a roadmap of development [1]. National planning today requires collaborative work, information sharing and exchange of ideas among multiple parties and stakeholders in different locations [2]. Experts also believe that technology can change group and collaborative work, and that there is a good possibility that it can result in major enhancements to productivity [3].

Collaborative software (also referred to as groupware) is computer software designed to help people involved in a common task achieve goals. One of the earliest definitions of collaborative software is, "intentional group processes plus software to support them" [4]. The design intent of collaborative software (groupware) is to transform the way documents and rich media is shared to enable more effective team collaboration. Collaboration, with respect to information technology, seems to have several definitions. Some are defensible but others are so broad they lose meaningful application. Understanding the differences in human interactions is necessary to ensure that appropriate technologies are employed to meet interaction needs [5].

The research field of CSCW (Computer Supported Cooperative Work) addresses how collaborative activities and their coordination can be supported by means of computer systems. The design raises a number of questions such as: What characterizes cooperative work?; How can we model cooperative work?; Which computer based facilities should be provided?; And what are the basic characteristics of useful platforms for CSCW-systems? [6].

This paper aimed at presenting our research result from the study of National planning in Nigeria and the efforts towards assisting in planning federal budgets and fiscal activities through the design and development of a virtual collaborative planning software for the National Planning Commission, Abuja Nigeria. We believe that the implementation of this virtual collaborative system will help the National planning commission of Nigeria reduce the risk of human errors and provide the tools that can bring people together and enable them to interact with each other in a meaningful way towards a clear goal.

The remainder of this paper is organised as follows: A review of literature in computer supported collaboration was conducted in section 2 while the deployed methodologies and application program interface and tools were discussed in section 3. The fourth and last section discussed the obtained results and concluded the paper.

II. REVIEW OF RELATED WORK

Computer-based support for collaboration spanned several areas of human endeavour; from learning to planning, design, working, health, etc. Researchers all through the years have been using computers to support different kinds of collaborative activities. Collaborative software is a broad concept that greatly overlaps with Computer-supported cooperative work (CSCW); though they were both believed to be equivalent by some authors. In particular, [6] believed that groupware is part of CSCW. They particularly claimed that CSCW and groupware addresses how collaborative activities and their coordination can be supported by means of computer systems.

Architecture for computer-supported collaborative design that distinguished between a shared visual representation and a shared underlying representation was presented by [7]. The authors first proposed that computer-support for collaborative design required a shared understanding of the design artefact among a design team. They believed that the development and support for this shared understanding was built on current

developments and research in AI, CAD, CSCW and computational models of design. They went further to suggest that the shared understanding should comprise both a visual representation and a semantic model and should be an explicit representation in order to be effectively shared [7].

Reference [6] gave an overview of the research field of CSCW. The paper aimed at introducing some of the essential problems addressed within CSCW, and to illustrate some of the approaches taken for better understanding the central aspects of cooperative work activities and to design computer-based systems supporting collaborative work activities. The examples and discussions by the authors were largely taken from design oriented work domains and the authors believed that most of the claims will, however, be generally valid [6].

The research by [8] analysed transformations in collaborative activities that a computer supported collaborative writing system introduces into co-authors' practices and discussed implications for the design of collaborative tools for writing. Their analysis was grounded in user studies of four different groups of co-authors writing an academic report during two different collaborative situations. Their approach involved having two groups collaborating in face-to-face using a word processor and the other two groups collaborating at a distance using a synchronous collaborative writing system. The study analysed differences between the activities of the groups and focused on transformations that the CSCW system introduced into the organization of the co-authors' collaboration. The results showed that the use of a CSCW system presented constraints in the collaborative activity.

Grønbæk et al [9] and [10] investigated how to support work and in particular cooperation in large-scale technical projects. The investigation was based on a case study of a specific Danish engineering company responsible for management and supervision of one of the world's largest tunnel/bridge construction projects and it uncovered challenges to Computer Supported Cooperative Work (CSCW) in this setting. The goal of the research was to determine requirements for CSCW as they unfold in this specific setting as opposed to survey and laboratory investigations. The requirements provide feedback to product development both on specific functionality and as a long term vision for CSCW in such settings. The initial cooperative analysis identified a number of bottlenecks such as sharing materials, issuing tasks, and keeping track of task status in daily work, where support for cooperation was needed. Grounded in the analysis, cooperative design workshops based on scenarios of future work situations were established to investigate the potential of different CSCW technologies in this setting. In the workshops, mock-ups and prototypes were used to support end-users in assessing CSCW technologies based on concrete, hands-on experiences. The workshops uncovered several challenges. First, support for sharing materials would require a huge body of diverse materials to be integrated, for example into a hypermedia network. Second, tasks are closely coupled to materials being processed thus a coordination tool should integrate facilities for managing materials. Third, most daily work tasks are event driven and plans change too rapidly for people to register them on a computer. Without meeting these challenges, new CSCW tools are likely to introduce too much overhead to be really useful [11].

A paper by [11] described a case study of supply chain collaboration facilitated by a decision support environment in a high-tech electronics supply chain with multiple independent companies. The authors in their approach first developed a theoretical perspective on the basis of previous work from literature. Then the findings were synthesized into a research model using a methodology based on theory-building case study research. The work's empirical base was a real-world case in a supply chain with four independent companies in high-tech electronics that were have observed and worked with over a period of two years. A collaborative planning process was designed and linked into the existing planning and execution processes, and tooling consisting of a decision support system and a data management environment was developed and linked into the existing IT infrastructure. The researchers also described the phases in the implementation history and the decision support system in their report and also compared the research model with the case findings as well as discussed the limitations to and opportunities for the research [12].

An examination of the role of Information Technologies (IT) and particularly Internet Based Geographic Information Systems (Internet GIS) as spatial decision support systems to aid community based local decision making was carried out [13]. The paper also covered the advantages and challenges of these internet based mapping applications and tools for collaborative decision making on the environment. The author discussed the potential of GIS in environmental planning and its importance for supporting public participation. A review of computer supported collaborative work systems for group decision making in environmental planning was discussed and the significance of virtual reality and three dimensional GIS visualisation was stated. The necessity of utilising Internet GIS for community based planning, the issues related to the distribution of geographic data on the Web and those asserting the power of Internet map servers for locating maps on the Web were equally examined. The author concluded the work by determining the potential contributions of the Web based participatory planning support systems to the environmental planning discipline.

A novel approach for collaborative assembly planning in a distributed environment was presented by [13]. The research showed that the typical or standard CSBAT (Connection Semantics Based Assembly Tree) can be applied to a given assembly problem. The structure of the Co-ASP (Collaborative Assembly Sequence Planning System) was presented in the paper and an example to illustrate the collaborative planning approach was also described [14].

Reference [14] described the design and development of a Collaborative Virtual Geographic Environment system (CVGE). The system integrated the technologies of GIS, remote

sensing, distributed virtual environments, multimedia, and CSCW. The system was a 3D, distributed, and graphical world representing and simulating geographic phenomena and processes to enable geographically distributed users to explore geoproblems and theories and generate hypotheses, and to support geomodel building and validation and collaborative ecological planning. The work further reported an approach to establishing a CVGE across the Internet, and its application to the collaborative planning of silt dam systems in watersheds through the integration of distributed virtual environments, geographical information systems (GIS), planning models of dam systems, and geocollaboration. Conceptual and system frameworks of distributed CVGE, and the 3D modeling of virtual geographic environments and virtual collaborative studios in addition to the mediated tools for collaboration, such as streaming media based communication, shared whiteboards for text input and graphics drawing, and text-based dialogue were also presented [15].

Shen *et* al., [15] presented a review of the R&D literature on CSCD, from the pre-CSCD technologies of the 1980's to today's state-of-the-art CSCD. Research challenges and opportunities on CSCD were also discussed and highlighted. The authors' accounts were based on first-hand research and industrial experience in this area. The work therefore discussed the R&D overview of the field, research challenges and opportunities for the future. They concluded that to achieve its full potential and the vision of fully integrated collaborative product development systems, significant R&D efforts are still required. The authors also believe that some of the research challenges discussed in the paper may be addressed within next few years, while some of them may need a few decades to be thoroughly addressed [16].

An approach to rapid development of virtual planning experts that can collaborate to develop plans of action requiring expertise from multiple domains was described in [17]. This approach was implemented into a new type of software tool, called Disciple-VPT, which included an extensible library of virtual planning experts from different domains. Teams of such virtual experts could be rapidly assembled from the library to generate complex plans of actions that required their joint expertise. The basic component of the Disciple-VPT tool was the Disciple-VE learning agent shell that could be taught directly by a subject matter expert how to plan, trough planning examples and explanations, in a way that was similar to how the expert would teach an apprentice. Copies of the Disciple-VE shells were used by experts in different domains to rapidly populate the library of virtual experts of Disciple-VPT.

III. MATERIALS AND METHODS

A hybrid methodology derived from the combination of the Structured System Analysis and Design Methodology (SSADM) and the prototyping methodology was adopted in this research work. The investigative phase of the SSADM was deployed as the paradigm for systematic study in order to obtain information on the current trends in the research area of computer supported collaborative systems. The information obtained necessitated the definition of a high-level model (HLM) for collaborative planning suitable for a developing economy like Nigeria's (Fig. 1).

This HLM was tested by the design of a collaborative planning tool for the National Planning Commission, Nigeria. The choice of the SSADM was hinged on its high availability for system study and preliminary design and implementation. As the SSADM provided a system's approach to analysis and design of information system its phases as were adapted in this research are discussed in the following paragraph.

At the preliminary investigation and problem analysis phases, the researchers studied and identified the visions and missions of the National Planning Commission, Nigeria as well as identified the problems. It was discovered at this phase that the commission was yet to achieve its vision of determining and advising the president of the federation on matters relating to National development and the overall management of the economy. The commission was also plagued by the problem of decreased efficiency, delay in articulation and preparing of government budget, rigorous process and bottleneck in budget planning and execution, poor budget monitoring and implementation, poor understanding in budget articulation and presentation of same and improper communication among others. Thus, the need to support the activities of the commission with IT facilities was established. This led to the requirements analysis phase where the system environment objectives were identified and clearly stated, both functional and non-functional expectations such as Performance, Reliability, Usability, Integrity, and Interoperability were also identified.

The design of the virtual collaborative system was hinged on the HLM defined earlier (Fig 1) and it aimed at transforming the way documents and rich media is shared to enable more effective team collaboration. The prototype system was implemented using the HTML, JavaScript and PHP. HTML was used to create the passive client-side web pages and the tags were generated in Microsoft Frontpage API. The dynamic and server sides of the application were developed in JavaScript and PHP.

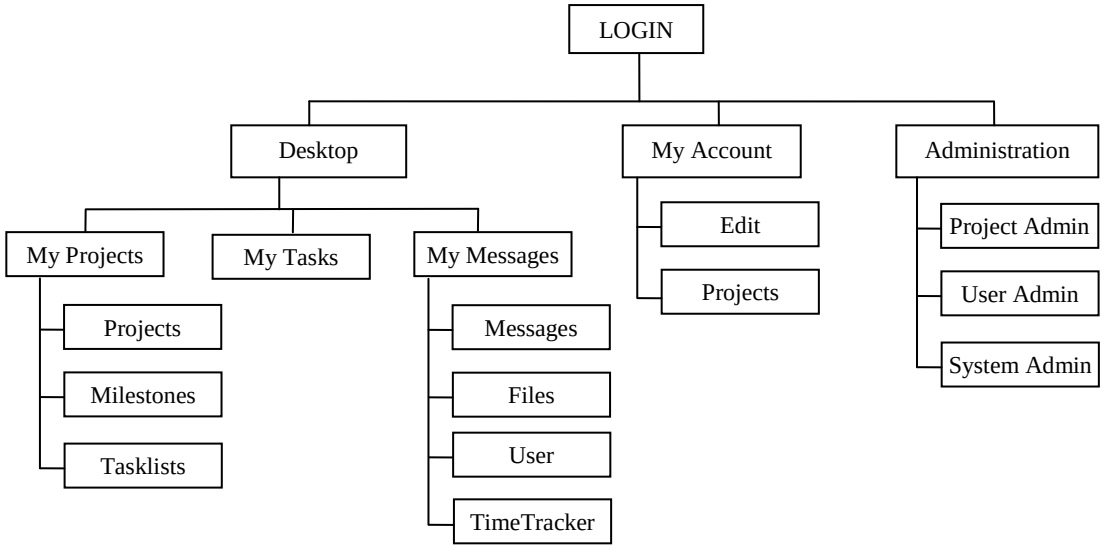

Fig. 1: The High Level Model of the Collaborative Planning System

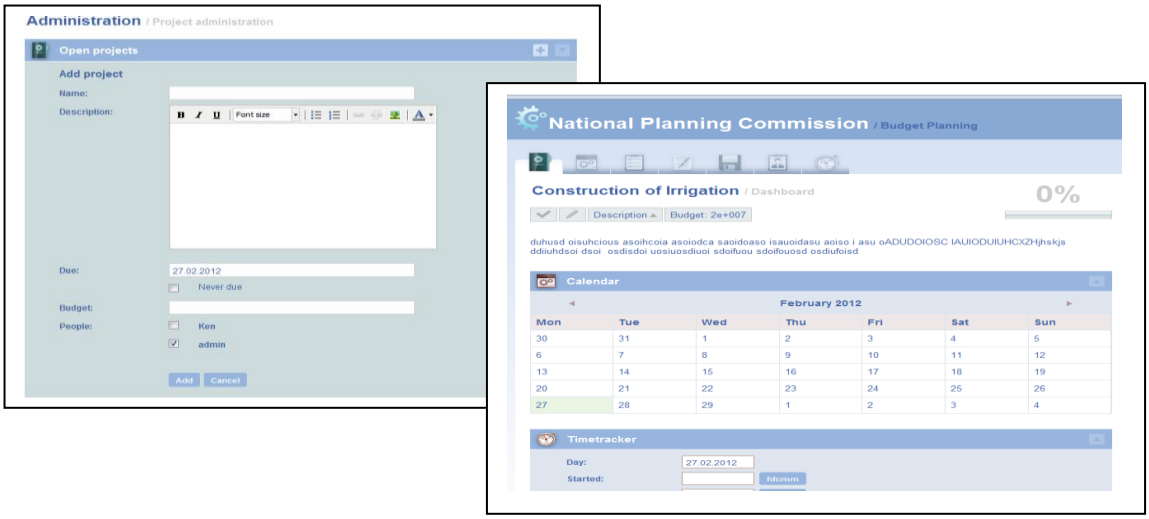

Fig. 2: Sample GUIs from the Virtual Collaborative System

IV. RESULTS

A high-level model (HLM) for collaborative planning suitable for a developing economy like Nigeria was defined in this work (Fig. 1). The model is a hierarchy of design entities; each entity representing a module. The HLM defined earlier gave rise to a prototype virtual collaborative system which consisted of various modules. The virtual collaboration system adopted the top-down approach, in which the main program was defined first, followed by the specification of the sub-systems. Here, the program design progressed from the general to the particular, each program unit (module) being progressively refined, designed and listed separately. The modules were integrated together in a way that a program could branch to another module, executes the program there and returns to the main (calling) program after execution.

The software is a collaborative working environment that provided supports for workers and enabled them work together irrespective of their geographical locations. The system consisted of graphical user interfaces; GUIs-based forms which

integrated all planning-related activities into a robust virtual collaboration system. A number of pop-up and push-down menus were introduced in the implementation for ease of use; command buttons and hyperlinks enabled the navigation through the web of pages that make up the entire package (Fig. 2).

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