Connected Kids: Designing Database Software for Web-Based Information Dissemination to Multiple Audiences

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Connected Kids (CK) is a web-accessible database application whose purpose is to disseminate information about activities and resources for youth in Troy, NY (hometown of Rensselaer Polytechnic Institute) and surrounding Rensselaer County. Our principal partner in the design and implementation of this community information system has been Troy City Government, which has provided cost-sharing, direct support, and leadership in advocating for the project. Other partners in this project are approximately 20 not-for-profit and government organizations that provide recreational activities for youth, arts and cultural education, and a variety of social and employment services. Representatives of these organizations have been involved in focus groups discussions to consider the initial direction of the project, participatory design with respect to the design of most functionalities, usability testing of data input pages, and now actual data input. We have also involved middle and high school students, parents, and teachers and social support personnel in focus group discussions about the project in an effort to design system functionalities from multiple perspectives. A working prototype of the system now operates reliably and we hope to go live with it in the very near future.

Our project is interdisciplinary in that social scientists, principally communication researchers, have worked with computer scientists in iterative processes of participatory design involving community members and system development. The questions driving the development of the project from the social science side are:

- How do organizational, legal, political, and social agendas affect the development of a community information system?
- How can processes and practices of participatory design in software system development be modeled?
- What factors aid or impede the adoption and diffusion of IT project in local government?
- How can this case study be transformed into a model of social/technical system design that is useful to other developers and other communities?

Issues and questions driving the project from the computer science side are:

- Develop a framework for querying large databases based on multiple orderings of objects.
- Develop query processing methods that improve the performance of multiple types of order queries by integrating caching and indexing methods.
- How do we integrate a decision making tool to a search interface that allows the system to make personalized decisions, only showing objects that have not been seen or whose ordering has changed?
- Develop unified RDF specifications and query methods for the completed information software for long term maintainability.

Most recently, our conceptual work during this period has focused on modeling the processes involved in the design of community information systems, which seem to be considerably more complicated than other types of software design, and which we have presented in a series of papers. First, we have argued that since new communication technologies structure the social world around us, social science researchers should become actively involved in the process of design and adopt an orientation toward inquiry that focuses on questions of ethics and values when conceiving, building and implementing IT systems with programmers and systems engineers. We also have argued that design of a community-based information system is

particularly challenging because the diversity of community interests cannot be reduced to the singular interest of a typical or representative user, but must be captured in all its complexity to ensure effective implementation of the system. Design of such a system thus raises fundamental questions about traditional data-collection methods, about the design of complex, multi-purpose information systems, and about the maintenance of such systems over time. Finally, we have noted that design involves certain practical problems in the collection and interpretation of data on users' needs and the development of design specifications responsive to these needs. We draw on activity theory to provide a conceptual framework for such a design effort by showing how users' conscious and unconscious or partially conscious motives can be inferred from their activities, and how data collection methods such as focus-group and participatory-design meetings provide appropriate means of collecting data about users' activities.

In September 2003, we demonstrated the CK system to our organizational partners and more recently have begun to work with our partners on data input, as a prelude to going live with the system in late spring or early summer. As our work transitions from system building to system implementation, we are encountering a number of legal and political challenges that in our specific case, and perhaps more generally, pose the threat of impeding the diffusion of digital government applications and diminishing the likelihood of long-term project sustainability. In seems inevitable that we will focus more specifically on these challenges in the future.

From the perspective of system development, we are recently involved in evaluating the search result presentation methods from a user's point of view and the efficient evaluation of various types of order queries from the system point of view. In general, we argue that a result presentation system that continuously adapts to the user's current search activity by showing representative categories in his/her searches and that allows them to formulate queries using these methods and also ranks the results based on previously selected queries will help users find what they are looking for. Currently, we are in the process of evaluating this hypothesis. From a system perspective, storing order information and querying it will make it possible for users to find other users that most closely match their interests, for the system to quickly show best matches to a specific query. To this end, we explore two options. The first option is for the system to cache the results of previous queries and use them to answer future queries quickly. This will allow even the complicated ranking methods to be computed quickly. The second option is to compute the users' preferences for different objects as a way to find users with similar interests. This requires the storage and querying of order information for different users. To this end, we develop an extension of the relational data model and developed equivalence relations that allow us to optimize queries for early returns. We developed a new method for early returns where the aim is to find a set of ordered list as early as possible. The results are shown to the users even if this list does not contain the most relevant object as long as the order of objects cannot be changed with additional results. We also develop the notion of partially known values and show how they can be stored and queried efficiently.

The design of our project requires that we find ways for young people within our digitally divided community to contribute multimedia products they design and create to the CK system. We have made it possible for parents, teachers, and young people to both access and contribute to the information and multimedia content in the database by rebuilding computers for local youth-services organizations and by inviting young people to contribute their own art work, stories, and science and technology information resources to the database. We have undertaken these activities with assistance from Rensselaer undergraduate students, who have provided both computer networking support, maintenance, and recycling and also course design and instruction for development of computing, writing, and drawing skills.