

Human-Centered Systems for Business Services*

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1 Project Summary

This NSF-funded project is a collaborative effort with the State of New Jersey to address two major problems in consuming and providing government services: the *integration* and *customization* of services. The government services needed by the citizens or businesses often require horizontal integration across autonomous government agencies, whose information systems are heterogeneous and difficult to interoperate. The service consumers, both citizens and businesses, face a challenging task of locating relevant services and information from various documents abundantly available on the Web. They are in need of a system to locate and integrate the services that are tailored to individual preferences and constraints.

2 Research Activities

To guide entrepreneurs through the process of establishing their business, we have developed a decentralized workflow management system (WFMS) that is capable of (1) generating a customized workflow based on user parameters, requirements and constraints; (2) automatically executing the different processes involved at relevant agencies in the appropriate sequence by authorized individuals, adhering to the business policies of those agencies; (3) visually reporting the progression of the workflow to the entrepreneurs; and (4) integrating with existing state agency information systems. Our primary research activities to include:

1. *Decentralized Workflow Execution Model*: The decentralized workflow execution model eliminates the need for a centralized WFMS which has known problems such as limited scalability and performance bottlenecks. Our decentralized model relies on (1) on-the-fly construction of *self-describing workflows* and (2) their execution with the help of light weight *WFMS stub* located at each agency. A self-describing workflow is a partition of the workflow that is associated with the tasks' definitions, the agencies responsible for their execution, and the control flow information.

2. *Service Customization*: Our service customization relies on a rule base reflecting the rules and regulations of the state agencies. In particular, our approach is based on the domain knowledge of services and regulatory rules, and is represented as service ontologies and rules topic ontologies. We have developed algorithms that evaluate compositional rules against a user profile, thereby automatically generating the inter-agency workflow customized to a specific user.

3. *Dynamic Change Management*: While a business registration process (in general, a workflow) is in progress, different changes may occur: (1) changes to the goals of the business process, that is, changes to the user requirements, (2) unanticipated exceptions that arise during execution, and (3) changes to the business rules and regulations. To handle these *dynamic changes* while delivering the eGovernment services, we have developed a decentralized workflow change management system that automatically identifies *migration rules* that specify operations and tasks needed to adjust the workflow to achieve run-time customization.

4. *Ontology Construction*: The rule base comprising of agency regulations is extracted directly from various state agency documents using Natural Language Processing technology. We have developed algorithms and a tool called OntoStruct, for automatic extraction of ontological information from text sources using domain ontologies and text processing technologies. This research has concentrated on finding relationships between terms, a set of services and regulatory rules.

3 Project Participants

The collaborating state government agencies and representatives include Office of Information Technology (OIT): Wendy Rayner (former CIO), Judith Teller (new CIO), Adel Ebeid (CTO), Odysseus Marcopolus (Director, E-government), Sue Colbert (Manager, E-government), Lydia Quill, Lynn Raleigh, and Chris Foley;

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Division of Revenue: Jim Froucion and Jane Coult; Small Business Development Center: Nat Bender; Dept of Commerce; Dept of Environmental Protection; Department of Labor; Department of Community Services. The research partners include Rutgers University: Nabil Adam, Vijay Atluri and Francisco Artigas; Columbia University: Kathy McKeown and Vasileios Hatzivassiloglou; University of Maryland at Baltimore County: Yelena Yesha; and Baruch College, City University of New York: Richard Holowczak. Student participants include Rutgers University: Soon Ae Chun, Dihua Guo, Ahmed Gomaa, Aabhas Paliwal and Timucin Bakirtas, University of Milan, Italy: Pietro Mazzoleni; and Columbia University: Melania Degeratu.

4 Prototype: MyNJBusiness

The prototype system, *MyNJBusiness*, has been developed as a proof of concepts for the business registration services in the State of New Jersey to support small and medium sized entrepreneurs. MyNJBusiness is intended to foster the establishment of new business in a transparent manner and to facilitate effective long-term interactive relationships with them. It is designed to guide and help both the entrepreneurs and business owners, and the various state agencies which process the applications from the entrepreneurs. The system demo is available at <http://cimic.rutgers.edu/dgov>.

5 Project Management and System Deployment

We realize that, for a project to be successful, one need to maintain the delicate balance between research and development. To achieve this balance, while the research team has focussed primarily on the developing research strategies and techniques and implementing them as a prototype, the state agencies have maintained their development efforts and adopted the suitable features of the prototype into their existing systems. We have established two levels of work groups (not necessarily exclusive). The first is the steering committee comprising of decision makers from government agencies and the project leaders to set the planning goals and establish research, development and deployment directions. The second is the focus working groups consisting of representatives from different agencies, participating researchers and students, who have met more frequently for technical and development discussions. In these meetings, the prototype system details have been presented and discussed for improvement. During this 3 year period, the OIT of NJ has redesigned the portal for the business-related information and services that act as a broker to facilitate interactions between public citizens and the State, and among state agencies. Full-blown application of MyNJBusiness was planned to be linked from this portal.

6 Success and Impact of the Project

The research and development results of this project fostered other E-government activities. Specifically, the results of the research activities are exploited in the Spatially Integrated Coastal Permitting System (SICOP), funded by NOAA. The collaborating government agencies of SICOP include Army Corps of Engineers in NY District, NJ Department of Environmental Protection, NOAA Coastal Services Center, NJ Meadowlands Commission/MERI and Rutgers - CIMIC. SICOP is an on-line electronic environmental consultant that acts as a road-map to determine the required steps for obtaining permits based on the location, development type, and the applicable regulatory requirements of each participating agency. The prototype of this system is available at <http://meri.rutgers.edu:8080/sicop/main.html>.

As a result of this project, several other collaborations have been generated between Rutgers and the NJ state agencies. These include the data interoperability and data sharing project among the NJ State agencies and the DMV inter-state license registration project.

This project resulted in one completed Ph.D. dissertation and a Masters thesis, as well as three on-going Ph.D. dissertations. The project also contributed in re-designing existing Ph.D. level courses including the Applications of Database Systems and Information Systems Security at Rutgers University. There are numerous journal and conference papers generated as direct results of this project (available from <http://cimic.rutgers.edu/dgov>).