

Microsoft Imagine Cup 2005



Eastern Europe Imagine Cup
Thessaloniki, Greece
May 13-16th 2005



IMAGINE A WORLD WHERE TECHNOLOGY DISSOLVES THE BOUNDARIES BETWEEN US.



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Project Team



Vesselin Gueorguiev is an assistant-professor at Computer and Control Systems Department of Technical University of Sofia. He is senior researcher at the Advanced Control System Laboratory. His interests are in two major areas: computer graphics and animation and computer science. His research is in the area of photorealistic animation and 3D graphics. Additionally he works in the area of real-time operating systems and real-time networking. He has lead and participated in Microsoft Research projects.

Nikolay Baldzhiev – born on October 8th 1982. Graduated Electronics Technical School, Bansko. Currently 4th year student. Microsoft Certified Professional. Participated in research and development at the Advanced Control Systems Laboratory. Participated in 2004th Imagine Cup Central and Eastern Europe round.



Emanuil Markov – born on September 30th 1979. Graduated from 125th High School in Sofia. Currently masters level student. Participated in research and development at the Advanced Control Systems Laboratory. Participated in Microsoft Research project and 2004th Imagine Cup Central and Eastern Europe round.

Velizar Bodurski – born on May 8th 1981. Graduated from Electronics Technical School - Goce Delchev. Currently masters level student. Participated in research and development at the Advanced Control Systems Laboratory. Experience in quality assurance at a network hardware development company. Participated in Microsoft Research project.



About the University

The Advanced Control Systems Laboratory, Technical University of Sofia, is a university laboratory specialised in industrial computer technology and computer control systems. Its research is oriented to computer control systems' architecture, algorithms and software for real-time computer control as well high-level N-tier distributed systems and heterogeneous networks. Many post-graduate, master and bachelor students participate in laboratory research activities. eLab is one of the student group in the laboratory.

Today, millions of people from all over the world make billions electronic presentations. Most of them are created with Microsoft PowerPoint. More and more people are starting to make multimedia presentations for presenting their ideas, projects, lectures etc. But making presentations this way also conceals some restrictions and risks. Some of the most widespread problems are listed below:

- Sometimes the audience sleeps during the lectures, because the presenter is standing still, they cannot clearly see what's on the presentation screen, or because the presentation is static.
- Often a good looking presentation can be ruined because the presentation system is not well calibrated, so the colours are not displayed correctly.
- Presenters have great difficulties when having to make a presentation using more than one presentation system. Usually they have to tear around between the presentation systems, which ruin the concentration both of the presenter and the audience.
- Many students are ashamed to ask questions on the education material to their lectors, and therefore they do not absorb information from the lecture.
- When the students try to write down everything that's written and said by the presenter they are usually writing everything automatically and after the lecture is over they often do not remember anything from its contents.
- The present style for making presentations is challenging for people with impaired hearing to participate in common presentations.
- People with sight problems are restricted to sit close to the presentation screen in order to be able to follow the material.

The goal of the current project is to solve all of the problems listed above, providing integrated universal presentation control system. Using this system presenters can make more efficient and interactive presentations with minimal effort. Also this system will give the audience the chance to have better contact with the presenters and to receive more information from the viewed presentation.

Architecture

The proposed architecture assumes that the lecture hall will have a wireless network. The presentation server can be used any system that can support .NET Framework and Microsoft PowerPoint XP/2003. The presenters can control the presentation either from PocketPC or from the presentation computer. Attendees can connect to the presentation computer with any kind of smart device or computer supporting .NET Compact Framework / .NET Framework.

Features

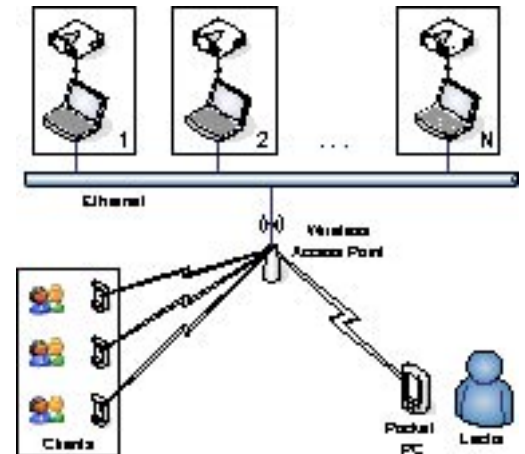
All of previously listed problems and even some more can be solved using the SmaPCon presentation system. With a single PocketPC (equipped with camera) with wireless connection to the presentation computer, presenters can have complete control over their presentations. The system provides presenters and audience the following features:

- Presenters have the freedom to move around the lecture hall and to interact with audience.
- Presenters can control more than one presentation server with single PocketPC.
- Presenters have the freedom to draw on the presentation screen from their PocketPC.
- People with impaired hearing can participate.
- Audience members can receive presentation slides on their PocketPC.
- Audience members can send messages and questions to the presenter during presentation.
- Presenters have the ability to make automatic colour calibration.
- It is possible to follow the presentation via the Internet (especially when audio and video information is provided in the setup).

Presenter scenario

Initially presenters need to prepare their presentation computers, and connect them to the projecting systems and to a wireless access point. After initial configuration, when the SmaPCon system starts, the presenter uses his PocketPC, connected to the wireless network, to choose which presentation to run on each computer.

If the colours are not satisfying the presenter can make colour calibration on the presentation system. The devised calibration process does not require a lot of time and effort.



During the presentation the presenters can view the presentation on their own PocketPC, and control it, through specially developed viewer application (p3app). The viewer has two modes – controlling mode and drawing mode. When the viewer is in drawing mode, presenters can make various drawings or write using the PocketPC's stylus. This data is transferred to corresponding presentation computer. There it is scaled according presentation screen resolution, and is shown over the current slide. The drawing data is stored on the presentation computer and also resent to the mobile devices of registered users from the audience. In controlling mode the presenter can consecutively navigate through presentation steps, go to a specific slide or switch presentations. Having this functionality gives presenters the freedom to move around the lecture hall and interact with the audience.

The provided system enables presenters to control multiple computers during the presentation. From their PocketPC they can switch between controlled computers and issue commands to them.

Attendees scenario

After the presentation computers are configured every person from the audience can register on the presentation computer with a PoicketPC or other smart device. Authentication information is provided by the presenter. They can view images of slides (properly scaled for the screen resolution of their device) or additional text, sound or video. They will also receive the presenter's drawings. In addition they can take notes directly over the currently viewed slide and review the presentation and drawings later.

During the presentation, the audience can write messages, and send them to the presentation computer. These messages are accessible to presenters after the presentation. This way they can react to the questions of the audience and improve the content of their presentations.

Using the additional information provided via this system people with impaired hearing can receive sign language translation of the lecturers' words (if such is provided) or text prepared in advance.

With a PocketPC device short sighted people can follow the presentation on their device's screen. Thus they will be able to sit any where in the presentation hall.

Remote participants scenario

With the described framework not all attendees should be in the presentation hall in order to participate in the presentation. When someone needs to attend to a presentation but due to some problems can not come in the presentation hall, he can connect via the Internet to the presentation computers and receive all the information about the presentation. If the presenter has decided to provide audio and video information it can be accessible to all remote attendees too. So they can have a better access to presentation content.

With SmaPCon some specific borderlines between presenters and attendees are significantly diminished. Both physical and mental limits are much easier to overcome.

Technologies

- Wireless communication
- Multithreading
- XML Web Service
- Microsoft Office XP / 2003
- SQL Server 2000/MSDE
- .NET Compact Framework
- .NET Framework

How could you take this further?

In future implementations in virtual classrooms the possibility of integrating the SmaPCon presentation system will be explored. The developed framework gives possibilities of implementing some basic characteristics of virtual classroom. SmaPCon authentication system should be improved in order to work with centralized university server giving access to lectures and additional materials only to authorized students.

There are plans to introduce this system to several universities in Bulgaria, and observe how it is accepted by presenters and audience.

Project Team



Darko Jovicic was born on 29th March, 1982 and is in his fourth year of computer engineering at the University of Split. Since having his first computer - a C64 - he has been very passionate about technology. Darko's professional interests include databases and web programming, and his hobbies are astronomy and playing guitar.

Kreso Baric was born 10th November, 1976 in Osijek, Croatia. He completed mathematical high school and currently studies computer engineering at the University of Split. For a long time Kreso trained for running and participated in two World and one European cross-country championship. His professional goal is to become a professor.



Nikola Dlaka was born 30 June, 1983 in Split, Croatia. Currently in his last year at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture. Nikola started programming in high school, when he got to know C, C++, Java, C# and some other less known programming languages. Currently he is interested in exploring the MS .Net platform. In his free time he enjoys watching all kinds of sports, especially soccer and curling.

Toni Jakovcevic was born on 21 August, 1982, in Split, Croatia. He finished Mathematical High School, Split, where his final work was "Chess engine in Pascal". He is in his final year of computer engineering at University of Split. His interests include ASP.NET, SQL, C#, C++, MFC, Java, Direct X. He likes basketball, swimming, soccer, running, reading and going to cinema.



Ivan Saskor (mentor) wrote his first program in 1986 and started an exciting journey from programmer to chief architect in a company called NETMedia. He is oriented on architecture of OLTP and OLAP solutions based on Microsoft SQL and .NET framework. He is founder of SQL & Developers User Group in Split and is one of two Croatian representatives in International PASS organization. He is a regular speaker at Croatian conferences related to Microsoft technology.

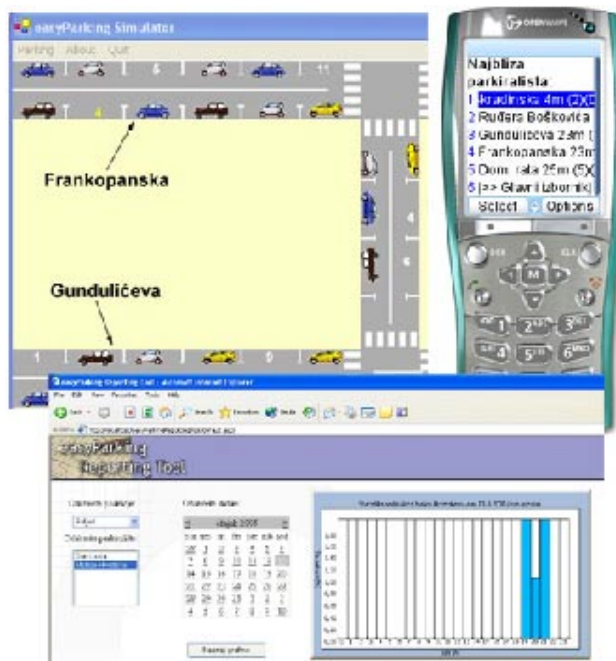
About the University



The Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split, was founded in 1960 and has grown tremendously since then. Currently it offers six undergraduate programs as well as graduate M. Sc. and Ph.D. degree programs in electrical and mechanical engineering. Its newest programs are computer engineering and industrial engineering, which started four years ago. It has more than 1,500 students. The Faculty encourages students to research and readily provides the support required to undertake innovative projects.

Project introduction

This project addresses concerns faced when people who live with a disability or people who are in an unfamiliar city are trying to find a parking space. In Europe, 10 percent of the population is considered disabled. In Croatia, there are not nearly enough parking spaces for people who are disabled, and those that are available are often used by people who aren't disabled. It's frustrating for everyone to locate a parking space, but it's particularly frustrating for people who are disabled or in an unfamiliar city. The goal of this project is to use technology to reduce frustration, help people get to their appointments on time rather than being late due to parking challenges, and reduce fuel costs, traffic congestion and pollution.



Project description

The easyParking system allows users to receive information's about free and available parking spaces on their mobile phone. The application dissolves boundaries; it can be installed in any location, is especially useful for disabled people and visitors, it can be used in many ways (i.e., SMS, Web Mobile Application and Pocket PC), and it's localized. The easyParking application can be accessed through a Web application or by sending SMS. Those using Pocket PC or Smartphone can receive a picture with a route to parking thanks to the application's integration with MapPoint.

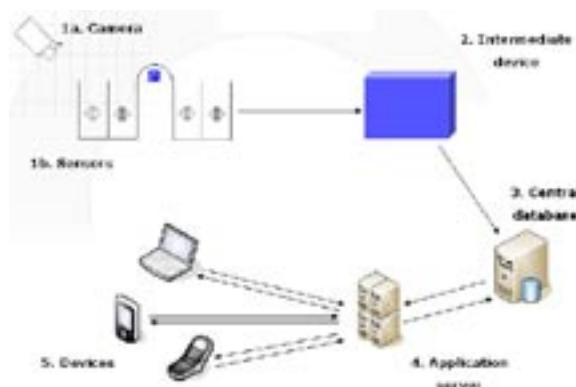
Benefits

- ➔ It identifies the nearest free parking places
- ➔ It conveys the status of each parking space in one district
- ➔ It has a smart component ("favourites" lists) that remembers where users prefer to park
- ➔ It allows parking companies to receive statistics of each parking

Architecture

The development process began in January 2005. The team thought about the system for a month and a half and then began developing using the following technologies:

- ➔ .NET Framework
- ➔ VS Professional
- ➔ MS SQL 2000
- ➔ ASP.NET with C#
- ➔ Microsoft Office
- ➔ Openwave cellphone simulator
- ➔ MapPoint
- ➔ SMS Gateway



Purpose of project

The purpose of this project is to make lives of people easier, especially those living with a disability and those who are not familiar with the city in which they are trying to park. The goal of the project was to dissolve boundaries by helping people with disabilities and people in unfamiliar cities locate free and available parking spaces. Another closely related goal of the project is to encourage people to use technology to help them in everyday situations.

Team Member Biographies



Anastasios Valsamidis, 23, has studied electrical and computer engineering at the Aristotle University of Thessaloniki. His research interests are nanotechnology and hardware design. He is a proficient C# programmer. He is a keen athlete and enjoys listening to music.

Fani Tzima, 23, has studied electrical and computer engineering at the Aristotle University of Thessaloniki. Her research interests are data mining and environmental systems. She enjoys travelling and reading literature.



Vasiliki Kosmidou, 23, has studied electrical and computer engineering at the Aristotle University of Thessaloniki. Her research interests include biomedical signal processing and human-machine interaction. She enjoys watching movies and drawing landscapes.

Aikaterini Dikaiou, 22, is studying electrical and computer engineering at the Aristotle University of Thessaloniki. Her research interests include biomedical signal processing and wireless communications. She likes photography and enjoys playing the piano.



Leontios J. Hadjileontiadis (tutor) – Assistant Professor at the Signal Processing and Biomedical Technology Unit, Division of Telecommunications, Department of Electrical and Computer Engineering, Aristotle University. His research interests include digital signal processing, higher-order statistics, fractal analysis, fuzzy-logic, wavelets, and polyspectra for biomedical, educational and seismic signal processing applications.

About the University



The establishment of the University of Thessaloniki, as the second Greek university, was legislated in 1925, during the premiership of Alexandros Papanastassiou (first Greek Democracy). This signified a new starting point in matters of higher education. The university is characterized by an innovative attitude. Today Aristotle University consists of 41 departments as well as many other units, such as laboratories, study rooms, libraries and clinics, which make it the largest university in the country in terms of staff, student number and offered facilities. At the same time, due to outstanding research work and activities undertaken by teaching and scientific staff, the university has gained international recognition.

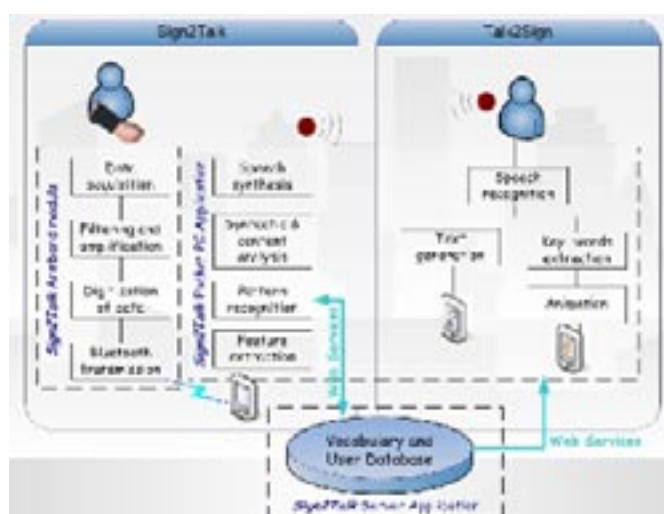
Purpose of project

Sign2Talk was developed to address the communication difficulties of people with hearing loss. In particular, it focuses on translating American Sign Language (ASL) into speech and vice-versa, to formulate an integrated solution that would efficiently facilitate deaf or hearing impaired people's communication.

An overview of the structure of the Sign2Talk system is depicted in the diagram below; the establishment of bidirectional communication between the hearing-impaired and the rest of the community is evident. In particular, the system: uses a wireless, custom-made device (armband) to acquire data related to the arm and hand movement, Surface Electromyogram- (sEMG) signals and spatial information (SI) in order to recognize ASL gestures; translates ASL gestures into American English text and speech; translates speech into animated ASL gestures and/or text; personalizes to the user's specific way of signing through self-training procedures; improves Quality of Service automatically, based on statistical analysis of system use, and provides extensive user support through dynamic vocabulary updates via Web Services.

Physically, the system is divided into three discrete, yet closely coupled, modules, i.e., the Sign2Talk Armband, the Sign2Talk Pocket PC Application and the Sign2Talk Server. The Sign2Talk Armband is a custom-made device used to acquire the essential data for ASL gesture identification (sEMG, SI). The acquired data is initially conditioned and then sent to the PDA via Bluetooth link. The Pocket PC Application is the system control unit. During the Sign2Talk operation, it receives gesture data from the armband, analyzes it, recognizes the performed gestures – using Hidden Markov Models – and outputs speech. Accordingly, in the Talk2Sign operation, it recognizes speech, processes it and outputs text and video of ASL gestures. The system also offers the option of downloading new words from the Sign2Talk Server or filing requests for additional ones. The server consists of: (a) an MS SQL Server 2000 data-base, containing a dynamically updated vocabulary and user identification data; (b) an IIS 5.0 Web Server, hosting Web Services for data exchange between the server and the Pocket PC Application, and (c) a BizTalk Server 2004 holding orchestration logic for the available Web Services.

Sign2Talk can have a great social impact worldwide and significant 'added value', since it turns a set of devices (e.g. PDA, Bluetooth, electrodes, etc) into a useful tool. It provides the bed-set not only for productive exploration of the team's abilities to address such a problem, but also to understand and integrate the needs of the hearing-impaired community, in a joint attempt to dissolve the social boundaries they face.



Team Member Biographies



Bálint Tóth (toth.b@alpha.tmit.bme.hu) is 24 years old in his final year as a MSc EE student from the Budapest University of Technology and Economics, Hungary. His main research areas are telecommunications, text-to-speech (TTS) conversion, human computer interaction (HCI) and mobile applications.

Dr. Géza Németh (tutor, nemeth@tmit.bme.hu) is an Associate Professor at BME TMIT. His interests include the development and applications of multi-lingual speech synthesis systems, speech I/O integration, human factors of man-machine interfaces and the introduction of modern infocommunications technologies into real-life services.



About the University



In 1782 Emperor Joseph II established the Institutum Geometricum as part of the Faculty of Liberal Arts at the University of Buda. The Institutum, the direct predecessor of the Technical University of Budapest, is the first in Europe to award engineering degrees to students of land surveying, river control, and road construction. Currently more than 110 departments and institutes operate within the structure of seven faculties. About 1,700 lecturers, 700 researchers and other diploma holders, and numerous invited lecturers and practical specialists, participate in education and research at the Budapest University of Technology and Economics. Approximately 10 percent of the University's 9,000 students are from 40 countries abroad. The Budapest University of Technology and Economics issues approximately 70 percent of Hungary's engineering diplomas.

The Department of Telecommunications and Media Informatics, Budapest University of Technology and Economics (BME TMIT, www.tmit.bme.hu) is the main research and university-level education center of Hungary in the convergent communication, information and media technologies.

People around us determine our behaviour, emotions, psychic reactions, fate, fortune, desires and thoughts. But it has always been a challenge to meet new people with similar interests. Nowadays life is even faster and rougher than it has ever been. People in the hard haste care less about each other and as a result, the distance among us increase and we have fewer friends. Additionally it can be quite hard to make new acquaintances, as people are often too uncomfortable or shy to start conversation with strangers.

Project description

The goal of the present system, which is called MeetU©, is to bring people with the same range of interests together – anytime, anywhere. With the help of Bluetooth™ capable Windows Mobile 2003 based Smartphones and PDAs the boundaries among strangers who don't know each other but could become best friends, have finally met their end.

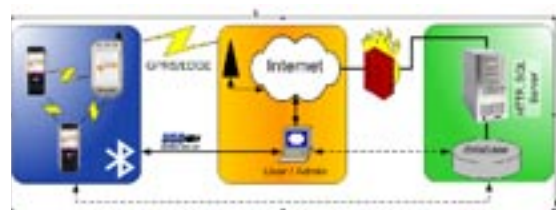
Users can create a profile of themselves with a photo and it is stored locally on a mobile device. A part of the profile can only be seen if it is validated on the server with the help of the thin layer administration interface. The validation on the client is performed during the synchronization with the server via Web Services. During the synchronization all data is uploaded and the newest database (which contains the profile's categories such as main interests and parameters) and banners are downloaded. If the synchronization is done for the first time, the user receives a unique username and a randomly generated password from the server for the MeetU© homepage. Furthermore Web Services enable maintenance and supervision of the client software for the administrators and make the system scalable. Server based administration also makes variable advertisements possible, which is an important factor in commercial use. The advertisements are displayed on the thick layer mobile client and on the MeetU© homepage.

If MeetU© users are close to each other, a Bluetooth™ connection is established between (or among) the mobile devices, and the users' profiles are exchanged. The devices makes notifications that a MeetU© user is nearby, and alert if the other users have similar interests. During the Bluetooth communication not only the profiles are sent and received, but also the database and the banners if one of the users has newer database, than the other one. Additionally the MeetU© system can be easily integrated into an existing community building homepage, like www.msn.com.

The current application framework provides an out of the box solution for the mobile-to-mobile, mobile-to-server, server-to-mobile communication and presents an example for the integration into an ASP.NET based HTTP server.

Developing process of project with sketches

The system consists of a client application (available both on PDAs and Smartphones), a web service, an administrator interface and a public homepage. The mobile devices are communicating with each other via Bluetooth and they connect to the Internet with GPRS/EDGE or via the computer if the device is connected to it with e.g. USB.



Through the Internet the clients connect to the server to synchronize. The database and the banners can be modified through the Internet by administrators. A thin layer solution shows how to attach the system to an existing or to a new web page, which can also be seen and used through the Internet.

Purpose of project

MeetU© helps people meet new acquaintances and to bring people together with the same range of interests.

Team Member Biographies



Joanna Szlasa, 24 years old, studied linguistics at the Warsaw University, and is studying computer engineering at the Warsaw University of Technology. Her interests include foreign languages, English literature, visual arts, painting, drawing and photography and cooking.



Bartłomiej Zass, 21 years old, is studying computer engineering at the Warsaw University of Technology. His hobbies are sailing, extreme sports, dancing and programming.



Patryk Bajer, 25 years old, is studying computer engineering at the Warsaw University of Technology. He is interested in photography, especially of cats,) and planning and developing applications.



Konrad Madej, 21 years old, is studying computer engineering at the Warsaw University of Technology. His interests include railways, photography and software engineering.



Włodzimierz Dąbrowski (tutor) is Assistant Professor at the Institute of Control and Industrial Electronics, Electrical Department, Warsaw University of Technology. His research interests include object-oriented system design, software engineering, databases, IT project management, two-dimensional control systems and e-learning education.

About the University



Warsaw University of Technology is a research-intensive, doctoral level academic institution focused on undergraduate and graduate programs almost exclusively in engineering and applied sciences. With more than 30,000 students served by over 2,000 professors and instructors, Warsaw University of Technology is the largest and the highest ranking engineering university in Poland.

The origins of Politechnika Warszawska - Warsaw University of Technology - date back to 1826, when programs in engineering in the institution officially commenced. There are 17 departments/faculties covering almost all fields of engineering and applied science. Sixteen of these faculties are based on two urban campuses in the capital city of Warsaw, and one faculty in the ancient city of Płock in north-central Poland. For more information on the university, please visit <http://www.pw.edu.pl/english/index.html>

Project description

We live next door. From time to time we meet together in the yard and say 'Hello' to each other. After that we rush back to the everyday duties. Although we are close neighbours, there is no real contact between us. We can't find the way to integrate. We have no common subjects to talk about – we know ourselves too little. How can we socialize? How to cross the boundaries that lie between us? Arctic Mary gives the helping hand. She emboldens shy persons, gives them reasons to meet and talk. What is also important, she secures a large amount of time that can be spent, for example, for coffee meetings with our neighbours. Arctic Mary thinks about the daily duties for us, letting us do more fancy things. She is also an irreplaceable friend of men who can't struggle through the daily duties. She solves also many other problems, despite being only a... refrigerator! However, she is exceptionally outgoing for a pantry-fridge, because she is connected with her fellow fridges through the Internet. When you run out of yeast during the Sunday evening cooking, Arctic Mary will check if there is yeast that she can borrow from the neighbouring pantry-fridges. She will ask if anybody could drop in to borrow it and, by the way, meet and talk – that of course integrates. Arctic Mary will ensure that all important products are on the shopping list in the right time. She can warn about exceeding the expiration date and will take care of us by giving suggestions that drinking milk after 10 PM is unhealthy. She can also suggest what should be bought to prepare a chosen dish. Arctic Mary can share favourite recipes with her fridge friends. She is also able to organize parties. Outgoing Mary also crosses the boundaries that lie between vegetarians and meat eaters – she can help in preparing the right menu. Moreover, she breaks cultural boundaries – she can offer us recipes for culinary specials from other regions of the world. We could get to know the culinary habits in places situated far away from us despite the distance. She is really versatile and can do many other things! Arctic Mary is an irreplaceable companion for a man, woman, bachelor, husband, mother and wife.

Developing process of project with sketches

The first step in developing the solution was designing it using UML diagrams. Class and deployment sketches were used. After that development of the main fridge Web Service was started. First of all a security layer was implemented. After that a part of the team started working on ASP.NET application and Pocket PC application, while the others were working on Web Service and fridge front panel tablet PC Windows application. The work was synchronized by SubVersion repository. After finishing development of Web Service a part of the team started testing others' work.

Purpose of project:

Helping people crossing the following boundaries:

- Time boundaries
- Cultural boundaries, lacks of knowledge about some culinary habits in other world regions.
- Helplessness and unskillfulness of men in the kitchen
- Social boundaries, shyness, rare meetings with friends
- Lack of contact with the outside world
- Lack of culinary talent and imagination
- Boundaries between vegetarians and meat-eaters
- Numerous technological limitations



Team Member Biographies

Andrei George Dunca, 21 years old, is a student in the 2nd year at the Technical University of Cluj-Napoca, faculty of Automation and Computer Science. His interests include Web Development and Databases, and he plays basketball from time to time. He designed and implemented the back end of the LocalPoint framework.

Tudor Ioan Salomie, 21 years old, is a student in the 2nd year at the Technical University of Cluj-Napoca, faculty of Automation and Computer Science. He enjoys playing basketball, bike riding and going on mountain trips. He is interested in Web Services and Object Oriented Programming. He dealt with the front end of the client applications and with the implementation of several service providers.



About the University



The Technical University of Cluj-Napoca is one of the eight universities in Cluj-Napoca. The Faculty of Automation and Computer Science trains specialists and carries out high level research activity in the fields of automated control engineering and computer science and engineering.

Project introduction

Imagine that you are visiting a new place and, even though you feel like a stranger, you are only one touch away from every point of interest in your vicinity. Furthermore, you can forget all about the trouble of planning a sight seeing tour as a number of possible itineraries, tailored to your own interests, are suggested.

Project description

Our solution is a three-tier, service-oriented architecture that provides a communication middleware between smart device users and location-specific services found in the user's vicinity. Based on this architecture, an AI-based module that suggests possible itineraries according to the user's profile was also implemented.

Team Member Biographies



Miloš Blagojević – born on May 25th, 1981. Student of information systems at Faculty of Organizational Sciences, University of Belgrade, Serbia and Montenegro. Student member of IEEE section Serbia and Montenegro. Since May 2004 he has been a member of a research group within Laboratory for Information Systems at the Faculty, where he participates in industrial projects and research concerning software development methodologies, databases and other solutions. Involved in creating graphical IDE-s (Integrated Development Environments) for simulation and modeling languages such as CSMP, VRML and GPSS and holds courses of this languages at the Faculty of Organizational Sciences in Belgrade as well as courses “Data structures” and “Designing Information Systems”. He was a lead programmer in commercial multimedia education software called “Azbukvar 2002”. Interested in developing CAD solutions based on OpenGL and/or DirectX, game programming, artificial intelligence (neural networks, fuzzy logic and genetic algorithms), semantic Web research and simulation problems. In his spare time he plays the piano and the guitar and sings in the church choir.

Kostandin Dimitrijević – born on October 20th, 1981. Student of information systems at Faculty of Organizational Sciences, University of Belgrade, Serbia and Montenegro. Since May 2004 he has been a member of research group within Laboratory for Information Systems at the Faculty, where he participates in industrial projects and research concerning software development methodologies, databases and other solutions. Involved in creating IDE-s (Integrated Development Environment) for simulation and modeling languages such as CSMP, GPSS and VRML and holds courses of this languages at the Faculty of Organizational Sciences in Belgrade as well as courses “Data structures” and “Designing Information Systems”. He is interested in developing CAD solutions based on OpenGL and/or DirectX, game programming, artificial intelligence (neural networks, fuzzy logic and genetic algorithms) and workflow research. In spare time plays a lead guitar and composes songs in his rock band called “Anything But Down”.



About the University



Faculty of Organizational Sciences (FOS) is the leading faculty for management and information systems in Serbia and Montenegro. FOS belongs to the group of technical faculties and is a constituent part of Belgrade University. It was founded in 1969, after having been initiated by more than 200 organizations with the aim of strengthening the economy with valuable contemporary knowledge in organization, management and information systems. FOS is equipped with the highest technology for performance of scientific and academic research activities in the area it develops: IT equipment, multimedia and Internet. FOS is the main Internet provider for Serbia and Montenegro’s academic network. The Faculty has proven itself capable of following and carrying out its mission. In conditions of intensive changes in the surroundings, FOS grew up to be a leading scientific and academic institution.





Introduction

Just a Drop Away is a large-scale, real-time, robust, distributed, easily enhanced, scalable, self-maintainable, auto-updatable, multimedia, multi-lingual, geographical information system that is able to address all the problems that occur during any part of the emergency handling life cycle, from the moment the accident occurs until the moment injured people arrive to the hospital, in order to minimize the consequences of the accident. Hopefully, the use of the system can permanently reduce the number of fatal outcomes for a wide variety of accidents on a very large territory (one or even more states) by bringing together people that need help and the people that have enough good will and desire to provide it.

Project description

The idea behind the “Just A Drop Away” system is to raise social awareness by providing a means to form a community of voluntary blood donors that live or work in the same neighborhood. This would be done by equipping them with the Smart Device applications that would allow them to help people that need blood quickly. By contacting people in cases when somebody from their immediate surroundings is injured the application would ensure the high responsiveness and at the same time increase the chance of the injured people recovering. The project was also designed let people report the accident with another Smart Device application, and, by doing so, increase the possibility of quickly locating accident victims. This would all be conducted in the language users understand, overcoming the possible cultural barriers that may occur in ethnically mixed environments.

Another part of the system is for the medical teams. This part of the system is used for directing the teams to the accident site as well as collecting multimedia data (audio, images) from the site in order to shorten the time needed to prepare the operation room. The most important feature of this part of the system is the ability to automatically start the process of collecting required quantity of blood from the members of our voluntary blood donor communities (if the available quantity is insufficient). The required quantity of blood is estimated by using the expert knowledge of the medical teams while they are still at the accident site. This way, when the injured people arrive in the hospital everything is prepared for their treatment.

All of this is backed-up by the powerful peer-to-peer system that is responsible for providing just-in-time information for the dynamic geographical web service discovery as well as keeping all the Smart Device applications up-to-date with a powerful auto-update engine. Due to its distributed nature and the multiple system failure recovery mechanism, the system is able to stay operative and functional even in such situations like tsunami, floods, earthquakes and other natural catastrophes. This is very important because in these situations the number of injured people is very high so the system must work with its full strength.

Developing process

The entire project took three months. One month was spent on project analysis that included visits to National Blood Transfusion Institute and Emergency Center in Belgrade, where the crucial information about the accident handling life-cycle and its problems was collected. With the challenges in mind, another month was spent designing the architecture of the system as well as prototype applications. The final month was devoted to the coding and testing (debugging) the system.

Purpose

The main goal of the project is to connect people who need help with people who are prepared to provide it. Just a Drop Away is an effort to fully automate and parallelize the accident handling process in order to significantly reduce the time required to provide help and increase the injured people's chance at survival.

Team Member Biographies



Miha Lesjak was born on October 6th, 1981. He has been developing software for the past four years on platforms ranging from Linux to Windows. He is currently interested in the .NET framework - especially in C#, ADO.NET and Windows Forms. He spends his free time as far away from computers as he can: playing basketball, mountain biking or spending time with his friends.

Tadej Gregorčič was born on December 15th, 1981. He has been developing software in various languages (C, C++, C#, Java) for the past 5 years, focusing mainly on real-time computer graphics, algorithms and distributed systems. He tries to balance his spare time between meeting friends and indulging in his hobbies, which include general and comparative linguistics, translation, poetry, reading, playing guitar, basketball, bicycling and traveling.



Boris Krivonog has been developing on Linux and Windows using Visual Basic, Delphi, C#, C and mainly C++. He loves doing low level programming with driver developing, object-oriented design and sometimes, for relaxation, electronics. He is currently interested in the .NET framework with C# and becoming a C++ guru. In the spare time, he likes mountain biking, mountaineering and reading computer related technical books. In the previous years,

Simon Jurič has been developing applications targeting different devices and platforms. His current interests are the .NET Compact Framework and Office based solutions. He is also a co-founder of the Slovenian Student Developers Portal www.kodirnica.net and was rewarded with the Microsoft Student Partner title for his work in the student area. He is spending his free time with his friends, watching web casts and gaining experience in the project management area.



Tomaž Kosar (mentor) received his BSc degree in computer science in 2002. He is currently a Ph.D. student at FERl, where he works as a young researcher. His research is concerned with design and implementation of domain-specific languages. Other interests in computer science include domain-specific visual languages, compilers, refactoring, unit testing, aspect oriented programming and object-oriented design. He is a student member of the IEEE.

About the University

The Faculty of Electrical Engineering and Computer Science is part of the University of Maribor, Slovenia. Overall, there are 2,401 undergraduate and 304 graduate students registered for the 2004/2005 academic year in seven different programmes, one of which is computer science. FERl employs around 250 full professors, associate professors, assistant professors, teaching assistants, young researchers, and technical and administrative staff. The undergraduate programme has around 500 subjects; the graduate programmes incorporate 120

Beside pedagogical obligations, FERl is also a scientific institute with explicit regional, national and international significance. Its regional significance is reflected in its close co-operation with the industry in and around Maribor, which also employs the majority of graduates and post-graduates. The national significance is particularly reflected in institutes, as compound parts of FERl, as well as in teaching centers, which implement the dissemination of basic and applied studies throughout the Republic of Slovenia. International significance is reflected in the faculty's participation in international research activities with numerous projects, the exchange of students and professors, publications in respected scientific magazines, participation at international conferences and the organization of the same.



Introduction

People are social by nature. But in spite of all the technological advances the average person is still limited in his ability to effectively function as such within the omnipresent heterogeneity of our society. Natural boundaries such as culture, language, location and knowledge are all well definable yet seldom tackled in a way that would allow the accumulating plethora of paradigm shifts of our era to be witnessed and partaken by a wider social spectrum. EthnoCon seeks not to eliminate these boundaries, but to circumvent them, using the increasingly accessible and convenient high-tech gadgets that have been available for years without ever reaching their full potential. Combining GPS navigation, wireless Internet access, cameras, microphones and embedded systems with an intuitive software interface, EthnoCon is taking the next step in the ongoing process of social convergence.

Main Features

The main instruments chosen to challenge the problem include:

- Videoconferencing
- Speech Recognition and Synthesis
- Sound Compression
- Automated Translation
- Automated Punctuation
- Context Analysis
- Conversion of text into a universal pictograph-oriented language (and vice-versa)
- Extendable and robust MSN
- Messenger-style conversation server
- GPS navigation
- Social networks and user profiles
- OCR with automated translation
- Culture Tutorials
- Suitable for individuals with visual and hearing impairment
- Multiple platforms (Ebox, PC, Pocket PC, ...)
- Intuitive User Interface



Description

With its simple and friendly user interface with voice feed-back and commands, EthnoCon is accessible to the widest possible social spectrum, regardless of age, culture, and even disability (e.g. hearing and visual impairment).

By incorporating technologies such as videoconferencing, automated translation, optical character recognition (OCR), speech recognition and synthesis and GPS navigation, and by enabling and extending the use of these technologies on various devices, Ethnocon gives both experienced and novice users the opportunity to effectively function beyond their usual limitations.

Regardless of whether the device used to access the network is a PC, a Pocket PC or an embedded system, Ethnocon enables the user to conduct a videoconference in his own language, translate captured images of documents, receive relevant cultural information based on his current location,

build extensive social networks, broadcast his whereabouts and interests

and view/search those of others with Econverge, and to navigate through an unknown environment using detailed maps and an extensive trip-planning system.

With the aim to target the highest possible number of customers, Ethnocon employs an intuitive and modern user interface with live localization on each of the aforementioned platforms.

In addition to simultaneous translation with subtitling and synthesized speech, which push speech technology and thus computer-aided verbal communication to its limits, Ethnocon is introducing Epicto, a culture-independent communication system based on pictographs (with translation to and from other languages), to serve as the last resort when all other options have been exhausted.

Being aware of the saturation of the IT market with certain aspects of the system (e.g. communication), EthnoCon was designed to be open for integration with existing applications such as MSN Messenger.



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Econverge Social Network System

User Scenarios

Perhaps the best way to show how EthnoCon can play a vital role is by example.

Scenario 1 – Exploring Cultures

After finishing his work at the university, Peter embarks on a trip to Eastern Europe. His journey leads him to Bulgaria. Upon entering the country, he connects to the Ethnocon network using his Pocket PC and mobile phone, and based on the information collected by his GPS receiver, he is instantaneously offered basic information on Bulgaria and its culture. One thing surprises him the most – that people in Bulgaria nod their heads for no and shake them for yes! After having spent the entire day hiking, Peter is feeling quite hungry; he takes his Pocket PC, connects to Ethnocon and uses the trip-planning function to lead him to the nearest restaurant. Inside he finds that all the menus are in Cyrillic, so he uses the Pocket PC to take a picture of the menu, after which he uses the Ethnocon client to choose the source and target languages and send them to the server for translation. As he can switch between the original and the translated image of the menu on his Pocket PC, he is able to order his desired meal by pointing it out on the screen. After paying, he notices that the batteries on his mobile phone have run out; since he has no way of connecting to the network now, he cannot use simultaneous translation, so he uses the offline version of Epicto, Ethnocon's pictograph function to communicate with one of the locals to find out where he can buy souvenirs for his family.

Scenario 2 – The Awkward Meeting

Michael enters the conference room at his company to meet his client Yoshi from Japan.

He receives a call from the translator that she would not be able to come due to a major traffic jam. As none seem to speak any common languages, they both connect to the Ethnocon network using their Pocket PC's. They set their clients to translate to their respective languages, and they start speaking into the handhelds' microphones. The audio is simultaneously sent to the server, which then processes the input and they both receive the translations on their screens while hearing them through synthesized speech. After an hour in the meeting, they come to the point when Yoshi needs to consult the chairman of his company back in Japan. Michael finds it appropriate to take his notebook and connect it to Ethnocon to contact the chairman. They disable the translation of audio and set the source language to German and the target language to Japanese for text translation. After a few seconds, the videoconference with the chairman is established. After the chairman has set his language pair to Japanese/German on his Pocket PC, they are able to discuss the relevant matter in their respective languages – Michael and the chairman read the translation from the subtitles while Yoshi simply talks with his boss in Japanese.

Scenario 3 – Saving Lives

Mia is a young, modern and technology-aware student. She often uses EthnoCon to contact her friends, scan and translate documents, plan her trips, etc. Apart from all that, she is very thorough when entering information about herself in her Econverge Profile, including her blood type, her hobbies, general interests and the occasional preparedness to meet with a random EthnoCon-using tourist and offer guidance when she has got no errands to look into (by making certain information, such as her location and interests, temporarily publicly available). One day, when driving home from her university, she witnesses a major traffic accident. The ambulance is on its way, but as there are many injured and in need of prompt medical attention (and she is reluctant to provide it herself), she uses her Pocket PC, connects to Econverge and issues a query for any EthnoCon users in the vicinity that are either doctors or have taken their first-aid course recently. Luckily, she is able to find a doctor a block away, contacts him to inform him of the emergency, upon which his immediately following first aid plays a vital role in an injured person's recovery.

Conclusion: Discover the World the Way it is Meant to be Discovered

EthnoCon aims to take modern communication to a new level. Recent developments and advances in the IT industry such as the rapid growth of WiFi networks are creating an excellent basis for potential users throughout the world. A fine example of this is the Baltic European country Estonia, which has nearly all of its 45,000 sq km covered by WiFi! Never before have communication, orientation, socialization and technological effectiveness been as unconditional as with EthnoCon – Converging Cultures, Languages, Ideas, Technologies and Social Individuals.

Team Member Biographies



Konstantin Zhereb, a mathematician, has been successfully participating in various mathematical olympiads since he was at school. And he has won many of them. Sometimes it seems there is no such a mathematical problem that he cannot solve. He is also very fond of literature. Although he likes science fiction he is also a great fan of classical literature. At the moment he is a student of Ukrainian branch of Moscow Institute of Physics and Technology (UB MIPT).

Taras Kushko (UB MIPT) is very hardworking and organized. And, yes, he's a very good programmer. If you want to implement some feature in code – just tell Taras about that and in almost no time you'll find the job done. He is very concerned with his studies but that does not prevent him from participating in numerous software development projects.



Petro P. Protsyk is a student at Kiev National Taras Shevchenko University of Kiev. His research interests are symbolic logic, automated theorem reasoning and formal language processing. He is good at programming and he took a third place in all-Ukraine informatics contest in 2001. He likes cycling and modern literature.

Pavlo Shelyazhenko is a student of Kiev National Taras Shevchenko University of Kiev, Mechanics and Mathematics Department. He studies financial and actuarial mathematics. His research interests include arbitrage conditions on financial markets, stochastic processes. He is fond of reading and likes playing computer games.



Anatoliy Yu. Doroshenko (tutor) – Professor of computer science in the Department of Cybernetics at Kyiv National Taras Shevchenko University and Department of Management and Applied Mathematics in the Ukrainian Branch of Moscow Institute of Physics and Technology. His research interests include formal methodology of computer science, methods of programming, parallel computing and intelligent information system applications.

About the Universities

Moscow Institute of Physics and Technology (MIPT or Phyztech) was established in 1951 as the elite Superior School of Physics and Technology similar to l'Ecole Superior Politechnique founded by Emperor Napoleon in Paris. Today there are 104 institutions. Branch divisions spread to the Urals, Vladivostok (Far East), and Kyiv (Ukraine).

Kyiv National Taras Shevchenko University is considered as the number-one Ukrainian classic university, and a major centre of advanced learning and progressive thinking. The first 62 students started their studies at Kyiv University yet in 1834. In 1939 Kyiv University was named after Taras Shevchenko. At present the student body of Kyiv University totals about 20 000 students who study in 22 departments

Project Description

One of the tendencies in education in the modern world is that the interest in the natural sciences, particularly mathematics, is decreasing. Many traditional mathematical societies of students are still primarily aimed at mathematical contests. The main disadvantages of this traditional way of uniting people interested in mathematics is that these societies are small and separated; it is hard to get involved in them because of large amount of specific knowledge needed.

Common Knowledge Community (CKC) is a system primarily designed to attract students and people interested in natural sciences to the mathematical studies. This is achieved by providing facilities for collaborative problem solving, storing and exchanging mathematical knowledge and hosting mathematical games.

Essentially, CKC offers the opportunity for joint problem solving. To simplify working with problem, all contributions to the problem (called “artifacts”) are represented in graphical form. A special diagram associated with each problem shows all created artifacts and their relationships. Each artifact can be commented on and translated to other languages by participants, which can help remove boundaries and misunderstanding among students from different regions.

For each area of mathematics, solved problems are stored together with definitions of important concepts and methods of solving. They form the “common knowledge” base – facts that everyone studying this area should know.

To attract more participants, mathematical games are provided, both short- and fast-paced contests and extended challenges. Those who participate successfully receive various rewards, one of them being an increase of rating and new titles.

CKC provides computer aid in any area, reducing unnecessary human efforts, thus giving every member the possibility to work with the problem in the most convenient way. To achieve this various formal methods were used. In particular, statements and proofs can be formalized; this allows automatic correctness checks. Furthermore, such formalization implies unified representation of mathematical knowledge that contributes to common understanding and the possibility of automatic translation.

Formalized statements, or proofs, are created using ForTheL language developed in Kyiv National University. Being a formal language it is also very close to natural English, so it can be easily understood and written. Still there are versions of ForTheL closed to other natural languages that can be created, so formal texts can be translated unambiguously into any version.

CKC is based on the client-server architecture. XML Web services are hosted on the server, providing access to MS SQL Server databases with all created artifacts. Mathematical services, such as automated reasoning and symbolic computations, are also provided on the server side. Smart Client technology is used for the client portion. Different client versions are available for different hardware platforms, such as desktops, Tablet PCs or Pocket PCs.

Most of the program interface features can be changed by “agents” (special plug-ins that can be developed by every user). Exchanging and using agents allows each user to configure the CKC view for maximum convenience. Agents can also provide additional functionality, such as using external mathematical services.

Team Member Biographies



Denis Zarin is a team leader and inspirationist of Maorie project. He is doing his postgraduate studies at Moscow Aviation Technical University, and leads research projects concerning artificial life, social behavior and team reasoning. Denis spends his spare time reading books on software engineering, project management and marketing, as well as developing small computer game projects with AI.

Alexander Sidorkin is a 4th-year graduate student, taking an active interest in Computer Science and AI in particular. As a chief technologist of Maorie he was responsible for overall system architecture, API and Communication aspects. Thanks to his great programming and architectural skills, we were able to develop Maorie from the initial idea to the software product.



Sergey Mikhanov is a post-graduate student doing his research in the area of distributed AI and intelligent composition of Web Services. He defines his global goal as “To be on the frontier. Always.”, and this is the reason why he is in Computer Science. In Maorie, he was an ontologist – responsible for the development of ontology broker and core ontology itself.

Ravil Gaifullin is a 3rd-year student of Moscow Aviation Technical University, taking an active part in MAILabs research projects. Ravil’s contribution to the social behavior modeling experiments that were carried out at part of Maorie Project cannot be underestimated.



Dmitri Soshnikov is a faculty advisor of Imagine Cup team. He has PhD degree in Computer Science from Moscow Aviation Technical University, and International Bacchalaureate from United World College of the Adriatic. As an Associate Professor at the Computer Science Department and the leader of MAILabs Research Group he directs a number of scientific research projects in the field of distributed knowledge representation and reasoning. Dmitri is the author of more than 30 publications, including a monograph on using distributed production-frame knowledge representation for knowledge sharing and reuse, as well as the number of papers at domestic and international conferences.

About the University



MAILabs research group is a division of Faculty of Applied Mathematics of Moscow Aviation Technical University that carries out research and educational projects in the area of Artificial Intelligence and modern computer technologies. We are a group of young people who care to make this world a better place to live through advances in science and technology. By involving many graduate students in research projects we give them a chance to obtain hands-on experience in software development, and also gain unique atmosphere of innovation and enthusiasm that drives all our efforts!

For Microsoft Imagine Cup 2005 we have developed a product that combines a number of technologies that we are working on. We have formed a team of four best post-graduate and graduate students that worked hard on different aspects of Maorie technology that we proudly present on Imagine Cup 2005:

MAORIE: Multi-Agent Ontology-Relevance Interconnection Engine

How can we define a human being?

Many great philosophers were challenged by this question, still the answer is unclear. We tried to find it in terms of reasoning, but children make Turing's test crash. We tried to explain it with languages and the ability to communicate, but then we find out that other beings like dolphins also utilize complex communication.

But there is one criterion always applicable to all human beings – it is the criterion of social behavior. To be honest, many animals demonstrate social behavior, thus making our quest even more complicated. But social behavior is something that entire human civilization is heavily based on.

Now let us examine what a modern society really is. At the first glance this view is amazing. We are living at the age of information, surrounded by thousands of electronic devices. Hardware and software tools help us do our work much better and more effectively than ever before. From all our activities, communication is the major component of our everyday life that dramatically affects human society by having direct influence on our social behavior. Moreover, it is suggested by some philosophers and futurologists (among them V.F.Turchin) that effective communications would be responsible for the formation of the “global brain” of the humankind.

While computers dramatically improved our communication abilities (with e-mail, icq, skype, etc.), there are still some aspects of communication that are not covered by computer automation. We still cannot get a stranger at the street involved in our problems. In order to discover an interesting person we need to spend hours in conversation. At many times we find ourselves passing over messages from one of our friends to the others.

Our world is not perfect – and so are the modern communication technologies. By drawing on other technologies from the area of Artificial Intelligence, we believe we can make things better.

Let us introduce Maorie system – technology designed for dissolving communication boundaries. We will discuss both social impacts of Maorie and technical implementation. You can get more information on Maorie Project at the project web site: <http://maorie.mailabs.ru>.

Maorie World: A Story So Far

A goal of our research was to develop a product able to dramatically affect the process of human acquaintance and the formation of social groups. We wanted to give everybody an opportunity to get acquainted with the people extremely hard to reach in the real world.

Our initial research concerned both social and technical areas. Main questions of interest were:

- How are social groups organized?
- How do people get acquainted?
- How can we make acquaintance process more efficient, thus dissolving the boundaries?

To give all the answers we were challenged to build theoretical model of social behavior, on one side, and to find a way to make acquaintance more efficient, on the other side. Our product, Maorie, was based on the outcome of our research activities.

Social Groups and Acquaintance Phenomena

First of all let us consider the structure of social groups, which is defined in terms of social atoms consisting of persons acquainted with a particular person (further called subject). Close view shows strong correlation between subject's area of interests and areas of interests of his friends and acquaintances. It can be easily explained from common sense point of view: we communicate with people having similar interests. From helicopter view we see community of doctors, community of developers, etc. – a variety of intersecting groups centered around different interests in multi-dimensional space. That shows natural clustering of people.

So, we need to define an attribute or set of attributes determining factorization of people space. Natural way to define such set of attributes is to use the concept of ontology. The simplest form of ontology can be viewed as a hierarchical tree of concepts defining interests. Thus we can associate a person with a set of nodes in this tree; furthermore, we can use logical expressions based on ontology nodes to define person's profile in a language of formal description logic. Our model exploits ontologies as a way to describe an abstract space of conceptions (i.e. “areas of interests”) and mechanism of associating people with the set of nodes. Thus, any person can be characterized by a profile that is represented by a complex term in description logic. This is our model describing social groups clustering.

Another conception to discuss is acquaintance. Once again, we will examine it from the common

sense point of view. Say, you need a doctor to help your pet. How will you find him if there are no pet doctors in your social atom? Most probably you will check if someone from your social atom knows such a doctor personally, and you may decide to explicitly query your well known persons. Finally, this sequence of queries (your friend querying his friend if his friend is a doctor, etc) gives us transitive nature of the acquaintance phenomena.

Another question to stress out is how we decide which persons to pass query to. Most probably we compare our query (“searching a pet doctor”) and each of our friends, calculating how relevant our query is to that specific person. For example, if we have a friend who is dentist, we can decide to ask him if he knows how to reach the pet doctor. Strong definition of described value of similarity between a query and a person is given by the concept of ontological relevancy.

Ontology-Based Annotation

Now let us closer examine the way person’s profile is described. There are many systems that allow user to perform a textual search over the flat directory of other users’ profiles (e.g. ICQ White Pages) or over user’s social network with regard to the distance from the subject to object measured in this network (e.g. LinkedIn, www.linkedin.com). Our model implies comparing the semantics of user query and some other person’s profile. This is done by using ontological relevancy conception, which is based on the mathematical model of description logics and its implementation in such descriptive languages as RDF and OWL, which belong to the family of Semantic Web standards. We also utilize another related RDF-based standard, FOAF (Friend-Of-A-Friend), that has been developed to describe friendly relation between individual web pages, and is now used by some community sites such as LiveJournal.com. By extending FOAF network with richer ontology annotations we can create a semantic contact network on top of which Maorie distributed multi-agent system (described in section 3) would operate.

The profile of every user is constructed on the basis of the existing or user-defined ontology. More precise, the user creates his own definition of himself in terms of the selected ontology or ontologies. It is done by binding the user identity to concepts defined by ontology, using roles defined there, too.

For instance if someone is willing to share that he is the university student and his name, the definition would be something like this: PROFILE is-subclass-of STUDENT, PROFILE HAS-NAME “John Smith”. ‘STUDENT’ and ‘HAS-NAME’ in this example are the names of the ontology concept and ontology role respectively. The string entity “John Smith” is used as an atomic primitive and does not take part in relevance calculation.

There are a lot of developed ontologies for different aspects of human activities today. We have developed base Maorie ontology by deriving it from the part of Standard Upper Merged Ontology (SUMO). Moreover, user communities could create their own ontology in OWL language describing any taxonomy they wish to use and share with others. By using open ontology standards Maorie system becomes extremely extensible.

Ontological Relevance

When the user wants to find some other person, he creates a query in a way similar to creating a profile. He uses ontologies to bind the query id to ontology concepts. During the query propagation through the network of nodes, the ontological relevance of a query is computed against user profiles. This is done by traversal of the concept graphs in profile and query. Every concept used in profile definition is compared with every concept in query definition with respect to the roles that were used to bind these concepts to profile or query. The distance in the graph to the most concrete common parent of every concept pair is used to compute this pair’s relevancy as: $\frac{a}{b \cdot d_p^c + c \cdot d_q^c}$, where d_p and d_q are the corresponding distances, and a , b and c are the coefficients that were defined using statistical analysis. Total relevance of the concept and query is computed as a weighted sum of the concepts relevancies, where weights are different for every role and are defined in the process of model testing by means of software simulation.

Social Impacts

Now we can explicitly imagine impacts of deploying Maorie system in the real world.

First, now you can search for new contacts easily and efficiently. All you need to do is to describe your query and send it out to the net. Thousands of agents in different networks will propagate your query, find many people relevant to your query and send the results back to you (and to the contacts involved).

Moreover, you do not even need an access to the transport network of your potential recipient. Any

networks can be used for query propagation: e-mail, MSN Messenger – Maorie will take care of your request. Moreover, you do not need to speak the same language with a potential contact – since ontologies are formalized representation of concepts, they can be bound to any human language, thus taking care of intercultural barriers that people speaking different languages might have when meeting each other.

Another example – you are sitting at computer science conference, your PDA is running Maorie system and many scientists are around. Using Maorie you can send your queries using ad hoc networking, or just collect profile information of the people nearby, exploiting the physical proximity of recipients.

And one of the most valuable effects is that every single person in the global Maorie World now is a fully functional part of Maorie Net, being able to produce, cache and propagate queries in the network. So, we are faced with the global, fully decentralized network of agents, ready to serve our requests.

Finally, Maorie implicitly acts as a flexible community building tool, because groups of social atoms centered around specific interests are in fact communities.

Deploying Maorie will dramatically affect acquaintance process, thus dissolving many cultural and geographical boundaries. A great thing to strive for, is it not?

Overall Architecture: Micro- and Macro-agents

The following diagram provides an overview of the whole system:

Maorie system is based on two-level multi-agent approach. In the high level of abstraction Maorie Network consists of macro-agents, corresponding to individual computers or PDAs running Maorie. On this layer activities like the acquaintance itself are located. Macro-agents consist of micro-agents dealing with the low level tasks like message queuing and processing. Micro-agents can also be distributed over LAN nodes.



Adopting multi-agent approach gives an opportunity to build fully decentralized system using peer-to-peer message propagation and the experience gained from other peer-to-peer systems like Gnutella and Skype, which shows that this method dramatically increases scalability and availability of the entire network.

One physical person can be represented by more than one macro-agent, either fixed (desktop) or mobile (PDA, SmartPhone) – thus there is a task of synchronization between different macro-agents representing a single person. All transactions between macro-agents are encapsulated in the Acquaintance Logic Layer discussed later in this chapter.

Macro-agents communicate by exchanging packets that are relayed through different transport networks, such as e-mail, MSN Messenger and ICQ, and ad hoc messaging via Bluetooth and Wire-Fire protocols. Packet dispatching and forwarding between different types of networks is fully transparent for a user.

As for technologies used, whole Maorie system is developed using Microsoft Visual Studio C# and is based on Microsoft .NET Framework (and Microsoft .NET Compact Framework, too). Micro-agents communicate using Microsoft Web Services Enhancements 2.0. Desktop clients are tested on various Microsoft Windows platforms, PDA client is compatible with MS Windows Mobile 2003.

Acquaintance Logic

All specific logic about acquaintance process is encapsulated in the middleware layer named Acquaintance Logic Layer. We can distinguish between two types of messages processed by this layer: queries, which carry out our request defining the goal of our search, and proposals, which contain user profiles of people who actively want to acquire contacts. Literally, proposals are pushed to the network saying “I want to get acquainted, here’s my profile”. All the decisions about queries and proposals processing are made by this layer; they are: relay a request, detect a relevancy between query and proposal or query and profile, drop a request.

One of the potential problems of peer-to-peer networks is flood – mass uncontrollable sending of messages. To avoid this problem we introduce a factor of attenuation (called weight) involved in decision making about message routing, which is implemented by multiplying message weight by factor of attenuation on the every transit node. Thus every packet will “die” after some hops through the net, because its weight will fall below discard threshold. This method gives us a solution to the flood problem. Moreover, this mechanism of attenuation will work even in case when some fake nodes exist and produce wrong actions with messages weight (like increasing instead of decreasing). This significant benefit is available due to fully decentralized topology of Maorie system.

In total, there are three coefficients involved in message routing decisions: discard threshold, a minimum weight of request to be relayed, relevance threshold, involved in detecting the case of acquaintance based on relevance, and forwarding limit – a sum of weights for all requests being relayed constraining forwarding rate.

Client Architecture

Looking inside the macro-agents we can see entities called micro-agents. The entire functionality is produced by the interaction of different types of micro-agent as shown below:

- Core agents interaction is provided by Routing Agent, that encompasses two specific modules: (1) Acquaintance Logic Layer and (2) Reasoning Engine, that computes ontological relevance between arbitrary queries/requests.
- Ontology Broker is an agent responsible for maintaining ontology cache used in relevance computation. It is particularly important for mobile platforms that have no permanent Internet connection but still need to compute relevance using some known ontologies initially stored and maintained by the broker.
- Interface Agent provides interaction with the user, allowing him to enter/modify profile and query, request new ontologies for annotation from the Internet, view lists of contacts, status of requests, etc.
- Communications Agents are gateways to specific transport networks, such as e-mail, MSN, ICQ, etc.
- There also is a specific part of the system called Core API. It encapsulates core functionality used by all agents.



Micro-agent interaction is implemented using Microsoft WSE 2.0. It makes client architecture extremely agile, e.g. there are no constraints that micro-agents should reside on same physical computer or network node (e.g., in the LAN environment it is possible to employ one ontology broker per network domain), and also which communication protocols are supported by a given installation. There is no difference between desktop and mobile (PDA, SmartPhone) clients, with the exception that in mobile client all micro-agents are combined into one application without using the WSE, due to mobile platform constraints and lower performance.

Ad Hoc Networking and Mobile Devices

It is important to note that the proposed model of acquaintance also works in the wireless ad hoc networks formed by PDAs/SmartPhones over such means of communication as Bluetooth and/or Wi-Fi. In addition to being able to transfer requests and responses over wireless network (which is achieved by just providing corresponding communication micro-agents), we enhanced the wireless experience by specific handshake protocol allowing mobile Maorie clients to meet each other. This allows us to expand our social atom by some initial random contacts, which will later on either disappear, or be converted into permanent contacts depending on the ontological relevance.

Wireless networks are an important part of Maorie concept, because it allows us to overcome the boundaries of the transitive closure of our social atom. For example, suppose we are looking for a nice girl that is interested in AI, and there is no such person among our friends, friends of our friends, etc. We can let our query sit in our PDA and just walk around, and whenever a person corresponding to our query walks into the range of our wireless network we will be immediately notified.

To provide the immediate notification, we developed a small extension for mobile devices like PDAs (and notebooks, too) called “Blinker”, which provides basic actions like blinking and beeping when a person relevant to one of our queries has been discovered in our physical vicinity.

By employing wireless networks, Maorie provides us means to see “who is in the crowd”, and immediately spot potentially interesting contacts. This is a very convenient tool for thematic gatherings, such as conferences.

Concluding Remarks

In such a short proposal it is virtually impossible to cover all aspects of the Maorie project. One of the real challenges was to determine propagation parameters and see how the system behaves on the large scale, in fixed or ad hoc networks. A separate subproject was dedicated to developing of a modeling framework called Aquarium. It incorporates multi-agent approach to simulate behavior of the people crowds, on top of which we applied ontology relevance algorithms and literally saw the community clustering occur.

One of the main ideas behind the Maorie project is to take part of human communication related to initial acquaintance and automate it using AI technologies. In fact, we can extend this idea further to other areas of communication. Maorie project is just a first step in that direction, but a step large enough to greatly enrich our communication experience and break some cultural, traditional, inter-lingual and psychological boundaries between people.