Thinking about the future: The application of intelligent agents in student services

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Abstract:
An intelligent agent is software that can act independently to accomplish tasks on behalf of its user.
In this paper, the author presents:
• a scenario for the future use of intelligent agents in the provision of student administrative services
• a description of various categories of intelligent agents
• a brief history of research in intelligent agent technology
• examples of intelligent agents on the World Wide Web
Thinking about the future:
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Introduction

WARNING -- This is not a “how we did it” piece, it’s a “how it might be done in the future” piece.

I wrote Elwood’s Story, below, in early 1995 to get people at the University of Minnesota who were meeting to discuss the future direction of student services at that institution to think radically. That is also the purpose of this presentation.

Following Elwood’s Story I’ll cover briefly some background material on intelligent agents and the state of the research in that area and, finally, review a few example accessible via the World Wide Web.

Elwood’s Story

Elwood is considering which college to attend. He downloads a copy of the University’s intelligent agent from the University’s site on the World Wide Web. The intelligent agent begins a conversation with Elwood:

IA — Hi! If we’re going to work together, it would help me to know your name and some other things about you.
Elwood — My name’s Elwood.
IA — Hi Elwood! The University is a big place. It’s got lots of programs of study and thousands of courses on all sorts of topics. Are you interested in a particular degree or field?
Elwood — I’d like to get a bachelor’s degree and I’ve always been interested in India.
IA — Well the University does offer bachelor’s degrees in a number of programs that would allow you to concentrate on India. It has some of the best faculty in the world specializing in areas like Indian Art History, Geography, Anthropology, and Women’s Studies. Language instruction is available in Hindi, Marathi, and Sanskrit. The Ames Library of South Asia has one of the best collections in the country. On your screen you’ll see folders of the descriptions of the classes offered on India and listings of the degree requirements of the various baccalaureate programs. There’s also a folder of career options. Would you like to look those over now or shall we continue our conversation?
Elwood — I’ll look at them later. Keep talking.
IA — Have you attended other colleges or universities?
Elwood — Well, I’m still in high school, but I’ve taken some courses at Normandale and Macalester College on the Postsecondary Enrollment Options program.
IA — If you like, I can tell you how those courses will count towards a degree at the U.
Elwood — Great!
IA — I've had the University request those transcripts. It will take a few minutes for them to go across the network and get evaluated. In the meantime, you could read about the programs and courses. I'll let you know when I've got the information. Shall I also get your high school transcript so we can get started with the Admissions process?

Elwood — Sure. I go to Saint Paul Central.

IA — I'll talk with you again in a few minutes, unless you have any questions for me.

Elwood — If I wanted to speak with one of the teachers you mentioned, like the Sanskrit teacher, would you arrange it?

IA — Sure! Give me your phone number and I'll ask Professor Malandra's intelligent agent to have him give you a call.

After reviewing the materials that the intelligent agent has provided, including the transfer work evaluation, and the phone conversation with Bill Malandra, Elwood decides he wants to apply for admission. The intelligent agent walks him through the process. Interacting with the University's Student System where necessary, it provides information about housing options and helps Elwood apply for housing. Elwood is not aware that he's entering information on the Housing system—he just having a conversation with his intelligent agent. (By now he's named it Harvey.) Harvey helps Elwood apply for financial aid and has found a scholarship on the University's Scholarship Data Base for Sanskrit students who attended Saint Paul Central. Harvey also gives Elwood placement tests and forwards the results to the University Student System. Before it's time for Elwood to register, Harvey has a conversation with him about what time of day he likes to have his classes, what approach to learning he prefers—mostly lectures, lots of class discussion, etc.—and other information that will help it make a recommendation about the classes to take. Using that information and information about Elwood's previous courses, the course offerings for the term and future terms, and the courses Elwood needs to take to graduate, Harvey comes up with a list of courses for Elwood to consider.

Harvey — Hi Elwood! It's about time for you to register. I've put a list of classes you might want to take in a folder on your screen. If you click on a course you'll see information the instructor provided about the course. You told me you preferred small classes with teaching award winners, so those are the ones on the top of the list. Some of the courses on the list are highlighted. Those are ones that you need to take soon. Also keep in mind that you need to have at least 15 credits to keep your Sanskrit Scholarship. Look the list over and wake me up when you know what you want to take or if you have any questions.

Elwood — Harvey! The Indian Cultures course you suggested says it's only for Sophomores and I'm a few credits short. Won't that be a problem?

Harvey — I suggested it because it's a prerequisite for another course you might want to take next semester in order to be able to take a required course for your major that you need to take next year because it won't offered for another two years after that. I contacted the intelligent agent of the Indian Culture course and explained the situation. That agent was able to make the exception and an approval is already on your Student System record.

Elwood — Thanks! I guess I'll take the courses you recommended and also the Geography course. By the way, why did you put that on the list?

Harvey — It's a meteorology course and you told me you were interested in weather.
Harvey — I've contacted the Student System and you’re now registered for those courses. The books and reprint packets that are required are in the Books folder on your screen. Shall I order them for you?

Harvey — Do you prefer electronic versions or paper copies?

Elwood — Books on paper and electronic reprints.

Harvey — Done. The reprints are in folders by course. I've also downloaded the syllabus. I also checked your student account status—the tuition and fees and housing charges and books come to $4005; your scholarship and other financial aid comes to $3000. The details are in the Bill folder on your screen. Do you want to pay the remainder with the credit card you gave me for the application fee or put it on the installment plan?

Elwood — Installment plan. Do you know anything about student jobs?

Harvey — I'll scan the data base of available jobs and give you a list. You told me about the other jobs you’ve held when you applied for admissions.

Harvey — Here’s the list of jobs. I’ve highlighted a few that have something to do with India. They all fit with the schedule of classes you’re taking. Would you like me to arrange any interviews?

Elwood — The one in Ames Library would be great.

Harvey — I’ve contacted the calendaring package used by the library and scheduled you for an interview at 8 AM tomorrow. Get a good night’s sleep!

Throughout the semester Harvey keeps Elwood informed about events on campus that he might be interested in attending, monitors electronic news sources for information pertaining to Elwood’s classes, orders women’s basketball tickets for him, and arranges for several pizza deliveries. Harvey also monitors the grades that instructors give Elwood on tests and papers. Halfway through the semester, they have the following conversation.

Harvey — I see that you’re not doing as well in Calculus II as you did in the Calculus I class you took at Normandale. You are doing well in your other classes. Would you like me to arrange for a Calculus tutor?

Elwood — How did you know that? And yes, I guess I might need a tutor.

Harvey — The intelligent agents of your instructors send me your grades. I also got a message from the intelligent agent of the Calculus instructor suggesting a tutor.

Elwood — What would have happened if I didn’t want a tutor?

Harvey — If I didn’t arrange for a tutor now and your Calculus grades don’t improve, the Calculus instructor’s intelligent agent would contact the intelligent agent of your advising specialist and it would contact me to arrange an appointment for you with her.

Elwood — You’d better sign me up with the tutor.

Harvey — Done. I’ve added it to your calendar. Thursdays from 4 PM - 5 PM in 100 Smith Hall.

Harvey continues to help Elwood throughout his academic career. When it comes time to apply for graduation, Harvey handles that. Harvey also signs Elwood up for an interview at the Career Development Office with 3M, which is looking for a Sanskrit speaker to work marketing tape to Indian corporations. Elwood’s new job requires him to learn something about marketing and Harvey suggests some marketing courses offered in the evening. As time goes on, Harvey helps Elwood make his way through an MBA program and lets him know whenever new Meteorology courses are offered. Harvey also keeps Elwood informed about campus and
alumni events, processes his membership in the Alumni Association, and requests a donation to
the new Capital Campaign. How can Elwood turn Harvey down?

Inelligent Agents

So what do you think -- Science fiction or just around the corner?

A little of both is my guess. As a linguist, I can tell you that the user interface--talking Harvey--is an extraordinarily difficult problem. It is being worked on by many researchers in the area
where linguistics and computer science overlap. The research is taking place in our own
universities and in corporations like IBM, Apple Computer, and Microsoft. Progress is being
made, but it will take time to resolve. As for the other aspects of Harvey, information retrieval
agents are there now, as are agents that interact with software systems and calendaring agents.
The really challenging pieces, besides the user interface, are managing the interactions between
multiple software agents and, of course, putting it all together.

Briefly, what are intelligent, or software, agents? In an theoretical article1 in 1977, Carl Hewitt
described an object he called an “actor”, which he defined as a “computational agent”. These
actors would communicate with other actors by passing electronic messages and would carry
out their actions concurrently. In 1996, Hyacinth Nwana defined an agent as “a component of
software and/or hardware which is capable of acting exactly in order to accomplish tasks on
behalf of its user”.2 In a 1995 IBM White Paper, an intelligent agent is defined as “software that
assists people and acts on their behalf”.3

The IBM White Paper when on to identify eight application areas for intelligent agents: systems
and network management; mobile access/management; mail and messaging; information access
and management; collaboration; workflow and administrative management; electronic
commerce; and adaptive user interfaces.

Also in 1995, J. A. King identified thirteen specific types of intelligent agents: search agents;
report agents; presentation agents; navigation agents; role-playing agents; management agents;
search and retrieval agents; domain-specific agents; development agents; analysis and design
agents; testing agents; packaging agents; and help agents.4

The definitions are all somewhat fuzzy. There is disagreement over what constitutes an
intelligent agent. Some, including King, would go so far as to view print monitors as intelligent
agents. Still others take a much narrower view.

1 Hewitt, C., (1977) “Viewing Control Structures as Patterns of Passing Messages”, Artificial
Intelligence 8(3), 323-364.


IBM Corporation.

Few standards—or probably more precisely, many competing standards—exist for multi-agent systems. Computer scientists have created languages such as PENGI, COOL, IMAGINE, ABLE, APRIL, AGENTO, Oz, KQML and others to support multi-agent functioning.

Interestingly enough, some of the skills that are seen as characteristics of high-function intelligent software agents—planning, problem solving, learning, focusing, responding to interrupts and inaccurate information, and communication—are skills that also characterize the best student services staff. (Missing from the list are kindness, empathy, and role modelling, but those things would be a considerable stretch for software!)

It is not my purpose here to summarize the state of research in the field. That’s the stuff of doctoral dissertations, not short conference papers. The section, References and Intelligent Agent Resources, contains a list of a few good summary articles and some URLs to access if you are interested in that topic. Better yet, use one of the search tools on the World Wide Web to find the ocean of information available electronically. Use an intelligent agent to find intelligent agents!

**Examples of Intelligent Agents on the World Wide Web**

In this section of the paper I’ll describe some interesting intelligent agent applications accessible via the World Wide Web. Nothing quite so as fancy as Harvey, but you might see a bit of him in them . . . .

The two most common uses of intelligent agent technology on the World Wide Web are shopping agents and information retrieval agents. Below are examples of both.

**Firefly (http://www.firefly.com/)**
This intelligent agent recommends music that you might like, based on ratings that you and other users have given. The theory being, it seems, that if you like artists A, B, C, and so on and other users who also like those same artists also like artist Z’, you will too.

**BargainFinder (http://bf.cstar.ac.com/bf/)**
This intelligent agent, created by Anderson Consulting, searches nine music retailers on the World Wide Web to locate and find the best price on audio CDs.

**Webdoggie (http://webhound.www.media.edu/projects/webhound/)**
This intelligent agent, created at MIT, is a personalized World Wide Web document filtering system. It recommends new World Wide Web documents based on documents you’ve liked in the past.

**Eyes & Editors (http://www.amazon.com/)**
This intelligent agent is a personal automated book searcher which will send you e-mail when a book you want to know about is published. It allows keyword, author, title, and subject searches using Boolean logic.
iFind (http://m5.inference.com/ifind/)  
This intelligent agent is a search tool that invokes other World Wide Web search engines in parallel, then merges the results and eliminates redundancies while clustering the results into understandable groupings.

Metabot (http://metabot.kinetoscope.com/)  
This intelligent agent is a Java aplet that performs searches using various search engines on the World Wide Wed and returns a ranked list of sites with redundancies removed. It will also search the full text of documents on it finds and return information, such as e-mail addresses it has found.

Newshound (http://www.sjmercury.com/hound.htm)  
This commercial intelligent agent searches news sites on the World Wide Web and e-mails articles of interest.

These are only a few examples of intelligent agents accessible via the World Wide Web. A quick search will yield many, many more. A search tomorrow will yield more again! In an interview in the May 1996 Internet World, Jim White, who’s been involved in internet software development since before there was an internet, estimated that within five years more than half of the traffic on the internet would involve intelligent agents. He went on to say that his guess was probably high on the time side.5 Hello Harvey!

Some Concluding Thoughts

Do we have Harveys in our future? That probably depends on when we intend to retire. As we've seen, many of the pieces of the necessary technology are here already, many more are arriving daily. When I started in the registrar business, about twenty years ago, my first job involved hand writing transcripts. It would have been difficult to imagine then the technology we now have. How many of us would have believed then that many--most or all, in some cases!--of our students would have their own computers. That they would register themselves, update their own demographic records, and check on their grades, all from almost anywhere in the world. That the user interface (had we even heard that term then?) would be graphical and not limited to 24 lines of 80 characters on a green screen? I could go on, but you probably get the picture. The message is “imagine the unimaginable (and you’ll probably miss on the conservative side)!"

References and Intelligent Agent Resources


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