Designing an Ontology-based Intelligent Tutoring Agent with Instant Messaging

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Outline

- Introduction
- System Architecture of the Proposed Intelligent Tutoring Agent (ITA)
- User Case Scenario and Discussion
- Conclusions

Introduction

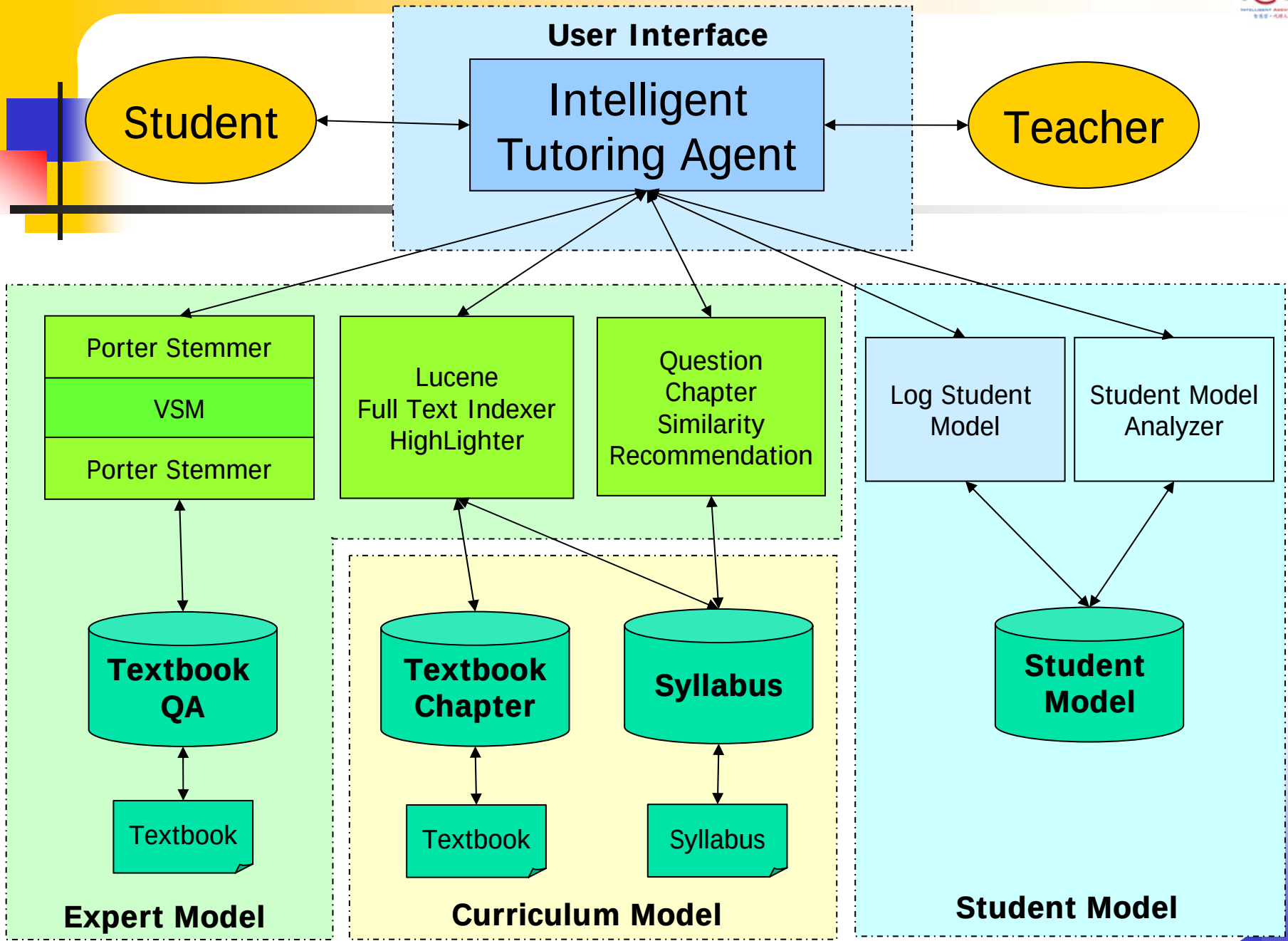
- Instant Messaging (IM)
  - offers new opportunities as well as challenges to both educators and students.
  - MSN Messenger
    - The most popular IM system
    - Communication protocol
- Intelligent Tutoring Agent (ITA)
  - uses the ontology, INFOMAP, and question answering techniques through the Instant Messaging platform for the “operating system” course.
  - tutoring agent
    - help a teacher track, record, and understand a student’s status.
  - interpret natural language to facilitate communication between the student and the tutor.

Ontology-based ITA

- INFOMAP
  - The ontology we used is an ontological knowledge representation framework called INFOMAP.
  - INFOMAP consists of domain concepts and their related sub-concepts, such as categories, attributes and actions.
    - The relationships of a concept to its associated sub-concepts form a tree-like taxonomy.
    - INFOMAP not only classifies the concepts, but also classifies related concepts.
  - Feature of INFOMAP
    - represent and match complicated template structures
      - hierarchical matching,
      - semantic matching,
      - frame (non-linear relations) matching,
      - graph matching.
  - Extract important concepts from a natural language text.
- ITA uses INFOMAP and question answering techniques during the teaching process.

System Architecture of the Proposed Intelligent Tutoring Agent (ITA)

- Expert model
- Curriculum model
- Student model
- User interface


User Interface
Student
Intelligent Tutoring Agent
Teacher
Porter Stemmer
VSM
Porter Stemmer
Lucene Full Text Indexer HighLighter
Question Chapter Similarity Recommendation
Log Student Model
Student Model Analyzer
Textbook QA
Textbook Chapter
Syllabus
Student Model
Textbook
Textbook
Syllabus
Expert Model
Curriculum Model
Student Model

Expert Model

- Textbook, Textbook QA, Matching module (VSM).
- Jakarta Lucene full text indexer to index the full text of the textbook.

Curriculum Model

- The curriculum model used in our ITA is similar to the pedagogical module in some ITSs.
  - The curriculum model in ITA includes the syllabus and the chapter module from the textbook.
  - The teacher uses the curriculum manager to arrange learning modules (i.e., the syllabus or lesson plan), where each module may include one or more learning objects to help students learn.

Student Model

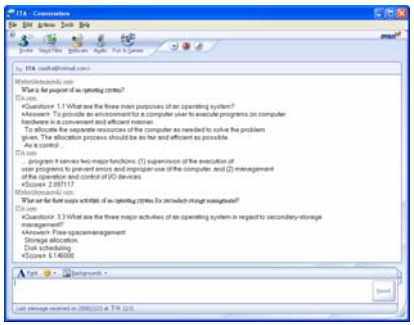
- A Cognitive Student Model - An Ontological Approach
  - We have previously proposed a student model called “Identification, Simulation, Interaction, and Mapping” (ISIM).
  - We adopt the ISIM strategy for the student model in ITA.
- The ITA logs a student’s learning behavior in the student model.
  - The teacher then uses the student model analyzer to detect the students’ beliefs and misconceptions from their answers to diagnostic tests and by tracing the student’s actions.

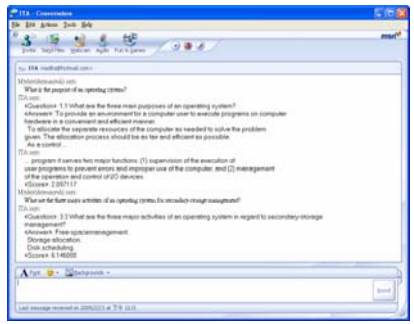
User Interface

- Unlike traditional web-based approaches, we use MSN Messenger as the user interface of the proposed ITA (IASLITA).
- The benefit of adopting the Instant Messaging (IM) system in the ITA is that it is widely used by students.

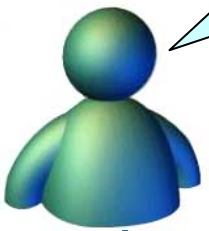
IASL ITA

- To use IASLITA, the student has to add the IASLITA contact ID: iaslita@hotmail.com to the MSN Messenger contacts list.





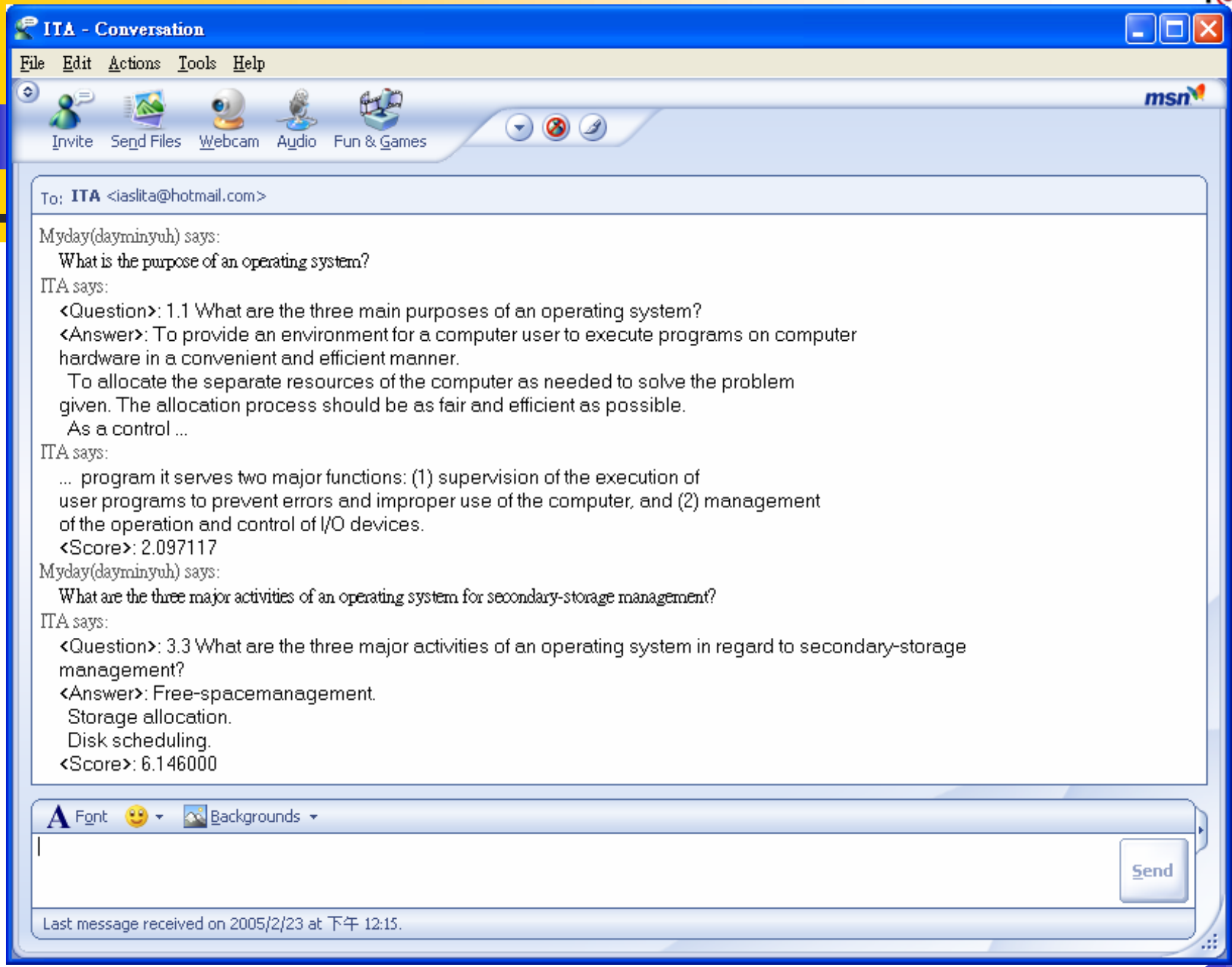
What is the purpose of an operating system?



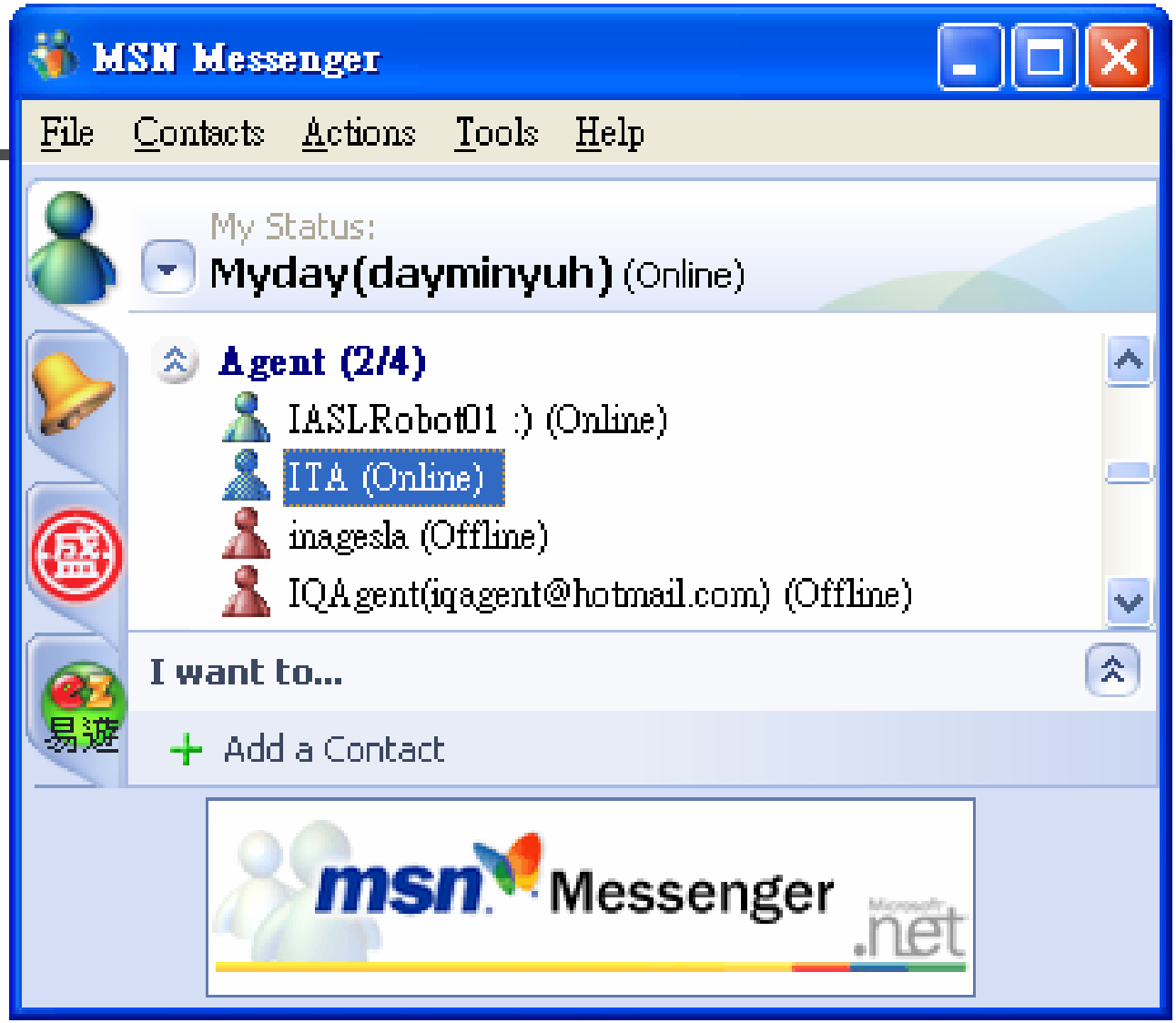
Student

To provide an environment for a computer user to execute programs on computer hardware in a convenient and efficient manner.

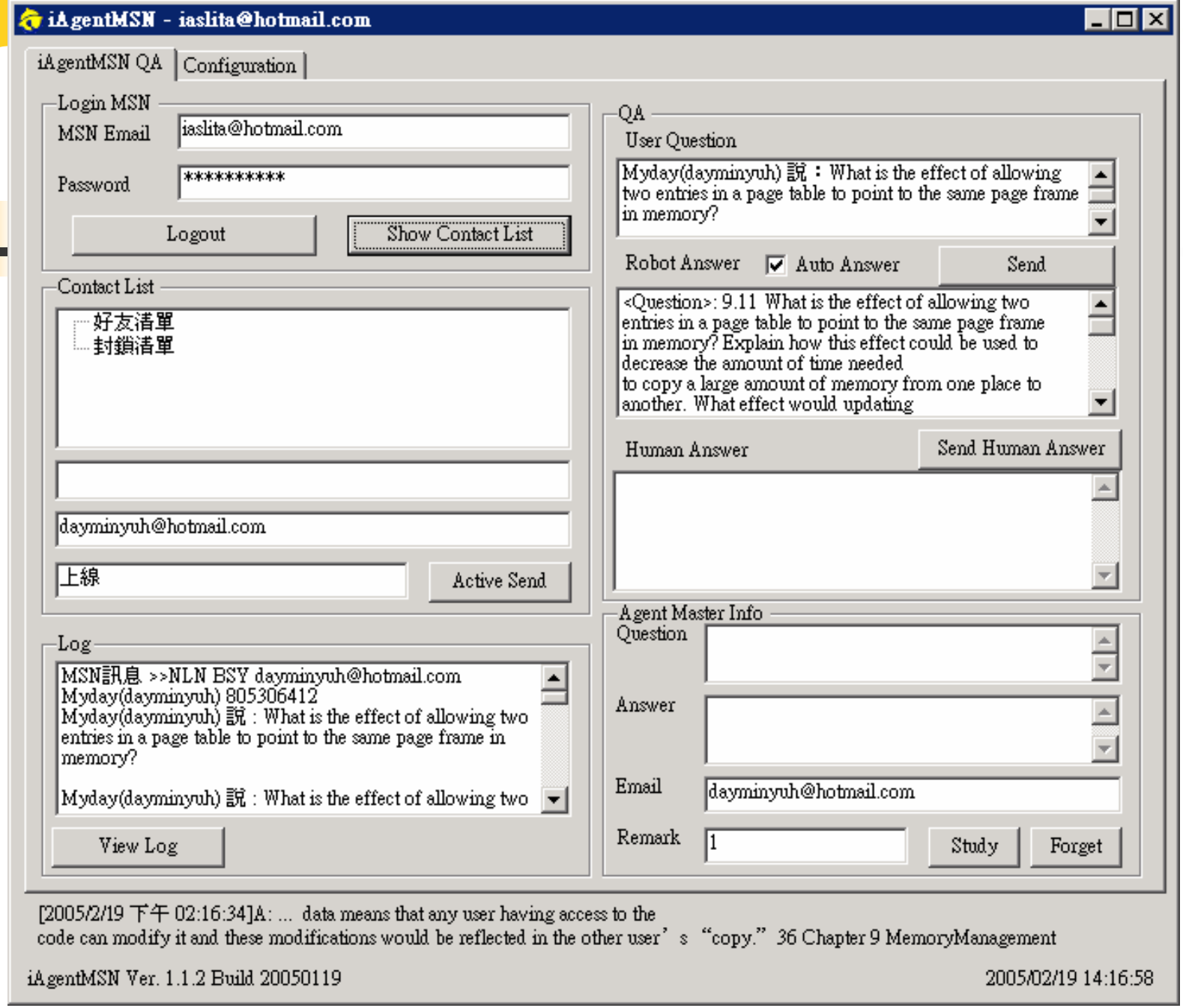
IASL ITA



The user interface of IASLITA



The IASLITA in the contacts list of MSN Messenger
iaslita@hotmail.com



The ITA management console

User Case Scenario

- After the teacher has finished a section of the “Operating System”, the teacher may give some assignment to the students, keep a record of learning objects, or answer students’ questions.
  - We use the textbook “Operating System Concept” as the foundational knowledge of the ITA.
- When a teacher answers a student’s question, the ITA records the question and the answer in a knowledge base (QA pair).
  - When another student has a question, the system searches the database for the question and the relevant answer.
- If the student’s question matches a previous question, the ITA provides the answer; otherwise, the ITA invites the teacher to answer the question and records the answer.

Discussion

- ITA assist the teacher to communicate with students, record their questions, and analyze their status.
- ITA plays a facilitator role in a collaborative learning environment.
- Instant Messaging (IM) used in ITA provides real-time communication and interaction, which enhances students' learning motivation much more than a static website, or a Web-based ITS.

Conclusions

- We propose an Intelligent Tutoring Agent (ITA) that integrates INFOMAP and question-answering techniques through the Instant Messaging platform of MSN Messenger for the “operating system”.
  - During the teaching process, the ITA interface interprets natural language to facilitate communication between the student and the tutor.
- We have presented an overview of the architectural design, the AI techniques used, and the user interface.
- Advantages
  - Students: Receive help immediately upon encountering a problem
  - Teacher: Facilitate classroom instruction in a collaborative learning environment

Future work

- INFOMAP and AIML Integration
- Systematic Evaluation
  - Empirical Study
    - Technology Acceptance Model (TAM) (Davis, 1989)
    - Theory of Planned Behavior (TPB) (Ajzen, 1985)

Q & A

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