Implementation of an Affective Agent for Aplusix

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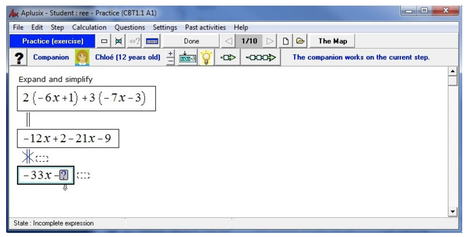
Introduction

Embodied conversational agents or ECAs are capable of behavior similar to that of humans. They can interact with a human user or with one another as human beings would in typical face-to-face conversations [3]. This level of interaction with human users provides the potential for ECAs to be used in a learning environment, particularly one known as an intelligent tutoring system or ITS - a computer program that makes use of artificial intelligence to provide learners with individualized instruction[2]. With this, the objective of our research is to determine what considerations were needed in order to design, implement, develop, and test a motivational agent for Aplusix, an ITS for algebra, that could interact with the student on a real time basis.



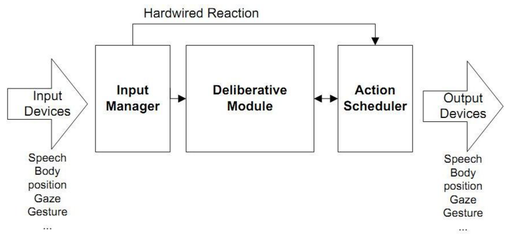
Methodology

ECA Architecture

Applied in this research was the ECA overall architecture as described by Cassell et al. [3]. It discussed the components that make up the proposed architecture.

ECA Architectural Components:

- Input Manager
- Hardwired Reactions
- Deliberative Module
- Action Scheduling Module



ECA Design

A facial expression manipulation program called the Grimace Project [11] was used for the look of the agent. Currently, the agent has three emotive faces: a smile, an open mouthed smile, and concern.

Interfacing with Aplusix

The agent runs as a separate application from Aplusix. Upon its execution, an application window appears, bearing the picture of the agent on the left and its message on the right. Aslo, it automatically connects through UDP to a hardcoded specified port number. The communication between agent and Aplusix begins when Aplusix connects to the agent through UDP via the same port number.

ECA Implementation

Input Manager

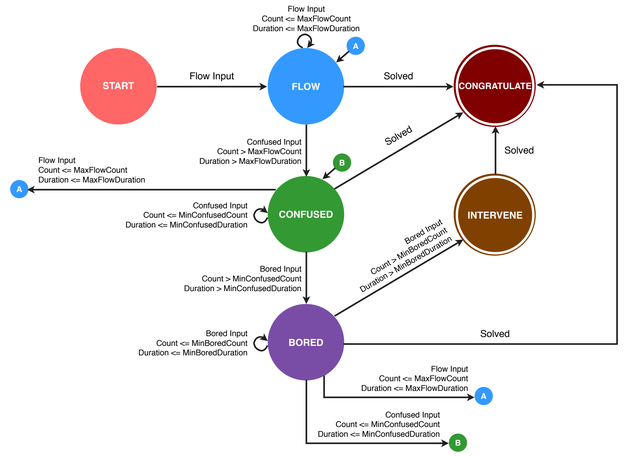
The agent's Input Manager was designed only to read input from one source, the Aplusix logs. Upon receiving these logs it will disseminate which of them are to be used for further deliberation. Depending on what the logs contain, the data is either sent to the Deliberative Module or the Hardwired Reaction.

Hardwired Reactions

The Hardwired Reactions of the agent was used to avoid unnecessary deliberation when it was not needed. Currently the agent does not recognize the need to know the affective state of the student when he or she terminates a program without completion of the problem, or the deletion of an already correct answer.

Deliberative Module

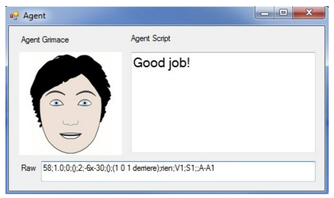
The Deliberative Module of the agent is responsible for the detection of the affective state of the student and the determining of the appropriate response. It makes use of the information gathered by Bate[2] and Lagud[7] on the calculation for the affective state alongside the student models as measure for the agent's reaction.



The Process of Data

1. Understanding Module - evaluation of logs according to the three affective states of boredom, flow and confusion
2. Decision Module - determining test level speed and comprehension according to the student models
3. Generation Module - generation of logs according to the result of the analysis

Action Scheduling Module



The Action Scheduling Module of the agent dictates when the reaction or the deliberation of the logs is appropriate to be sent at the given instance. It displays a scripted response along with its stock voice when it receives evaluations done by the Deliberative Module and the Hardwired Reactions. When it detects that the evaluation is from the Hardwired Reactions, the program automatically executes the requested response. When the evaluation comes from the Deliberative Module, however, it first observes whether or not the evaluations were the same successively (in the case of our agent if it were recieved three times). Only when this is satisfied will the agent fire the appropriate response.

Results

In order to verify the extent of the capabilities of the agent, a premilinary test run with six students, all of which were first year students of Ateneo High School. Also, in order to fully understand the capabilities of our agent, we developed it to be able to generate logs during a testing session.

Most Common Actions:

1. Number Input
2. Delete
3. Cursor

Most Common Response: "Keep Going"

After preliminary testing the students were asked to answer a survey evaluation form that determined the capability of the agent to be motivational for each student. The evaluation of the agent was that although it was rated as 83% friendly, and that it was 69% positive in wanting students to do well, the agent was also 81% irritable and the want to have it as a tutor was 47%.

Discussion

Design of the Agent

Requirements were added in the creation of an ECA such as its necessity for **propositional** and **interactional information, multimodal output** and **timing**. However, multimodal input and conversational function model was not implemented for it was beyond the scope of our study because our agent is only able to read from Aplusix logs. In effect, the agent had a **restricted "conversation"** with the student.

Development of the Agent

Development focused on main **intelligence** and the **aesthetic delivery** (which falls under the Deliberative Module and Output Devices respectively) since most of the components of the ECA architecture was already in development, thanks to the studies done by Lagud[6]. Bate[2]. and Lim[7].

Integration of the Agent with Aplusix

A special version of the Aplusix was created for this study in order to have real time reactions to real time student behavior.

Initial Testing of the Agent

The agent was able to detect correctly the current state of the student based on our observation of the logs. Although the timing of the responses, too much responses in a short period of time, did not seem appropriate to give the student proper motivation. Despite its propensity to repeat itself too often, the agent was found to be relatively pleasing and friendly.

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