Developing a Cloud Robotics Infrastructure for a Humanoid Robotic Teaching Assistant

Michael Cowling, CQUniversity
A Short Introduction to Boris the Teaching Assistant

(AKA How Can A Robot Help Me in Class?)
A Little Bit About Me ....
The CREATE Lab

Fostering Collaborative Research & Engagement Around Technology & Education

Coming Soon! (in the meantime, visit www.michaelacowling.com)
ADOPTING technology in the classroom should just be a part of the learning process, an academic from Queensland’s CQUniversity says.

Dr Michael Cowling has written a report on technology, which he will present this week in Adelaide, suggesting it was better to stop thinking about technology as an enhancement or a distraction and for teachers to view it as just part of the classroom.

He said this was particularly important as technology became more a part of students’ lives, with one study indicating a “near ubiquitous” level of access to mobile phones or computers, and another showing 86 per cent of students preferred using the internet to finding information, rather than looking in a book.

“When we all adopted whiteboards instead of chalkboards or digital projectors instead of overhead projectors, we didn’t spend 10 years talking about a ‘whiteboard-led classroom’ or a ‘projector-enabled classroom’,” he said. Dr Cowling said the trend towards a technology-led pedagogy needed to be replaced instead with pedagogy-led technology.

This acknowledged that learning was the most important part of education.

Dr Michael Cowling will present his paper at the International Education Association and Australia New Zealand Student Services Association joint conference at the Hilton Adelaide from today until Friday.
Pedagogy

Before

Technology
Start with the Problem in the Classroom

THEN

Think about ways to Solve that Problem

THEN

Work out How Technology Can Help
Robotics

Building a Robotic Teaching Assistant

Robotics Architecture in the Cloud

Artificial Intelligence Support for Local Semi-Autonomous Robot Companions
What is the problem?

- Teachers are short of time
- Students sometimes worry about asking a teacher questions or interrupting the class
- Teaching Assistants can help, but they’re not experts in the subject matter – often volunteers or parents
- Robotics can provide students with a familiar, humanoid system to interact with, but without the concerns of ‘looking stupid’
## What does a Teaching Assistant Do?

<table>
<thead>
<tr>
<th>Task responsibilities</th>
<th>Percent of Sample</th>
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<tbody>
<tr>
<td>Working with small groups of students on academic tasks (e.g. reading, maths, word study, science)</td>
<td>100%</td>
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<tr>
<td>General classroom support for students and teachers</td>
<td>100%</td>
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<tr>
<td>Administrative duties for teachers (e.g. photocopying gathering resources, data entry, filing, setting up activities)</td>
<td>96%</td>
</tr>
<tr>
<td>One-on-one support for ascertained students with disabilities</td>
<td>67%</td>
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*Top 4 Teaching Aide Tasks (Harris & Aprile, 2015)*
NAO Robot

- Produced by Aldebaran Robotics
- Around 2 feet tall
- 2 cameras (top and bottom), 2 microphones (left and right)
- Basic Voice Recognition
- Full Articulation (moving hands, feet, sitting down, laying down etc)
- Programmed using graphical tool (Choreographe) or Python
Choreographe
Our Robotics Project

- Industry Partnership - ACME Robotics
- Commercial Robot called Boris
- Robot as a Robotic Teaching Assistant
  - Collects Feedback from Students
  - Poses Questions to the Instructor
  - Acts as an Autonomous Guide for FAQs
- Needed to develop a system that could control this type of robot
<table>
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<th>Command</th>
<th>Description</th>
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<tr>
<td>MVE</td>
<td>Moves the robot. Parameters for this instruction are: W - Forward; S - Stop; A - Left; D - Right; Q - Turn Left; E - Turn Right; X - Stop</td>
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<tr>
<td>SET</td>
<td>Used by the Lecturer only. “SET:Timer=X” where X is the number of seconds. Designed to set / configure many different variables for testing purposes.</td>
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<tr>
<td>SPK</td>
<td>Appends question to the list of questions. Lecturer can decide when questions will be answered by touching buttons on the robots forehead. Questions will be added to the questions database.</td>
</tr>
<tr>
<td>SPN</td>
<td>Speak now. Used for when asking urgent questions, the question will not be saved in the database.</td>
</tr>
<tr>
<td>RES</td>
<td>Response from student. Student can click on the smile and crying face image where robot would then either nod its head or yawn. More responses can be added and format used is “RES:fun” or “RES:bored”. Will be used in the future to aggregate an average response from the class and reflect in the robots ‘mood’.</td>
</tr>
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*Robotic Assistant Instruction Set Commands*
Overall Program in Choreographe
Server Side Programming

Robot and Server (speaking a question)
1. User connects to server IP address from browser
2. User click walk and browser send GET request to index.php?do=s
3. Server: If ‘sAsk.php’ exists, writes “SPK<question>” to the file
   a. Server (boris.php): Checks ‘sAsk.php’ and if content is not empty, send contents to Boris. Then deletes ‘sAsk.php’ content. File is locked before reading and deleting content.
5. Robot: Receives content from server. (In this case ‘SPK:<question>’)
   a. Since content starts with ‘SPK:’ calls speak function.
   b. <question> is added to the queue for the robot to ask when prompted by the lecturer

Robot & Server Code Sequence
Bringing it All Together
Research Design

- Design Based Research (DBR) Methodology
  - Initial Data Gathering & Initial Prototype
  - Classroom Testing – Teaching Acceptance Model (TAM)
  - Pre and Post Testing for Learning Outcomes
  - Qualitative & Quantitative Data Collected – Survey & Focus Group
  - Data Analysis & Prototype Refinement
Our Friend Boris