

COMP3900  
Hal\_3900 Report

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	The Problem . . . . .	1
1.2	Existing Solutions & Problems . . . . .	1
1.3	Our Solution . . . . .	2
1.3.1	Our Contributions . . . . .	2
1.3.2	Aim, Purpose & Scope . . . . .	2
1.3.3	Differences to Existing Systems . . . . .	3
<b>2</b>	<b>Background</b>	<b>4</b>
2.1	Usage Scenario . . . . .	4
2.1.1	Student . . . . .	4
2.1.2	Course Administrator . . . . .	5
2.2	System Architecture . . . . .	6
2.2.1	Architecture Diagram . . . . .	6
2.2.2	Data Scraping & Processing . . . . .	6
2.2.3	Extensible Backend . . . . .	6
2.2.4	Interactive User Interface . . . . .	6
<b>3</b>	<b>Data Scraping &amp; Processing</b>	<b>7</b>
3.1	Input & Output . . . . .	7
3.2	Example Usage . . . . .	7
3.3	Technical Details . . . . .	7
<b>4</b>	<b>Extensible API</b>	<b>8</b>
4.1	Input & Output . . . . .	8
4.2	Example Usage . . . . .	8
4.3	Technical Details . . . . .	8
<b>5</b>	<b>Interactive User Interface</b>	<b>9</b>
5.1	Input & Output . . . . .	9
5.2	Example Usage . . . . .	9
5.3	Technical Details . . . . .	9
<b>6</b>	<b>Conclusion</b>	<b>10</b>
6.1	How Existing Problems Were Addressed . . . . .	10
6.2	Improvements . . . . .	10
<b>7</b>	<b>Appendix</b>	<b>11</b>
7.1	Technologies . . . . .	11
7.1.1	Node.js . . . . .	11
7.1.2	Vue.js . . . . .	11
7.1.3	Dialogflow . . . . .	11

# 1 Introduction

## 1.1 The Problem

Online learning is changing the way students access and engage with higher education. Courses with online delivery increase the flexibility and accessibility of education by providing students with a platform to learn course content in their own time, at their own pace. Increasingly courses which are taught face to face include some online content delivery, including course materials, quizzes, online lecture recordings, and forums to ask questions and discuss the course content outside of class. Because online learning is so prevalent in higher education, it is crucial for universities to ensure students are satisfied with their learning experience.

There is a delay between when students ask a question and when they get a response, and this can vary from hours to days. Answering individual student questions via email or on forums requires a significant amount of time for tutors, course administrators and lecturers. Often the same questions will be asked many times by different students, making it inefficient to have course staff respond to each one individually.

Some key factors that contribute to student satisfaction in the online learning space are:

- Students' preferences for actively participating in learning, rather than through passive learning styles.
- Students' expectations on instructors to facilitate their learning by organising the course resources<sup>1</sup>
- The amount of interaction students have with each other, and the availability of their instructors.<sup>2</sup>
- The availability of strong administrative support when using online learning tools or when confused about assessments and learning expectations.
- Course staff who are concerned with the quality of their course delivery, and want to know what their students need the most help with
- The availability of individual support and extended materials

Making these factors available to students becomes more challenging as classes grow in size. Course staff are thus in need of a more effective way to support with their students.

## 1.2 Existing Solutions & Problems

Currently at UNSW, learning support is provided to students through email, forums and help sessions. This is very man-hour intensive, requiring many tutors to be on

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<sup>1</sup>[https://www.researchgate.net/publication/282699144/\\_Student\\\_Satisfaction\\\_with\\\_Online\\\_Learning\\\_Is\\\_it\\\_a\\\_Psychological\\\_Contract](https://www.researchgate.net/publication/282699144/_Student\_Satisfaction\_with\_Online\_Learning\_Is\_it\_a\_Psychological\_Contract)

<sup>2</sup>'Key Factors for Determining Student Satisfaction in Online Courses': [https://www.learntechlib.org/primary/p/2226/article\\\_2226.pdf](https://www.learntechlib.org/primary/p/2226/article\_2226.pdf)

hand to answer questions which, of themselves, are quite repetitive. In addition, as these courses become larger with increasing enrollment sizes, it becomes more difficult to be able to give students individual attention.

Another side effect of growing cohort sizes is the fact that many tutors and lecturers are forced to spend most of their time answering admin related questions, which is time that could be spent improving the course. The current solution has been to hire more staff and offload the majority of questions to forums, however these are full of repeated questions and require many tutors to moderate them.

This growth is becoming unsustainable, and with the rise of online education platforms, many students are eager to interact with course material in a more meaningful way. Waiting for a tutor to respond often creates a disconnect between the initial question and the answer, which limits the effectiveness of the response. This is provided that the tutor finds time to respond at all.

Chat bots have been deployed in some areas of secondary education, which interact with students in meaningful ways outside of class hours<sup>3</sup>, and some have even been created to answer university-level questions<sup>4</sup>. However these tools can not be easily adopted by all university courses, or their administration and assessments.

## 1.3 Our Solution

### 1.3.1 Our Contributions

Our bot provides a platform for students to ask questions in real time. This addresses the issue of course staff being too busy to respond to questions in a timely fashion. This also grants lecturers and tutors more time to dedicate towards delivering and improving the course itself.

The bot goes beyond this by providing quiz functionality as well. Students can request to receive quizzes, and see questions and answers provided by the bot. This gives students meaningful interactions and a helpful study tool that doesn't draw from the time of course staff.

### 1.3.2 Aim, Purpose & Scope

Our goal was to create a course companion chat bot for students to enhance their learning experience. The chat bot should provide students with support by responding to their questions about course administration and the content they are learning in real time. In addition, the bot will monitor students' understanding of the course content with follow-up questions. This is expected to increase both the amount and the quality of student interaction within the course. The bot will also provide students with more frequent and timely interactions. This helps by diverting more complex questions to

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<sup>3</sup><https://botsify.com/education-chatbot>

<sup>4</sup><https://www.canberra.edu.au/about-uc/media/newsroom/2018/february/students-make-new-friend-in-lucy-the-chatbot>

tutors and lecturers, who in turn will have more time to respond to such questions in depth.

The chat bot will provide administrative support by keeping students informed of their grades and upcoming due dates. This is expected to increase positively affect learning outcomes by boosting students' motivation to study. In addition, it will also enhance course delivery by keeping staff informed of their students' learning needs and frequently asked questions. It will reduce the load on course staff by answering many of the questions that students have and allowing them to focus on the overall delivery of the course.

### **1.3.3 Differences to Existing Systems**

The main difference between our bot and the existing solution of allocating the work to tutors is that the bot does not require an active human at all times. This addresses a number of problems addressed above, primarily saving time for course staff. The bot can be active throughout the day and respond to questions immediately, which is useful for both students and tutors, who previously had to email or post on forums at their convenience.

Our bot is innovative by...

## 2 Background

### 2.1 Usage Scenario

#### 2.1.1 Student

**User Story: I have just started the course and I want to find more information about my lectures and assignments.**

- I log in to the student portal with my name or student number
- I ask the bot questions:
  - Who is the lecturer? *“John Shepherd lecturer”*
  - When is my assignment due? *“Assignment 1 submission week 6 worth 9, assignment 2 submission week 10 worth 11”*
  - How do I do the labs? *“Each week there will be one or more exercises to work on. These exercises will be released in the week preceding the lab class. Labs will be done in pairs and you and your lab partner should discuss the exercises before going to the lab to maximise the usefulness of the class...”*

**User Story: I have some questions for COMP1521 that I want the answer to right away. It’s a few days until my next tutorial.**

- I log in again
- I ask the bot questions:
  - What is qtspim? *“Qtspim... provides a gui front-end useful for debugging”*
  - How do I make a stack frame in MIPS? *“Create a stack frame for itself change \$fp and \$sp. Save the return address \$ra in the stack frame. Save and \$s registers that it plans to change”*
  - What are the MIPS floating point registers? *“Mips has 32 32-bit general purpose registers and 16 64-bit floating point registers as well as two special registers hi and lo for manipulating 64-bit integer quantities...”*
  - What is the clock sweep algorithm? *“Uses a reference bit for each frame updated when page is used. Maintains a circular list of allocated frames. Uses a clock hand which iterated over page frame list skipping and resetting reference bit in all reference pages...”*
  - What does execve do? *“Execve... Convert one process into another”*
  - What is envp? *“Envp contains strings of the form key-value”*
  - What does fork do? *“Fork... Create a new child process copy of current process”*
  - What does sigpipe mean? *“Sigpipe... broken pipe no processes reading from pipe”*
  - What does sighup mean? *“Sighup... hangup detected on controlling terminal/process”*
- I get these answers right away and don’t have to ask my tutor.

**User Story: I want to revise for the midterm test.**

- I log in to the chat bot and ask “quiz me”
- I read the quiz questions and try to answer them
- I click “show answer” and check if my answer was right or not
- I am having difficulty with the revision questions for process management in C, so I ask “quiz me on C process management”
- I get some quiz questions specifically about that topic
  - *What happens to a child process if the parent process exits?*
- I think about the answer and once I decide, I check if I was correct by clicking “show answer”, which displays the admin inputted data

### 2.1.2 Course Administrator

**User Story: I want to set up my course to work with the chat bot, so that my students can use it.**

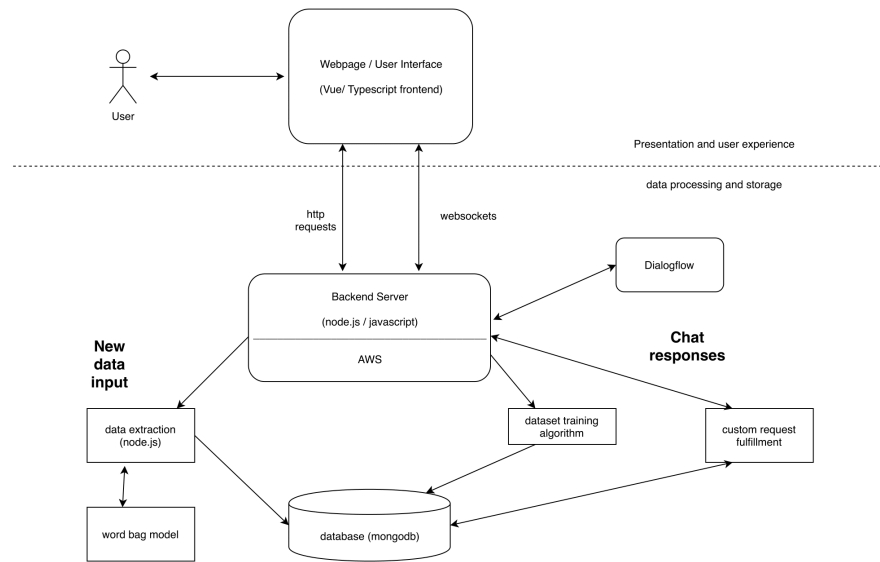
- I register and log in to the admin portal
- I input my course information in the new course setup page
- I supply links to the html pages I want to be included in the data: course outline, assignment specifications, and course content pages that are available online
- I submit the form, and then when the course setup is ready, I’ll be able to see it in the admin portal when I refresh the page
- The setup might take a few minutes as the data is processed, but I can do something else while I wait

**User Story: I want to add quiz questions for my course to help my students revise.**

- I log in to the admin portal and select my course from the menu
- I view the quiz questions I have already added
- I delete some old questions I no longer want my students to see
- I select “add questions” and input more questions
  - What is the size of the general registers in MIPS? Why can’t we store a C long long int, in the \$t0 register? *mips is a 32 bit architecture and as such the registers and relevant logic circuits only support 32 bit numbers.*
  - What happens to a child process if the parent process exits? *The child process runs independently and does not exit.*
- These will be available right away to students

## 2.2 System Architecture

### 2.2.1 Architecture Diagram



### 2.2.2 Data Scraping & Processing

### 2.2.3 Extensible Backend

### 2.2.4 Interactive User Interface



## **3 Data Scraping & Processing**

### **3.1 Input & Output**

### **3.2 Example Usage**

### **3.3 Technical Details**

## 4 Extensible API

### 4.1 Input & Output

### 4.2 Example Usage

### 4.3 Technical Details

## **5 Interactive User Interface**

### **5.1 Input & Output**

### **5.2 Example Usage**

### **5.3 Technical Details**

## **6 Conclusion**

### **6.1 How Existing Problems Were Addressed**

### **6.2 Improvements**

## 7 Appendix

### 7.1 Technologies

#### 7.1.1 Node.js

#### 7.1.2 Vue.js

#### 7.1.3 Dialogflow