# **Introduction to Teaching and Learning with Chatbots Powered by Student-In-the-Loop Knowledge Bases**

Zhengyuan Wei, Alex Kiang, Albert T.L. Lee\*, S.M. Yiu, Victor C.S. Lee, and K.H. Lam

\* Corresponding email: tlalee@eee.hku.hk

The work is supported by the UGC and the FITE funding.

### Abstract

Problem

Face-to-face interactions with individual students to give timely responses to their questions certainly makes the learning process more effective and pleasant. Unfortunately, this is hard to achieve in practice with an ever-growing number of engineering students against limited manpower and resources [1].

Approach
----------

- To enrich students' learning experience and reduce the workload of teaching staff, knowledge-based GenAI chatbot is developed to enable students receive immediate responses to their course-specific queries.
- Retrieval-augmented generation has been demonstrated to be highly effective in generative AI applications, significantly improving the accuracy of the chatbot.



### Outcome

- Increasing willingness to ask questions
- Dramatically reduce response time
- Contribute to higher satisfaction levels
- Scalable solution to manage student queries

## Methodology

#### **Knowledge Base** O: What is the password

- Q1 Q: What is the password forELEC3848 wifi?A: "password"
- Q2 Q: What are the use of
  essential libraries imported?
  A: `jetson.inference` contains
  pre-trained neural network ...
- Q3 Q: No camera detected when using Raspberry Pi.
  A: Check the configuration of Raspberry Pi. Go to raspiconfig ...

More questions and answers...

	EC
1 Retrieve	EIC
	H
2 Generate	
<sup>3</sup> Forward	
4 Rectify	

•••	<pre>- &lt; &gt;</pre>	ם discord.com 🖓 כֿ	Û	+	C
	ELEC3848 Integrated De $\checkmark$	🗰 🗱 🛣 Search 👘 👫	Q		?
EDS EIDP +	<ul> <li>GENERAL</li> <li># announcement</li> <li># student-help-desk</li> <li>ELEC3848_2B (TUESDAY CLASS)</li> <li># group-b1</li> </ul>	<ul> <li>Chen Xin - E6 04/15/2024 1:57 PM</li> <li>@ELEC3848-bot Could I set the config of the camera of respberry pi to different config? like 320320, 640640 etc</li> <li>@Chen Xin - E6 @ELEC3848-bot Could I set the config of the camera of respberry pi to different config? like 32</li> <li>@Chen Xin - E6 @ELEC3848-bot Could I set the config of the camera of respberry pi to different config? like 32</li> <li>ELEC3848-bot APP 04/15/2024 1:57 PM</li> <li>Yes, you can set the configuration of the Raspberry Pi camera to different resolutions, such as 320x320 or 640x640</li> <li>This is done by adjusting the camera settings in your code. If you're using the picamera library in Python, you can set resolution like this:</li> </ul>	ہے۔ pixels. et the		
	<pre># group-b4 # group-c2 # group-c5 # group-d1 # group-d4 # group-d6 # group-e1 # group-e4 # group-e4</pre>	<pre>import picamera # Create an instance of the PiCamera class with picamera.PiCamera() as camera:     # Set the resolution     camera.resolution = (320, 320) # For 320x320 resolution     # Or     # camera.resolution = (640, 640) # For 640x640 resolution     # Start the camera preview (optional)     camera.start_preview()     # Camera warm-up time     time.sleep(2)     # Capture an image or start recording     camera.capture('image.jpg') # Replace with your desired file path and name     # Or for video recording     # camera.start_recording('video.h264') # Replace with your desired file path and</pre>			

		<pre>name # group-f1</pre>	
5 Append	$\overline{\bigcirc}$	# group-f4       Remember to replace 'image.jpg' and 'video.h264' with the file path and name w         ~ ELEC3848_2C (THURSDAY CLASS)       image or video. Adjust the resolution to your desired values by changing the camera.re         # group-b3       How can I adjust the camera settings using the `picamera` library in Python?	here you want to save the captured esolution setting. (edited)
Tippena		<pre># group-b6    FITE</pre>	

- The incorporation of knowledge base into the chatbot enhances its accuracy. The quality of knowledge base is assured by the instructor.
- Students play an important role in discovering the deficiency of the adopted AI model, which helps to refine and enrich the knowledge base.
- The content of the knowledge base (including FAQ, troubleshooting tips, etc.) will grow and consolidate in a few more semesters since its debut.

# Survey & Data Analysis



## **Benefits & Recommendations**

- Commercial LLM performance
- Increased visibility of shared responses among groupmates
- Course-specific knowledge base augmentation
- ➤ Well-defined UI and pipeline to improve chatbot usability
- > Improved accessibility and availability of multimedia contents

Highly recommended for other courses that contain:

Intensive problem solving
 Practical group projects
 Repeated questions
 Multimedia materials

### **Conclusion & Future work**

The positive feedback and comments from students demonstrate the efficacy of our teaching chatbot augmented by course-specific knowledge base for enhancing teaching and learning. Building upon this methodology, we aim to extend the chatbot to more courses and refine the knowledge base specific to such courses.

#### <u>Reference</u>

[1] National Academies of Sciences, et al. Assessing and responding to the growth of computer science undergraduate enrollments. National Academies Press, 2018.