Intelligent Control Final Project

Intelligent Prediction and Management of Battery Charging Demand Based on Fuzzy Control

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I. Abstract:

In this project, the usage status of CPU, RAM, and battery is used to determine the battery charging demand. In other words, the fuzzy domain consists of the usage levels of CPU, RAM, and battery, and the output is the charging demand. In the end, this project successfully implemented fuzzy control to adjust the charging demand according to the user's needs and created a monitoring GUI.

II. Method:

Use the Python **psutil** package to obtain sensor values from the computer (this project utilizes CPU, RAM, and battery). These values are then inputted into a membership function to obtain an output. Figure 1 illustrates the flowchart of this project, which employs a two-layer fuzzy control system to reduce the complexity of rule formulation. The input for the first layer of fuzzy control is CPU and RAM, and the output is power, representing the performance usage status. Refer to Figure 2 for detailed rules. The input for the second layer of fuzzy control is power and battery, and the output is demand. Refer to Figure 3 for detailed rules.

Finally, the entire fuzzy control model is packaged and integrated into a GUI interface. This project utilizes the **kivy** package as a tool for GUI development.

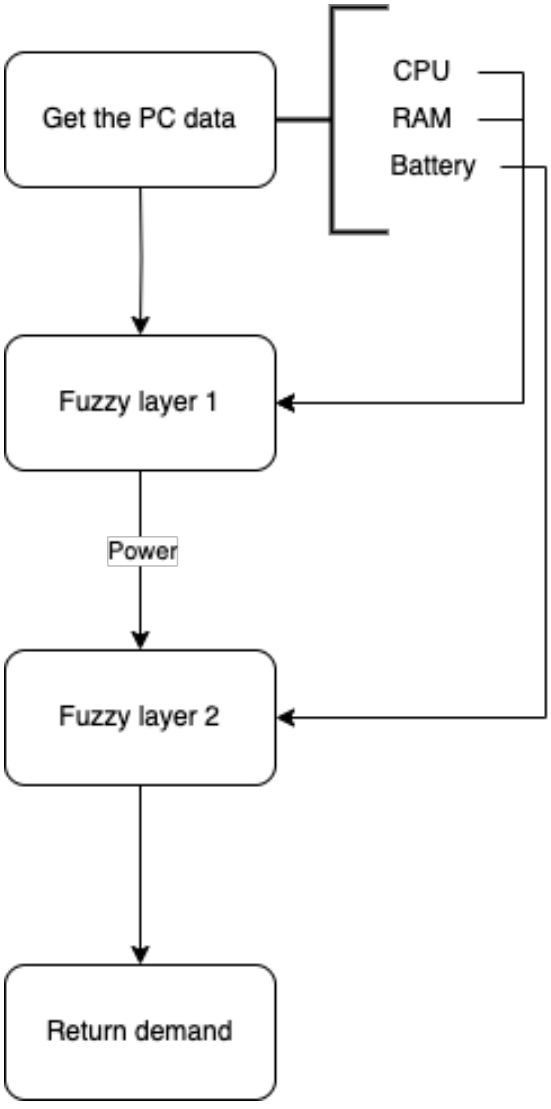

Figure 1 Flowchart

ram\cpu	low	normal	high	higher
low	low	low	normal	high
normal	normal	normal	high	high
high	normal	high	hogh	high

Figure 2 The rule of the first fuzzy control

power\battery	less	little	normal	high	higher
low	high	normal	low	low	low
normal	high	high	normal	normal	low
high	high	high	high	normal	normal

Figure 3 The rule of the second fuzzy control

III. Result and Discussion:

Figure 4 and Figure 5 present the membership functions for the first and second layers of the fuzzy control, respectively. By inputting arbitrary values from Figure 6, it can be determined that the fuzzy control system has been successfully established.

Figure 7 display the interface screens of the GUI.

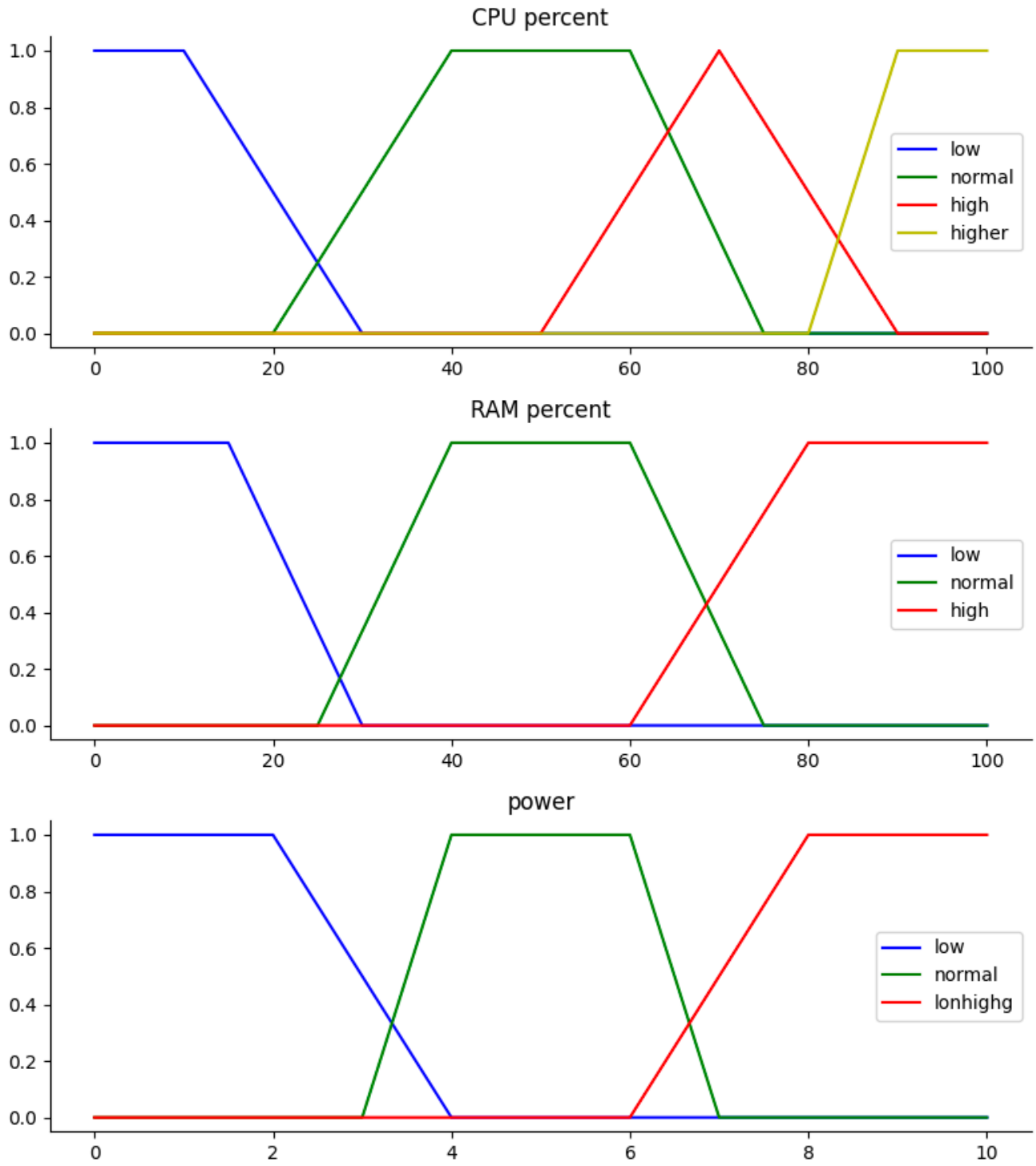

Figure 4 The membership function of the first fuzzy control

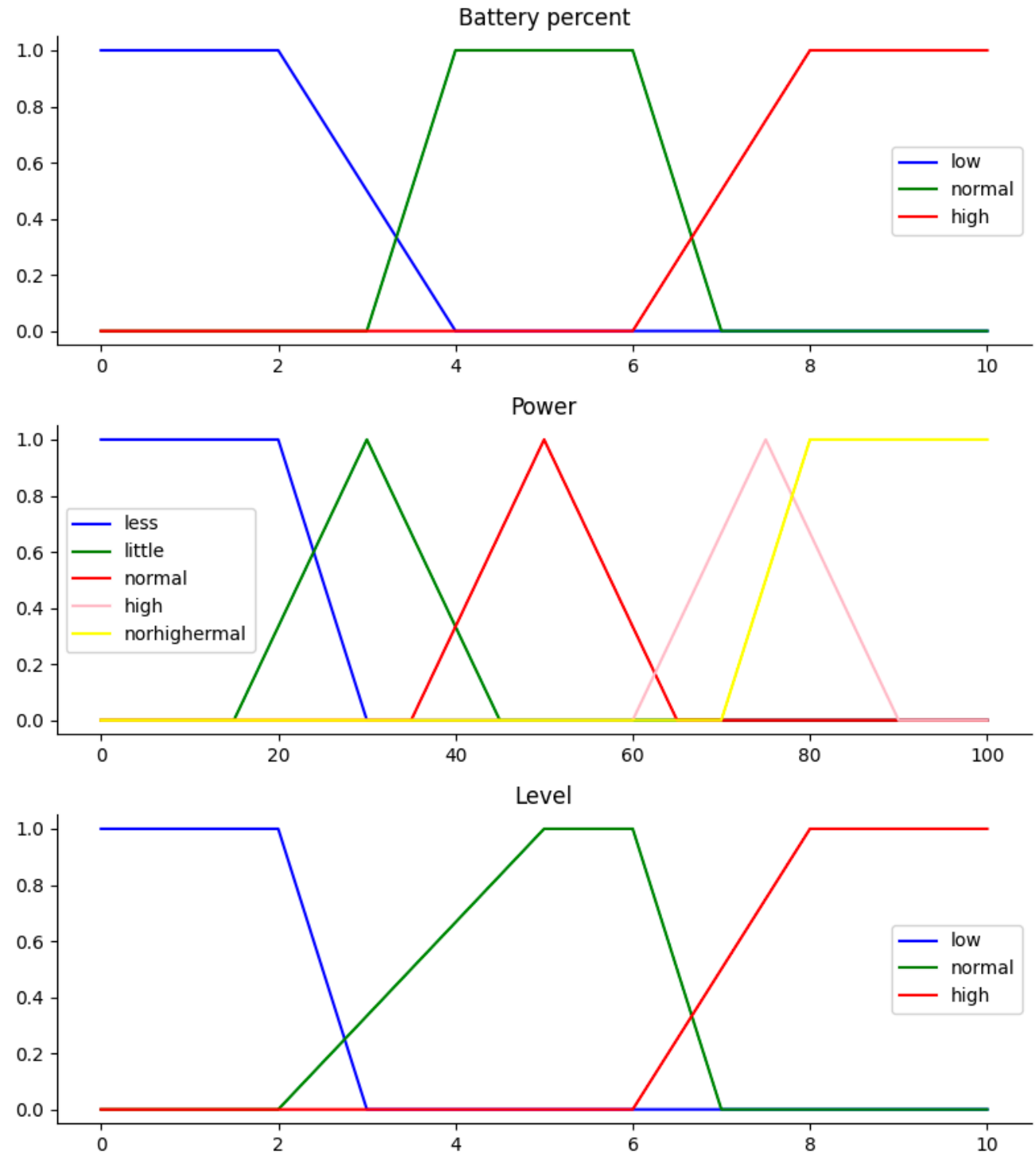

Figure 5 The membership function of the second fuzzy control

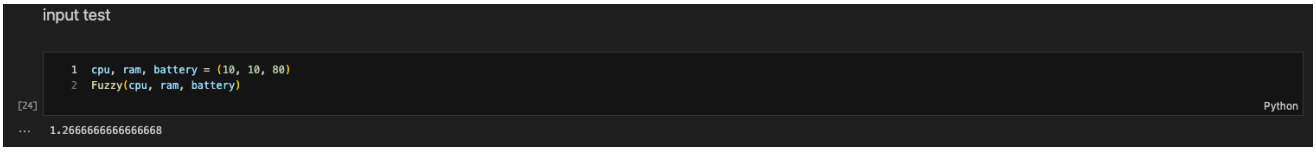

Figure 6 Simulate test

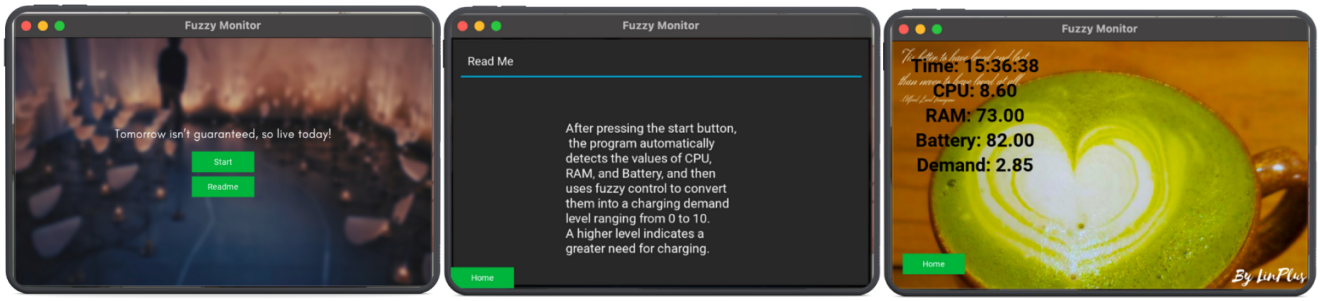

Figure 7 GUI's screen shot

IV. Conclusion:

In the final stage of this project, a GUI interface was developed and successfully implemented to incorporate the proposed fuzzy control design. The current GUI can accurately calculate the charging demand, which ranges from 0 to 10, with 10 indicating an urgent need for charging. This calculation is based on real-time monitoring of CPU, RAM, and battery information, collected every second.

V. Future development:

- Increase the reliability of the parameters.
- Incorporate multiple data inputs to manage charging demand.
- Optimize the GUI interface.

VI. Appendix:

YouTube link: [111-2 Intelligent Control]Fuzzy control project - YouTube