

COMP7460 MSc Practicum for Information Systems

Topic: Implementation of voice recognize technique to simulate mouse clicks with a low cost joystick device for severely disabled people

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Background

- ▶ the assistive technology purpose to ensure that the disabled people can access to information technology and get connected to the world for communications, learning, work and social participation.
- ▶ In Hong Kong, the newspapers have reported some real stories about CP patients when they have shared about their studies experience and face up the huge challenges of physical disability in their daily life [1][2][3].
- ▶ the assistive technology is not mainstream IT development direction and such commercial market is comparatively small that there is a lack of business interest and research funding to support these projects.
- ▶ Most of the Cerebral Palsy peoples have very poor hand function and speech disorder, they can only use the computer to keep contact with other people or their family via social network platform. However, there has no a sophisticated solutions to fulfill their needs.

Project aims

► Problems:

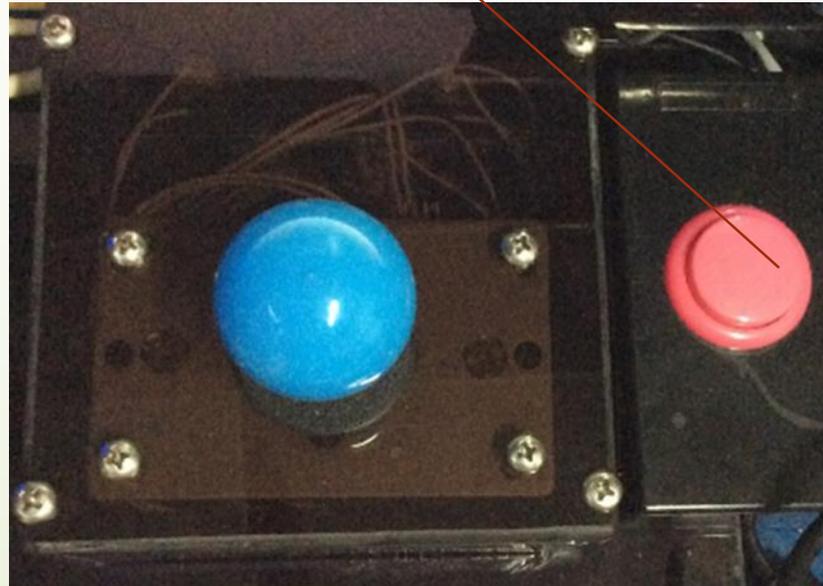
- As Cerebral Palsy patients symptom has poor hand function and speech disorder, they are very difficult to control the mouse drag and drop function, typing characters on keyboard, the new method is needed to replace the traditional input characters in keyboard, more accuracy and efficiency.
- Avoid to do the repeat movement for opening the windows applications frequently

► Solutions:

- To change their traditional input method, such as an on - screen keyboard with rolling character.
- To set time to execute a specific program on the system menu
- To voice recognize technique to simulate mouse clicking behavior and fast forward to rolling character.
- To set the cursor movement speed for joystick mouse device.

New hardware device design – Generic USB Joystick with single button

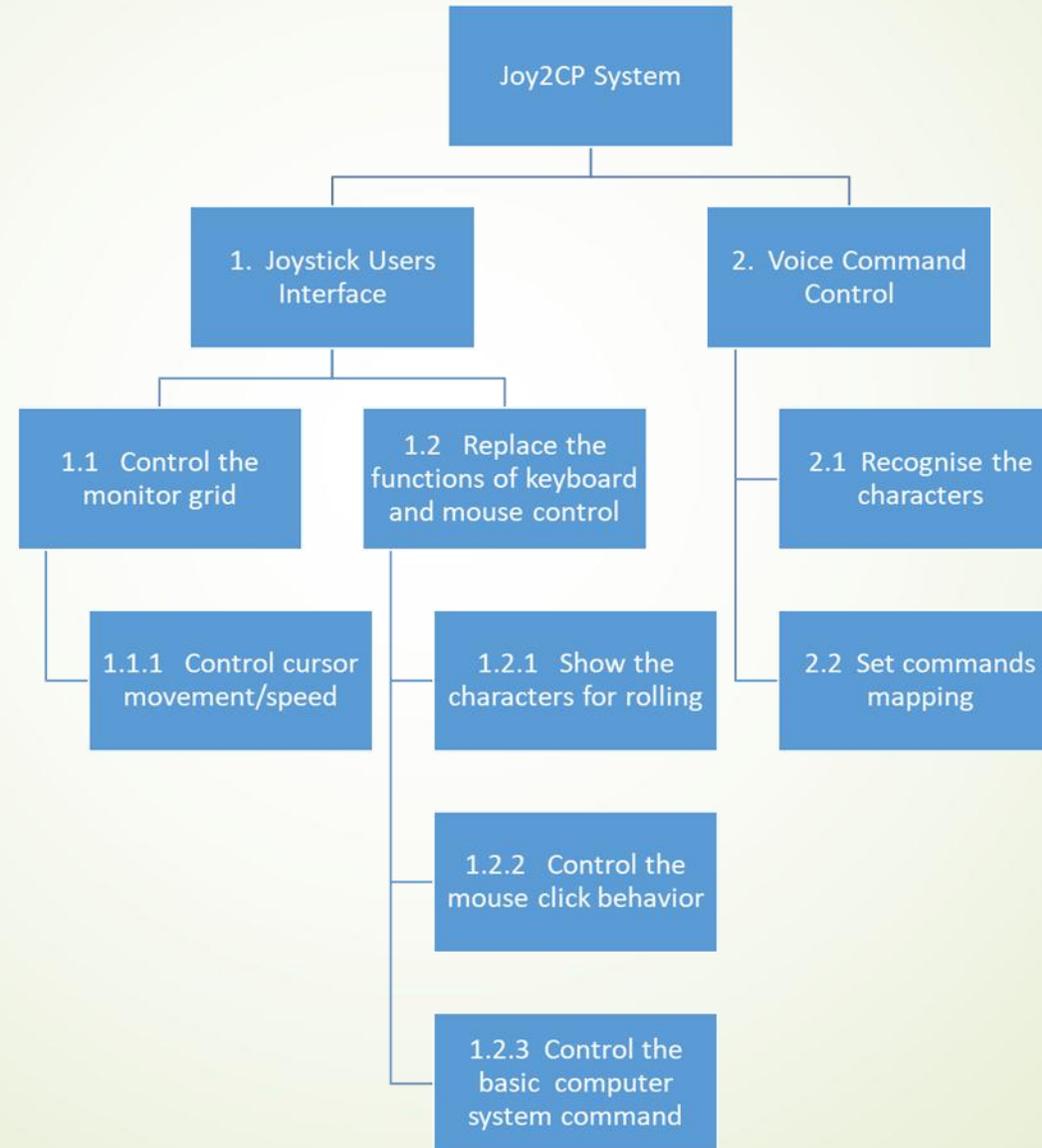
- ▶ For the part of new joystick mouse design, it has only used a single button, instead of left click and right click buttons. As the CP patients find it very difficult to control joystick cursor and press a button simultaneously.
- ▶ The single button is only used for controlling the function of monitor grid, the cursor can jump to the nine different position in monitor dimension which is according to the 'z' shape. User can fast move the cursor near to their target, it is more faster than using the joystick control cursor movement only.



Implementation of IT System components

- ▶ Joystick users interface
 - Hijack cursor movement from joystick device without any extra driver support
 - Control cursor movement speed for faster or slower
 - Function of monitor grid
- ▶ Voice recognition system [compatible with the Kinect device or speaker]
 - Voice training
 - Voice commands with the mouse clicking behavior control mapping
 - Storing the information of configuration system setting in the database servers
- ▶ System menu and rolling character system
 - Rolling the three different categories characters, included digital, English characters and special symbols
 - Open the specific windows system applications, e.g. notepad, web browser, file manager etc.

Functional decomposition diagram



UI design – joystick control the cursor movement and speed

- ▶ The function of joystick user interface
 1. Change the cursor movement speed
 2. The system can be minimized in the system taskbar
 3. Change the function of monitor grid or rolling character
 4. Press the joystick single button to jump the nine different position which is according to 'z' shape



UI design – rolling character and system menu

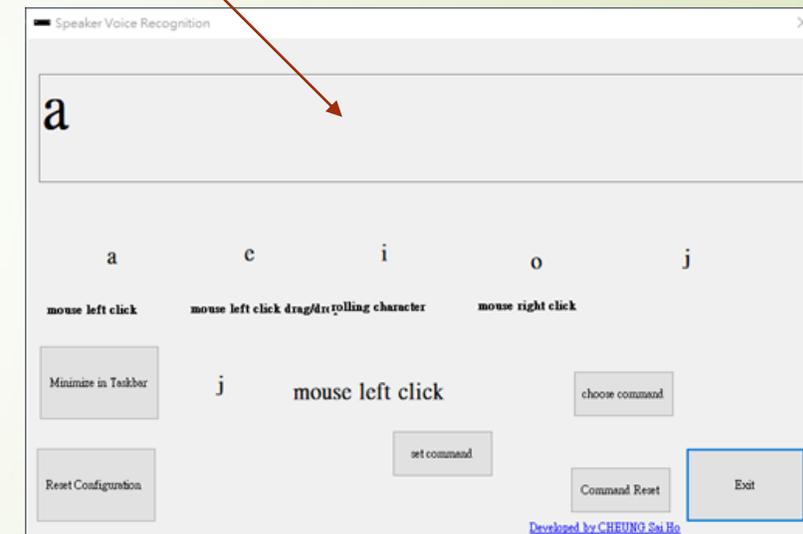
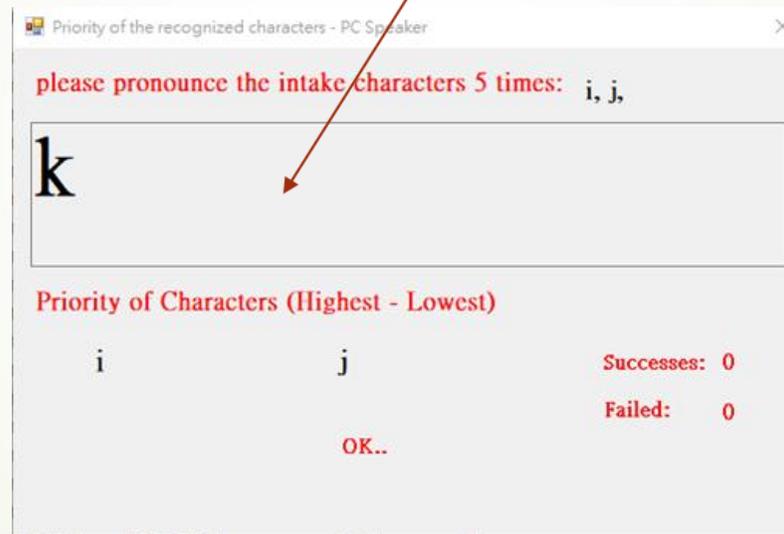
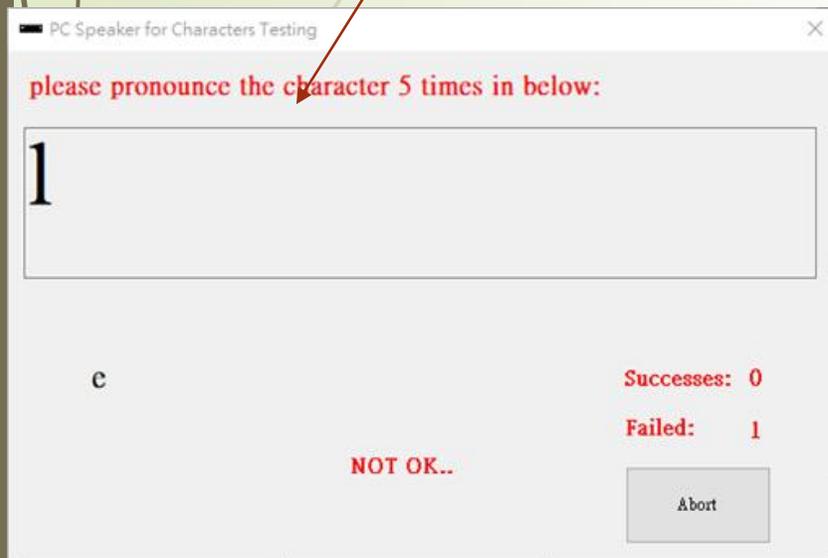
- ▶ The interface of system menu
- ▶ The function of rolling character
 1. Rolling character for English characters
 2. Rolling character for digital
 3. Rolling character for special symbols



UI design – the voice recognition system

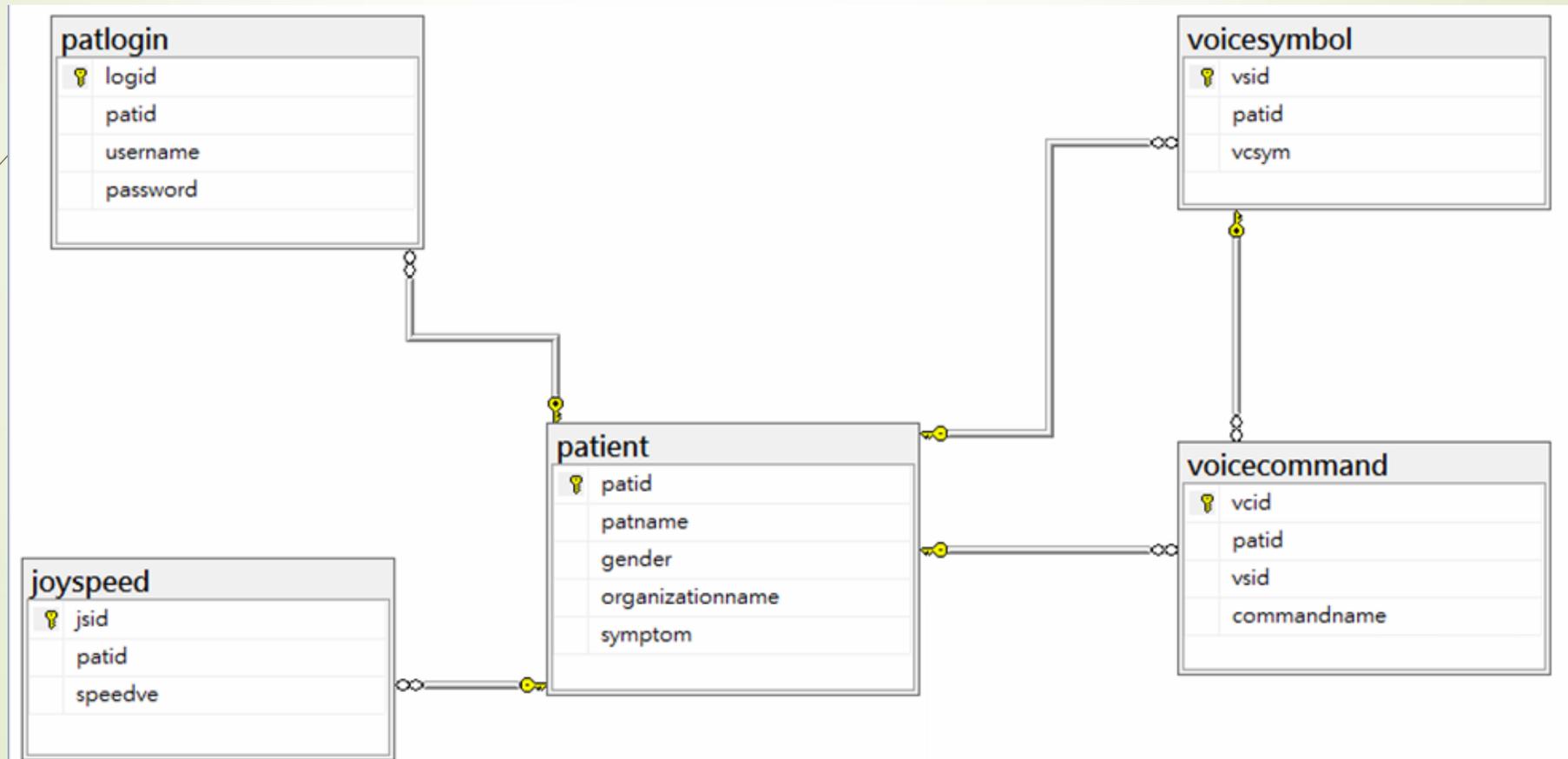
► The function of voice recognition system

1. Voice recognition training
2. Priority of character in order to the percentage of recognition
3. Simulation the mouse clicking behavior via the voice commands



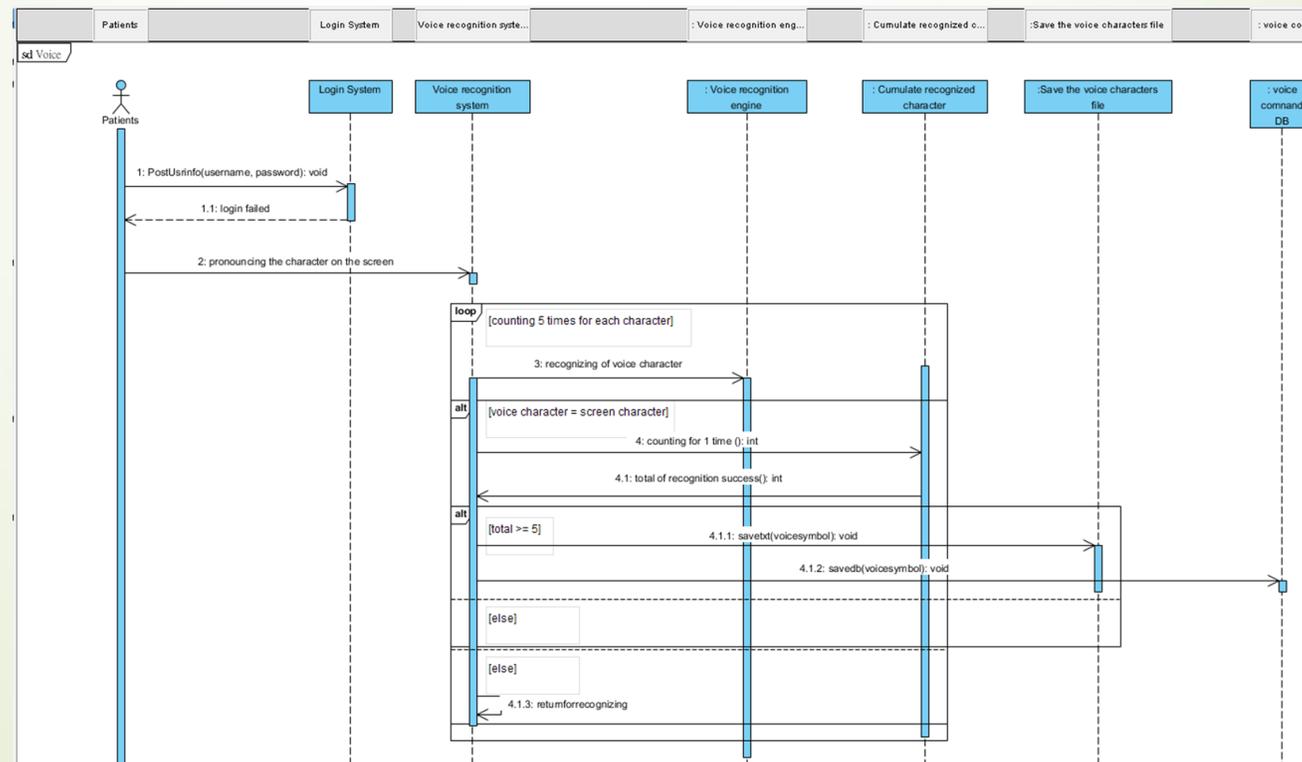
Entity Relationship Diagram

- In this diagram, it has contained the five database tables in the backend system which stores some kinds of information from the joystick and a voice recognition system, such as patient information, system login information, voice command information, joystick movement speed information and patient's voice symbols information.

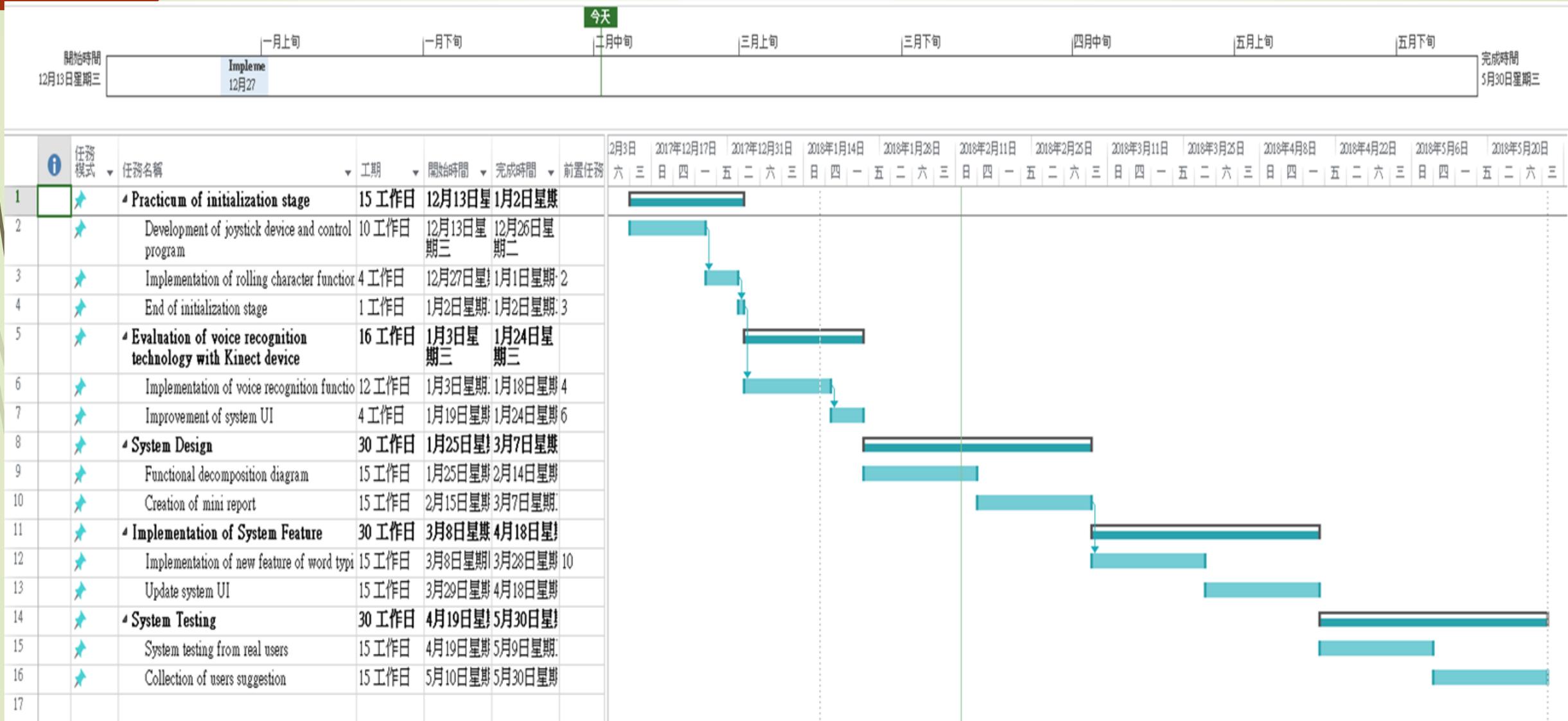


Sequence Diagram

- ▶ In this diagram, it has described the program workflow in the voice recognition system. there has proposed a new method to simplify and increase the accuracy of the voice recognition process in this system. The patients need to pronounce the twenty-six English letters when they login to the system successfully, the voice recognition system has stored the characters in the database system which is recognized successful within five times for each character. It is at most contained the five characters to represent the five different system commands in the system interface.



Gantt chart



Further development

- ▶ The part of rolling character should be added the auto-complete function to reduce the typing time when the patients do not need to type for the whole words or complete sentences every time.
- ▶ The system interface should be need to do some graphic design in the buttons layout, e.g. enlarge the buttons sizes for different kinds of interface layout, use more graphic icon to replace the button of word description. As some patient's eye vision ability is low, they need some special interface design for using it more easily.
- ▶ There should be provided some teaching movie clips in the website or social media platforms, the patients can watch easier for self-learning at home or school.
- ▶ The system should be used some machine learning or artificial intelligent technique for estimating patient's using computer pattern, reduced the repeat movement for them.



User's demo video clips

- ▶ <http://owncloud.atproj4u.com:8800/webdisk/index.php/s/lhllCbylUSQMbxl>
- ▶ <http://owncloud.atproj4u.com:8800/webdisk/index.php/s/e27BbfEFBDLEtb4>

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