

Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation Design Proposal)

(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: JBPE164

Project Title: Brainly Friendly

Project Type: Investigation Design Proposal

To our best knowledge and after thorough literature research, as at 1/6/2022, there ~~are~~/ are no* similar works. If there are, the reference links are as below:

Not applicable

The enhancement our project has made for the existing related products or research is summarized as below:

Not applicable

***Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.**

1. Background

Dementia patients are typically incapable of recognizing relatives, they will gradually lose confidence to call them. According to the WHO, 60% of dementia patients live in low-to-middle income countries.

An affordable and easy-to-use face recognition prototype that does not require external devices was developed to help dementia patients and the elderly to recognize relatives and uphold their dignity.

2. Objective(s)

- To develop and optimize a low cost, small form factor, portable and user-friendly face recognition integrated device
- To help dementia patients and the elderly recognize relatives, uphold their dignity, boost their morale and living standards

3. Hypothesis

Dementia is a brain disease. The memory, language, and learning ability of patients are affected. There are cases of memory deterioration such as forgetting names of relatives or forgetting where their homes are. The symptoms of memory deterioration or forgetfulness is a great burden to the patient and their caregivers, in both psychological and physical aspects of their daily life. According to the World Health Organization (WHO), 60% of dementia patients live in low-to-middle income areas or countries, and there is expected to be about 82 million people with dementia in 2030. According to the Mental Health Rethinking Report 2017, there are 100 thousand dementia patients in Hong Kong, which takes up 10% of all elderly. There is still not a cure for dementia. However, good management of their daily life and appropriate training can be utilized to slow down memory deterioration. One of the non-pharmacological ways that support Dementia patients or elderly is to provide a simple way for them to recognize relatives based on Face Recognition technique.

Nowadays, the employment of face recognition usually relies on the usage of mobile phones or computers with the aid of web pages with JavaScript or binary programs. Mobile phones or computers are both relatively expensive, and are difficult to be used and afforded, especially for dementia patients or elderly in low-income families.

Summarizing the above factors, our study will focus on the development and optimization of a low cost, user-friendly, small, portable and talkable face recognition integrated device for dementia patients or elderly.

4. Methodology

1. Market Research

Hardware:

The integrated device should have the following characteristics:

- Affordable (<HKD 150) while having sufficient processing power for face recognition.
- Standalone - can operate without connecting to external peripherals / devices
- Simple and easy to use - The user can identify a person simply by pointing the camera at the person
- Small in size

We selected ESP32-CAM and ESP32-S as the main hardware platform for the project.

Software:

The library of software should have the following characteristics:

- Small and efficient - can run on a platform with limited processing power
- Optimization of recognition ability can further enhance the face recognition performance of the integrated device

We selected ESP-FACE as the facial recognition library for the project as it is native to the microcontroller.

2. Hardware Integration and Coding

As an ESP32-CAM has an integrated camera, it would be used for capturing images and facial recognition. An ESP32-S connected to a PAM8403 speaker would be used as the satellite speaker.

Before face recognition takes place, personal photos would be enrolled into a micro SDHC card. Each person has an ID No. When turned on, the ESP32-CAM starts capturing images from the camera until it detects a face in the captured image similar to one of the personal photos. Then, it sends the ID No. of that person via Wi-Fi to the ESP32-S. Finally, the PAM8403 would read out the ID No.

5. Expected Results and Impact of research

The prototype has been tested multiple times and the variables (Model types, P-Net score threshold, etc.) have been fine-tuned. Out of 45 photos (15 registered as person A, 15 registered as person B, 15 unregistered), 39 were correctly identified, yielding an accuracy of 86.7%. Although the accuracy has room for improvement, it is still a great tool for dementia patients and the elderly to utilize.

6. Conclusion

In conclusion, we have successfully demonstrated the development of a face recognition prototype for patients of dementia or elderly based on ESP-CAM, ESP32-S, PAM8403 and a speaker. The integrated device allows users to recognize their relatives and voice out their names based on the pre-stored images and WAV files. It has a low price (~HKD 100), small form factor, is standalone and portable with sufficient processing power to support face recognition without the usage of mobile or computer. Simple and single step operation is important for dementia patients or elderly for daily use. Besides, to achieve the highest successful recognition rate, both face recognition model and P-net score threshold have been studied to optimize the device performance.

*** Our project is developed based on our school's previous project and the enhancement is as below:**

Not applicable