Raspberry Pi-based Scanning Translation Device

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- Introduction
- Implementation
- Usage
- Summary

Functions

- 1. Data acquisition and processing
- 2. Optical character recognition
- 3. Word translation and Pronunciation

Hardware components

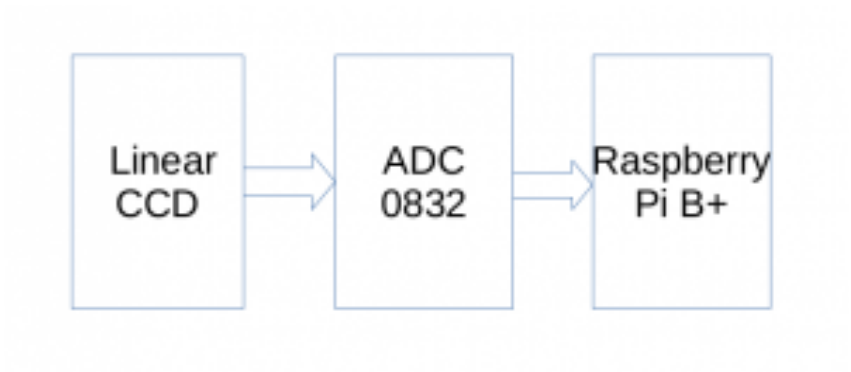

Figure : The main components of the system:Charge-coupled device(CCD), ADC converter, Raspberry Pi.

The diagram of procedure

Figure : Software procedure.

Acquire data from CCD

- Linear CCD: TSL1401RLF, a linear sensor array consists of a 128×1 array of photodiodes, associated charge amplifier circuitry. The CCD is to convert the light intensity to analog voltage.

Convert voltage to digital number

- ADC converter: ADC0832 to convert the output voltage from CCD to digital number.

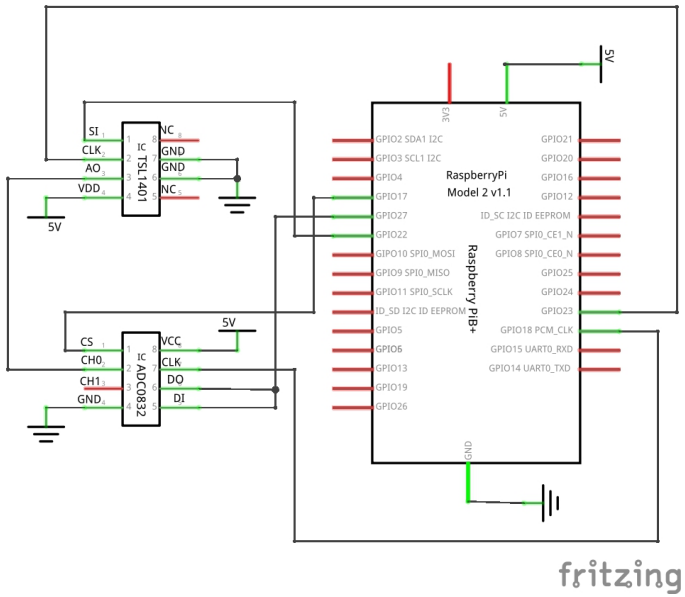

Figure : The schematic diagram of the system.

Binaryzation and data saving

- Save the light intensity into a 1-D array.
- Binaryzation: According to the light intensity and the threshold value, modify the values of the array, which results in new light intensity.
- Output results to a text file.

Creating picture and denoising

- Use Python to crate the picture according to the text file we have gotten.

Figure : The original picture.

Creating picture and denoising

- Denoising: Step 1

Figure : The picture after removing vertical white stripes.

Creating picture and denoising

- Denoising: Step 2

Figure : The picture after removing horizontal black stripes.

Creating picture and denoising

- Denoising: Step 3

Figure : The final picture.

Optical Character Recognition(OCR)

- OCR: The mechanical or electronic conversion of images of typewritten or printed text into machine-encoded text. We use **tesseract**, a command-line OCR engine, in our system.
- Command line usage: **tesseract test.jpg test -l eng**
- Extra: Case conversion, delete useless characters,save to file.

Translation and Pronouncing

- Console Version of StarDict program (SDCV):

```
cat test.txt | tr -cs [:alpha:] "\n" | sdcv | head -n 20 | awk 'NR>2{print}'
```

- espeak (A multi-lingual software speech synthesizer)

```
cat test.txt | espeak
```

Finished product

Figure : The finished product.

Connect to a computer

Figure : The device connected to a computer.

Menu

Figure : The menu. We can choose any operation from the list.

Recognition of words

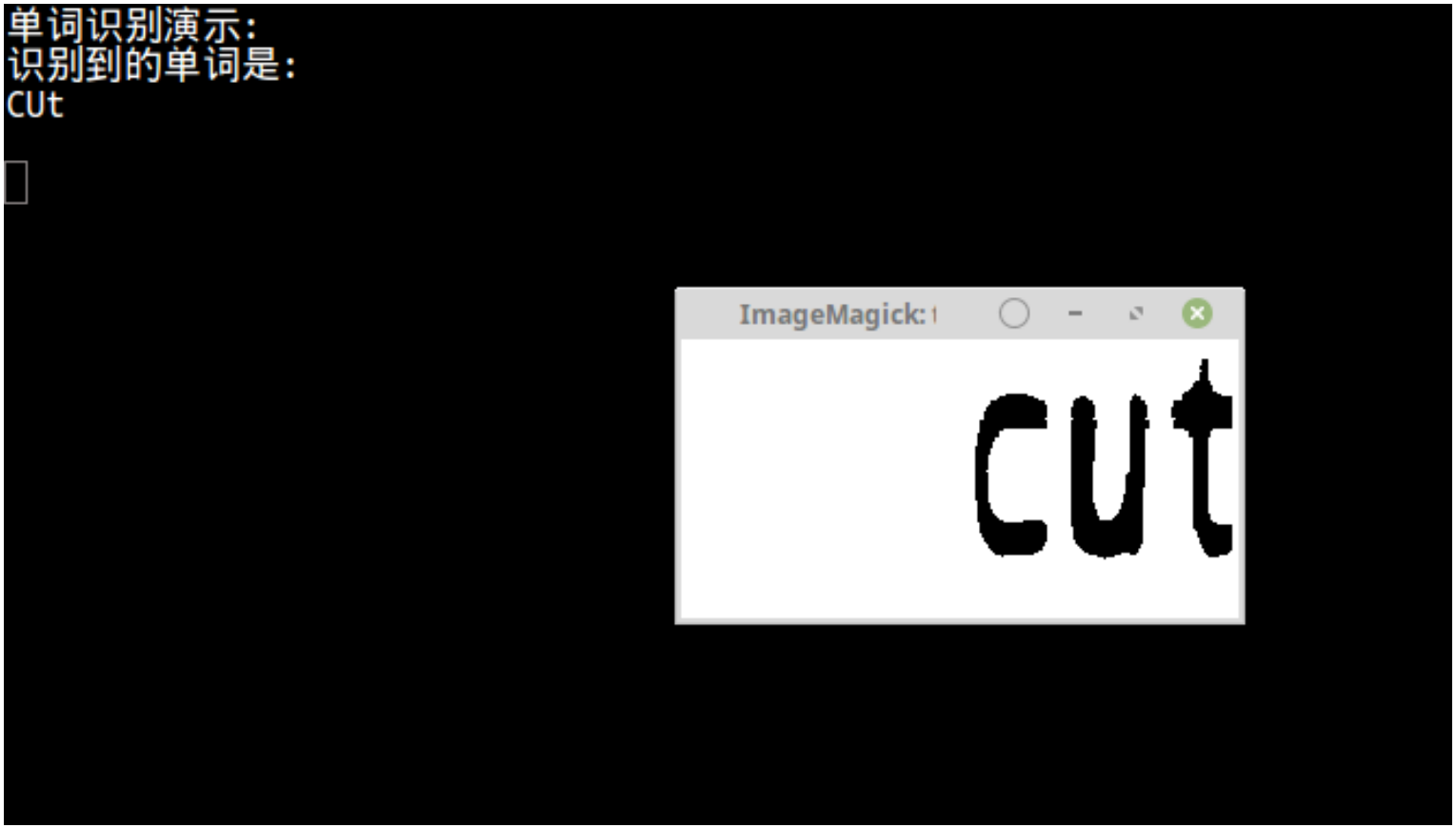

Figure : Recognition of words.

Off-line translation of words

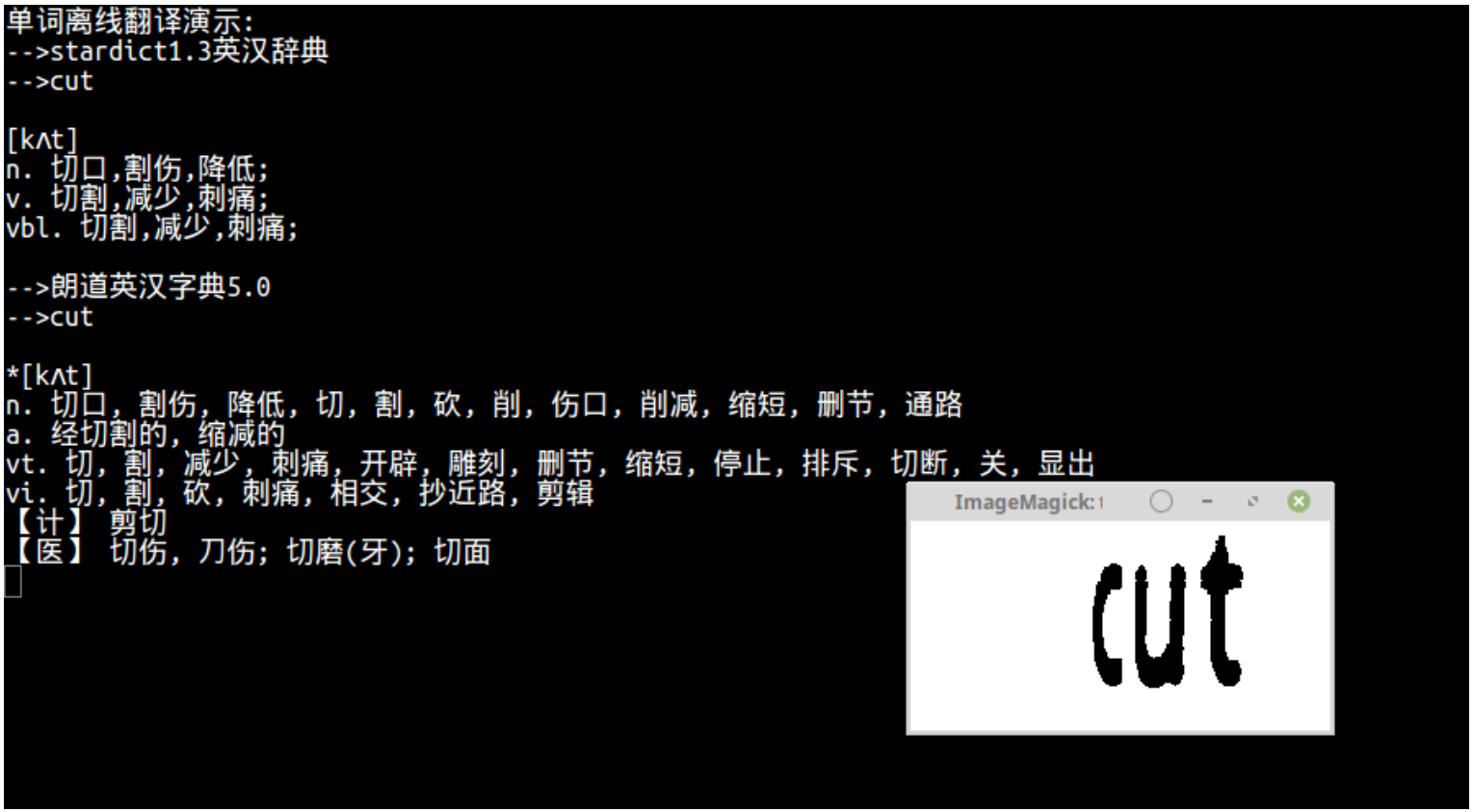

Figure : Off-line translation of words. One can download any dictionary they need.

On-line translation of words

Figure : On-line translation of words. We can use Youdao API to translate words on-line.

Sentence recognition

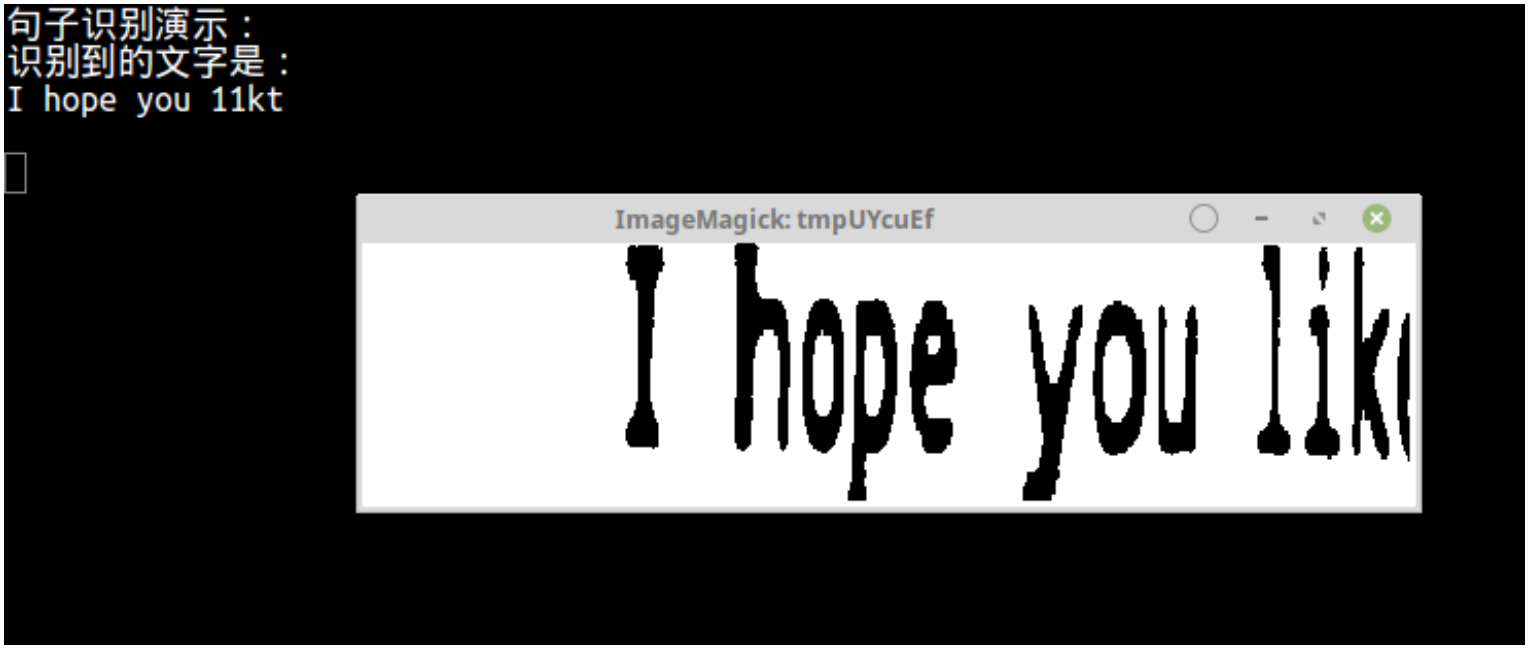

Figure : Sentence recognition test

Sentence translation

Figure : Sentence translation test.

Summary

- The Raspberry Pi-based scanning translation device can acquire and process data from linear CCD, recognize optical characters, translate words and sentences, and covert to audio signal.
- Data acquisition(C), processing(C), denoising(Python) are implemented in this project.
- Auxiliary tools: OCR, sdcv, espeak, Youdao API.

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