Sign Language-Speech Translation Device

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Situation

- Disabled people may possess considerate talent that is often wasted.
- Individuals might come across hindrances due to their disabilities.
- People with disabilities can be more productive if provided the necessary tools.
  - ♦ **What technologies can be integrated to sustain a two way translation device that can convert American Sign Language to speech and vice versa?**

Problems

- Nondisabled individuals are not usually familiar with sign language unless they had an incentive to learn it, such as having a deaf relative or friend.
- Languages need to be understood by both parties in order to establish communication. Deaf and mute people may be unable to engage with society independently; they may require someone who understands sign language to be able to communicate.

Solutions

Optical Fiber Glove-based Sensor

- Optical fiber will be attached to a glove. The light will travel from one end of the fiber to the other.
- The bending of the optical fiber will cause the light to attenuate.
- A charge-coupled device will receive the attenuated light and will convert it to an electrical signal, which is then transmitted to a processer.
- The change of the light intensity relative to the reference light can be correlated to the angular position of the fingers[1].

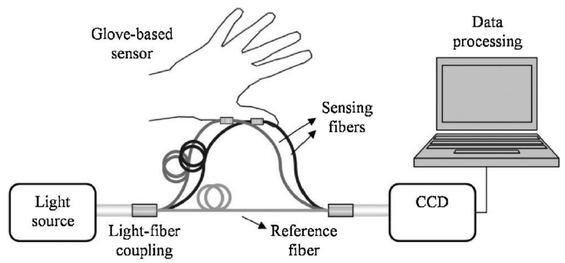

Figure 1: Experimental setup of the optical fiber sensor system [2]

Artificial Intelligence (AI) Facial Expression Recognition

- Different facial expressions result in the change of skin textures by forming wrinkles.
- To interpret wrinkles, the recognition system computes the changes that appear in the upper and lower face areas of the individual.
- There are four main phases in the recognition system:

1- Image Acquisition: a camera captures the frontal view.

2 - Pre-processing: the system will detect the first and last frame of the expression, extract the face area using AI, then convert the face to an elliptical shape in a grey scaled image.

3- Feature Extraction: Gabor Wavelet Method was chosen to represent the facial expressions.

4- Classification & Recognition: The system relates the acquired image to a set of videos that involve common facial expression patterns used in the construction of the sign language sentences[3].

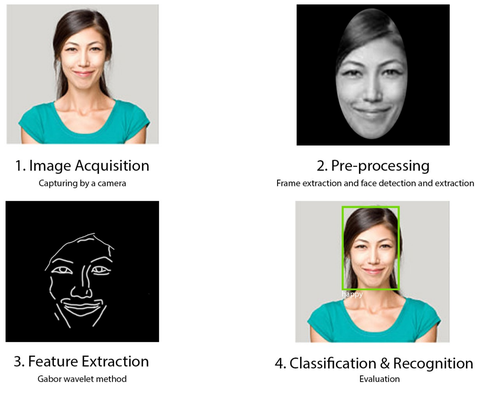

Figure 2: Facial expression recognition stages[4]

Evaluation

The final product is targeting the general consumer. Hence, affordability and convenience are deciding factors in the final solution.

- Glove-based sensor:
  - ♦ Exhausting if used for a long period of time.
- AI facial expression recognition:
  - ♦ Requires calibration and training.
  - ♦ Needs a server, meaning that the product must be connected to the internet.
  - ♦ If no server is used, it will require huge computational processing power and frequent system updates.
- The cost of the software varies.

Table 1: Estimated cost of hardware

Part	Approximated Average Market Price (AED)
Camera with night vision	500
Monitor	400
Processor with server	100
Processor without server	1400
Gloves with optical fiber sensor	500
CCD sensor	100
Audio Speaker	50

References

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