

# Show Me the World (SMW) : An Intelligent Cloud of Things System for Sight-Disabled People

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## BACKGROUND

- According to the Ministry of Health and Welfare, the number of people with visual impairment in South Korea is estimated to be 252,794 in 2018. As the nation enters an aging society rapidly, such number is also increasing.
- Because of their disability, they have to rely on various aids from other people, but it's very difficult for humans to provide such helps all the time. So automated technology is required to help them live independent lives even when other people are not around them.

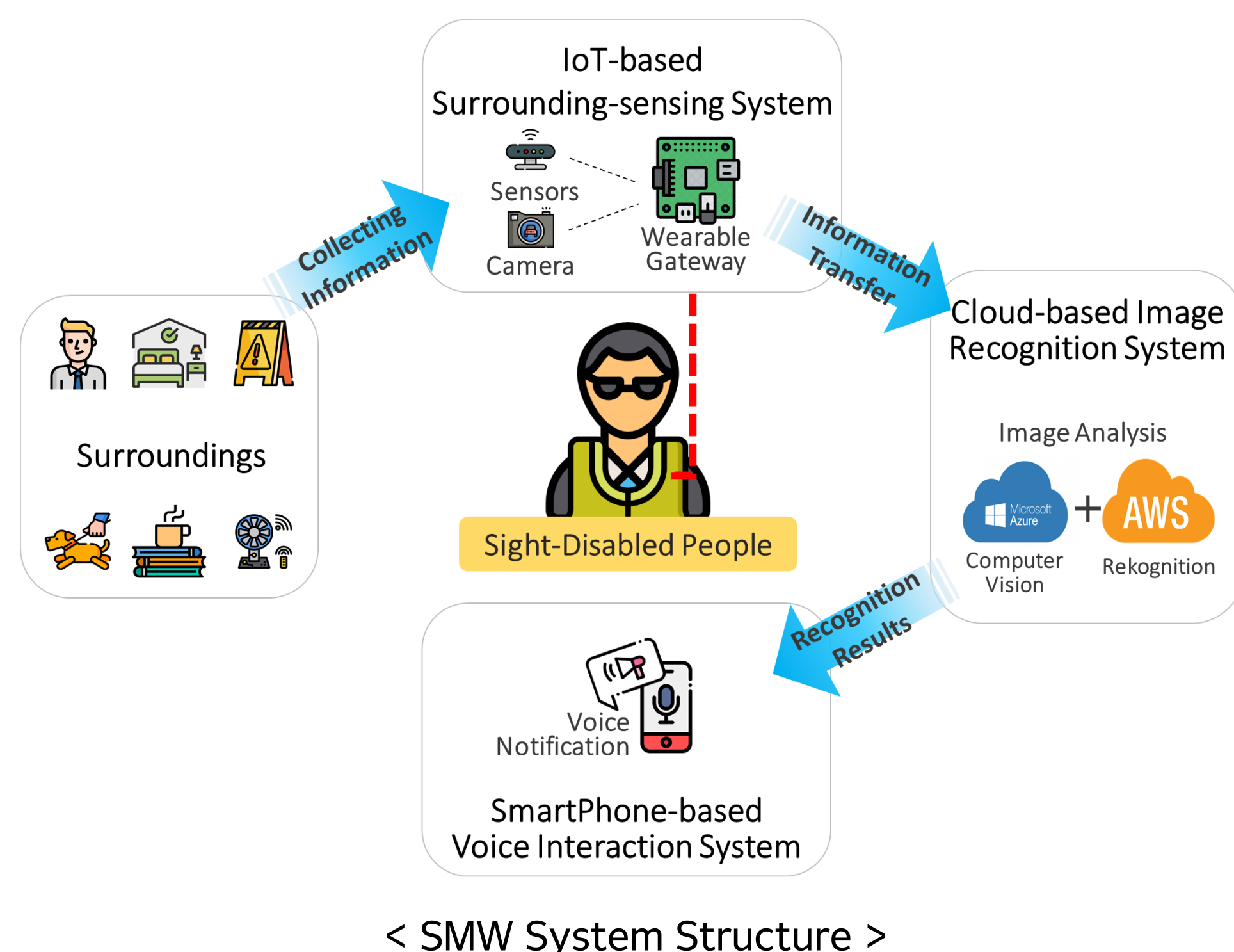
## OBJECTIVE

- For their living and safety, sight-disabled people need to know or understand their surroundings in the world. So we develop a surrounding-aware system to extend their limited vision ability for the better understanding of the world.
- This system aims to expand their social participation and strengthen communication with people around them by providing information about their surroundings.

## APPROACH

- We propose an intelligent cloud of things system which can recognize surrounding objects, spaces and their events.
- SMW uses IoT sensing devices such as a motion detector and a camera to obtain information about the user's surroundings. SMW also employs a wearable gateway to manage those sensing devices.
- SMW supports cloud-based image analysis tools to recognize other people approaching the user and to detect the existence of objects and spaces.

## SYSTEM DESIGN



Major components of SMW are the IoT-based Surrounding-sensing System, the Cloud-based Image Recognition System and the Smartphone-based Voice Interaction System.

## SYSTEM IMPLEMENTATION

### IoT-based Surrounding-Sensing System

- SMW employs three sensors : motion detector(HC-SR501 PIR), ultrasonic sensor(HC-SR04) and Pi camera V2.1.
- The Raspberry Pi-based wearable gateway is implemented to collect data from those three sensors and to interact with data analytics systems in the backend cloud using MQTT.
- The gateway uses Raspberry Pi Zero W as the hardware platform and Johnny-Five and AWS IoT Device JavaScript SDK as the software platform.
- The IoT-based surrounding-sensing system is designed to be event-driven. Major events raised by sensors include user requests, motion detection and obstacle detection.



### Cloud-based Image Recognition System

- This system supports two types of analysis: facial and object analyses. It receives camera images from the IoT-based surrounding-sensing system.
- The facial analysis system recognizes the identities of people appearing in images. In addition, it also analyzes their facial expressions, ages and genders. This service requires the registration of people's photos. It uses the AWS Rekognition cloud service.
- The object analysis system identifies objects and the types of spaces in images. It uses the Microsoft Azure Computer vision service.
- We are currently evaluating the performance of image recognition services in public clouds.



### Smartphone-based Voice Interaction system

- This system is implemented by an Android mobile application.
  - It recognizes the user's voice requests and generates the voice responses from the backend cloud system.
- < Application Interface >

## CONCLUSION AND FUTURE WORK

- Advanced ICT technologies can help sight-disabled people to live independent and safe living. Those technologies can recognize persons and identify objects in surroundings.
- SMW uses advanced IoT, cloud and AI technologies for object identification and facial recognition. It provides such information for sight-disabled people through the smartphone-based voice interaction system.
- In the future, SMW will be extended to support text recognition for the enhanced understanding the world.