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HKU develops multi-purpose IoT device to enable public safety alert

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Stay Alert Stay Healthy (SASH) box is a one-stop service applicable to multiple scenarios like body temperature, face mask monitoring, and circulates COVID-19 information from government open databases



A team led by Dr K.K.Y. Wong and Dr Y.K. Choi at the Department of Computer Science of the University of Hong Kong (HKU) has designed and developed a multi-purpose IoT (Internet of Things) device named Stay Alert Stay Healthy (SASH) box which can be applied in multiple scenarios, providing a one-stop service for the public eager to stay safe during the COVID-19 pandemic.

The SASH box is built on the low-cost Raspberry Pi 4 which provides the computation resources necessary for hosting a lightweight server application as well as analyzing the incoming data from its attached sensors.

It can be used to detect people with abnormal body temperature, whether they are wearing a face mask or not. It can also crawl updated COVID-19 information (e.g., locations of confirmed cases and required self-isolation cases) from government open databases to provide timely references for the general public.

The SASH box is equipped with LEDs, a speaker, and a consumer grade thermal camera, enabling it to alert people to potential risks in the environment. The research team developed application components to enable it to operate as a multi-function device and a low-cost and effective solution for corporate and individual use.

Unlike hybrid thermal camera devices commonly used in the market, the SASH box is equipped with a single thermal camera but not RGB cameras to avoid compromising privacy. The team had collected and analyzed over ten thousand thermal images and trained high-performance machine learning models to detect human faces with and without face masks using the low-resolution (120x160) thermal images captured from the device. AI algorithms have also been developed for modulating detected temperatures to cater for temperature fluctuations in the surrounding environment and the hardware itself.

The SASH box is capable of retrieving up-to-date information, e.g., COVID-19 cases, from online databases. The team is now developing speech recognition and text-to-voice capabilities in the device to provide easy accessibility for elderly people and people who are visually impaired.

Apart from working as a standalone gadget, the SASH box can also serve as a server and host useful applications for connecting devices. Users can easily retrieve information and monitor the environment in which a SASH box is located (e.g., households, classrooms, elderly homes, clinics, bus/taxi cabinets) in real-time by connecting their mobile devices such as smart phones or tablets from a remote site. The design of the SASH box also allows ready scalability so that multiple devices can be connected to form a satellite network to facilitate sharing and monitoring of environmental data.