Enabling gesture-based controls for first responders and K9 units

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Presentation Context

- Wearable devices and gesture recognition
- Wearable devices for humans
- Wearable Devices for Animals
- UAV gesture control
- Conclusions

Wearable devices for humans

Humans use wearables in order to communicate with gestures in the field of action. Two reasons to generate gestures: (a) For Immediate danger and (b) high environmental noise resulting to difficulty for oral commands

- Developing an Artificial Intelligence (AI) smart wearable framework named MORSE (MOvement Recognition for firSt rEsponders)
- This framework tracks the FR arm movements which map them to pre-defined messages or alerts, creating personal awareness messages and notifications

Wearable devices for humans

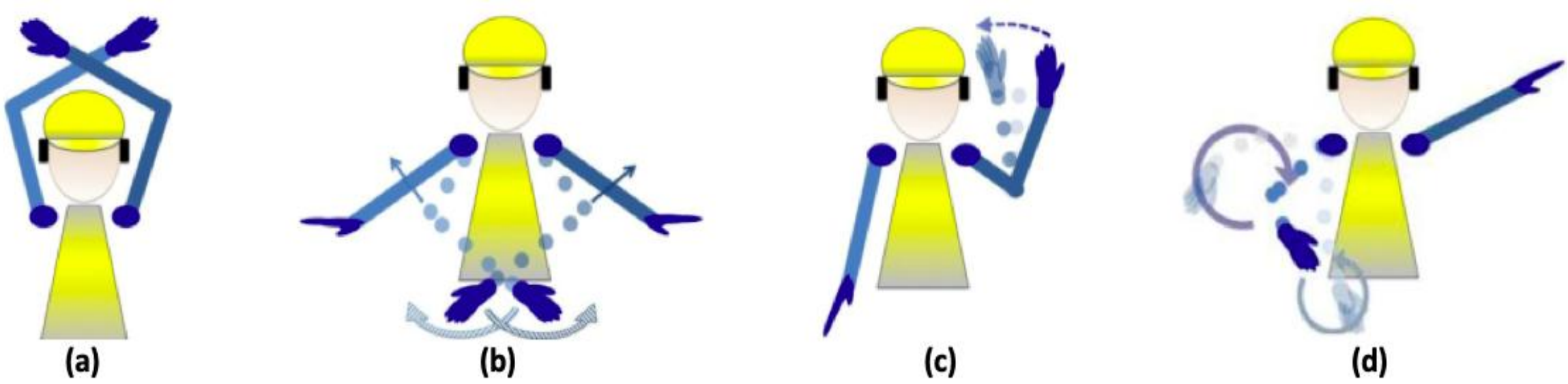


Figure 1. Gestures for recognition by the MORSE component: (a) "Recommend stop", (b) "Emergency contained", (c) "Recommend evacuation", (d) "Fire indication". The “distress” gesture is custom (not displayed here).

Wearable devices for animals

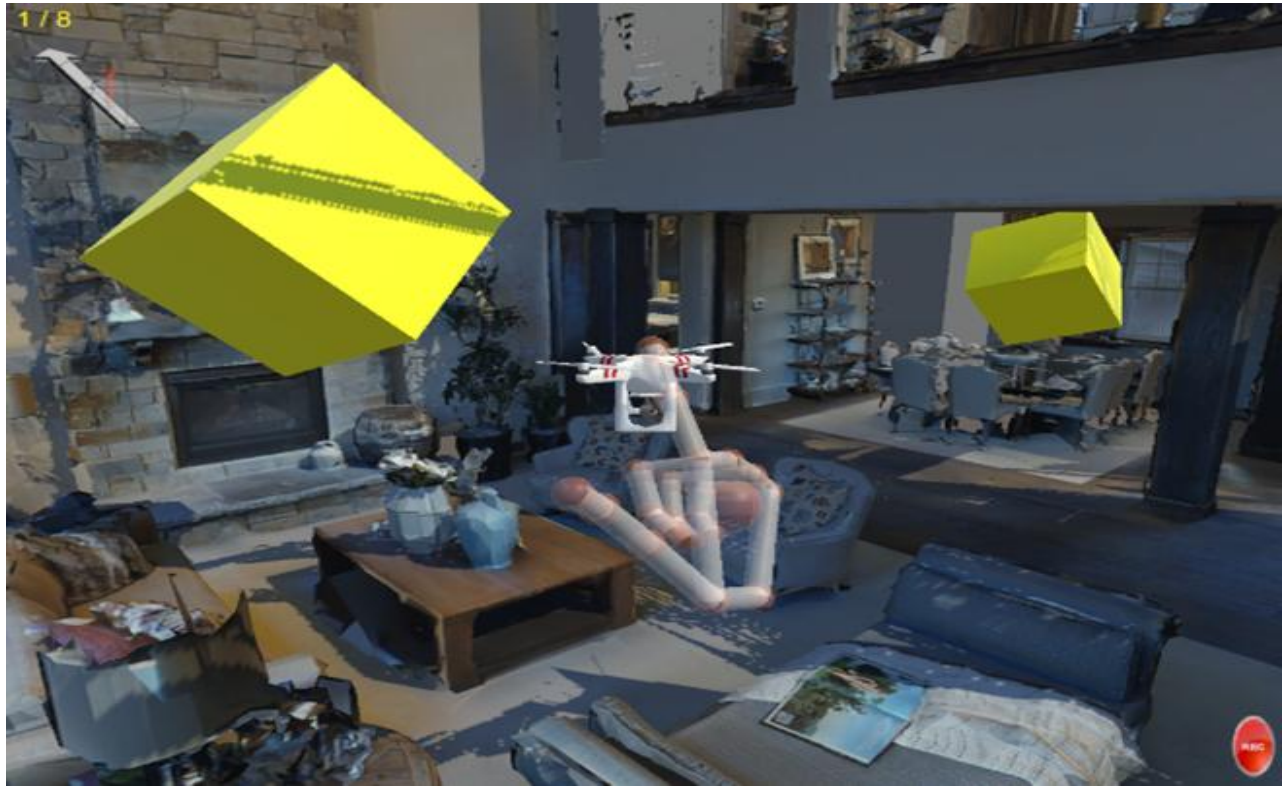
- Wearables designed for K9 units trained for SAR operations in disaster areas
- A neck-mounted, wearable device for animals designed
- An artificial intelligent (AI) algorithm developed to detect barking of the K9 unit and recognize its activity whenever a dog performs a movement that can be translated to a specific action
- This algorithm runs in the computing unit in the dog’s collar and results to the playback of predefined audio messages, by a speaker also embedded in the dog’s collar

Wearable devices for animals

- This apparatus is used for informing a detected victim that help is on the way and provide support until the FR team arrives
- To extend the collar's coverage, a Base Station is also being considered as an intermediate hop node between the collar and access to FASTER's main infrastructure
- The wearable device for animals is also able to broadcast the location of the K9 unit, information that is displayed by a specially designed application that helps the FR to track the dog's movement by displaying its location on a map

UAV gesture control

A vision-based gesture control allowing FRs to fly UAVs in an intuitive and effective manner, without compromising their freedom of movement, safety, and ability to carry out their mission



Controlling a UAV with finger-based gestures in a simulated environment

UAV gesture control

Two different modes of control UAV with simple gestures using a single hand:

1. finger-based control defines a minimal set of gestures that correspond to controlling, one at a time, throttle, yaw and pitch forward
2. while palm-based control directs the UAV to follow the attitude and lateral movement of the user's palm, allowing for all UAV control combinations

UAV gesture control

- The gesture recognition module for both control modes is based on LeapMotion, an infrared hand tracking peripheral
- The two control modes were implemented in a UAV flight simulation environment, gamified with the inclusion of in-game collectible objects which define a path users can try to navigate using gestures
- The resulting application provided the means to evaluate gesture controls a user study, with the participation of both FRs and members of the general populace. **Palm-based** control proved more effective, more intuitive, and easier to learn among a pool of volunteer testers, although finger-based control can be useful for slow and precise maneuvers in tight spaces

UAV gesture control

Pitching forward (left) and backward (right) with the DJI Mavic 2 using palm-based gestures. Note how the UAV follows the attitude of the user's palm.

Conclusions

- Modern wearable devices with significant computing power in small sizes enable the design and implementation of novel technologies for low-overhead messaging, alerting and control for work-overloaded FR teams operating inside a disaster area
- Wearables for humans, a set of pre-selected gestures are used to train an AI-based component called MORSE
- Wearable solutions are being developed for the K9 units for recognizing canine activity
- In terms of control, gesture-based UAV commands can be more intuitive and reduce the clutter of equipment carried by FR pilots on the field

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Thank you for your attention

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