Project No.	Project Title	
2021-01-115	Gesture recognition for drone search and rescue	
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Abstract

As drones' popularity is steadily growing in many applications such as in Search and Rescue (SAR), yet a major limitation in their use still exists as a drone operator is needed within the rescue team. In cases like this, when the operator encounters a person which might be in danger, usually there is no way for them to communicate as there is no input-output system embedded on the drone, furthermore, the connection between the drone and his operator can limit the range which the drone can reach. prior studies proposed a gesture recognition interface to be embedded on the drone for interacting with bystanders. Our project's research goal is to create a human-drone interface based on gestures recognition to provide vital information for the SAR team and aiding the rescue mission.

Our system consists of an Intel RealSense camera (D415) with hand detection and hand tracking model and raspberry pi 4 which the interface is embedded on. The interface consists of questions which the person is presented with and by detecting each answer, a follow up question presented accordingly, after receiving the data, the SAR team gets vital information regarding the injured person's condition, and the drone provides guidance until the arrival of the rescue team. We used python for our algorithm, as our project is a continuation of an old project, several changes have been made to improve the UI/UX, the hand starting position configured so the first detection of the hand will be at the center of the screen and any movement will be accordingly. As the system tracks the hand location at every iteration (function which detects and processes the hand location), in lack of detection, the system will hold until the next successful detection, and thus prevent miss selection of an answer which can be caused by unwanted movement of the drone or the person's hand. Additionally, upon lack of detection, the system will hide the hand icon on the screen for indication.

In addition to the changes in the configuration, we created three possible questions structures, two possible answers, four possible answer and scale question (in range of 1-9), when the person "hover" over an answer, the answer's text increase every iteration, after 20 iteration the answer will be chosen and cover the screen. additionally, a return button has been added to provide the user an option to return to the former question if needed. After examining the best hand recognition formation, we found that an open, slightly spread, formation has the best hand recognition percentages, accordingly, we selected the palm icon which appears on the screen so the user will naturally imitate this action. Additionally, we chose background color while considering visual limitations in the general population due to color blindness. As mentioned before, to extract the most relevant data from the person, we built a story line, with the help of two medical staff personals, which chose the next question based on the current answer, and thus provide the rescue team as much information as possible while not overburdening the injured person.

In conclusion, our work showed that a gesture recognition interface, such as the one we developed, is a promising avenue since it can operate under varied conditions and provide valuable information to the SAR team which can help saving lives.

Keywords: SAR, drone, autonomous, hand-gestures