2022 年英特尔杯大学生电子设计竞赛嵌入式系统专题邀请赛

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作品题目 **（中英文对照）**	觅迹寻踪——基于边缘计算的灾害搜救仿生虫型机器人		

作品简介 （中英文对照，中文限500字以内）	本作品为一个部署在边缘平台端与仿生机器人上的搜救机器人系统。系统可以应用在危险复杂的灾害场景，替代救援人员，提高救援效率与成功率，保障人民群众生命安全。系统由边缘计算端与蠕虫机器人两部分组成 边缘计算端主要由 GNS-V40 与 DE10-nano 平台组成，GNS-V40 上部署了 SLAM 中的 VINS-Fusion 算法，能够利用机器人端回传的深度图像信息与 IMU 信息来实时建图，再根据转换得到的八叉树地图进行智能路径规划，帮助机器人更好地在复杂环境中行进。建图之后，V40 平台通过利用 OPENVINO 部署的基于 AI 深度学习的 TensorFlow 框架下的 yolov5 算法对回传的图像数据进行处理。在图像识别过程中我们通过 OneDNN 库和 OPENVINO 的 AUTO 功能来对运算进行加速和优化，并且通过 OPENCL 将 DE10-Nano 平台与 V40 主机在边缘节点进行并行运算，再次加速深度学习运算的速度，从而加快救援速度和成功率。 机器人端由蠕虫机器人的机械结构，嵌入式模块和传感器组成。机械结构和步态算法参考蠕虫等生物外形，保证了机器人在复杂环境下的稳定运动。机器人上搭载了 Intel Realsense D435i 深度摄像头与毫米波雷达，摄像头进行视觉深度信号与 IMU 信号采集，而毫米波雷达具有较强的穿透性，可以在地震、塌方等有阻隔场合下检测呼吸心跳信号，再通过高性能天线将各种信号连同机器人的实时位置发回边缘计算端。 This project aims to design and develop a search and rescue robot system deployed on the edge platform end with a bionic robot. The system can be applied in dangerous and complex disaster scenarios to replace rescue personnel, improve rescue efficiency and success rate, and protect people's lives. The system consists of two parts: the edge computing side and the worm robot The edge computing side mainly consists of GNS-V40 and DE10-nano platform. The VINS-Fusion algorithm in SLAM is deployed on GNS-V40, which can use the depth image information and IMU information returned from the robot side to build a map in real time, and then perform intelligent path planning based on the converted octree map to help the robot better travel in complex environments. After building the map, the V40 platform processes the returned image data by using the yolov5 algorithm under the TensorFlow framework based on AI deep learning deployed by OPENVINO. During the image recognition process we use the OneDNN library and OPENVINO's AUTO function to accelerate and optimize the operation, and parallelize the DE10-Nano platform with the V40 host at the edge node through OPENCL to accelerate the speed of deep learning operation again, thus speeding up the rescue speed and success rate. The robot side consists of the mechanical structure of the worm robot, embedded modules and sensors. The mechanical structure and gait algorithm refer to the worm and other biological shapes to ensure the stable movement of the robot in complex environments. The robot is equipped with Intel Realsense D435i depth camera and millimeter wave radar. The camera performs visual depth signal and IMU signal acquisition, while the millimeter wave radar has strong penetration and can detect breathing and heartbeat signals in blocked occasions such as earthquakes and landslides, and then sends various signals back to the edge computing end along with the real-time location of the robot through the high-performance antenna.