Development Toward Intelligent Homecare-assisted Robot with IoT

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Abstract—The use of Internet-of-Things (IoT) for integration in the service robot design has become a field of interest today. This study aims to demonstrate the viability of IoT-connected approach in a homecare service with intensive task such as navigation capability and situation awareness by using depth-images and laser scanning. From the demonstration, the proposed home service robot configuration with IoT communication can potentially provide interactive and delicate homecare quality.

I. INTRODUCTION

The application of Internet-of-Things (IoT) is an emerging technique for robotics, especially for service robots as provided with multiple tasks for indoor environment. The indoor service robot can interact and interpret the environment correctly while processing the various kinds of information from IoT sensors [1, 2]. The main advantages including dynamic scalability and better resource utilization make home IoT scheme compelling and are extremely useful in home service robotics [3]. In this way, the constant incorporation of new computation algorithms can be executed for robots as soon as they are implemented. Consequently, the integration of IoT networking is expected to be widespread in the forthcoming years in the service robot field, so that the robot can supplement information collected from intelligent environments, monitor user’s health and daily activities, cooperate with other home appliances, and so on. This paper presents a prototype, running over a computer-based mobile robot using the information extracted from the on-board depth image sensor and the laser scanner. Besides, with the aid of IoT communication, the robot can carry out the homecare tasks in a more humanized manner and provide effective living-care service via physical human-robot interaction.

II. METHODS AND RESULTS

The developed robot currently functions the navigation and situation awareness in the home environment. With the connection of IoT network computing, the utilized data and programs can be upgraded according to changed homecare service. Fig. 1 illustrates the diagram of the implemented home robot with the navigation control and activity recognition of users. The robot carries a depth camera which sends frames to the home cloud server and processes the 3D point clouds (3DPCs) to recognize the current user’s activity. The 3DPCs obtained from the frame pair can be used for robot to perceive the current situation and activate the corresponding homecare service. For example, once the family members are detected in the living room, the robot will receive the navigation command and move to the desired location under the scheduling of homecare task (e.g., cleaning, monitoring).

To be aware of the user status, the pose recognition based on head and body part is applied so that the several human activities such as sitting, walking, and fall can be identified by the robot or vision sensors which are setup in the home. The home cloud server, hereafter, can process the activity data and arrange the required service for the robot. The intelligent navigation unit in the robot including localization, path planning, and safety behavior control is also responsible for communicating with home IoT networking to drive the robot to assist and support humans. It is worthy to mention that, through the connection ability with IoT network and home cloud server, the robot can update the map data and navigate itself autonomously using lightweight algorithms under the limited on-board resources.

III. CONCLUSION

This paper presents a development of homecare-assisted robot with the integration of home IoT networking. The further study is undergoing to target a more intuitive human-robot interaction by means of multimodal interface design such as speech and gestures.

REFERENCES