Smart Appliance Identification using A Smartphone Camera

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1 INTRODUCTION

Many smart appliances are being deployed with the trend of Internet of Things to enrich the functionality of our physical environment. However, identifying and interacting with them become more complicated because of the large number, as well as their proprietary control protocols and applications.

Existing approaches to identify an appliance require either cumbersome identification process or large deployment overhead [1]. Our system allows users to identify an appliance by capturing an image of it using a smartphone camera. The identification is done by localizing the image in a pre-built 3D model on the server. In comparison to image matching based approaches [2], image localization utilizes more memory to improve both speed and accuracy [4].

2 SYSTEM OVERVIEW

Figure 1 shows our system overview, which consists of two main phases to operate: an offline *Modeling Phase* and an online *Identification Phase*. The modeling phase is an one-time effort that creates a 3D model of building, which is used by the online identification phase that recognizes appliances in a query image.

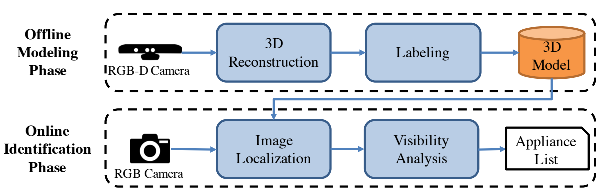

Figure 1: System Architecture.

In the offline phase, we first capture a video using an RGB-D camera (e.g., Microsoft Kinect) around the appliances to construct a 3D point cloud. Any 3D reconstruction system can be used, such as RTABMap [3] or bundler [5]. With the 3D point cloud, we label 3D points of all appliances using our labeling tool.

In the online phase, a user captures a query image of any appliance she wants to control using our mobile app, as shown in Figure 2. The query image is sent to our server and localized against the 3D point cloud. With the image location, we can project labeled appliance points onto the image plan to identify the appliance closest to the image center. With the identified appliance, we can talk to the building management system for interactions.

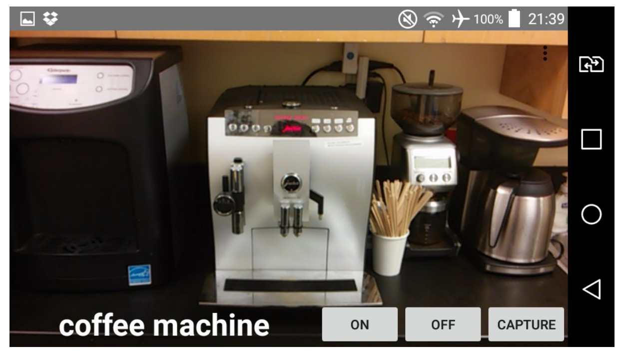

Figure 2: Android Application.

3 DEMO DESCRIPTION

We plan to set up 3 smart appliances in a miniature office space on our booth: a fan, a lamp, and a space heater. Before the demo session, we build a 3D model around the appliances, and label them. During the demo session, we distribute Android phones with our app on it. Visitors can capture a picture from any angle and distance to identify a particular appliance among the three. After identifying an appliance, they can control the appliance using an overlaid control interface. In addition, we will show how a 3D model can be easily built and labeled. This demo requires power and Internet connection.

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