

MR-FoodCoach: Enabling a convenience store on mixed reality space for healthier purchases

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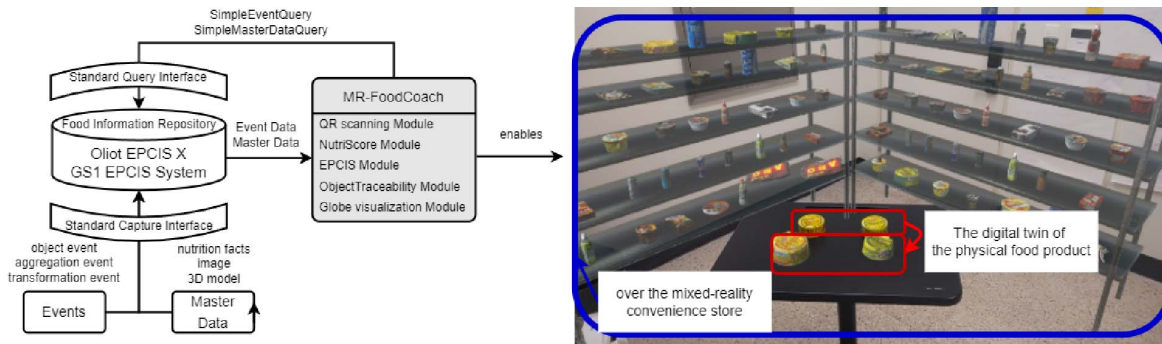
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Figure 1: A mixed-reality-enabled convenience store, MR-FoodCoach, promotes the selection of healthier and safer food products.

ABSTRACT

We study ways to improve the shopping experience in a mixed-reality environment. In the demonstration, the participants would experience the concept of mixed-reality-enabled convenience stores for healthier purchases. Over Microsoft HoloLens2, anywhere can become a convenience store where physical and virtual foods can be recognized and deployed. The prototype would help customers with healthier purchases. For each product, its nutrition facts and even an intuitive metric, NutriScore, are available for customers. Furthermore, the visualization of its footsteps in supply chains over the globe would guarantee transparency of its origin. GS1 EPCIS standard and temporal reachability computation enable the demonstration.

Index Terms: Human-centered computing—Human computer interaction (HCI)—Interaction paradigms—Mixed / augmented reality; Applied computing—Life and medical sciences—Consumer health—Information systems—Information systems applications—Spatial-temporal systems

1 INTRODUCTION

The mixed-reality technologies have provided benefits for various applications [6]. For example, tourists can sight-see ruins in historical sites, and embodied interactions are helpful for students. We study ways to improve the shopping experience in a mixed-reality environment. We expect that the mixed-reality technologies would enable healthier purchases. With mixed-reality gadgets, anywhere can become a convenience store by embracing physical and virtual spaces unlike existing studies having only focused on virtual spaces [1]. Physical food products can be recognized by image processing, barcodes, QR-codes, RFID tags, etc., while virtual food

products from various online sources can be integrated and visualized over the gadgets. Customers would reap benefits from abundant information such as raw nutrition facts, intuitive metrics, footsteps in supply chains, etc.

There are challenges in implementing mixed-reality-enabled convenience stores. One challenge results from data quality. Even the largest food dataset, Open Food Facts¹, cannot inevitably cover all the food products worldwide and thus suffers from incomplete data. We apply a de-facto standard for information systems for supply chains and logistics, GS1 EPCIS². Another challenge results from object traceability, a problem closely related to the computation of temporal reachability.

Figure 1 shows an overview of MR-FoodCoach. In the demonstration, the participants would wear a mixed-reality device, Microsoft HoloLens2. The device runs the MR-FoodCoach application developed with Mixed Reality Toolkit 2. The application works with our GS1 EPCIS implementation, Oliot EPCIS X³ as a food information repository. The food information consists of events and master-data where an event describes a crucial moment for a food at a specific moment (e.g., observation), while master-data holds the data that is not prone to change in its lifecycle (e.g., nutrition facts). The food information is stored and queried via standard interfaces so that users can consume it in a common way.

MR-FoodCoach contains several modules. The QR scanning module recognizes QR-attached physical products. The NutriScore module computes an intuitive indicator for healthier foods. The globe visualization module visualizes the history of a specific food product on a Unity asset, Globe - Data Visualizer⁴. The module works with the EPCIS module to interact with the Food Information Repository and with the ObjectTraceability module to analyze the history of a specific food product.

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¹Open Food Facts, Web Page, <https://world.openfoodfacts.org/>

²GS1 EPCIS, Web Page, <https://www.gs1.org/standards/epcis>

³Oliot EPCIS X, Web Page, <http://dfpl.sejong.ac.kr/epcis/home/index.html>

⁴Globe - Data Visualizer, Web Page, <https://assetstore.unity.com/packages/templates/systems/globe-data-visualizer-80008>

2 DEMONSTRATION

In the following demonstration, the participants would experience the advantages (i.e., easy accessibility and food safety) of a mixed-reality-enabled convenience store with three steps.

2.1 Step 1: Exploring a convenience store embracing physical and virtual worlds

In this step, the ISMAR 2022 participants would wear Microsoft HoloLens2 running the MR-FoodCoach application. The immediate vicinity becomes a convenience store, with the application embracing physical and virtual spaces. The application can recognize physical food products through QR-code and generate their digital twins with 3D models scanned by Qlone 3D scanner over iPhone 13 MAX and nutrition facts by interacting with the server. In addition, the participants could summon digital shelves with various templates (e.g., category). All the summoned food products can be reorganized and manipulated by hand/eye-based interactions.

2.2 Step 2: Selecting healthier foods through easily accessible information

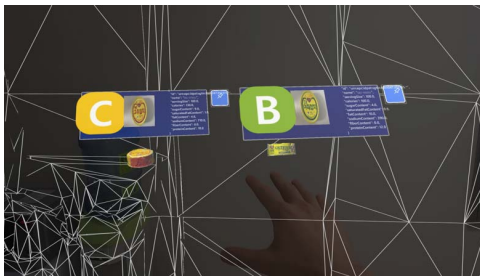


Figure 2: The canned tuna on the right side is healthier than the left one: MR-FoodCoach promotes the selection of healthier food products through easily accessible information

In step 2, we show that MR-FoodCoach guides users to select healthier foods through easily accessible information. The participants can open a menu collection by clicking one of the food products. The left menu in the collection would show the 2D image, nutrition facts, and NutriScore [4] of the selected food. NutriScore is a handy A-E label that enables the comparison of healthiness at a glance, where A indicates the most healthy food within the same assortment. With the application, it is not necessary to gaze at nutrition facts attached to a physical product and calculate the level of healthiness as shown in Figure 2.

Technical Highlight: MR-FoodCoach adopts GS1 EPCIS standard and leverages its implementation, Oliot EPCIS X. We collected hundreds of food product datasets, including nutrition facts, images, and 3D models in a standardized way. The data is publicly available through the standard query interface.

2.3 Step 3: Avoiding foods exposed to hazardous environments

Contaminated food yields 600 million cases of food-borne illness and 420,000 deaths every year [5]. Foods with ingredients exposed to chemical contamination or virus (e.g., norovirus) should be discarded as soon as the contamination is found. Tracking the history of foods would free users from food contamination. In step 3, the ISMAR 2022 participants click the right menu in the menu collection to enjoy the visualization of object traceability (Figure 3).

Technical Highlight: The challenges in object traceability mainly result from the transformation and aggregation of everyday-objects that yield recursive queries between applications and servers [2]; the

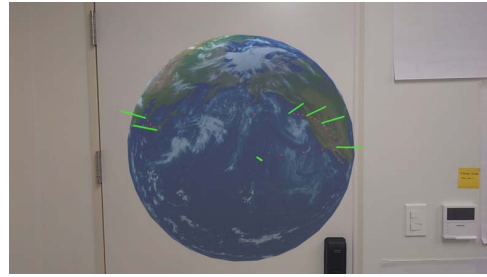


Figure 3: The interactive globe over mixed-reality visualizes the footsteps of the selected canned tuna.

computation of object traceability is closely related to the temporal reachability problem in temporal networks [3]. To alleviate the burden of the resource-constraint device (HoloLens2), Oliot EPCIS X computes, instead of the device, the temporal reachability over supply chains and provides the temporal paths and geo-coordination for the visualization. For the demonstration, we capture synthetic EPCIS events for several food products that are visualized as footsteps over a 3D globe.

3 CONCLUSIONS AND FUTURE WORKS

The demonstration shows a concept of mixed-reality-enabled convenience stores embracing physical and virtual worlds to guarantee easily accessible information and food safety. One of the future directions is to investigate an approach to visualize how information is diffused over time. In a circumstance where there are two groups of temporal graph analyses (temporal evolution and temporal information diffusion), like a dimensionality reduction technique is applied for reducing snapshots to points in the former [7], we expect there is an effective and efficient approach to the latter.

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