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| 1. Invention | | | | | | | | | | |
| Invention Title:  Enhanced restaurant experience using computer vision | | | | | | | | | | |
| Lab:  CSIC | | Project Name:  Computer Vision | | | | | Project Code (PLM):  RDR0116ZZ-10PG | | | Cost Center:  C3400423 |
| Project Related HQ Person: | | Related HQ Project (if applicable): | | | | | Project Funding HQ Business Unit: | | | |
| Check if urgent: | | Reason: New feature for upcoming product (AR Menu/ GS8) | | | | | | | | |
| 2. Inventor(s) | | | | | | | | | | |
| Full Name  (Last, First MI) | Home Address  (Street Address, City, State, Zip) | | | | | Work Phone &  Email Address | | Citizenship  (Country) | Empl. Status  (Employee/Dispatcher/Contractor) | |
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| 3. Conception of the Invention | | | | | | | | | | |
| a. Was the invention conceived in the United States? | | | | | If not, in what country was the invention conceived? | | | | | |
| b. Date of first written description:  December, 2015 | | | | | Where can this description be found?  SRA / Mountain View (confluence, ARCore space) | | | | | |
| c. Was invention developed using non-Samsung (e.g., university, government) funding? | | | | | If so, what was the source of funding? | | | | | |
| 4. Construction of the Invention | | | | | | | | | | |
| Was a model or prototype made? | | | If so, when was it constructed and where can it be found?  December 2015, SRA / Mountain View (stash server, Arrow/exp repo) | | | | | | | |
| 5. Use of the Invention | | | | | | | | | | |
| Are there specific plans for its use? | | | If so, when was it (or will it be) used?  2017 | | | | | | | |
| For what purpose will it be used? (e.g., project/product name, industry standard)  New feature for Samsung Pay and S-Health. | | | | | | | | | | |
| 6. Disclosure/Sale of Invention (either past or near future) | | | | | | | | | | |
| a-1. Has invention been (or will it be) disclosed to others outside Samsung? | | | | If so, to whom was it (or will it be) disclosed? (e.g., vendor, conference, standards body)  Foursquare, Wikitude GmbH, participating restaurants | | | | | | |
| If so, when was it (or will it be) disclosed? | | | | | | | | | | |
| a-2. Was the disclosure or will the disclosure be made under a Non-Disclosure Agreement? | | | | If so, when was it (or will it be) executed? 2Q/3Q 2016 | | | | | | |
| b. Has Samsung actually sold (or will it be selling) any product using the invention? | | | | If so, when was (or will) the product be first sold?  1Q 2017 | | | | | | |

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| 7. Related Invention Disclosures or Patent Applications By Inventors (briefly explain relation) |
| “Guided phone positional tracking using computer vision.” – describes a use of Augmented Reality to help Samsung Pay users. |
| 8. Invention Overview |
| **a) Background of Invention**  Augmented Reality (AR) refers to mixing computer-generated imagery (CGI) into the observable visual field of the user. The two primary methods of augmenting a view of reality are: 1) using head-up displays to project the CGI on to a partially transparent display surface such as glasses or goggles worn by the user, 2) using conventional display surfaces, such as tablet or smartphone screens, to show a live camera view combined with CGI. AR technology can be used in many areas including entertainment, education, health, industrial applications, and so on. This invention describes an enhanced restaurant dining experience utilizing AR technology. |
| **b) Summary of Invention**  This invention covers the following three key features:   1. Presenting an augmented restaurant menu to the user. 2. Linking items from the augmented menu to mobile payment software for purchase. 3. Linking items from the augmented menu to mobile health software (e.g., for calorie tracking or nutrition analysis). |
| The system architecture is shown below: |

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| **c) Primary Value of Invention to Samsung** |

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| **d) Closest Existing Technologies to Invention**  A common use case for augmented reality is to provide a virtual content layer that augments traditional printed content – for example magazine ads or movie posters which, when viewed by the AR application, reveal additional information. An augmented menu is an example of such “information overlay”, however our invention goes beyond information overlay. The core idea is to leverage real-world context, which is constructed and visualized via the augmentation, as an input to services such as payment and health. |
| **e) New Features of Invention**  This invention contains a number of innovations around software and techniques including:   * Using computer vision techniques to identify restaurant menu items and:   + augment with personalized content   + provide personalized nutrition/health recommendations   + import from / export to a payment application or service   + import from / export to a health / fitness application or service |
| **f) Advantages/Disadvantages of Invention**  This invention has the following advantages:   * Provides in-context viewing of enhanced restaurant menu data (e.g., location, descriptions, nutrition, photos). * Provides personalization opportunities (e.g., filtering, highlighting based on user preferences). * Streamlines adding meal intake data to applications such as S-Health. * Streamlines uses of coupons / promotions in applications such as Samsung Pay. |

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| 9. Detailed Description of Invention |
| **Augmenting physical menu with personalized content**      The first step to accurately identify the menu items of a restaurant is to correctly locate the restaurant where the user is at. Multiple approaches can be used to locate the restaurant, including GPS, wireless, and reading NFC tags provided by the restaurant. Once the restaurant is located, a notification is presented on user’s device to inform user that an AR enhanced experience is available at this restaurant. Figure 1 shows an example of such a notification on restaurant identification.   |  |  | | --- | --- | | images/Asset%201.png |  |   Figure 1. Restaurant identification  Once the user is seated at the restaurant, he/she can start using the AR enhanced app. The application shows a camera view of the physical menu, and the user can enable personalized augmentation by selecting a certain menu item from the camera view. Figure 2 illustrates a user browsing a restaurant menu from the camera view and preparing to make the selection. User can simply draw a circle around a certain menu item in the camera view to select it, as shown in Figure 3. After the user finishes selection, an augmented menu with personalized content is overlaid on the menu item in camera view, see Figure 4.    Figure 2. User browsing menu from camera view    Figure 3. User selecting menu item    Figure 4. Augmented menu content with personalized recommendations  Figure 5 shows an example format of augmented menu overlay. The augmented menu item includes one or more pictures of the dish, nutrition facts and ingredients of the dish, as well as personalized contents.  images/Asset%204.png  Figure 5. Augmented menu item overlay  Figure 6 shows an example user interface for entering user’s dietary preferences. A user can select food he/she prefers and avoids, as well as set up warnings on food allergies.    Figure 6. User inteface for dietary preference  **Providing personalized nutrition/health recommendations**  User-provided dietary preferences is one of the sources of information that can be used to provide personalized recommendations such as nutrition suggestions and health advices. More sources can be used in addition to generate customized recommendations for each individual user, including:   * Demographic profile: age, gender, ethic group, nationality, region of residence, etc. * Dietary preferences: vegetarian, vegan, diary-free, low-fat, low-calorie, low-carbohydrate, etc. * Health condition: diabetes, obesity, heart desease, etc. * Physical activities: time and frequency of sitting, standing, sport activities, etc. * Routines: restaurant visiting patterns, grocery shopping frequency, dietary intake history, etc. * Software information: calendar, social network, etc. * Other: weather, sickness, etc.   Information above can be not only obtained explicitly from user’s input, but also collected and inferred implicitly using various activity trackers and contextual analyzers on user’s mobile device. Based on such personalized recommendation, each individual user will see different information even if she/he has the same profile or health condition as others.  **Health/Fitness application integration**  This invention also features integration with Health/Fitness applications such as S-Health. This includes importing user profile and preferences from an health/fitness application, and exporting meal intake information to an health/fitness application or service. Figure 7 shows an example of integrating the AR restaurant experience application with an health application and automatically record the time, total calories, and other statistics of a meal.  images/Asset%2010.png  Figure 7. Integration with health/fitness applications      **Payment application integration**  Another feature of this invention is integrating the AR restaurant experience application with payment/discount applications. Figure 8 shows an example of such integration with Samsung Pay. From the augmented menu view, the user can tap the “order” button to electronically order one or more items from the restaurant. Once the order is sent, the Samsung Pay application will be opened and provides the user with different payment methods such as credit card and/or restaurant gift cards. After the payment went through, a bill will be recorded within the payment app. This feature simplifies the ordering and payment process and promotes usage of other Samsung apps.    Figure 8. Payment application integration      **System Overview**     * Physical Menu – this is a printed menu used in one of the participating restaurants. * Camera Input – a series of camera images, some of which may contain views of the physical menu. * Sensor Input – provides GPS, accelerometer, gyroscope and other inputs from sensors on the mobile device. * Pose Tracking – provides position and orientation of the mobile device w.r.t. the physical menu. * OCR (Optical Character Recognition) – converts printed text in regions of the camera images to machine-encoded text. * Item Reconciliation – matches OCR text and estimates of visible menu regions with a digital representation of a menu of a known restaurant, the result is a series of menu items and information about where they occur on the menu. * Item Enhancement – provides graphical/visual elements that augments the information on the physical menu and is placed in the camera view frame. |
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| 10. Alternative Embodiments of Invention |
| There are no known alternatives to this embodiment. |

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| 11. Signatures | | | | |
| **a) Inventors**  I/we, the undersigned, are the sole and original inventor(s) of this invention. | | | | |
| Inventor 1 | Date |  | Inventor 2 | Date |
| Inventor 3 | Date |  | Inventor 4 | Date |
| **b) Witnesses**  I/we, the undersigned, have reviewed this invention disclosure and understand its contents. | | | | |
| Witness 1 | Date |  | Witness 2 | Date |
| **c) SRA-SV Management**  We, the undersigned, have reviewed and approve of this invention disclosure as to its scope and completeness. | | | | |
| Project Lead | Date |  | Lab Manager | Date |

Inventors (and witnesses) should initial and date each page of Invention Disclosure and any attachments. Submit completed Invention Disclosure to SRA-SV Patent Dept. If you have any questions, please contact Jade Sche at (408) 544-5945 ([j.sche@samsung.com](mailto:j.sche@samsung.com)), Jasenka Eminovic at (408) 544-5603 ([j.eminovic@samsung.com](mailto:j.eminovic@samsung.com)), Louisa Toy at (408) 544-5083 ([louisa.toy@samsung.com](mailto:louisa.toy@samsung.com)), Ruke Wang at (408) 544-5615 ([ruke.wang@samsung.com](mailto:ruke.wang@samsung.com)) or Justin Chang at (408) 544-5677 (Justin.chang@samsung.com).