

IRL

Innovative Retail
Laboratory



Innovative Retail Technologies Seminar 2018

Projects (V 1.0)

Here, you will find the
project number & name

Here, you will find information about the **customer** and the **group size** for this project. You don't need a group to register for the seminar, as we might match you up with other interested students.

In addition, **recommended skills** (i.e., it would be good, if you have these) and the **technology that should be used** will be denoted here.

Finally, we give an indication, whether or not **physical prototyping of components** will be necessary in this project.

Here, you will find a short description of the project.

Here, we provide you with a link to a GoogleDoc showing **the specific must-have features** and the **grading scheme** for this project. Sometimes, **additional information** to the project are given here as well.

Project 1: IRL/UMTL-Teaser Tool

Customer: Pascal Lessel

Group size: Min: 3, Max: 4

Recommended skills:

- Experience with web development
- Good aesthetic understanding/UI skills

Technology that should be used:

- Node.js
- SQL-based database
- AngularJS

Is prototyping of physical components necessary: No.

This project has the goal to develop a **web-based application** that has three main views:

IRL-view: A map of the Innovative Retail Laboratory area is shown. On it, the exhibits are highlighted (e.g., as icons) and user can click on it to get a short information about its purpose and can see visual material (e.g., videos) that are shown in a show reel. The idea is that users that have no access to the exhibition area, can get an overview on what we are doing.

UMTL-view: A tag-cloud is shown representing the different research areas at UMTL. A user should be able to click on a tag in the cloud to get more information to it (i.e., who is working on these topics, which focus these people have, latest publications). Furthermore, also visual material should be shown. The idea is to have a discussion platform with our visitors, about the research we are doing.

IRL/UMTL demo mode: In both scenarios, if no user interaction happened, the system should activate a demo mode - a mode in which the display encourages people to start interacting with the system and teases its contents automatically.

Please note, the IRL-view will only happen on a stele; while the UMTL-view is most likely only shown on a normal screen or tablet. The data for a) and b) can be retrieved by an API. This projects offers a high potential for developing an appealing user experience and will be graded in this respect.



For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 2: Demonstration of Shifty - A Novel Haptic VR Controller

Customer: André Zenner

Group size: Min: 2, Max: 4

Recommended skills:

- Experience in VR-development in Unity3D / C#
- Experience in working with 3D scenes
- Good aesthetic understanding
- Basic understanding of VR interactions

Technology that should be used:

- Unity3D
- HTC Vive
(SteamVR Controllers & Trackers)

Is prototyping of physical components necessary: No.

The goal of this project is to develop an **interactive Virtual Reality (VR)** experience with Unity. The experience is supposed to showcase the capabilities of [Shifty](#), one of the haptic VR controller prototypes developed at the UMTL.



By shifting an internal mass, **Shifty can change the weight and inertia** felt by the user during VR interaction. When combined with corresponding visualizations in VR, this haptic effect can **convey the feeling of virtual object weights, shapes, and materials**.

In the VR experience developed in this project, users should be able to interact with the *Shifty* controller in 3 virtual environments:

- a *shopping* environment in which users can pick up different items of different weight or shape-changing items
- a *factory* environment in which users maintain a virtual machine by using different tools that feel different
- a *kitchen* environment in which users can feel the weight of different pans and feel if the pan is filled with ingredients or empty.

The project offers many opportunities for additional features that can be agreed upon in the Requirements Meetings and depend on the interest of the group. The hardware prototype of *Shifty*, the corresponding API to interface with it, as well as 3D models, textures and other necessary assets will be provided.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 3: Interactive Cheese Counter

Customer: Frederic Raber

Group size: Min: 2, Max: 4

Recommended skills:

- Experience in Java / C# development
- Interest in exploring and testing new technologies and concepts
- Good aesthetic understanding

Technology that should be used:

- To be discussed

Is prototyping of physical components necessary: No.

The goal of this project is to **enhance the current version of the interactive cheese counter** (see [here](#) for details) with new technologies. Currently, the product at which the customer is pointing is recognized **by a Kinect 2 depth camera**; the recognized product is displayed **on the screen of the scale**. There are several ideas that could be used to further enhance the system:

- Cursor projection on the selected product, for example by using RoomAlive
- Projection of the selected product / product information on the front glass cover of the counter, similar to a head-up display inside a car
- Display of recognized product on the scale using the Bizerba PowerScale app framework
- Smartphone app displaying additional information about the selected product (e.g. recipes, wines that fit to the product etc.) and personalized offers on the customer's smartphone

The **project includes the related literature research** including a short report about different hardware setups and their potential regarding factors like cost, setup effort, maintenance effort, robustness and image quality; testing of potential hardware solutions, **implementation of the software** (including an interface to receive the selected product by the Kinect application) and **the installation of a system demonstrating the implemented solution**.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 4: Intelligent Trash Bin

Customer: Nico Herbig

Group size: Min: 4, Max: 6

Recommended skills:

- Experience in Computer Vision and Deep Learning
- Experiences in hardware development to use sensors, etc.

Technology that should be used:

- Python, OpenCV, Keras/Tensorflow for optical product recognition
- Node.js / AngularJS for the visualization
- Arduino for the scale

Is prototyping of physical components necessary: Yes.

This project aims to **build a trash bin** that knows **what is being thrown away via deep learning image recognition**.

Combined with a different system (which is not part of this project) **that knows what you bought**, this allows **you to have an accurate inventory of products you have at home**.

A small visualization (webpage) to show **what is currently in the trash bin** should be realized as well, which is also able to communicate the recognition results to an inventory system typically by a REST interface or websocket communication.

Finally, **a scale should be integrated** into the trash bin as well to know if a product was full when thrown away (which means you bought too much of it).

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 5: Gamified Reverse Vending Machine

Customer: Frederic Kerber

Group size: Min: 3, Max: 5

Recommended skills:

- Experiences in hardware development to use sensors, etc.
- Experiences in graphic / UI design
- Experience in game design

Technology that should be used:

- No specific requirements upfront, required hardware and programming languages etc. will be discussed with the customer.
- The system will have to communicate with other components in our lab via interfaces they provide (typically, some REST interfaces).

Is prototyping of physical components necessary: Yes.

This project has the goal to **develop a reverse vending machine (“Pfandautomat”)** that is **coupled with a game** so that bringing back empty bottles gets **more enjoyable for the customers**.

The game mechanics should be implemented in a way that customers are encouraged to throw in their bottles according to certain requirements **that ensure an efficient processing** (e.g. right timing, correct orientation, etc.).

The project is divided in two components: (1) **Creation of a physical prototype** of a reverse vending machine with appropriate sensors to detect thrown bottles, their orientation etc. and (2) **development of a visually appealing and enjoyable game** that is (mainly) operated by throwing in bottles. For the game, it is important that it is self-explanatory and quick to “learn” to make sure that the overall process is not slowed down, but accelerated.

The project offers **many possibilities for own ideas**, since the game design is freely selectable (of course according to appropriate arrangements with the customer). In this context, extensions such as a touch screen for further input are also imaginable, as long as the main objectives are not affected.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 6: Augmented Reality Fitting Room

Customer: Donald Degraen

Group size: Min: 2, Max: 4

Recommended skills:

- Experience with development in Unity3D
- Experience with Kinect or other camera-based interaction techniques
- Good aesthetic understanding

Technology that should be used:

- Unity3D,
- Android SDK
- Kinect
- Projector

Is prototyping of physical components necessary: Maybe.

This project **envisions a fitting room enhanced with several features which support the customer** in the purchase of clothing and accessories.

A user enters the fitting room with a set of clothes and apparel which she would like to try out. As common in a fitting room, the customer can view themselves in a mirror to assess if she likes the selected items. **In the AR fitting room, the standard mirror paradigm is extended with a green screen approach able to change the environment and lighting conditions by augmenting the backdrop.** The modified appearance of the environment can be changed manually, or is performed automatically based on the items the customer selected.

While the customer is trying out items, the **system provides accessory and clothing recommendations. Items are visualized realistically on the correct body position** (in-situ) using an AR implementation. The customer is **able to record short videos of herself** and play them on the screen to e.g. see how clothing looks from all sides.

Other features include the **integration of social media platforms** such that the user can share a pictures and recorded videos while receiving live feedback by friends. Additionally, the user is given the **tools to visually customize clothing**, e.g. by drawing on the canvas or by stamping predefined prints. Lastly, the user is given the **option to save her preferences to a mobile application** where she can decide to order it online.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 7: Arcade Article Finder

Customer: Donald Degraen

Group size: Min: 2, Max: 2

Recommended skills:

- Experience with development in Unity3D
- Experience with Kinect
- Good aesthetic understanding

Technology that should be used:

- Unity3D
- Kinect
- Projector

Is prototyping of physical components necessary: No.

This project involves the development of **an entertainment system** integrated with data **generated by customers** in the store. Currently, *Quuppa* tags integrated into shopping carts at Globus **are able to track customers' movements inside the store.**

In this project, you will use either pre-recorded or live data (depending on the availability) and integrate this information **into one or more games**. The development of these games will start out by **generating several concepts**. These concepts focus on the Globus supermarket setting and aim to bring out a playful overview of the events within. Additionally, these games have to enable knowledge transfer to the customer. Additionally, game concepts have to take into account the physical hardware required. As the final implementation has to fit within the supermarket theme, you have to consider how this game can function in such a setting. This means **that the game has to be playable in a busy setting, has to take quick player turnover into account and is rapidly deployable without the need for intervention by a technician.**

One example could be to develop a variant of a Pac Man game where customers in the store are the ghosts that the player needs to avoid. While moving through the Globus floorplan, the player needs to collect items from his shopping list and avoid touching the ghosts. In this concept, knowledge transfer is done by **reinforcing players' awareness of the layout of the real supermarket and the location of the items within.**

For this game, two hardware configurations are suggested, i.e. a wall projection or an arcade cabinet. Using a wall projector with a Kinect would allow for a more open and multiplayer gameplay. On the other hand, an arcade cabinet could possibly be better integrated within the supermarket itself and is more self-contained.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 8: Multi-touch Couch Table

Customer: Dr. Florian Daiber

Group size: Min: 2, Max: 4

Recommended skills:

- Experience with development in C++, Python, or Java
- Experience in user interface design
- Good aesthetic understanding

Technology that should be used:

- Samsung SUR42 Multi-touch Table

Is prototyping of physical components necessary:

Maybe some tangibles.

With the rise of touch-sensitive surfaces, **multi-finger gestures** (e.g., pinch and zoom gestures) **became prominent**. We zoom in and out on maps or photos on touch-enabled surfaces such as mobile phones or tablet computers (Han, 2005). Also, this new paradigm **required novel ways of interface organization**, relying much less on hierarchical menus, scroll-bars, or a dedicated representation of a pointer, such as a mouse pointer.

Tangible interaction is another promising paradigm since it enables the interaction with everyday objects in the environment in a very intuitive and natural way. In this project, **we aim to support multi-touch and tangible interaction particularly in smart environments**.



Here, we will look at the interaction with smart products on the **interactive couch table**.

The main goal of this project is **to design a new tangible, multi-touch user interface** for the couch table, either in Windows with the (deprecated) MS SDK or Linux with the [surface-2.0 open-source driver](#).

Jefferson Y. Han. 2005. Low-cost multi-touch sensing through frustrated total internal reflection. In *Proceedings of the 18th Annual ACM Symposium on User interface Software and Technology (UIST '05)*. ACM, New York, NY, USA, 115-118.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 9: Interactive Checkout Floor Projection

Customer: Marco Speicher

Group size: Min: 3, Max: 5

Recommended skills:

- Experience in Unity-development
- Good aesthetic understanding
- Experiences with visualization systems
- Experiences in 2D or 3D Animation

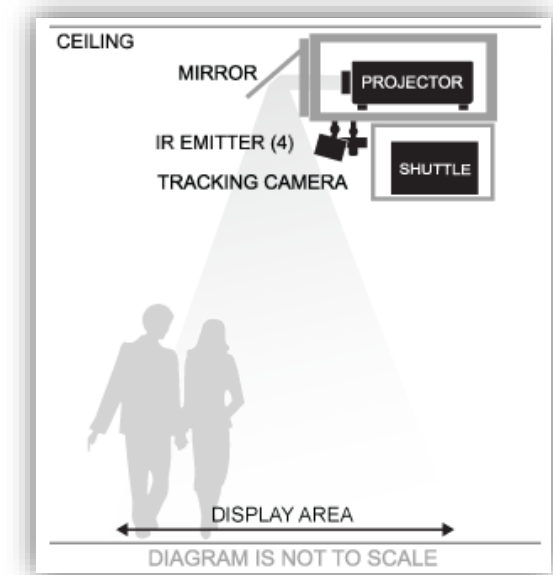
Technology that should be used:

- Unity3D
- Projector / Floor Projection
- Kinect SDK or Quuppa Service

Is prototyping of physical components necessary: No.

This project has the goal to develop a software written in Unity3D **that visualizes and augments the checkout and exit area of a supermarket.**

Without any physical barrier, **the customer gets feedback of her checkout by visual feedback projected on the floor.**



For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 10: The Attracting Door

Customer: Marco Speicher

Group size: Min: 2, Max: 3

Recommended skills:

- Experience in web development (Javascript, JQuery, Three.js)
- Good aesthetic understanding
- Experiences with visualization systems
- Experiences in 2D or 3D Animation

Technology that should be used:

- Web-based (JQuery and other javascript libraries)
- Projector / Floor Projection
- Directional speakers
- Microphone

Is prototyping of physical components necessary: No.

This project has the goal to develop an **aesthetic attracting animation**, projected on the customer IRL door to **change the behavior of customers** to approach the **door and decide to enter the IRL**.

The system will have two states:

- If the door is closed, project on the door (closed state).
- If the door is open, project on the floor (open state).

In both conditions, **the customers should be encouraged to approach the door**. By the usage of directional speakers a further modality is considered within the project. The directional speakers are directed to the direction of the customers to attract them (1) auditive, then (2) visually using the projection.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 11: GuerillAR

Customer: Denise Kahl

Group size: Min: 2, Max: 4

Recommended skills:

- Experience in developing in Unity3D / C#
- Strong design skills
- Experience with Augmented Reality (Vuforia)

Technology that should be used:

- Unity3D
- Android Smartphone

Is prototyping of physical components necessary: No.

This project has the goal to develop a **smartphone application that provides users with detailed information about product advertisements** (at a big advertising area/wall) through Augmented Reality (AR). Here, you can find a list of potential [ideas](#).

Besides **showing 3D representations of the products**, it shall be possible – depending on the product – **to play product videos or cooking instructions**. Furthermore, it shall be **possible to compare the prices of the products with other (online) prices** and to add products **to the shopping list of the user** (via an API we provide).

In addition to the implementation of the application, **the advertisements have to be produced**. Therefore, this project has a strong focus on design.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 12: Allergen FiltAR

Customer: Denise Kahl

Group size: Min: 3, Max: 5

Recommended skills:

- Experience in developing in Unity3D / C#
- Experience with Augmented Reality (Vuforia)

Technology that should be used:

- Unity3D
- Hololens

Is prototyping of physical components necessary: No.

This project has the goal to develop an **Optical-See-Through Augmented Reality (AR) application by using the Microsoft Hololens.**

It should visually filter out **products at a food shelf by visualizing different rectangle overlays on top of the unwanted/uninteresting products.**

The products to be overlaid are chosen based on the allergen profile of the user. This profile will be accessible via APIs that we provide.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 13: Accessible PriceTags

Customer: Maximilian Altmeyer

Group size: Min: 2, Max: 2

Recommended skills:

- Experience with Arduino
- Experience with web development

Technology that should be used:

- Arduino
- Node.js
- Java or Javascript for Android

Hardware that will be used:

- 5x Wemos MINI D1 ESP32
- 1x Raspberry Pi 3
- 1x Android Smartphone
- Alu foil

Is prototyping of physical

components necessary: Yes (the price tags).

This project has the goal to make price tags and product information **easily accessible for visually impaired users.**

Price tags shall be **augmented with sensors** (e.g. capacitive touch) such that users can touch the price tags to get auditive feedback about its price and the product itself via the users' personal smartphone.

The system that needs to be implemented **consist of augmented price tags** (at least 5) sending touch events **to a server**. This server then sends a message to all connected clients containing information about which price tag was touched.

Another part of the **system is an (Android) smartphone application**, which listens for these events and knows its position (i.e. which price tags are in the vicinity of the smartphone) to decide whether to interpret the message (i.e. give auditive feedback) or not.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 14: Queuing System for the Fresh Counter

Customer: Maximilian Altmeyer

Group size: Min: 1, Max: 2

Recommended skills:

- Experience with web development

Technology that should be used:

- Node.js
- MySQL/MariaDB
- HTML5/CSS3/Bootstrap/JS/AngularJS

Hardware that will be used:

- 1-2x Raspberry Pi 3
- 1-2x 7-10 Inch Screen for RPI3
- 1x Android Smartphone

Is prototyping of physical components necessary: No.

This project has the goal to provide feedback about the waiting time for customers **waiting to be served at a fresh counter**.

The system should **generate a QR code** that can be scanned with a smartphone by a customer. Scanning the QR code **opens a webpage**, on which the user sees **an approximated waiting time and how many clients are served before him**.

The user gets notified when he should get to the fresh counter to be served.

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 15: Location-based Store Manager's Dashboard

Customer: Frederik Wiehr

Group size: Min: 3, Max: 5

Recommended skills:

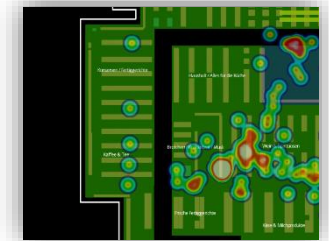
- Experience in web development
- Basic knowledge about Mashups (connecting different APIs)
 - e.g. [Indoor Navigation](#) REST API
- Ideally some experience with interactive maps, e.g. [Leaflet](#)

Technology that should be used:

- GeoDjango (Python based backend)
- Postgresql Database with Postgis spatial extension
- [Bootstrap](#) for the front-end (could be changed)
- Websockets

Is prototyping of physical components necessary: No.

This project has the goal to **develop a web-based application**, which uses an existing indoor positioning system **to assist the market manager and the employees** in an expendable set of **exemplary incidents that can occur in the market**.



Similar to a ticket system, an incident can pop up at any time and **employees can open, reassign and close them**. An incident contains location information and **uses the an indoor map to guide the user through a predefined process**, e.g., when a customer hits a button on his indoor navigation app (not part of this project) to indicate that he has a question and wants to talk to an employee at his current position.

The general idea is to create a flexible and dynamic base system / framework, that is able to handle a large variety of incidents and could be adopted and personalized later on by filling the system with content.

The project has a lot of opportunities for additional features that can be agreed upon in the requirements meetings (i.e., you can make suggestions what you would like to integrate further).

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 16: Demo Management System

Customer: Felix Kosmalla

Group size: Min: 2, Max: 3

Recommended skills:

- Experience in web development
- Good aesthetic understanding/UI skills

Technology that should be used:

- Django 2.0 (Python webserver)
- Django REST-Framework
- SQL-based database

Technology that might be used:

- React
- AngularJS
- Docker

Is prototyping of physical components necessary: No.

This project has the goal to develop a **web-based application including front- and backend**. The system is used to serve the following purposes:

- **Knowledge base for the individual demos:**
 - What does the demo show?
 - What is the story that needs to be told?
 - What do I have to do if the demo does not start?
 - Where is the demo located? (e.g. textual and geo-location)
 - Graphics, Video, Text
 - URL / Domain of the individual demo interface
- **Demo Tour Planner**
 - Before each demo, it should be possible to select a subset of demos and define an ordering.
 - During the demo, a special frontend website is displayed on a tablet or phone and serves as presenter nodes during the demonstration. It should also be possible to control each demo with the individually exposed functionality.
I.e. based on a JSON Object a user-interface needs to be rendered with the functionality provided.
 - A functionality to take pictures should be included in the UI (e.g. for group pictures)
 - After a demo the visitors should be handed a URL where they can relive the demo
 - When visiting the URL the visitors will see an overview of the demos they saw and the demos they missed. A comment / rating system allows the visitors to give feedback to the individual demos or the whole tour.
 - Pictures that were taken during the tour should also be displayed here

For the list of specific project requirements and the project grading scheme, open this [link](#).

Project 17: Context-based TV

Customer: Dr. Gerrit Kahl

Group size: Min: 2, Max: 4

Recommended skills:

- Experience with web development
- Good aesthetic understanding
- Basic knowledge about Alexa skills

Technology that should be used:

- Node.js
- AngularJS
- AWS for Alexa Skill

Is prototyping of physical components necessary: No.

This project has the goal to develop a **context aware application that provides information based on the current TV program.**

The application **uses an existing semantic TV application** that provides information of the current channel and some important visual facts, such as speaker or building identification. Using this information, **both an Alexa skill as a speech interface and a visual frontend should assist the user in requesting more specific data** (e.g. Who is the speaker, Provide some facts about this building). In addition, a **cooking video should be included** and connected to the interface for requesting all relevant data (recipe, ingredients list, required tools).

The UX/Usability of the application should be in clear focus during the development of the system. The project has a lot of opportunities for additional features that can be agreed upon in the requirements meetings (i.e., you can make suggestions what you would like to integrate further).

For the list of specific project requirements and the project grading scheme, open this [link](#).