Using Augmented Reality for a restaurant menu-based system

Computer Science Bsc Hons.

Project Proposal (1451 words excluding cover sheet, table of contents, ethics checklist & references)

UG-Malik, Hamzah, 07951860626, Hamzah.Malik@city.ac.uk

Supervisor: Alena Denisova – Alena.Denisova@city.ac.uk

Project proposed by: Hamzah Malik

Proprietary interests: None

Promises made: None

Contents

Problem to be solved **3**
Solution and project proposal **3**
Existing systems in place **3**
Project objectives **4**
Project beneficiaries **4**
Work Plan **5**
Applications Used **5**
User Testing **5**
Risks and mitigation **7**
Appendix **9**
Ethics Checklist **9**
References **15**

Problem to be solved

The restaurant industry within the UK is one of the most competitive in the world, with research conducted by the Global Restaurant Investment Forum mentioning that the "UK market was still the most popular in Europe" (Lake, 2019).

Despite this, there is a clear divide within the industry, with an average of two restaurants a week being shut down in 2018 (Butler, 2018) and the market expected to contract by -3.1% during 2019 - its fastest decline in over seven years (McAllister, 2019).

Yet when we inspect what draws people towards restaurants, we can locate most of the issue. One study taken to discover why people enjoy eating out at restaurants point towards the social experiences gained from eating out, declaring that fine-dining has become a "status symbol" to some (Fraikue, 2016). However, technological advances have led to many unexplored opportunities for the restaurant market in the UK - posing a risk to owners who could lose out on customers, revenue and interest altogether.

Solution and project proposal

My project idea involves developing an augmented reality mobile application that allows restaurant owners to showcase their products to customers in augmented reality before their orders arrive, providing an immersive experience that will leave customers wanting to return.

The mobile application will also allow customers to access an interactive menu wherever they are, regardless of location. This would lift the requirement of needing to be in a restaurant to view what the store has, allowing customers to view a plethora of different dishes from the comfort of their homes.

Whilst still quite a relatively new technology, businesses are already aware of how augmented reality could truly impact the industry. A study into the use of augmented reality in guiding serving sizes for food concluded that the technology trend improved accuracy and consistency of estimating standard serving sizes (Rollo, 2017). It's clear augmented reality has the potential to submerge consumers into an augmented world that could provide real benefit to businesses within the sector. The use of augmented reality will provide many more chances for restaurant owners to surprise customers and create a necessary buzz; by giving consumers something their competitors do not have.

Existing systems in place

Jarit (Jarit, 2019) is an example of an augmented reality application that allows its users to preview their potential order in 3D. Jarit's system use scannable barcodes to create a pop-up 3D model (Pence, 2011). Whilst like my project, Jarit's reliance on scannable markers to visualise models still requires another device to be used for your phone to scan the marker from. My application instead uses marker-less augmented reality which leverages a mobile's location as a basis for displaying information to the camera view (Pence, 2011). According to Jarit's website, their application is already in use within 100 restaurants.

La Petit Chef (La Petit Chef, 2019) veers away from traditional augmented reality, instead using visual mappings through LCD projectors to simulate an immersive 3D movie on customer tables (Panasonic, 2017). Whilst the application uses a different form of augmented reality to mine, the concept behind the application is similar. La Petit Chef gained international recognition when their YouTube video accumulated a total of 4.3 million views within the 10 months, causing there to be conversation regarding how successful visual 3D applications could be within the restaurant sector.

QReal (QReal, 2019) specialise in the use of augmented reality across a series of different use-cases, varying from in-restaurant menus to 3D banner advertisements. QReal's focus revolve on their ability to story tell, mentioning on their website how "with AR, the world can be your canvas" (QReal, 2019). QReal is one of the most popular AR applications on the market.

Project objectives

This project shall create a fully functional android application targeted at restaurant owners and consumers, which intends to engage customers and improve upon their experience.

To ensure my end results are successful, I have created a set of measurable objectives which I intend on achieving by the end of my project.

Objective	Measurable output
Create an application that runs smoothly on a mobile phone with low to medium mobile specifications.	The application will be tested on various mobile phone with varying system specifications, to determine what the minimum internal requirements are. The app should be able to run smoothly on a mid-range smartphone.
To create a well-documented and testable implementation that is well structured.	Ensure continuous work on the project throughout the year using source control tools such as Git, ensuring any problems that arise can be identified and targeted.
Development and design behind the user interface and navigation of app.	Detailed wireframes to be produced that visualise the flow between buttons, screens and in-app visuals.
Establish a strong understanding of the C# programming language and Unity game engine.	The understanding of how to develop mobile applications in Unity using C#. This will be done by incrementally attempting self-set coding milestones.
Find out what tools are needed to develop the application from both a design and implementation standpoint.	A list of resources that I can use to get help if required. This includes online libraries and frameworks.

Project beneficiaries

- Consumers within the UK – this project's primary target is the end user themselves. This app will provide them with an interactive restaurant menu accessible regardless of location and grants the ability to see their orders before it arrives.
- Business analysts – can use my project as a tool to gather valuable data about customer preferences from a select menu. This could include meaningful data such as what products are attractive to consumers.
- Restaurant owners – more engaged consumers in turn leads to more business for restaurant owners. They also receive insight into what products are most popular from consumer data.
- Programmers and designers – if a restaurant have internal developers and designers, they can continue contributing to the system and extend the functionality of my project.

Work Plan

Applications Used

My implementation will be an android application that uses the ARFoundation framework which incorporates features such as world tracking, plane detection and reference points.

This mobile application will be built using the Unity game engine which uses C# as its primary programming language. Unity has widespread support for augmented reality projects through several tools and frameworks (Unity, 2019) and feature a range of open source assets available online, which will be useful during development.

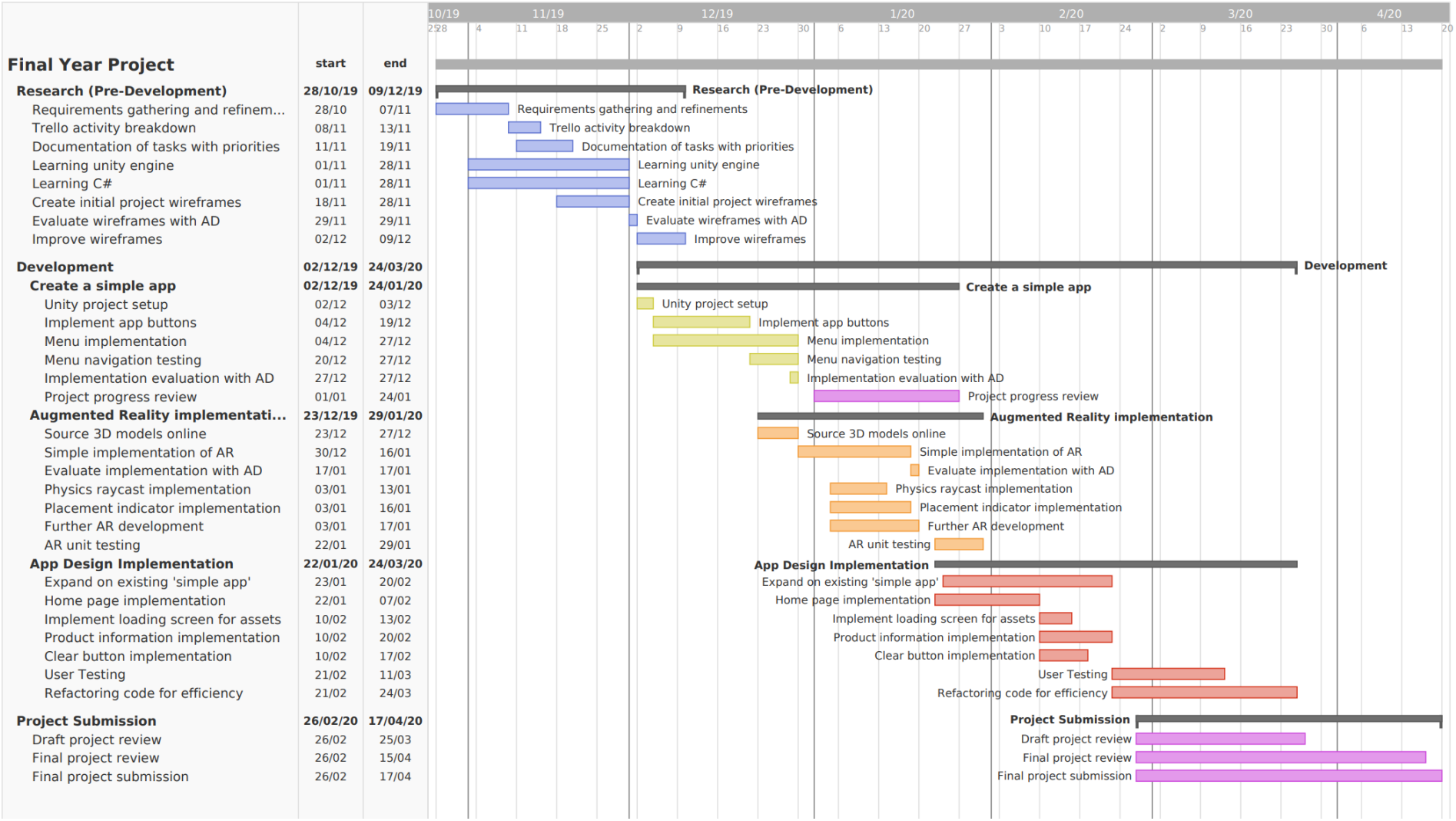
I will be using Visual Studio as my chosen integrated development environment as it's Unity's default editor for script files and widely recognised as an established IDE.

User Testing

Android mobile – I will be testing the functionality of my project across several different android phones to help me decipher what the minimum requirements are to run my project. Depending on how app performance, I may need to change AR rendering to support a wider collection of Android phones.

Attached below is a Gantt Chart created, showcasing the approach taken for each task involved within my project so that I reach my set objectives mentioned above.

teamgantt
Created with Free Edition



Risks and mitigation

Risk title	Problem / Mitigation	Severity	Likelihood
Sourcing 3D models online becomes too difficult due to a lack of available resources.	Needing to have to re-research how I could import other assets that aren't 3D into Unity. Rewriting and restructuring my application to appease such changes. To mitigate this problem, I'll have to instead source 2.5/2D models online.	Low	Medium
Complex requirements changed due to my programming capabilities.	Will slow down agility of development and a change in my requirements could lead to me not reaching my project objectives. Instead have realistic, feasible starting requirements and build my way up.	High	Medium
Unity research.	As I have never used Unity or C# before, I will need to familiarise myself with the software and programming language before development, which could take up a lot of time. Work plan should also consider slack time needed for tasks that take longer than expected. Start this early into my implementation.	Medium	High
Exams and Coursework.	There is a selection of other modules for me to worry about, and therefore a good chance my progress slows down as I begin to focus on other coursework. Ensure I create a work plan to keep up and start working as soon as possible.	High	Medium
Framework and distribution risks.	The ARFoundation framework is extremely volatile, due to it still being in development. Unity projects also have the tendency to break on devices that are using a different version of Unity used by the developer. To mitigate this, research into the ARCore framework as a backup tool and ensure I don't update my current	Low	Low

	version of Unity, or I will face major problems during the later stages of development.		

Appendix

Ethics Checklist

Research Ethics Review Form: BSc, MSc and MA Projects

Computer Science Research Ethics Committee (CSREC)

http://www.city.ac.uk/department-computer-science/research-ethics

Undergraduate and postgraduate students undertaking their final project in the Department of Computer Science are required to consider the ethics of their project work and to ensure that it complies with research ethics guidelines. In some cases, a project will need approval from an ethics committee before it can proceed. Usually, but not always, this will be because the student is involving other people ("participants") in the project.

In order to ensure that appropriate consideration is given to ethical issues, all students must complete this form and attach it to their project proposal document. There are two parts:

PART A: Ethics Checklist. All students must complete this part.
The checklist identifies whether the project requires ethical approval and, if so, where to apply for approval.

PART B: Ethics Proportionate Review Form. Students who have answered "no" to all questions in A1, A2 and A3 and "yes" to question 4 in A4 in the ethics checklist must complete this part. The project supervisor has delegated authority to provide approval in such cases that are considered to involve MINIMAL risk.
The approval may be ***provisional*** – *identifying the planned research as* likely to involve MINIMAL RISK.
In such cases you must additionally seek ***full approval*** from the supervisor as the project progresses and details are established. ***Full approval*** must be acquired in writing, before beginning the planned research.

A.1 If you answer YES to any of the questions in this block, you must apply to an appropriate external ethics committee for approval and log this approval as an External Application through Research Ethics Online - https://ethics.city.ac.uk/		*Delete as appropriate*
1.1	Does your research require approval from the National Research Ethics Service (NRES)? *e.g. because you are recruiting current NHS patients or staff?* *If you are unsure try - https://www.hra.nhs.uk/approvals-amendments/what-approvals-do-i-need/*	**NO**
1.2	Will you recruit participants who fall under the auspices of the Mental Capacity Act? *Such research needs to be approved by an external ethics committee such as NRES or the Social Care Research Ethics Committee - http://www.scie.org.uk/research/ethics-committee/*	**NO**
1.3	Will you recruit any participants who are currently under the auspices of the Criminal Justice System, for example, but not limited to, people on remand, prisoners and those on probation? *Such research needs to be authorised by the ethics approval system of the National Offender Management Service.*	**NO**
A.2 If you answer YES to any of the questions in this block, then unless you are applying to an external ethics committee, you must apply for approval from the Senate Research Ethics Committee (SREC) through Research Ethics Online - https://ethics.city.ac.uk/		*Delete as appropriate*

2.1	Does your research involve participants who are unable to give informed consent? *For example, but not limited to, people who may have a degree of learning disability or mental health problem, that means they are unable to make an informed decision on their own behalf.*	**NO**
2.2	Is there a risk that your research might lead to disclosures from participants concerning their involvement in illegal activities?	**NO**
2.3	Is there a risk that obscene and or illegal material may need to be accessed for your research study (including online content and other material)?	**NO**
2.4	Does your project involve participants disclosing information about special category or sensitive subjects? *For example, but not limited to: racial or ethnic origin; political opinions; religious beliefs; trade union membership; physical or mental health; sexual life; criminal offences and proceedings*	**NO**
2.5	Does your research involve you travelling to another country outside of the UK, where the Foreign & Commonwealth Office has issued a travel warning that affects the area in which you will study? *Please check the latest guidance from the FCO - http://www.fco.gov.uk/en/*	**NO**
2.6	Does your research involve invasive or intrusive procedures? *These may include, but are not limited to, electrical stimulation, heat, cold or bruising.*	**NO**
2.7	Does your research involve animals?	**NO**
2.8	Does your research involve the administration of drugs, placebos or other substances to study participants?	**NO**
A.3 If you answer YES to any of the questions in this block, then unless you are applying to an external ethics committee or the SREC, you must apply for approval from the Computer Science Research Ethics Committee (CSREC) through Research Ethics Online - https://ethics.city.ac.uk/ **Depending on the level of risk associated with your application, it may be referred to the Senate Research Ethics Committee.**		*Delete as appropriate*
3.1	Does your research involve participants who are under the age of 18?	**NO**
3.2	Does your research involve adults who are vulnerable because of their social, psychological or medical circumstances (vulnerable adults)? *This includes adults with cognitive and / or learning disabilities, adults with physical disabilities and older people.*	**NO**
3.3	Are participants recruited because they are staff or students of City, University of London? *For example, students studying on a particular course or module.* *If yes, then approval is also required from the Head of Department or Programme Director.*	**NO**
3.4	Does your research involve intentional deception of participants?	**NO**
3.5	Does your research involve participants taking part without their informed consent?	**NO**
3.5	Is the risk posed to participants greater than that in normal working life?	**NO**

3.7	Is the risk posed to you, the researcher(s), greater than that in normal working life?	**NO**
A.4 If you answer YES to the following question and your answers to all other questions in sections A1, A2 and A3 are NO, then your project is deemed to be of MINIMAL RISK. **If this is the case, then you can apply for approval through your supervisor under PROPORTIONATE REVIEW. You do so by completing PART B of this form.** **If you have answered NO to all questions on this form, then your project does not require ethical approval. You should submit and retain this form as evidence of this.**		*Delete as appropriate*
4	Does your project involve human participants or their identifiable personal data? *For example, as interviewees, respondents to a survey or participants in testing.*	**YES**

Part B: Ethics Proportionate Review Form

If you answered YES to question 4 and NO to all other questions in sections A1, A2 and A3 in PART A of this form, then you may use PART B of this form to submit an application for a proportionate ethics review of your project. Your project supervisor has delegated authority to review and approve this application under proportionate review. You must receive final approval from your supervisor in writing before beginning the planned research.

However, if you cannot provide all the required attachments (see B.3) with your project proposal (e.g. because you have not yet written the consent forms, interview schedules etc), the approval from your supervisor will be ***provisional***. You **must** submit the missing items to your supervisor for approval prior to commencing these parts of your project. Once again, you must receive written confirmation from your supervisor that any provisional approval has been superseded by with ***full approval*** of the planned activity as detailed in the full documents. **Failure to follow this procedure and demonstrate that final approval has been achieved may result in you failing the project module.**

Your supervisor may ask you to submit a full ethics application through Research Ethics Online, for instance if they are unable to approve your application, if the level of risks associated with your project change, or if you need an approval letter from the CSREC for an external organisation.

B.1 The following questions must be answered fully. All grey instructions must be removed.		*Delete as appropriate*
1.1.	Will you ensure that participants taking part in your project are fully informed about the purpose of the research?	**YES**
1.2	Will you ensure that participants taking part in your project are fully informed about the procedures affecting them or affecting any information collected about them, including information about how the data will be used, to whom it will be disclosed, and how long it will be kept?	**YES**
1.3	When people agree to participate in your project, will it be made clear to them that they may withdraw (i.e. not participate) at any time without any penalty?	**YES**
1.4	Will consent be obtained from the participants in your project? Consent from participants will be necessary if you plan to involve them in your project or if you plan to use identifiable personal data from existing records. "Identifiable personal data" means data relating to a living person who might be identifiable if the record includes their name, username, student id, DNA, fingerprint, address, etc. *If YES, you must attach drafts of the participant information sheet(s) and consent form(s) that you will use in section B.3 or, in the case of an existing dataset, provide details of how consent has been obtained.* *You must also retain the completed forms for subsequent inspection. Failure to provide the completed consent request forms will result in withdrawal of any earlier ethical approval of your project.*	**YES**
1.5	Have you made arrangements to ensure that material and/or private information obtained from or about the participating individuals will remain confidential?	**YES**

B.2 If the answer to the following question (B2) is YES, you must provide details		*Delete as appropriate*
2	Will the research be conducted in the participant's home or other non-University location? *If **YES**, you must provide details of how your safety will be ensured.*	**NO**

B.3 Attachments **ALL of the following documents MUST be provided to supervisors if applicable.** **All must be considered prior to final approval by supervisors.** **A written record of final approval must be provided and retained.**	***YES***	***NO***	***Not Applicable***
Details on how safety will be assured in any non-University location, including risk assessment if required (see B2)			**X**
Details of arrangements to ensure that material and/or private information obtained from or about the participating individuals will remain confidential (see B1.5) *Any personal data must be acquired, stored and made accessible in ways that are GDPR compliant.*			**X**
Full protocol for any workshops or interviews**			**X**
Participant information sheet(s)**			**X**
Consent form(s)**			**X**
Questionnaire(s)** *sharing a Qualtrics survey with your supervisor is recommended.*			**X**
Topic guide(s) for interviews and focus groups**			**X**
Permission from external organisations or Head of Department** *e.g. for recruitment of participants*			**X**

***If these items are not available at the time of submitting your project proposal, then **provisional approval** can still be given, under the condition that you must submit the final versions of all items to your supervisor for approval at a later date. **All** such items **must** be seen and approved by your supervisor before the activity for which they are needed begins. Written evidence of **final approval** of your planned activity must be acquired from your supervisor before you commence.*

Changes

If your plans change and any aspects of your research that are documented in the approval process change as a consequence, then any approval acquired is invalid. If issues addressed in Part A (the checklist) are affected, then you must complete the approval process again and establish the kind of approval that is required. If issues addressed in Part B are affected, then you must forward updated documentation to your supervisor and have received written confirmation of approval of the revised activity before proceeding.

Templates for Consent and Information

You must use the templates provided by the University as the basis for your participant information sheets and consent forms. You **must** adapt them according to the needs of your project before you submit them for consideration.

Participant Information Sheets, Consent Forms and Protocols must be consistent. Please ensure that this is the case prior to seeking approval. Failure to do so will slow down the approval process.

We strongly recommend using Qualtrics to produce digital information sheets and consent forms.

Further Information

http://www.city.ac.uk/department-computer-science/research-ethics

https://www.city.ac.uk/research/ethics/how-to-apply/participant-recruitment

https://www.city.ac.uk/research/ethics

References

Butler, S., 2018. *UK restaurant numbers drop for first time in eight years.* [Online]
Available at: https://www.theguardian.com/business/2018/jun/28/uk-restaurant-numbers-drop-for-first-time-in-eight-years
[Accessed 08 10 2019].

Fraikue, F. B., 2016. *REASONS FOR EATING OUT AND SOCIO-DEMOGRAPHIC.* [Online]
Available at: http://www.incedi.org/wp-content/uploads/2016/11/REASONS-FOR-EATING-OUT-AND-SOCIO-DEMOGRAPHIC-CHARACTERISTICS-OF-CUSTOMERS-FRAIKUE-F.B..pdf
[Accessed 10 10 2019].

Jarit, 2019. *Jarit - AR Garnish for your menu.* [Online]
Available at: https://jarit.app/#.
[Accessed 08 10 2019].

La Petit Chef, 2019. *La Petit Chef.* [Online]
Available at: https://lepetitchef.com/
[Accessed 28 10 2019].

Lake, E., 2019. *UK still most popular place to open restaurants despite increasing costs and competition.* [Online]
Available at: https://www.thecaterer.com/news/restaurant/uk-still-most-popular-place-to-open-restaurants-despite-increasing-costs-and-competition
[Accessed 05 10 2019].

McAllister, J., 2019. *UK restaurant market facing fastest decline in seven years.* [Online]
Available at: https://www.bighospitality.co.uk/Article/2019/09/24/UK-restaurant-market-facing-fastest-decline-in-seven-years-according-to-MCA-Insight?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright
[Accessed 19 10 2019].

Panasonic, 2017. *Le Petit Chef brings visual mapping to the restaurant table.* [Online]
Available at: https://business.panasonic.co.uk/visual-system/le-petit-chef-brings-visual-mapping-to-the-restaurant-table
[Accessed 18 10 2019].

Pence, H. E., 2011. *Smartphones, Smart Objects, and Augmented Reality.* [Online]
Available at: https://www.tandfonline.com/doi/abs/10.1080/02763877.2011.528281
[Accessed 28 10 2019].

QReal, 2019. *About QReal.* [Online]
Available at: https://qreal.io/about/
[Accessed 16 10 2019].

QReal, 2019. *QReal - Lifelike Models.* [Online]
Available at: https://qreal.io/lifelike-3d-models/
[Accessed 28 10 2019].

Rollo, M. E., 2017. *ServAR: An augmented reality tool to guide the serving of food.* [Online]
Available at: https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-017-0516-9
[Accessed 16 10 2019].

Unity, 2019. *Augmented Reality.* [Online]
Available at: https://unity.com/unity/features/ar
[Accessed 27 10 2019].