Ordering Pizza using Physical Objects

Initial Plan

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Project Description

We have all ordered pizza using either a web browser or a mobile application. Can we do something different? Can we help people who don't know how to use a mobile app or a browser to order pizza? Can we make the ordering process more entertaining? In this project, I will develop physical objects using 3D printing and Internet of Things (IoT) technologies, which allows users to order a pizza by interacting with physical objects and develop a system in which the order details will be sent over a SMS or E-mail system to the "Pizza maker".

To achieve the main aim of this project the design will go through a series of interactive low fidelity, high fidelity and co-design user studies to provide feedback from contributing testers from varied backgrounds to reduce prototypes down to a final design. A similar method to the study conducted in Anmol Srivastava's user research.[1] The co-design approach will also allow me to actively work with the users in the design stages to make sure the final design will meet their needs. The final design will then be 3D printed with the hardware needed to be able to read the data of each component embedded within it.

The final design will make use of Internet of Things hardware such as NFC/RFID tags and sensors and Raspberry Pi or an Arduino microcontroller with wireless functionality to be able to detect the ingredients that the user wants on their pizza and send via email. 3D Printing will also be used to create the final design.

This project will

- *Look at prototyping*
  - *Low fidelity prototyping due to lack of time and faster to iterate through changes. Easy to translate high level design concepts. Interactivity – Prototypes can be simulated by a real person.*
- *Participatory Design (co-design)*
  - *Actively involve the users in the design process to help ensure the result meets their needs.*

Project Aims and Objectives

- Gain understanding on prototyping methodology and procedures and to put these into practice
  - Understand what a sufficient group size or how many individuals is enough for each stage of the user study e.g. Low fidelity -> High Fidelity
  - Using these groups' research techniques on how to gather feedback as efficient as possible from participants by asking the right questions.
    - Open ended or questions answered with a scale value e.g. 1 to 10
- Evaluate user study feedback and iterate prototype designs to produce a final design
  - Analyse feedback generated through user studies to further improve on the prototypes
  - Identify downfalls in the prototypes and remove any that are deemed unsuitable
- Develop a 3D printed pizza ordering IoT device with the ability to send order details to "pizza maker"
  - Gain an understanding of how the 3D printer works
  - Research the best near field technology that will give best results when embedded within 3D printed objects
  - Identify the hardware that will be needed for the project e.g. tags, sensors etc.

    - Research any software frameworks or open source software that can help with the development of the 3D printed device.
- Deliver final research report with all relevant research and feedback data as well as self-evaluation and future works.
    - Produce a final report with all background research included, the user study methodology used and the justification for using this methodology. The report will also include any problems or setbacks I encountered while progressing through my project and what I did to solves the problems or mitigate the setbacks. Finally, the report will include an area of self-reflection addressing areas that I could improve on, as well as future works.

Feasibility and Related Work

In order to create this physical pizza ordering system that utilised physical objects I looked at existing applications or approaches to this problem. However, due to the uniqueness of the proposed idea I was unable to find a system whose purpose matched exactly to the purpose of my idea, but I was able to find applications that used IoT devices to achieve goals in the space of education or therapy.
Research into the use of a physical IoT device that interacts with parents and children alike to help encourage the learning of birds was developed by a team in Brisbane, Australia [2]. The team was able to find a positive effect of the device within the household and became aware of possible learning outcomes of using the device even though it was out of their research scope.
Another research paper looked at using smart objects for assistance in a medical scenario, more specifically occupational Therapy [3]. The design also utilised an Arduino board as well which is something that I have looked at using for my project. This is an area that before I did this research was not an area that I associated my project with but after reading the research paper I can see a clear opportunity in therapy use especially with Parkinson's sufferers that struggle to use a PC or phone app due to lack of accuracy.

Ethics

My project will need to be considered for ethical approval as I will be collecting demographic information from users that participate in the user evaluation tests. I will not be linking participant names to the information they provide in tests, I will instead assign an ID number to the information they provide.

Work Plan

All milestones and weekly plans are taking into account that work is being done in conjunction with other ongoing studies and will include numerous milestones that I [2]will aim to stick to strictly. I will also arrange meetings with my supervisor once a week to talk about current progress and communication will be maintained through Microsoft Teams to aid with guidance.

Week 1

- Initial meeting with supervisor to clarify project description and objectives.
- Ethics report filled in and submitted
- Hand in initial plan. Initial plan can change slightly although allows for guidance when starting the project.

- Research on similar research projects that have been conducted and available products on the market.
- Research on prototyping methodology.

Week 2 – 4:

- Research into technologies that are applicable to my project
  - Arduino vs Raspberry Pi
  - Sensors and tags
- Start Introduction section of Report
- Source a 3D printer and gain understanding of 3D printing I.e. best materials, the software used etc.
- Meeting with supervisor to discuss a plan for the evaluation.
- Recruitment for usability tests

Week 5 – 7

- Programming micro-controller
- Printing final design
- Continue progress on the report
- Review meeting with Supervisor (Week 5)

Milestone – Programming and Print of final design completed

Week 8 – 10

- Start final evaluation tests and compile feedback data
- Test the system to make sure everything is working/check for bugs in code
- Review meeting with Supervisor (Week 10)

Milestone – Have a finished system

Week 11 – 12

- Start the write up of the final paper

Milestone – Submit final paper

VIVA

- Preparation for VIVA demonstration

Milestone – Project Completion

References

[1] A. Srivastava, “Enriching student learning experience using augmented reality and smart learning objects,” in *Proceedings of the 18th ACM International Conference on Multimodal Interaction - ICMI 2016*, 2016, pp. 572–576.

[2] A. Soro, M. Brereton, T. Dema, J. L. Oliver, M. Z. Chai, and A. M. H. Ambe, “The Ambient Birdhouse,” in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI ’18*, 2018, pp. 1–13.

[3] A. Moraiti, V. Vanden Abeele, E. Vanroye, and L. Geurts, “Empowering Occupational Therapists with a DIY-toolkit for Smart Soft Objects,” in *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction - TEI ’14*, 2015, pp. 387–394.