Team Name: SHAPE
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Project Description
The goal of the project is to create a user interface through a smartphone application that can be used to get inputs from the user including touch gestures, voice capture, and movement. Our secondary goal will be to have an input device such as a camera that will monitor the user's gaze and transform accordingly. The end goal is to use the input data that we capture from the user and translate it to a program called Grasshopper that will change a 3D-modeled wall in Rhino based on variations in our input.

The goal for the smartphone application is to create a way for the user to easily interact with the wall based on different actions that they will be able to take. Our initial goal will be to design touch controls that will be implemented to allow the user to manipulate sliders in the application that will result in changes to the wall such as its size and shape. Our secondary goals for the user application are for the user to be able to talk to the app and the app recognize voice commands that will then be translated to different actions that will change the wall. Lastly, we may be able to translate phone movements using a smartphone accelerometer into movements on the wall in the Rhino model.

Our secondary goal for receiving user input will be to have a camera somewhere in the room or on a wall that will have facial detection and eye movement tracking. The intent here is to allow a user to gaze into the wall and have the wall change in shape when a face is detected, and if possible have it change depending on where the user is looking.

The second part of our project is to build a program that will take the data captured from the user and turn it into an action on the wall in Rhino, using the GrassHopper program and the Ghowl plugin for GrassHopper. The end goal for this portion of the project is to be able to translate the user input from both the smartphone application as well as the camera system to actions that the wall can perform.

Framework
The framework of this project will be done through Rhino, Grasshopper, Ghowl, and Android Studio for Android or Xcode for iOS. Rhino is a 3D modeling software that will be used to get a visual representation of the actual wall. Grasshopper is an add-on that assists with changing the 3D models without moving it manually. Ghowl is an add-on to Grasshopper that will allow grasshopper to take in data from other applications which will be used to send info from the phone application to Grasshopper. The idea behind this framework is that information will be taken via a phone or a camera, the information is then transferred to grasshopper via Ghowl, and then grasshopper will send the data to Rhino which will then manipulate the wall. These programs will use C# and Python as the main languages. Through this framework, the project should be able to complete its objectives without any trouble.

Features
The project's features will involve user input for the manipulation of the wall. These features will include facial detection to track the user's eye movement, a phone app to allow the user to manipulate the wall via touch, and voice recognition to allow users to give verbal commands that translate to actions. Other features will involve being able to process multiple tasks simultaneously, and potentially giving the wall the ability to illuminate to show the user the exact location that will be altered. If there is time left for implementing extra features, an extra feature for this project would be to create a method so that the user will be able to interact and

manipulate the wall without having to use any tool such as a smart phone. This means having the user manipulate the wall solely by looking at a location and thinking.

Limitations

The project is currently limited by multiple factors. The first factor is that a wall of this type has not been created. Therefore, we are pioneering the field of adaptive environments and nobody on the team has worked with this technology. Additionally, we are limited by the tools that we have access to, including accurate voice recognition software, accurate face tracking software, and the lack of direct access to the actuators which control the wall. Another limitation is time; all of the participants of the project have outside commitments limiting work to 9 hours per week per person. Due to the scale of the project, it is possible that we will be unable to implement all of the requested features within the expected time frame.

Review of Literature

Literature provided has not been the standard books or papers . Most of the literature that is being referenced for this project has been an assortment of videos demonstrating potential methods of implementing the wall and web pages describing software for facial recognition, voice recognition, activators, and manipulation of objects via a phone application. Through the use of this literature, the team will decide on how they want to implement the programs that will manipulate the wall.

Client Identification and Preferences

Our client is Mona Ghandi, Assistant Professor at the School of Design and Construction. Mona's vision is to have a physical environment that can change dynamically and autonomously based on the user's current activity. The ideal goal is for the user to think of an action they want to take and then have the wall take that action without the user having to do anything else. That is, the user has complete control over their environment and can work with it instead of around it.

Stakeholder Identification and Considerations

We do not have any current stakeholders besides the client because this is only a prototype. Eventually, the stakeholders could be everyday office workers and families. Therefore, we should ensure that our interface with the wall is intuitive enough to be utilized by people from a wide range of technical backgrounds including those who are not tech-literate.