IC201P: Design Practicum (Feb 2016)

3D Holographic Projector

Team number 14

Group members

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Group Photograph

Left to Right: Raghav, Saurabh, Prashant, Tapesh, Abhinav, Shradhan

Introduction

A hologram is a physical structure that diffracts light into an image. The term ‘hologram’ can refer to both the encoded material and the resulting image. We are trying to build up a holographic projection of objects around us and trying to exploit them to create easy visualization of models which could be used in educational fields like architecture and modelling software like SolidWorks, Autocad etc. We are trying to add some dynamic movement to the 3D objects for real-time behaviour like scaling a structure, moving it from one place to another etc. We are breaking the project into five-six steps, starting from a very basic model of a cube and proceeding further to make the holograms. 3D Holographic Display technology has endless applications as far as the human mind can imagine.

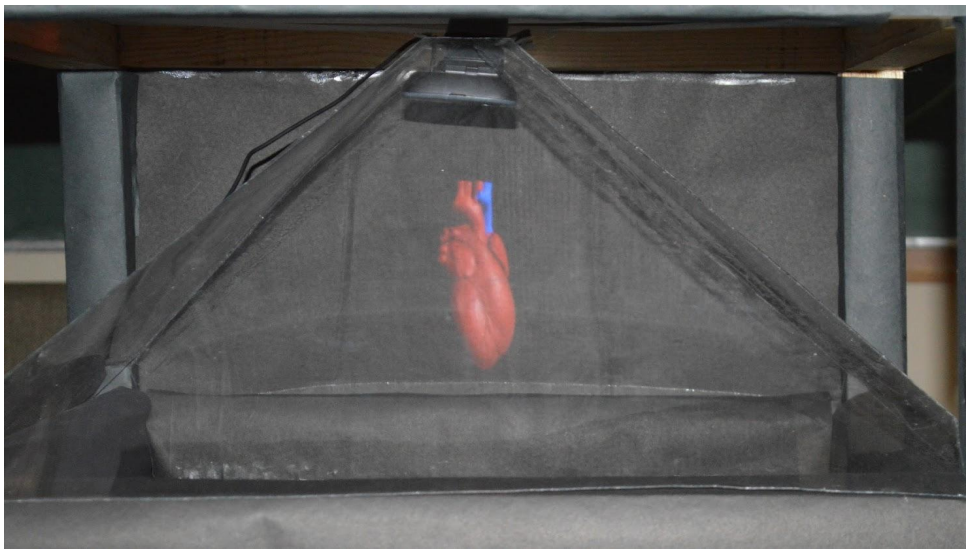
Problem Definition

The problem we are addressing is that we find it difficult to analyze and visualise 3D objects Like lattices, graphs, models etc. when we see it in a 2D plane. And we know that visuals have more impact on our memory and we can remember it for a long time. Solutions available in the market are either sophisticated or expensive.

Solution Methodology

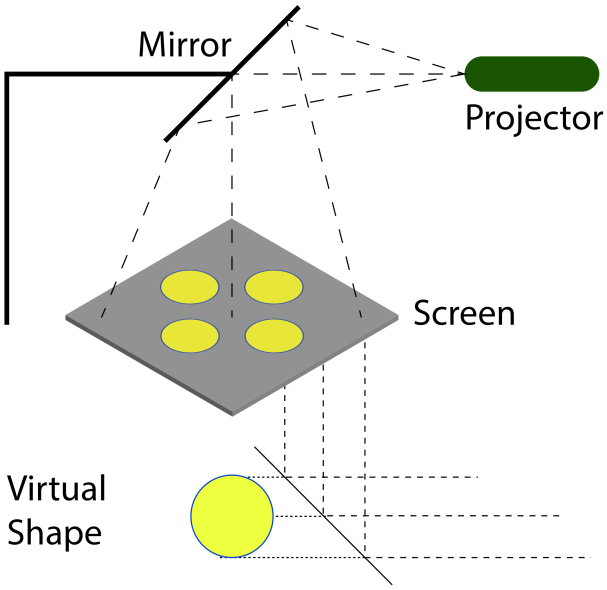
We are solving this problem using Pyramid based Technique. We can get four different views(left, right, front back simultaneously). In this, we are visualizing the 3D object with four different views. The object formed can be controlled dynamically and also by hand gestures. Interaction between multiple objects can be done using tracking pads.

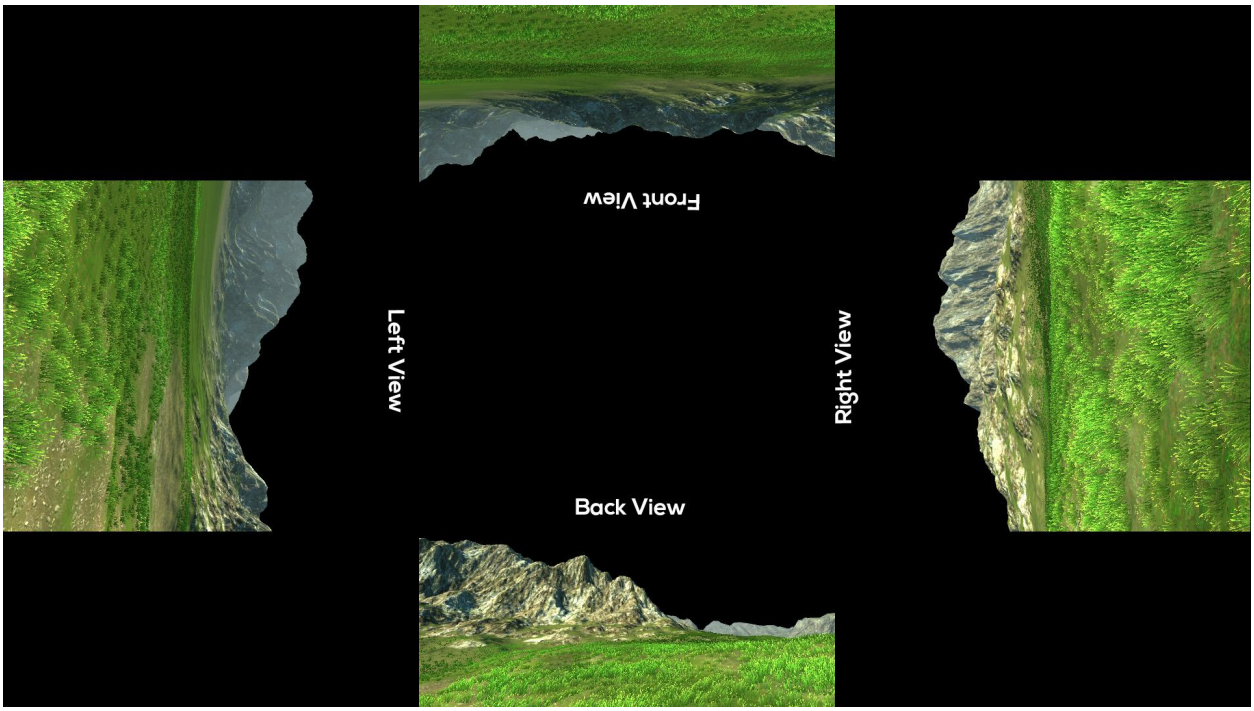
Real-Time manipulation of the 3D projection through
Hand Gestures: Simple Hand gestures like swipe, pinch, and grab can be used to perform simple tasks like rotation, translation of the projection.
Trackpad: The camera on top of the pyramid can detect some particular pattern which is movable and a corresponding projection is generated. Different trackpads can be used to display multiple objects.



Working

It works on the principle of Reflection. In this, the image will fall from the projector to the mirror, and then to the pyramid top where the screen is held. Each different view of an object will be formed on each side of the Pyramid which will be observed by the person. It will look like a 3D object with four different views.





Product Design

Mechanical Aspect:
Pyramid: The material used to make a pyramid is plexiglass/Acrylic Sheets and hot glue is used to join them. The base of the pyramid is of size 60 x 60 cm, the top is 10 x 10 cm and the height of the pyramid is 35cm.
Chassis: It is used to hold the screen so that it can be easily transported and give it structural stability.
Height - 40.5 cm
Base - 65 x 65 cm

Electrical Aspect:
RC Panel: It is used to control the QR pad so that 3D objects can be controlled dynamically. QR pads are placed on the top of the RC Panel. Arduino(UNO) is used to control the RC panel. There is two stepper motor to control the wheels.
Also, we are using a leap motion sensor which has two cameras and three infrared LEDs which detect our hands' position in 3D space

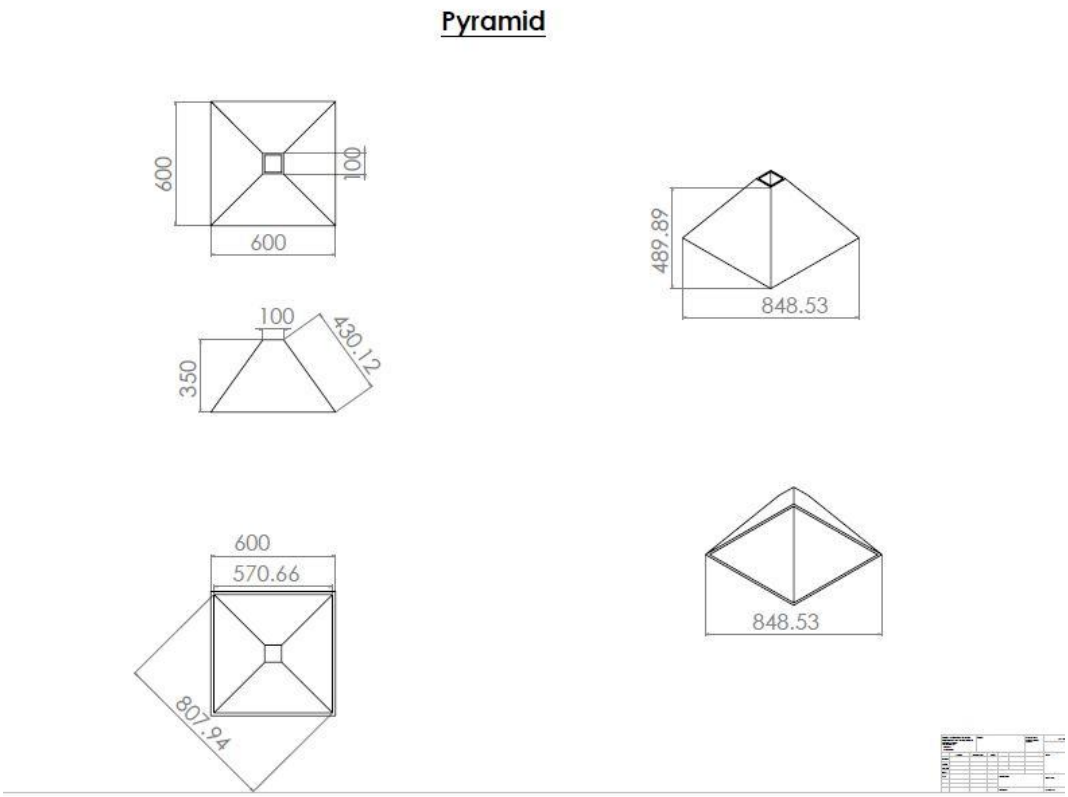
Computer Science Aspect:
To create animations we are using the software Unity which is used to create high-quality games. We would be using it to create animations.
Softwares

- Unity 5.4
- Vuforia
- Processing 3.2

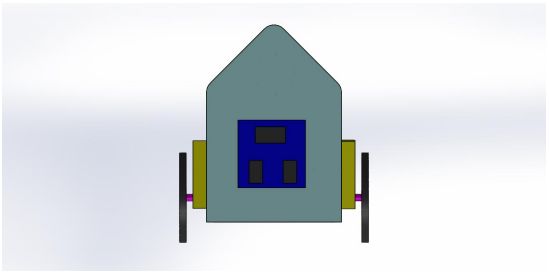
Languages

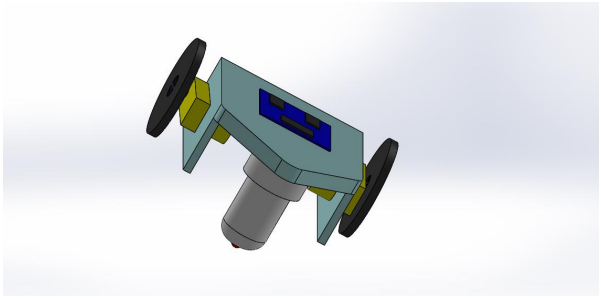
- C++
- OpenCV
- Python

Pyramid:

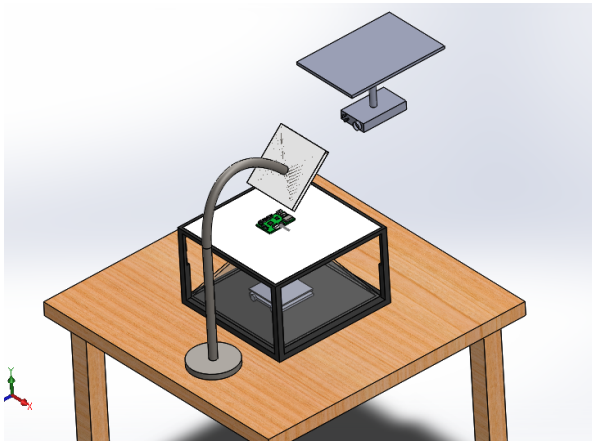


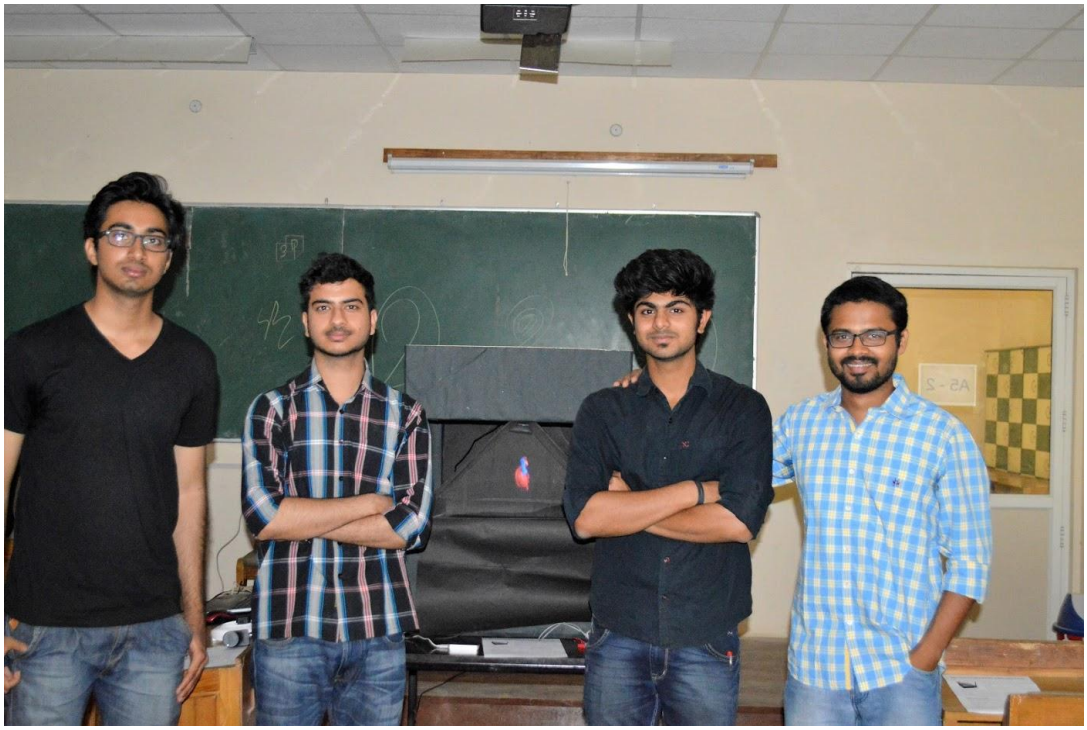
RC Panel:





Final Product





Components used

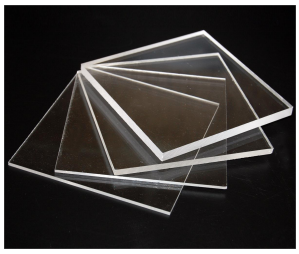
S.no	Item	Quantity	Cost per item	Total
1	Plexi sheet	10sq.ft	73.5	735
2	Leap motion Sens	1	6125	6125
3	Wheels	2	25	50
4	RF Module 433Ml	1	80	80
5	Butter Paper	3	15	45
6	Blackpaper	5	10	50
7	BO motor	2	75	150
8	Mirror	1	70	70
9	PVC Pipe	5ft	35	35
10	Arduino	1	600	600
11	Wires	40	3	120
12	Motor Driver	1	150	150
13	Stepper Motor	1	200	200
14	Glue Gun	1	300	300
15	Battery(9V)	4	20	80
			Total Cost of Product	8790

Different components with their specifications and use are given below:

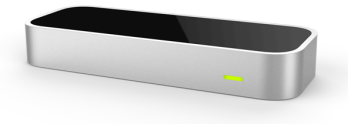
Webcam -
Logitech C270 HD
720 pixels
3MP
Use - Used to detect QR code

Stepper Motor
T=4kg-cm
Step Angle=1.6deg
Current 1.7A
Use - To move the wheel.

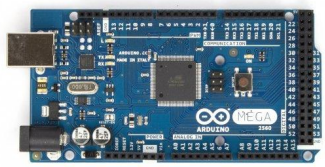
Pyramid
Plexi Glass Sheets
24inch*24inch
Use - To reflect the image.



Leap Motion Sensor
10fingers upto 1/100 of an mm
Use - to control the 3D object using hand gestures.



Arduino UNO
54 i/o pins
14pwm o
16 Analog pins
Use - to control the RC Panel



Proposed Assembly Process

For building the pyramid we are using a Plexi Glass sheet which would be joined together with hot glue. The dimensions of the sides of the pyramid are in a specific ratio so that the 3D projection is properly formed without any distortion. The RC Panel would be placed on the base of the pyramid. And the Leap Motion Sensor would be placed in front of the pyramid.

Future Aspects

- In the Open House, we demonstrated that we can control any 3D object (we showed a 3D model of the heart). In future, we will add the feature to break down the object i.e we can bisect the heart and explore different parts.
- We can also create a 3D projection of any physical object by clicking photos from different angles and then merging them to create a 3D model and integrate it with our product.
- We demonstrated that we can draw in 3D space. In future, we can also save our drawing (design) and we can take the measurements of the different parts of our design.

Conclusion

This technology will become a very integral part of human societies and civilizations in the future. In future, holographic displays will be replacing all present displays in all sizes, from small phone screens to large projectors. Holography being the closest display technology to our real environment may just be the right substitute when reality fails. It provides a real-time live view.

Applications of our product in different fields are:

- **Education purposes:** projecting live 3D graphs and models(architectural models, mechanical components, biological parts).
- **Visual Communications:** Imagine how great it would be if we can see the person with whom we are video chatting in front of us! This can be implemented in the future scope of our product.
- **E-Commerce:** Online products can be viewed as 3D models thus changing the way we shop online.
- **Marketing:** Innovative way to market products by placing a physical object inside the pyramid and displaying holographic animations on it.
- Entertainment purposes