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3D TACTILE DISPLAY

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***Abstract*-** Nowadays, with the rapid advancement in technology, we see the advancement in digital devices like high performance graphic processors, and the ability of more dominatingly the electronic hardware than software; We are now able to run games and many heavy applications of windows even on our palm sized smartphones. Not just some cloud gaming or emulation or launcher. But running actual windows or pc games on smartphone. After sometime we may see all PCs and Androids on same ground. Recently project renegade started by which a lot of smartphones like one plus 6T, samsung galaxy s9+, etc. can now run actual windows 11 and do quite well in performance. Its like a PC in the Pocket. But all that performance can be only seen on the most attractive part that is a good Display like OLED, AMOLED recently.

Though many people are lucky to have eyes to witness the power of such Displays. But yet many more Display technologies are yet to come one of which is 3D Tactile Display which may serve as good tool for people who don`t have the power of eyes, by letting them to touch the display and sense most of the things that we see on display like letters, numbers, icons, 3d shapes, etc. Though many such touchable tech exists but they are way to-expensive for many people. Here`s the aim to make it affordable for many people with the help of an additive manufacturing known as 3d Printing. Also this 3d display may serve as an entertainment item like for human faced animatronics for many people who are not visually impaired, it may serve as a tool for support making in 3d printing which can save material from making support structures that are mostly dumped.

In the society we must add blind people for some decision making, as more loyalty and faith can be expected from such people.

***Index Terms*-** About four key words or phrases in alphabetical order, separated by commas. Keywords are used to retrieve documents in an information system such as an online journal or a search engine. (Mention 4-5 keywords)

1. INTRODUCTION

3D display is something that is being seen from a long made by many researchers and scientists and now with the advancement in the technologies. Most importantly things being getting miniaturized like transistors, diodes and sensors and many more electronic devices. We all may witness the potential of 3d displays in the coming time in character development very impressively. Scope for future development for this project of 3D display can be widely seen in the area of entertainment, in the field of animatronics. The facial expression means a lot in describing many different signs of language, it's a way of communication in terms of emotions too. If people started using 3d displays by which they can get the sense of organic touch, the people may video call each other in 3d too and get real like vibes. And we can`t overlook how important is the Education and as for future development, 3d displays can be seen in education as well, the mathematical waveforms can be visualized and seen in 3d.

I. Many games like subways surfer, temple run, car racing, etc. can be played on this display by getting more realistic vibes from the changing environment of such running games.

II. Displaying features of real objects in virtual environments has recently attracted considerable research interest in the rapidly developing field of

Virtual Reality technology. Many studies have been performed on various aspects of the process, such as acquiring digital shape information of an object with a rangefinder, transmitting the data over a network, and displaying it in a remote location. By far the most common technique for displaying acquired 3D-information is representing shapes with geometrical primitives, and presenting them visually through computer graphics on a visual display such as a monitor or a projection surface. Another technique that has attracted a great deal of attention is displaying shape attributes through the sense of touch. One example is a haptic display called FEELEX developed by Iwata, comprised of an array of linear actuators and a flexible screen. Although this type of display is successful at realizing natural interaction with the bare hand, it is limited in its expressiveness because it is very difficult to construct a pin-rod matrix type shape display with high density and a long pin stroke at the same time. Some displays use piezoelectric ceramic as an actuator**.**

2. CONCEPT

The difference this project can make can be seen by its portable access to anyone. Many other researchers have built such display long time ago but that was to large, about the size of 2-3 washing machines. Such display can`t be kept and use on the palm of our hands or be stored in any of our pockets. It`s very difficult to move such big 3d displays from one to another room or place.

With the success in this project, may be not in pockets but one can carry and store a 3d display in small bag at ease. Anyone blind or normal person can use it.

The 3d models will be designed in such a way that the normal 2d screen smartphones or tablets can be inserted at one side of the model or as the base then the sensor 1.1 can sense the amount

of light coming from the pixels of 2d screen and set or move the mechanical bit up or down.

But some software need to be made that can convert or lower the resolution of the 2d screen, so that area of some N number of pixels of 2d screen get equal to the area of one mechanical pixel.

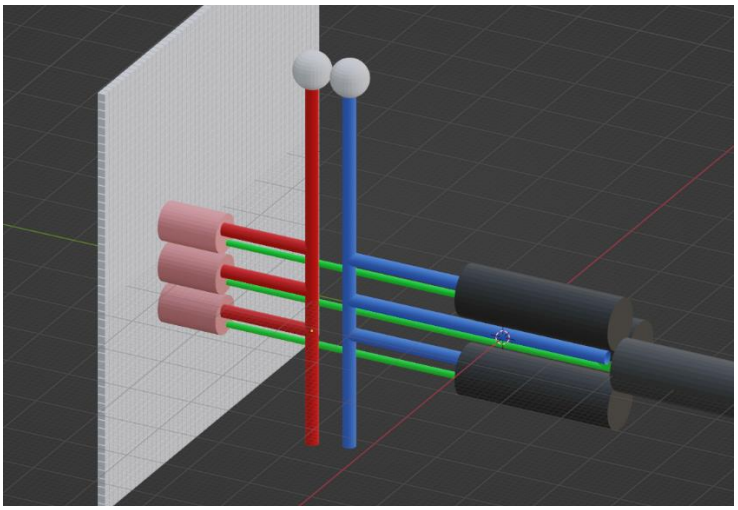


Figure 1 Concept

In this figure, the connection between sensors power supply and motors can be seen. Sensors are colored as pink; positive terminal of power supply is colored as red and negative terminal as blue. And the black cylinders shown are kept to visualize the position of motors.

The pixels of 2d screen are shown in white colored plane just next to pink colored sensors. So the amount of light can reach to sensors.

3.ILLUSTRATION

In the illustration, some step by step slides from **BLENDER** are shown with some labelling for visualizing the concept of design. Note that its not the final design yet more detailing will be added for aesthetics.

Note: In the following figures red line shows X-axis, yellow line shows Y-axis, blue shows Z-axis

Figure 2.1 : shows Layer 1, 2, 3 with position of motors and the Worm Gears(i.e. a 6 start and high lead angle)

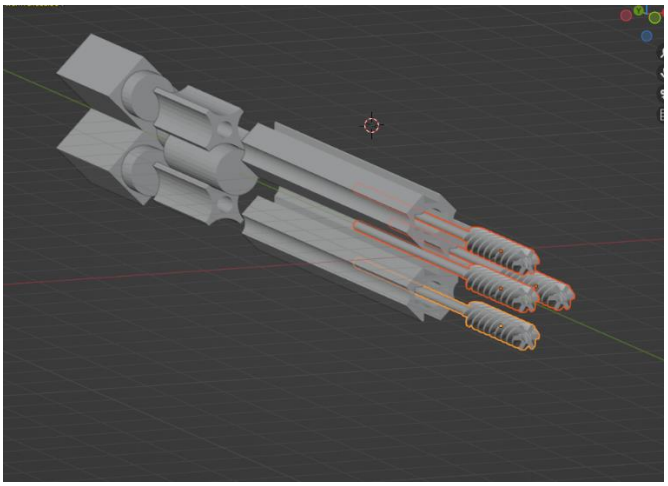


Figure 2.2 : shows the further addition of a final Layer 4, in which the mechanical bits can be easily inserted

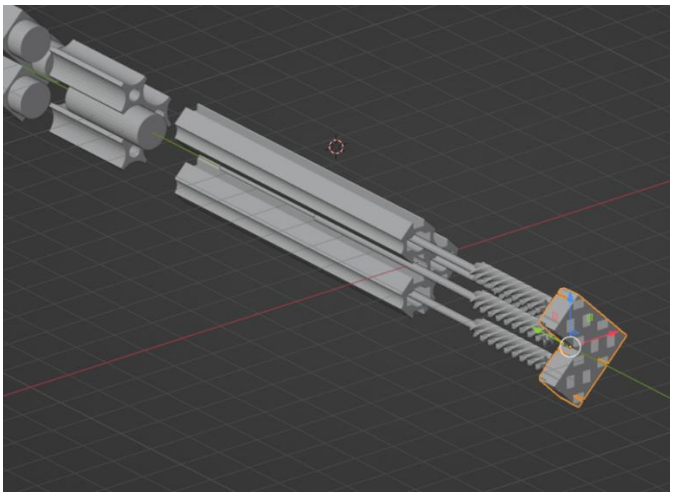


Figure 2.3: shows the position of how the bit is placed in final Layer

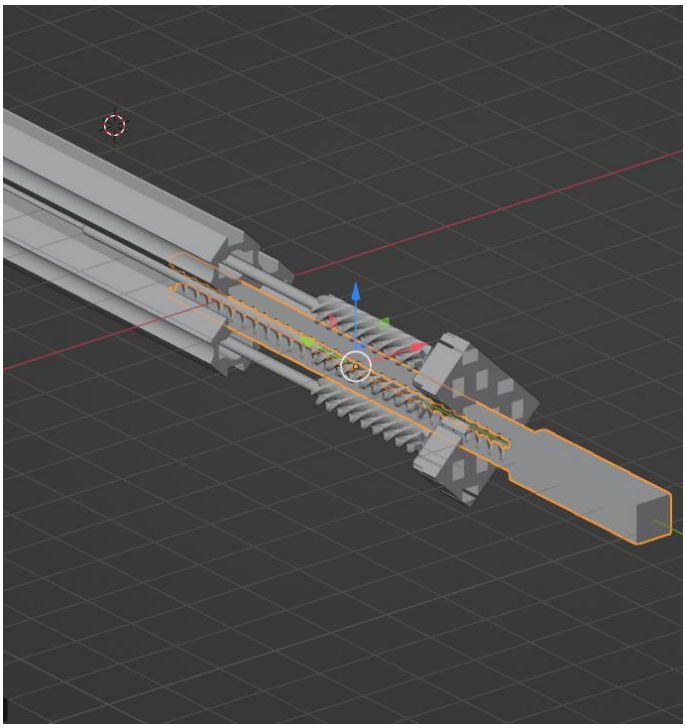
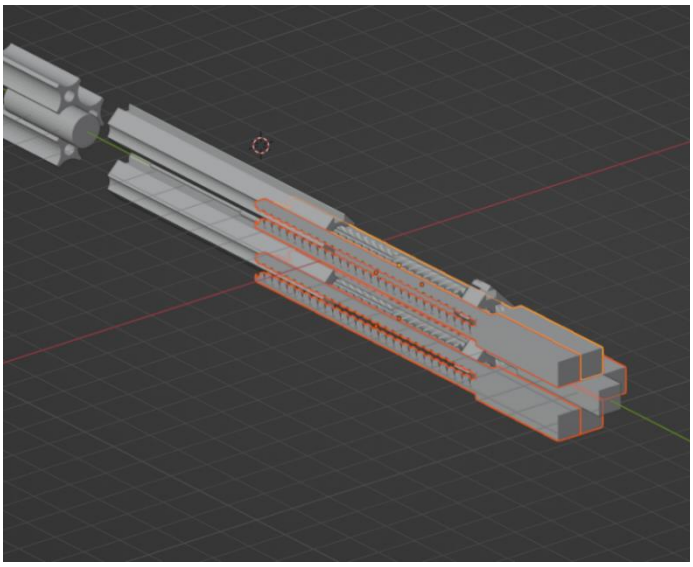


Figure 2.4: shows rest of the bits placed in slots of Layer 4



and Layer 3

Figure 2.5: shows the model in XZ plane, in which group of 6 bits are visible and now this complete model is being replicated to form a 2d array in XZ plane. And most importantly no gaps can be seen between any pair of bits. A uniform matrix of bits is seen.

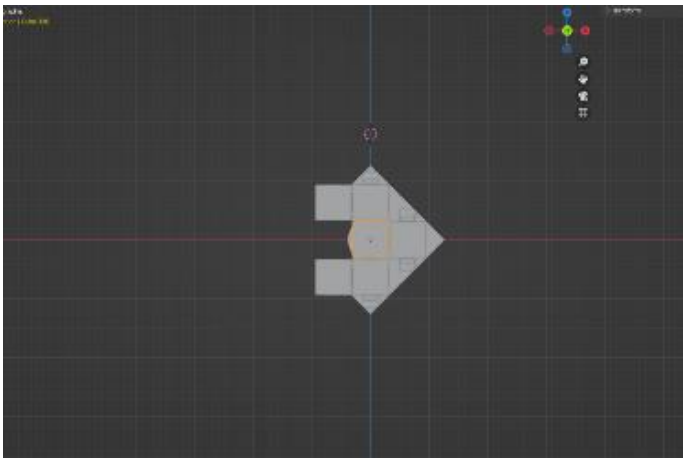
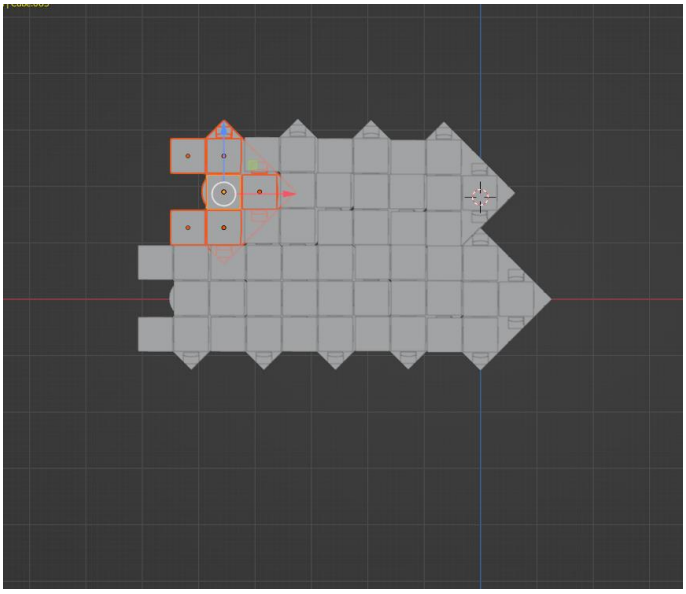


Figure 2.6



4. EXPERIMENTATION

In this we can see at which dimensions the mechanism works seamlessly, smoothly and efficiently. As there are many limitations with the printer to print in desirable and required small dimensions

Here in this image it can be seen that 02 layer named model in 2 different scales; the white one is 3mm larger in all XYZ scale as compared to the black one. As the detailing get lost when we print at scale equal to the black piece. And even for the white piece the detailing are not meeting expectations. And other technologies like SLA, SLS are very expensive for students to print such small files alone. Both of these parts took around an hour or double to complete in FDM 3d printer with layer height 0.05mm and extrusion width 0.22mm for black piece and 0.4mm for white piece.

To save material from making supports, the parts were oreinted like a standing pole position. But after some long discussion the minimum scale required print without loosing details is such that mechanical bit will have the top display area of 10mm square units. Such area may just give the working model,hard bound explanation to illustrate to viewers that how it gonna work.

Figure 4.0 test prints

5. LIMITATIONS

For this project following are the limitations and after that limitations of 3d printing are shown.

-Faster actuation

As in this projects micro coreless 4mm by 12mm motor, worm gear and rack gear will be used. Thus the gear ration will get highly reduced. It is not possible to get 1:1 ratio of gears.

-Depth of pixel

The micro mechanism may not let the pixel go very high or very low, if we want more depth actuation of bits then the size of the display will increase in one dimension

-Resolution

In 2D Displays we high resolutions like 2k, 4k, 8k, etc with the decreasing size of each pixel, and increase in

number of pixels. But in this 3d display we may only see a pixel of size 2 by 2 mm or even larger; and that too around 100s of total pixels only.

-Noise

Even after proper lubrication there is high probability of getting noise, which may not give a seamless experience. It is expected to give hindrance to our ears.

-Power consumption

We see that most of the high graphic running devices like gamming laptops and PCs require lot of electricity and their battery does not last like smartphone for a day. So this 3d display can`t last long without plugging in.

-Cost

The cost for making a single part like 02 layer with 0.1mm layer height in around 10 hours is found to be 900 Rupees with the help of voxel 3d printing service. Which shows how expensive this project may become if all parts get printed.

3D printing has become a trend. The thought of printing anything that you can design into CAD files is really enthralling. Apart from industrialists and entrepreneurs, a lot of enthusiasts and hobbyists are also following the trend.

6. RESULT AND DISCUSSION

After putting a lot of effort and time and some money, this project till 12th of May 2022 has not reached any presentable success due to engagement of 3d printers in other college activities. We got time to just see how much scale or minimum size is needed to print without loosing strength, detailing and resemblance. But even that quest didn't reached the expectations. Many people successfully made the 3d display. But some lack of knowledge and experience can possibly be the reason to un-completion of this project. Though many knowledge and experience is gained as a MOOC course of 3d printing hardware form University of Illinois was done by one member of this group. Some learning is made while removing errors from the STL models in editing mode in Blender. Now it has become easy to remove the undesired of region which is not required in the model.

7. USE OF SOFTWARE FOR EXPERIMENTATION

-Blender

This is a free and open-source 3D computer graphics software toolset used for creating animated films, visual effects, art, 3D-printed models, motion graphics, interactive 3D applications, virtual reality, and, formerly, video games

-Idea maker for raise3d pro2 printer

Idea Maker is a 3D slicing software that automatically generates support structure while providing a set of tools for manual editing and advanced purposes.

-Ultimaker cura

Cura is an open source slicing application for 3D printers. It was created by David Braam who was later employed by Ultimaker, a 3D printer manufacturing company, to maintain the software. Cura is available under LGPLv3 license.

8. FUTURE SCOPE

CHARACTER DEVELOPMENT

Scope for future development for this project of 3D display can be widely seen in the area of entertainment, in the field of animatronics. The facial expression mean a lot in describing many different signs of language, it's a way of communication in terms of emotions too. If people started using 3d displays by which they can get the sense of organic touch, the people may video call each other in 3d too and get real like vibes.

EDUCATION

Scope for future development for 3d displays can be seen in education as well, the mathematical waveforms can be visualized and seen in 3d.

GAME DEVELOPMENT

Many games like subways surfer, temple run, car racing, etc. can be played on this display by getting more realistic vibes from the changing environment of such running games.

9. CONCLUSION

In the name of conclusion, it can be stated that this project was started with the purpose; that is mainly for entertainment or an escape from loneliness for people that live alone and don't find their partner or loved ones around them to touch and feel their presence. Nowadays many of the relationships have become long distant and it is seen at many places that one fail to escape from the stress of work and negative environment. For which many web series help one to pass the time and let some stress go. This project in future may help to overcome stress and feeling of being alone and also for those who are not yet successful to meet their expected of desired ones.
Since 3D printing is one of trending things in the tech world and people have used it for all kinds of things including entertainment, art, education, medical needs and more. There is no doubt that in future, 3D printing will be one of the promising technologies that could change the world.

It is generally accepted that 3D printing will be a revolutionary force in manufacturing, whether positive or negative. Despite concerns over counterfeiting, many companies are already using the technology to repeatably produce intricate components, for example in automotive and aerospace manufacturing.

As 3D printers become more affordable, they will inevitably be used for local, small scale manufacturing, largely eliminating supply chains for many types of product. Consumer units for home use will even become feasible, allowing end users to simply download a design for the product they require and print it out.

There will be major challenges for the conventional manufacturing industry to adapt to these changes. The opportunities for technology and engineering are clearly huge, however, and the creative possibilities in product design and printing material formulation are nearly endless.

ACKNOWLEDGMENT

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