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DESIGN AND DEVELOPMENT OF HANDHELD GAME CONSOLE

Aniruddha A Shanbhag

Department of Industrial Design

M. S. Ramaiah University of Applied Sciences,
Bengaluru, Karnataka, INDIA

Vignesh Ravichandran

Assistant Professor, Department of Industrial Design

M. S. Ramaiah University of Applied Sciences,
Bengaluru, Karnataka, INDIA

Abstract—The project focuses on the Design and Development of Handheld Game Console. The design of the product aims to provide a gaming console with higher modularity, larger screen real estate and an overall comfortable gaming experience. Factors like compact factor, larger screen size and how comfortably it can be used are all considered while designing the product.

The Aim and objective of this project is to design a handheld game console that incorporates new features, suggestions and improvements of the existing gaming console and handheld gaming consoles and provide better ways of implementing it for an effective and comfortable use. The process of designing incorporates multiple steps which include literature study, material study, case study, location study, design trends, user study, market study, patent study & working the existing handheld game consoles to obtain the final product.

These studies include understanding the existing problems and next generation integration of the product and the mechanism used for major parts of the console. This gives an in-depth understanding of what is feasible in the current market. This also provides information regarding the exterior and internal components present in the handheld game console and other necessary parts present in the console.

The final product results in highly compact form factor of the handheld game console which can be easily carried in the small pouches and provides higher screen view of an immersive gaming experience. The final product contains a foldable screen with the hinge mechanism to open and close the screen, attached trigger on both sides which is attached to the main body of the console; it also has rotatory handles which rotate 270 deg. from 0 deg which is folded to 270 deg where the handles are placed on the screen.

Keywords— Watermarking, Haar Wavelet, DWT, PSNR

I. INTRODUCTION

The project focuses on the **Design and Development of Handheld Game Console**. The design of the product aims to provide a gaming console with higher modularity, larger screen real estate and an overall comfortable gaming experience. Factors like compact factor, larger screen size and how comfortably it can be used are all considered while designing the product. The initial process is literature study which includes Different Game Platforms, Types of Game Consoles, and Components Present in Game Consoles, Different Handheld Game Consoles and Components Present in Handheld Game Consoles. These were collected from Articles, E – Newspapers, Books, and Journals.

Data collection & Analysis of the project plays an important role in generating ideation sketches finalizing the concepts & selecting of the concept. Data Collection was done through Market Study, Product Study, Patent Study, Design Trend Study, Location Study, Material Study, User Study, User Journey, User Persona, and Case Study. Analysing the data collected lead to exploratory sketches, ideation, brainstorming and mind mapping. The evaluation of brainstorming, mind mapping and exploratory sketches lead to the creation of multiple concepts and the selection of the final concept.

The concepts are then validated by creating a mock-up prototype for understanding the concept and its working, this helps in getting valuable feedback from user after seeing the concepts and making necessary changes to improve the concepts, finally a feasible concept is among them which is partly based on the design trends and the current market and the user's preference. The selected concept is then visualized using Blender to better explain the usability and functionality of the product. The dimensional detailing is done by conducting an Ergonomic



study of the product using Indian Anthropometric Values. The Materials are then assigned to the Virtual model present in Blender to provide realistic renders, context renders and exploded view of the product. This helps understand how product and people interaction while also showing the internal components present in the product. An animation video is generated to show the working of the product, this is done using Blender, Adobe Media Encoder and DaVinci Resolve. All of these helps in understanding the effectiveness of the product and meeting the expectations of the consumer.

The selected concept is then made into a physical model with all the working present in it, the virtual model created in Blender helps better understand and create the physical model while the Ergonomics values are used to create the parts. While creating the physical model feedback is taken to improvise the product by making changes to the model or changing the placement of some parts to better support the working of the model.

II. BACKGROUND THEORY

A. Literature Study

The current video gaming landscape has taken shape through a mix of traditional at-home setups and other highly accessible modern platforms. Personal Computer set up's is considered one of the oldest forms of video game as it provides high-quality visuals and more versatility for a comfortable gaming experience. Over the years, the gaming domain has expanded dramatically through new technologies that target convenience and immersion. Mobile gaming has become a massive trend capitalizing on the widespread ownership of smartphones, allowing developers to bring popular titles and interactive experiences to the general users without requiring additional hardware. Cloud gaming has also taken its shape, as it provides subscription-based streaming model similar to OTT services that allows users to play in real time while saving on expensive hardware and storage space. Virtual and Augmented Reality (VR & AR) represent the immersive future of the medium, utilizing headsets to transport players directly into virtual worlds and expansive digital spaces like the Metaverse. Despite these rapid technological advancements, traditional arcades and simulators maintain a unique place in the gaming ecosystem. Operating as public venues where players pay by the hour, they offer a nostalgic, retro experience reminiscent of their peak popularity in the 80s and 90s, while also serving as the foundational concept for the modern simulation technology used today.

Types of Game Consoles

Microconsole is a home video game console, these came out in the early 2010's when mobile gaming was at its peak. This took advantage of in-built game library present on

phones for the Android operating system and provided it for a larger screen, this was powered by a low-cost computing hardware as it only required higher speed rates of the internet. This was later adaption and now is a well know concept called microcomputer in the 90's, these were more power efficient and were available at a slightly lower piece. This later on became cloud gaming services and provided wireless controller which we all know now is called video game console. Plug and play consoles another variant of microconsole which provided limited selections in the games, which gives consumer less ability to add more games. While microconsole used game library from phones, this used physical memory cards or optical drive where the game is stored, this costed more but provided more security of it getting hack or malfunctioning due to a virus, this made them a very reliable product. Handheld video game consoles are devices which have an inbuilt screen and has game controller features present into the casing. This have similar features to a smartphone, which includes rechargeable battery and is highly portable allowing it to be carried from one place to another. This has been one of the most reworked and revised concepts brought to life of the gaming market. Hybrid video game consoles devices combine the feature of both a handheld and home console which then can be used however necessary, this provides the versatility to games on the go while still having the progress present. This requires an additional accessory like the dock which converts it from a handheld console to home console. This has currently been the trend in the portable video game console and have grabbed people attention and has spurred up newer concepts in the market for improvement.

Components Present in Game Consoles

Console Unit is the other casing of the game console which holds the motherboard, CPU and all the other internal component and house it. This is the main part of the whole game console as it is providing inputs and output in a convent format factor. Controller are present as both a wired and a wireless controller which is used as an input device for playing games. It contains 2 haptic motor and an audio jack to able to connect to the headphones with no latency. Game Media was used to store the game which used to then connected to the console using a port or CD Slot. It's rarely seen in the present console as most of them are present online. External Storage are storage used for storing the progress of games. This was also used as storing the game itself as it could hold more data and had larger storage capacity. Accessories help improve the gaming experience and enhance one's gameplay. They are to be brought separately and is not there when one buys the console itself.

Different Handheld Game Consoles

Compact form factor has small screen which is used to play the games, these are usually a revised version of a retro console. They offer a limited number of games but give away nostalgia when played. Portable Game console has a much larger screen as of phone. These provide more intuitive experience while playing. This is compact enough that it can be portable and played on the go. Detachable game consoles offer removable parts for a seat back experience while playing. They also offer varying ports to make it more versatile while with the detachable components. Hybrid game consoles have the new trend of being able to use them in different forms. These provide the highest versatility present which makes it a good option for most users.

Components Present in Handheld Game Consoles:

Body Kit houses all the internal components and houses an opening of the display and inputs. Triggers are pressure sensitive inputs used for many games from racing to shooting. It provides a range of inputs for the same trigger. Thumb sticks are smaller version of the joystick we have seen. They provide the same function as the joystick but are used primarily by the thumb. D-Pad are clickable buttons present at the face of the devices. These are usually used to provide a single input for a selected task. Haptic Motors are the motors which provide a vibration when interacting with a game. The intensity varies which increases the immersion to the game. LED/ LCD/ OLED Screen is the display which is used to showcase the game to the user. They may have varying resolutions and sizes based on the form factor of the device.

Product Study

Table -1 Product Study

Product Name	Company	Tech Specs	Features	Weight	Accessories
Gameboy	Nintendo	148 x 90 x 32 mm, 64 KB Space, Screen Resolution: 160 x 144	2.6-inch reflective STN LCD Display Size – 47 mm x 43 mm	220 g	Charger, 8 MB Memory card, Detachable Battery,
PlayStation Portable & Vista (PSP & PS Vista)	Sony Brand - PlayStation	170 x 74 x 23 mm	4.3-inch LCD screen Display Resolution: 480 x 272 pixels	280 g	Charger, Removable SD Card, Screen Protector
Nintendo Switch	Nintendo	238 x 102 x 14 mm, Screen resolution: 1280 x 720 IPS (237 ppi)	Detachable Joy cons, Connection to external screen, Local multiplayer, Touch Screen	398 g	Dock, Tennis Racket, Golf Club, Steering Wheel, Pro Controller
Alienware Concept UFO	Alienware	203 x 100 x 20 mm Screen resolution: 1900 x 1200 LCD	Detachable Joy cons, Local Multiplayer, Touch Screen	800 g	Pro Controller, Steering Wheel
PlayStation 4/5	Sony, Brand - PlayStation	265 x 288 x 39 mm, CD Slot, Gaming resolution: 1080 to 4k	Haptic motor, Rumbling, Vibration Feedback Mechanism	2.5 kgs	Dual Sense Controllers, Headset, Remote, Additional Slot for CD's

Xbox Series X	Microsoft, Brand – Xbox	151 x 151 x 301 m, Gaming resolution: 4k up to 8k	Haptic motor, Intuitive Vibration motor, Rumbling	4.4 kgs	Dedicated dual band, Xbox wireless radio, Controller
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Controller

Table -2 Controller

Product Name	Company	Tech Specs	Features	Weight	Accessories
Nvidia Shield	Nvidia	203 x 203 x 127 mm Screen Resolution:1280 x 720 LCD	Detachable Screen, Touch Screen, Connection to an external Screen	1.4 kgs	Controller, Screen, Controller Holding Stand
Google Stadia	Google	163 x 105 x 65 mm, Gaming Resolution: 720p to 4k	Steaming of games, Multiple device support	268 g	Controller, Portable mount, Phone attachment mount

Accessories

Table -3 Accessories

Product Name	Company	Function	Features	Features	Weight
Steering Wheel	Nintendo	Converts the two Joy cons into steering wheel for playing	160 x 160 x 30 mm	Detachable joy cons, Attached to any surface	231 g
Dock Set	Nintendo	Converts the display output from screen to monitor / tv	196 x 115 x 58 mm	Local multiple, Larger Screen, Additional Controller	327 g

B. Brand Study

Sony; the costing is close to Rs. 20k – Rs. 60k. They initially started with the portable consoles, better known for their PSP and PS Vista, later in the years they came up with the concept of PlayStation which was a game console with a wireless controller. Now they are one of the leading brands in game console. They are now working of VR implementation for their consoles in the future. Nintendo; the costing is close to Rs. 10k – Rs. 30k. They were on the initial brands to bring games into the community, they are now known as retro games and are now considered collector's item; some of them know products were Gameboy, Nintendo 64. Recently the came up with the concept of hybrid game consoles which has taken over the market and is a game changer. Xbox; the costing is close to Rs. 50k – Rs. 2L. They were the ones who initially started

with game consoles and provided variation in the games offered. They owned more games when compared to PlayStation, this change in the strategy made them ahead of Sony. Recently they are working on portable game console and hybrid game consoles to compete with Nintendo Switch. Sega; the costing is close to Rs. 2.5k – Rs. 8k. They were the pioneer of compact game consoles in the market; this made them one of the leading companies in the late 80's and the 90's. They even introduced game consoles similar to other companies to compete with them. As the years went by, they stopped making game consoles, now it is considered as a retro console. Meta; the costing is close to Rs. 4k – Rs. 1L. Meta previously called Facebook was a late comer in this industry but created a revolutionary product called Oculus Quest. The quest made them one of the leading creators of VR headsets present. Now they are



working on metaverse which incorporates the VR headset to interact with others and create a virtual world for others. Google; the costing is close to Rs. 30k – Rs. 60k. Google also came into this market a little later on, but created a product which wasn't like other present; this was the Google stadia. This created google the opportunity to use their network to stream the games to the user similar Netflix, this completely removed the concept of storage as they are uploaded to the cloud. Google is now working to implement there google lens and other products to this concept.

Material Study

Table -4 Material Study

Product Name	Company	Function	Tech Specs	Features	Weight
Steering Wheel	Nintendo	Converts the two Joy cons into steering wheel for playing	160 x 160 x 30 mm	Detachable joy cons, Attached to any surface	231 g
Dock Set	Nintendo	Converts the display output from screen to monitor / tv	196 x 115 x 58 mm	Local multiple, Larger Screen, Additional Controller	327 g

D. Case Study 1

The main issues with all these next game consoles which have into the market are the lack the optimization it requires, with the rush to showcase their product the even go the extends where the final product lacks cooling and over time heats up the device and shuts down. When compared to other gaming media, PC hasn't had anything unique which stands out from the crowd and there isn't much variety in the PC community. When there is a new concept or product launched for game consoles, it has to extreme ends, boring design but practical or to unique of a design which makes it hard to blend with the environment. In hand held game consoles, there is a lack of premium feel for the triggers and compromise in local multiplayer of controller form factor and for smaller hands there is a limitation of reach which makes it easier to drop the product. The suggestions includes; better optimizing the product for efficient and high-performance use; provide additional grip in the box for the device, provide unique input attachments to enhance the gaming experience, make the

product compactible with multiple devices, provide an ergonomic fit for easy usage without damage, add additional accessories to provide a physical exercise while

C. Design Trend Study

There are three categories this includes handheld try to add different ergonomic form factors and bring comfortable form which is portable. Controller are unique and interning form while also focusing on the aesthetics and function. The other include aims to provide new variations to the market and focus on adding aesthetic value to their environment.

playing and optimize all the games to be used portable and continue from where they have stopped.

E. Case Study 2

The hand rest present on the current controller and less comfortable which causes strain over time, for specific games there is a limitation a limitation in the movement present. The overall set up get very generic and boring after a certain period of time; this also causes distraction as the PC used for gaming is the same for work. In certain cases, there is limitation of the posture in which one can sit and game, and overtime there must be a gap for break and stretching one's body. Out of the box the posture in which one games is very bad which then has to compromised by buying additional accessories and the colour calibration isn't the best either out of the box which mean we have to manually adjust it. Overall, there is a lot more crashing and lagging while playing games and for some games there is lack of precise movement present. The suggestions include; integration of colour change based on games, prefers additional input device which attaches to the keyboard, integration of expandable to compact form factor, implementation of additional buttons in mouse, would like to see feedback mechanism integrated, wants intuitive inputs, wants hot swappable keycaps and components.



F. Case Study 3

The buttons present are comparatively smaller and harder to press while gaming, there is a limitation of just one pair of triggers present. The battery life of these are very short and can only last for few hours of continuous usage. For safety there is a requirement of additional accessories which are required but they can add bulk to the overall product. The product itself can be scratch up easily overtime, the screen is much smaller which causes stain, there is a requirement to buy the physical copy of the game which can get lost and finally the form factor is bad for long term usage. The suggestions include; there must be a larger screen with larger buttons, wants additional inputs and different input methods, it must incorporate an ergonomic design, easy storage of games without carrying additional case, wants a universal cable for all devices, it can be converted to hybrid form console when needed, it must have local multiplayer option, it must allow cross platform interaction.

G. Case Study Findings

Most of the people prefer to game at their home or flat (comfort gaming). They want a portable game console which provides them various features and inputs to play. They want a more ergonomically better form factor for the console. They are interested in new ways of playing and would like to experiment them and enjoy the experience. They would like to be able to have digital copies of their games which makes it easier to carry. Majority of the users play RPG or story-based games, and they want more inputs for different attacks and moves. They want a wireless experience while gaming, to provide freedom of movement. They require a seamless transition between different platforms to be able to continue playing on the go. They want immersive feedback while gaming and it should be unique to each game. They prefer modular parts that can be easily swappable based on the games. They are looking for affordable accessories which enhance the experience of their games and finally, they are looking for game consoles which can be used by multiple people and can be enjoyed.

H. Customer Study of Primary Users

Most of the people prefer to game at their home or flat (comfort gaming). They want a portable game console which provides them various features and inputs to play. They want a more ergonomically better form factor for the console. They are interested in new ways of playing and would like to experiment them and enjoy the experience. They would like to be able to have digital copies of their games which makes it easier to carry. Majority of the users play RPG or story-based games, and they want more inputs for different attacks and moves. They want a wireless experience while gaming, to provide freedom of movement. They require a seamless transition between different platforms to be able to continue playing on the go. They

want immersive feedback while gaming and it should be unique to each game. They prefer modular parts that can be easily swappable based on the games. They are looking for affordable accessories which enhance the experience of their games and finally, they are looking for game consoles which can be used by multiple people and can be enjoyed.

Age Group: 6 – 12 Yrs.

The main requirement for this age group is to play with friends and enjoy, this is usually done to get a break from homework or a reward after completing some work. This is a stress buster for them and provides interaction with new people with similar interest as them. This over time helps in quick response time and helps develop the brain for complex solving skills. This age group also seems to play with their parents or siblings, so this also helps them spend time together while enjoying playing and interacting, eventually the kids will find a frictional role model in these games and idealize them. Their average screen time is around 0.5 – 1 Hrs. Their basic requirements include; that it shouldn't be addictive or harm the child's mental health and growth, it should provide easy use and must not cause any strain or physical pain to the child while playing with the console. Additionally, these should provide the child the activeness to do other activities and provide some education or moral meaning while playing with these consoles. Finally, there should be some implementation of a safety or child lock to these devices.

Age Group: 12-22 Yrs.

The main requirement for this age group is similar to the previous one like mostly playing with friends and this also provides them with a stress buster. Apart from these it helps them meet new people with new interest and interaction with a new set of people. This age is considered one of the most important stages of life, it requires quick response time and a healthy competition for them to do better and improve. This also helps them socially interact with an external crowd and provide them with new fields of interest. This also promotes them to show anger and rage in a less violent way and provide them an overall moral boost to do better at something. Their average screen time is around 2 – 3 Hrs. Their basic requirements include; that the form of the console must be compact for easy portability and must provide sufficient ways to play with multiple people present. The price range of this product must be in the affordable range of access by multiple people. This should not cause much strain both physically and mentally to them as this is still their developing phase. Finally, the structure of the console must be highly durable so that even during a break-out from rage or dropping it, the game console stays intact.



Age Group: 23 & Above

The main requirement for this age group mostly are interested in interacting with new people and finding similar interest to talk or socialize with others. At this certain age there are chances to lose one's reaction and muscle memory, console will help them improvise on their response time. If they are a family people, this helps them interact with their kids or other family members in a unique and different way. The usual form of gaming is much more for leisure rather than competitive with also helps them provide some physical activities to improvise their overall body movement. Apart from these they are usually kept as an aesthetic décor or as a show piece. Their average screen time is around 4 – 5 Hrs. Their basic requirements include; that the product must be aesthetically pleasing to hold and use, it must be simple and easy to play with. In terms of the product itself, it must be easily repairable, highly durable and compact in nature to easily carry out with other items. Finally, it should have a decent battery life for longer usage.

I. Feedback Given by Secondary Users

The secondary users include YouTube's, reviewer and their feedback include; that the design of the product must be better; there is overheating issues; there is no support for all functionality in third party game; there is a lot of physical issues. It can easily slip of the hand while using; It isn't easily repairable; the components are expensive. The cost of the device does not suffice with the performance and design. Overtime there is a lot of wear and tear to the device. There isn't much awareness of these types of device outside some countries. This is the next step of gaming and gaming interaction. This can change how we game and how we use our devices on the daily basis.

Research Findings

The problem faced includes; there is a general lack of variety in the current gaming consoles; there have been numerous concepts of ideas but have failed when implemented; there has been increase in the number of people who game and limited products and forms which are used; most of the people look at a new product / concept but don't want to invest until it actually works; they want a product which can be easily recyclable and provides right to repair by the customer themselves or through a service center; there has been a lack of companies taking advantage

of newer technology and are worried to implement them; there are very limited games which can be used by kids which improve their gaming experience while enjoying; the cost of the product, accessories and to repair the product has increased drastically; there has been a shift in the market in terms of portable hybrid gaming which is hard to get; there have not been any innovative solutions to existing products which forces people to buy the latest version and the design of the product has not taken into the consideration of cooling the device efficiently.

Conclusions of Research Findings

There has been more interest in the mobile / portable gaming; people are more interested in futuristic products for gaming; there is an increase interest in the aesthetics of the product more than core functionality; people want an affordable, easy to repair product which provides various functionalities; people are more interested in the modularity of the product rather than structural rigidity and finally, there is no age restriction present for these products but have an adverse effect on the younger and older generation.

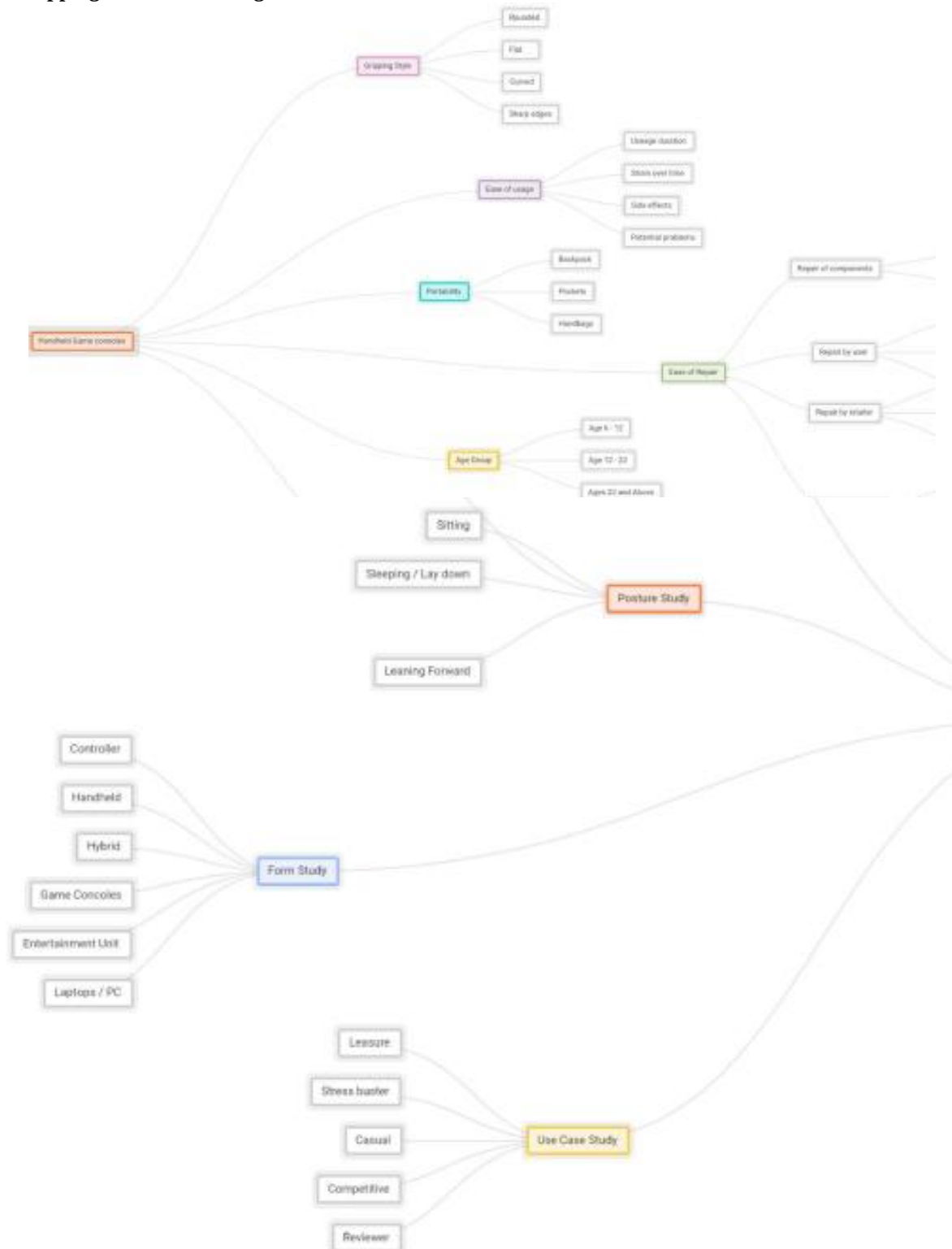
J. Conclusion

The Collected Data has information about Product Study, Market Study, Material Study & Case Study using Articles, Books & Journals, and E – Newspapers. The information regarding Case Study & User Study were done through Online Survey and In- Person questioning. This provided the problems which are currently faced by the User (Welder), the current material information, the current brands which provide the product and the location at which they are played. This helps in bring a general benchmark of the products and to compare features to take the inspiration.

III. CONCEPT GENERATION

Concept Generation aims to generate concepts that meet the requirements expressed by the Welders and Workers, this is done by using Mind-Mapping & Brainstorming, Visual Theme, Exploratory sketches, Concept Generation and finally selecting one concept. These are influenced by existing products. These concepts are further improvised and rendered in various software's.

A. Mind – Mapping & Brainstorming





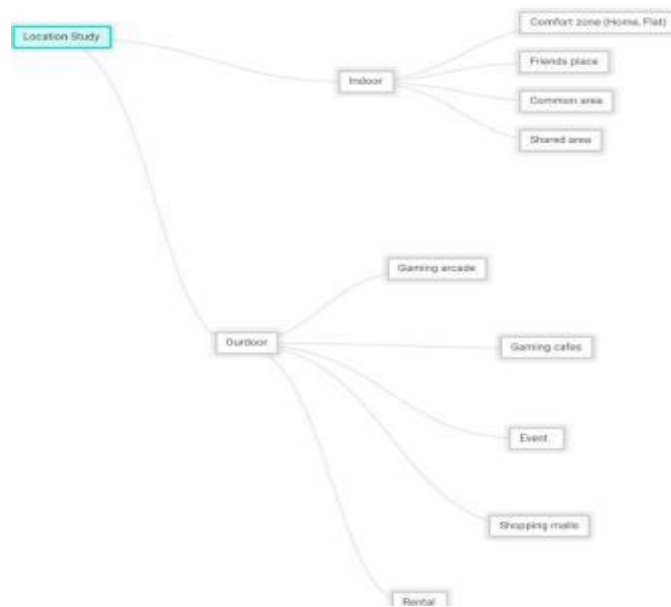


Fig. 1. Mind Mapping

B. Ideation Sketches

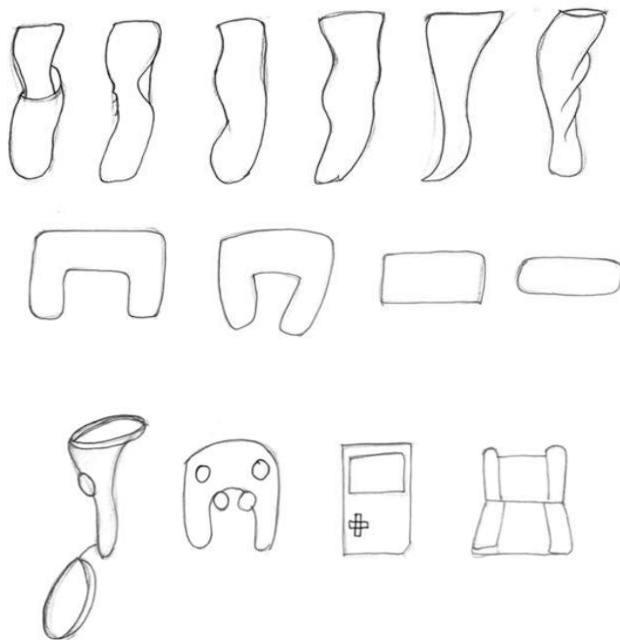


Fig. 2. Ideation Sketches 1

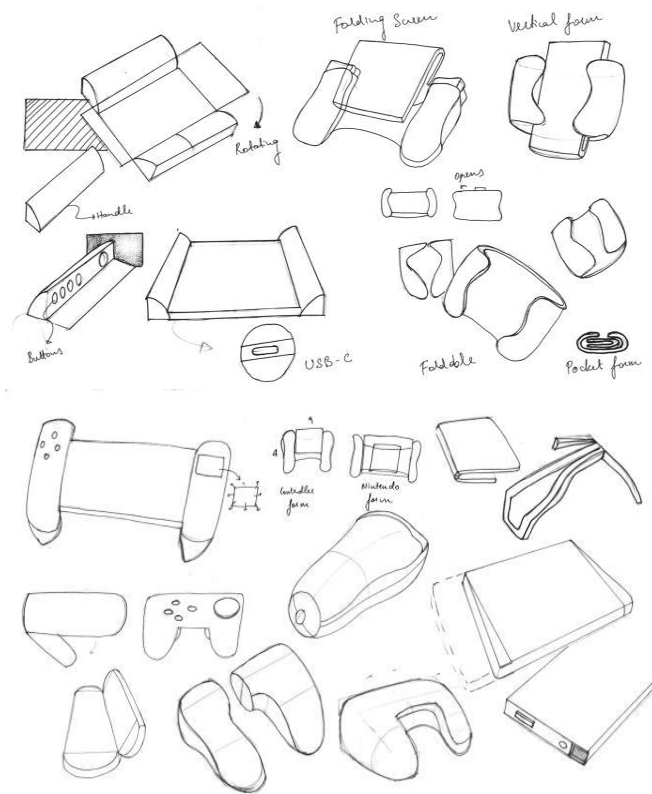


Fig. 3. Ideation Sketches 2

Ideation Sketches:

Initially the sketches for the various types of gaming units are drawn and an understanding of various grip styles present is done. Then sketches generated many focuses on making variety in form factor, various other inputs which can be used for playing and an overall understanding the means through which the user will prefer using the game console.

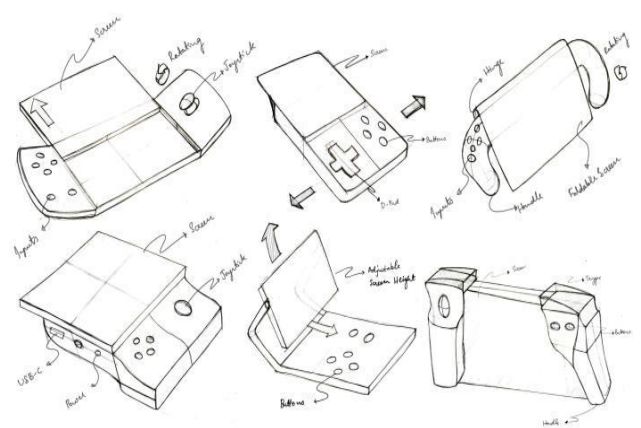
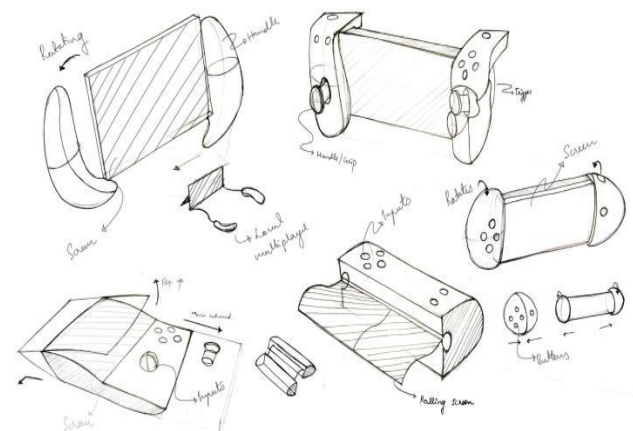


Fig. 4. Ideation Sketches 3

Ideation Sketches:

Initially the sketches for the various types of gaming units are drawn and an understanding of various grip styles present is done. Then sketches generated many focuses on making variety in form factor, various other inputs which can be used for playing and an overall understanding the means through which the user will prefer using the game console.

C. Concept Validation

Concept 1 Prototype Model and Validation





Fig. 5. Concept Prototype Model and Validation

Feedback and Input Provided:

This concept is simple to use and is ergonomically sound, additionally some elements are missing which must be added. Adding a trigger at the back, providing capacitive touch, adding rubberized feet at the bottom and a tap to release for the handle.

D. Concept Selected



Fig. 6. Final Concept Selected

Final Selected Concepts:

This concept was selected after validating by creating prototypes of six concept and validating these concepts and getting inputs from users. This concept is much more feasible compared to the rest is because it adds different elements of all the other concepts into one, when not in use everything is protected and compact. When using it provides a higher screen real estate when compared to the rest of the concepts.

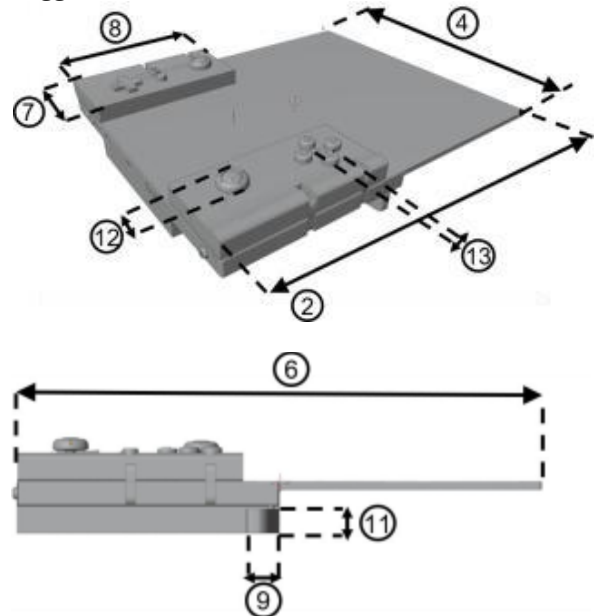
E. Conclusion

Concept Generation includes putting new ideas in the form of exploratory sketches to tackle the current product present in the market and its problems. After the exploration, different concepts were generated after considering the working and the internal working of the product. Finally, a concept is selected after validating the real-world use by creating the prototype of them this helped tackle the requirements of the current market and the users.

IV. CONCEPT DETAILING

Concept Detailing includes detailed virtual modelling, product context renders that represent the product with respect to the environment and humans, exploded view which represents the components, the working of the product and the physical model of the Final concept selected. Concept detailing incorporate, aesthetic details, construction details, ergonomic study, functional details, structural details, and surface details of the product virtually. The aesthetic detail comprises the exterior look & form. The constructional details comprise the modularity of the product. The ergonomic study comprises of human factors with respect to the product and its use. Structural details encompass materials, parts, etc. The surface details include texture, colour, etc

A. Suggested Dimensions for the Product



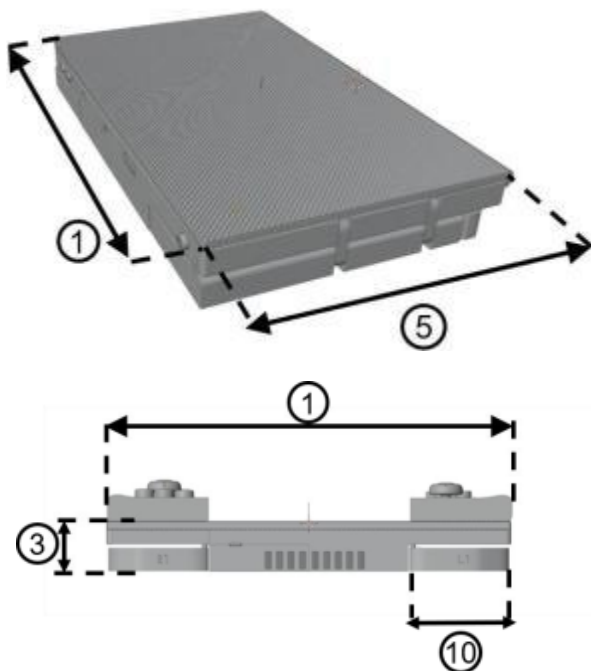


Fig. 7. Suggested Dimension

Table -5 Suggested Dimensions for the Product

Sl. No.	Parameters	Measurements (mm)
1.	Total Length of the Game console	175 mm
2.	Total Breadth of Game console (Unfolded Screen)	220 mm
3.	Total Thickness of the Game console	25 mm
4.	Length of the Screen	175 mm
5.	Breadth of the Screen (Folded)	110 mm
6.	Total Breadth of the Screen when unfolded	220 mm
7.	Length of the Game console's Handle	42 mm
8.	Breadth of the Game console's Handle	90 mm
9.	Length of the Triggers	15 mm

10.	Breadth of the Triggers	15 mm
11.	Thickness of the Triggers	15 mm
12.	Diameter of the Joystick / Thumb stick	15 mm
13.	Diameter of the button on the Game console	15 m

B. 3D Modelling & Rendering

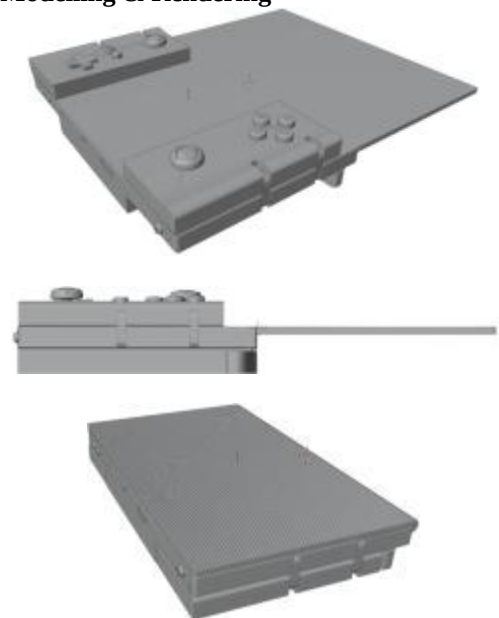


Fig. 8. Virtual Prototyping

C. Photo-realistic Renders





Fig. 9. Product Renders

D. Context Render



Fig. 10. Context Render

E. Exploded View

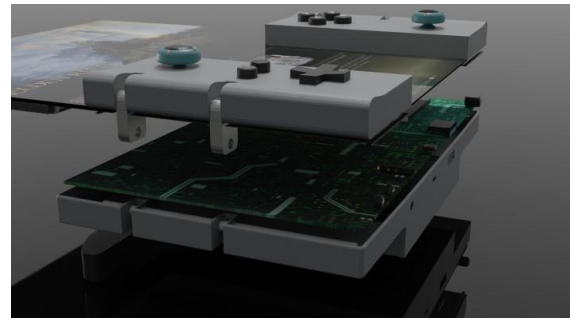
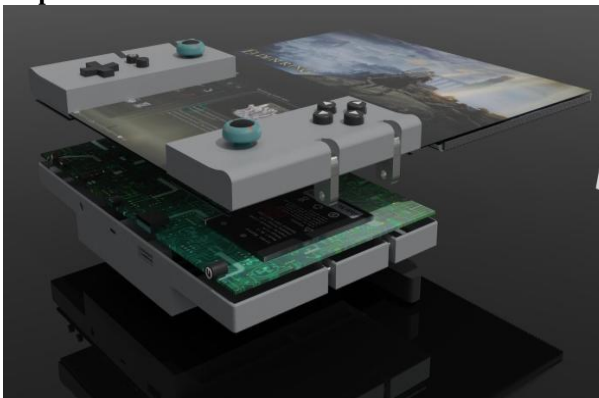


Fig. 11. Exploded Views

F. Product Specifications

- Polypropylene Plastic: Outer body, Handles, Triggers and Buttons
- Mild steel: Rotatory mechanism and screen hinge
- Rubber: Feet and Edges of the Handle

Polypropylene Plastic is one of the hardest materials in plastic and is considered on of the safest plastic which can be used.

When polypropylene plastic is used, it makes the whole weight of the body and handles quite less. Implementing these in handles and buttons also help is making them light weight. Mild sheet is used; it provides sufficient rigidity to the product which helps move and rotate the handles. This also help provide sufficient support to the screen and hinge while folding and unfolding. Rubber is used for gripping the base of the console, this also reduces the friction between the screen and handle while in use. Lastly it can be used as an additional layer on the handles for additional grips.

G. Physical Model Process

Creating the components

The various parts of the game console are made using the appropriate materials. These includes the body, screen, handles, triggers and triggers mechanism. After the completion of the making of the component, it is kept aside for assembling.

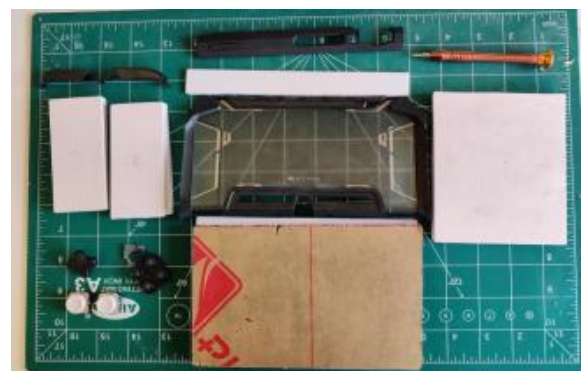




Fig. 12. Creating the Components

Assembling the components

The various parts of the game console are made using the appropriate materials. These includes the body, screen, handles, triggers and triggers mechanism. After the completion of the making of the component, it is kept aside for assembling.



Fig. 13. Assembling the components

Finishing

After assembling all the parts, paint spray is used to give the finish to the body and carbon fiber sticker is used for giving the textured feeling for the top and bottom of the console.





Fig. 15. Physical Model



Fig. 14. Finishing

H. Physical Model



I. Product Validation

Validating the product by giving it to users and getting their feedback and their overall thought of the product present. One user was done in person while the other two was done through an Online Meeting.

Feedback Given

User 1: "The feel of the product good and comfort the placement of the buttons seems fine but the joystick of the right handle is slightly high other than this the product seems pretty good"

User 2: "The overall concept has come out as the renders shows, there could be some changes in implementation of mechanism. Other than that, overall, the product seems in par with the design aesthetic I was hoping for"

User 3: "The product looks amazing and the concept is really good, with respect to the colour scheme shown, a duller colour can be used for the handles, there can be accent colour present on the D Pad and there is an absence of the additional triggers which are essential".

V. CONCLUSION AND FUTURE WORK

A. Conclusion

The project aims at providing a newer way of gaming and easier way of storing the device and following the design trends present in the market. The main aim of the project is to develop a handheld game console with modularity and provide higher comfort while gaming with large screen format. The development of concepts is made first by ideating ideas, selecting few ideas and improvising based on the data collected through research and other information sources.

The generation of concepts is taken and to validate these concepts is through creating multiple mock-up prototype to understand the real-life application. After validating the concepts, one is selected which is much more valid to tackle the problem better and in an efficient way. After selecting the concept dimensional details are got using ergonomics, this help makes the game console easily usable by majority of the users. This also helps in understanding how exactly the users use the product and see if there are any additional changes required to be made. After this a virtual model of the product is made with the dimensions in mind, this help visualizes the look when created. Then a



scaled model is created for the product which can then be given to users.

B. Future Work

This Project can be taken further by implementation of the suggestions provided by the users and incorporating them. This concept can be shown to companies who are expanding in the gaming industry and see their inputs and understand if the product can be produced. Additionally changing the rotating mechanism for the handle for a more efficient one. This will provide users a more efficient way of storing their game consoles in smaller bags and provide them a larger screen space for gaming.

VI. REFERENCE

Here is the formatted list of references based on your requested structure (**Surname First Name, Year of Publication, Topic, DOI No**).

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AUTHORS

 Aniruddha A Shanbhag

 Vignesh Ravichandran



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