



INNOVATION-LED R&D CREATING THE NXT PROGRESSIVE WORLD

Makers Lab[™] Compendium

Edition 2 April'23

FOREWORD



The word 'metaverse' was the second most-used word of 2022 as declared by Oxford , which reflects how popular this topic has been for us all.

At Makers Lab, we are constantly on the lookout for new technologies which will change the face of the world as we see it today. For a couple of years now, we have been experimenting with augmented reality, virtual reality, and have built concepts to experiment and test the boundaries of emerging technologies as well as partnered with our clients who experiment with this tech and related business models.

This year, the concept of metaverse itself got further defined which we see as seven layers - infrastructure, human experience interface, software+ AI + IoT, spatial computing, content-creator economy, monetization, and experience.

Kanchan Bhonde Product Strategy Head of Maker's Lab

Our team went into an overdrive to create more such solutions, and in fact, we enabled the first bank in India to be launched on to the Metaverse.

Today, we have more than 30 such solutions that touch different domains and verticals, and cover from experiential training to customer service with MetaHumans. Al and IoT form an integral part of the metaverse, and we have included some cutting-edge award-winning work done in this regard as well. It's been an exciting journey with our team comprising artists, gamers and techies working together to build stellar enterprise business solutions.

This is a collection of our story on how sowing the seed of technology can germinate in a lab and be nurtured and scaled into a fullfledged business unit – one that runs on innovation and imagination.



07 CASE STUDIES

- Uni-Verse- the Metaverse for First PSU Bank in India
- Digital Twin Real Estate
- <u>VR Mine Training</u>
- Digital Twins- Energy Plant •
- Meta Village
- Internet of Things (IoT) Based Convoy Management System
- Automatic Question Generation

23 RECENT RESEARCH AT MAKERS LAB

- Our Study on Therapeutic Drug on **3D Human Vascular Lung Model** Virtual Reality Application for **Online Learning Experiences**
- Brief on Panchang Weather Prediction
- Metaverse Database Research
- Banking in the Metaverse
- Quantum Security

OFFERINGS 28

- VR Field Engineer Training
- Meta Events: Inauguration in the Metaverse
 - Games: Career Turbo and Crossword
 - Customer Care Product Support •
 - Banking: SMB Offerings Marketplace in the Metaverse
 - VR Engine Assembly
 - Virtual NOC •
 - Dealer-verse •
 - Meta Telecom Store •
 - Smart City Shadow Analysis
 - Meta Coffee Shop
 - Al Meta Human •
 - Video in the Metaverse
 - AR Site Survey •
 - AR Warehouse Management
 - E-Dressing •

Case Studies

Uni-Verse - the Metaverse for First PSU Bank in India

<u> Digital Twin – Real Estate</u>

VR Mine Training

Digital Twins - Energy Plant

<u>Meta Village</u>

Internet of Things (IoT) Based Convoy Management System

Automatic Question Generation



CASE STUDY

Uni-Verse — the Metaverse for First PSU Bank in India

OUICK OVERVIEW

The Indian public sector undertakings bank is more than 100 years old, with 120+ million customers and a total business of \$106 billion. The biggest challenge for the bank is to remain relevant and assert its existence as a forward-looking modern bank, which has changed with times.

CLIENT BACKGROUND AND CHALLENGES

The client is a leading Indian public sector bank headquartered in Mumbai. It has 120+ million customers and a total business of US\$106 billion.

Key Challenges faced by the PSU bank were -

- The younger generation was getting attracted to the large private banks and considered this bank as an age-old bank
- Getting information of the products and services of the bank was becoming complex on the website for another sector of people who are not as tech savvy
- Expansion of any type of services would involve investments in expensive real estate

OUR APPROACH AND SOLUTION

- Tech Mahindra Makers Lab team understood the problem statement of the bank and suggested metaverse to be an excellent platform to reinvent the experience
- We provided a proposal with a minimum viable product (MVP) and a five-step approach for the bank to launch and grow its services in the metaverse
- We offered a solution that could enable any client to enter the metaverse, which is enabled in a web-based interface

BUSINESS AND COMMUNITY IMPACT

- Uni-Verse propels the bank to be India's first bank to be in the metaverse and amongst a handful globally
- The launch of Uni-Verse has generated significant interest from millennials and others who have been keen to experience the metaverse
- Uni-Verse delivers realistic look and feel with various touch points in a pleasant environment
- This has been made available on the web with a very good quality
- Lead generation
- Faster product/business service launches.
- Two of these phases have gone live and are seeing very good uptake.
- Winner of ETBFSI award for 'Best IT Software Solution Provider of the Year' for Uni-verse
- Winner of Gold Award in Mahindra Innovation Award for metaverse offering

• The user can choose an avatar and walk into the meta bank lounge • S/he can view different products of the bank • With the open banking APIs, the existing users can view their balance and mini statement • The solution enabled contextbased information sent to users based on which product they view • Enabled different user journey for new to bank and existing users

CASE STUDY Digital Twin - Real Estate

OUICK OVERVIEW

Like every domain of business, real estate is also trying to comply with the latest technologies for their branding and for increasing footfall. The case study involves the creation of a 3D digital twin of a proposed building, which includes all its amenities. The solution offers a unique experience for prospective buyers to virtually visit the simulations.

CLIENT BACKGROUND AND CHALLENGES

The client is a leading real estate client wanted to include prospects to have a virtual experience of a plot/building/ facade which is yet to be built. The problem included virtual tours for future projects to be showcased to the prospects within a defined time frame.



OUR APPROACH AND SOLUTION

A 3D digital twin of the envisaged building, complete with all the amenities has been created. The solution includes an experience for the prospects to visit these simulations where an AI concierge (AI avatar) engages with prospects, answer the queries using a voice-based chat bot in an avatar form, and help with the sale. Once the basic needs of the prospect are understood, it can also ask which floor and flat type the client is looking for and navigate to the same. The

BUSINESS AND COMMUNITY IMPACT

- Increase in sale at an early stage of the project
- Ability to showcase sample flats of all types thereby giving clients more options
- Reduce miscommunication and give a clear view about what the flat will look like when finished
- India's first metaverse in real estate
- Increased reach through the web-based application
- Futuristic approach on marketing and branding
- The same solution can be replicated to customers in retail and other domains

- interior of a finished flat is shown in a very elaborate view. Going forward, a commercial real estate owner may also use this digital twin to determine how and where to optimize the physical space, overlay sensor data on the digital twin and forecast which equipment is most likely to break down, generate a service ticket for preventative maintenance,
- and optimize energy usage.

CASE STUDY **VR Mine Training**

QUICK OVERVIEW

This case study focuses on an academic partner that provides live mine training to defense personnel, which can be dangerous due to the subtle differences in arming and disarming different types of mines. The training poses a risk of casualties due to errors by the candidates. To address this issue, Makers Lab proposed a concept and developed a 3D virtual training program for mine arming and disarming drills. The objective of this VR-based training was to not only reduce casualties but also cut down on training costs.

CLIENT BACKGROUND AND CHALLENGES

One of our academic partners conducts live mine training as part of its training for defense personnel. There are different types of mines which have slightly different ways of arming and disarming but these subtle differences need to be learned properly. There is a chance of casualties happening during on-field mine training due to small errors by the candidates.

OUR APPROACH AND SOLUTION

- Tech Mahindra team proposed and developed a concept to create 3D virtual training of mine arming and disarming drill flow
- The objective of the VR based training was not only to solve the problem of causalities but to reduce the cost required for training
- Users get trained on different components of mine virtually by using mine training simulator in VR and desktop applications

BUSINESS AND COMMUNITY IMPACT

- Easy training of mine, covering different types and versions
- More probability of getting it right as VR enables experiential training
- Zero risks
- Cost effective





CASE STUDY **Digital Twins**: **Energy Plant**

QUICK OVERVIEW

A leading government entity faced challenges in physically demonstrating the entire plant and its components to visitors due to remote locations and safety concerns. The client also struggled to train large groups of employees effectively. To address these challenges, Makers Lab provided a virtual reality solution that enabled any user to explore the power plant independently. The project required creating a highly detailed and accurate rendered 3D model with 1:1 precision.

CLIENT BACKGROUND AND CHALLENGES

An Indian central public sector, power plant, undertaking under the ownership of Ministry of Power, Government of India had challenges in demonstrating the entire plant to the visitors or new joiners to give an overview of the plant and its individual functioning components physically. This is because the plants are in remote locations and it's risky for visitors. The client came with an agenda where they were facing difficulty in training employees in large groups. Thus, we provided a virtual reality solution where any user can independently explore the power plant. It was challenging to create rendered 3D model with 1:1 accuracy. The project was highly detailed and precise for any practical purposes.

OUR APPROACH AND SOLUTION

- Tech Mahindra has developed a 3D model-based video animation of the entire plant and turbine
- We also developed a VR application for the virtual walkthrough of entire plant and functioning of turbine
- 3D power plant environment was created using actual drone footage
- With the help of this application, we were able to demonstrate the flow of electricity production

BUSINESS AND COMMUNITY IMPACT

- Easy access to virtual thermal plant
- Zero risks
- Cost effective
- Reduces the risk to fatal accidents
- Can be used for induction and training purpose of newly on boarded associates the plant

CASE STUDY Meta Village

OUICK OVERVIEW

The case study discusses the challenges faced in making technology and education accessible in remote areas where people may not be proficient in English. The Makers Lab team, as part of Tech Mahindra's CSR activity, developed a tool called "BHAML" (Bharat Markup Language) that allows anyone to code in their native language. BHAML currently supports HTML and CSS and is available in 10 Indian languages, with plans to support other programming languages and native languages in the future.

CLIENT BACKGROUND AND CHALLENGE

To make technology and education accessible in the remote areas of the country, as all the people in the world are not able read or write or understand English and most learning material and websites is dominated by English language. Villages have very limited resources and technology, what they lack is a seamless mechanism to create English-based programming/ software codes to take their Innovation to the world. Across the world, English is the third most spoken language, which covers only 5.43% of the world population and there are 6,909 distinct



OUR APPROACH AND SOLUTION

To enable the non-English speaking population to overcome the need of knowing English to learn technology, Makers Lab team has come up with a tool called "BHAML" or Bharat Markup Language through which anyone can start coding in their native languages. The free tool has been built as a part of CSR activity of Tech Mahindra and is available in 10 Indian languages. It supports HTML and CSS and there is a roadmap to support other programming languages as well as native languages.

Although there is an attempt to engage the children to teach them these technologies, it has been observed that they love to escape studies and play various video games. Roblox is one such popular platform. So, to ensure that the children can learn while they have fun, we created the first Meta Village in India which has a classroom to learn BHAML.

TechM has launched 'Meta Village', a digital twin of Pargaon in Maharashtra, to gamify learning. The Meta Village will enable the students to play on the Roblox platform and learn the basics of computers and coding in BHAML.

BUSINESS AND COMMUNITY IMPACT

- This initiative is a step towards 'Make in India', to drive innovation in the education sector at the grass roots level
- Making technology accessible to everyone
- 2000+ teachers attended the BHAML session
- 50,000+ students used the BHAML tool regularly and it is getting included in the curriculum across different schools in India



TechM Launches Meta- village for gamified learning

https://economictimes.indiatimes.com/tech/technology/tech-mahindra-launches-meta-village-for-gamified-learning/articleshow/90800460 cms



Launch of Meta village by TechM

https://www.thehindubusinessline.com/info-tech/tech-mahindra-launches-me ta-village-to-gamify-learning/article65314684.ece



TechM launches Meta village

<u> https://www.livemint.com/companies/news/tech-mahindra-launches-</u> netaverse-based-solution-to-gamify-learning-11649751769702 html

CASE STUDY Internet of Things (IoT) Based Convoy Management System

QUICK OVERVIEW

The Indian army has thousands of vehicles used for various purposes ranging from commutation of personnel, delivering armament to delivering the groceries, to stations across borders. Army maintains large convoys for the purpose of operations. They are often at the boundaries of the country, so they work together for mutual support and protection. To track the whereabouts of convoy, Makers Lab has revamped its fleet management platform, Vetturino, to convoy management system with a user-friendly dashboard. This is possible as the product is customizable and can be appropriately tailored to enterprise needs.



CLIENT BACKGROUND AND CHALLENGE

The convoy in the army normally moves along the outward post of the country where the strategic timelines are of prime importance. It is very difficult for the drivers to ensure no mechanical failures during race around the time. Monitoring different parameters to keep track of the health of the vehicles. When all necessary parameters of the vehicle, such as, engine RPM and temperature, speed are monitored closely it becomes possible to catch all anomalies that may eventually cause the vehicle to slow or break down. Also, for the safety of the convoy in- terms of the personals and the armaments is essential, the monitoring of the convoy location from remote aids to this to a greater extent.

OUR APPROACH AND SOLUTION

Our approach to this problem was to understand the root of the challenges faced during transit for military operations. Vetturino is constantly evolving to measure newer parameters and comparing them with each other, for better understanding of the vehicle conditions. This solution allows monitoring and reporting which helps in reduction of the number of breakdowns and breaches that are usually caused when not under observation. With constant observation, the efficiency of these vehicles further improves as any anomaly is detected and resolved before it's too late. The product also aided as management tool for allocation of vehicles to the convoys and creates a bird's eye view of the complete system.

BUSINESS AND COMMUNITY IMPACT

Vetturino was earlier designed specifically for fleet management but now it has matured to cater for monitoring individual vehicles to multiple convoys. The monitoring tool not only serves the convoy commander with complete data it also features multilevel dashboards to aid the driver on field commander and multi convoy commander based on their requirements.

CASE STUDY

Automatic Question Generation

OUICK OVERVIEW

CHAT

BOT

A UK-based broadcasting client has an online learning platform for school-age pupils. The client wanted the capability to challenge a greater depth of knowledge of the children, within any given curriculum through automatic question generation (AQG) from the study guides. Makers Lab at Tech Mahindra has conceived and built an AQG to automatically generate multiple choice questions (MCQs) from the study guides. The solution entitles generation of correct answer as well as distractors (distractors are the wrong answers in a multiplechoice question) for these questions.

CLIENT BACKGROUND AND CHALLENGES

The client was looking to develop automatic questions generator -AQG to:

- Reflect on the students' proficiency
- Introduce the concept of intelligent tutoring
- Generate quiz from the entire text in the study guide to challenge a greater depth of knowledge within any given curriculum through AQG
- Generate the correct answers as well as distractors for these questions
- Create a roadmap to develop a general system that could span across a range of study material and reduce human intervention.

OUR APPROACH AND SOLUTION

Discovery: As it is done before introduction of Chatgpt era, we went through all the prior research on the task of automatic question generation and experimented with each of the steps - text summarisation, keyword generation, sentence mapping, question generation, and distractor generation. We then identified few areas where the system could be improved and started experimenting and looking for ways to improve the system.

BUSINESS AND COMMUNITY IMPACT

The automatic generation of questions and distractors allows any number of questions to be generated by the system, thereby ensuring that the topic is covered in its entirety. It is a useful tool for teachers as well as pupils to test their knowledge. The questions can be generated on demand and thereby create a new way of testing the pupils.

The automatic generation of distractors is the most challenging part of this solution because it is also tricky for humans to choose the correct distractors which are incorrect but related and are thought provoking for the pupils. This is an attempt by Makers Lab to contribute new algorithms to this problem statement.

Optimization: The team came up with many improvements through extensive experimentation. These include realizing that the text summarisation task could be skipped as it seemed to omit some important information from the text, trying out different keyword generation algorithms and adding a keyword ranking approach to filter the best keywords. The final solution included better question and distractor generation methods; and included a process model to predict the quality of the generated questions.

VR Field Engineer Training

Games: Career Turbo and Crossword

Customer Care – Product Support

Banking: SMB Offerings Marketplace in the Metaverse

VR Engine Assembly

Virtual NOC

<u>Dealer-verse</u>

Meta Telecom Store

Smart City – Shadow Analysis

Meta Coffee Shop

<u>Al Meta Human</u>

Video in the Metaverse

AR Site Survey

AR Warehouse Management



- Meta Events: Inauguration in the Metaverse

 - E-Dressing

OFFERINGS VR Field Engineer Training

QUICK OVERVIEW

The case study involves a challenge faced by a UK Tier 1 telco in training their newly onboarded associates about hazardous situations using traditional methods of reading and watching videos. These methods were found to be inadequate, especially for the millennial workforce who are digital natives. To address this issue, the telco created a proof of concept (PoC) for a virtual reality (VR) training program in a simulated data center environment. The aim was to provide experiential learning to network field engineers and to cater to the needs of the millennial workforce. The case study explores the effectiveness of the VR training program and its impact on the learning outcomes of the new workforce.

CLIENT BACKGROUND AND CHALLENGE

As a solution, we have created VR training for network field engineers, in a simulated data center environment as a PoC for UK Tier 1 telco. The challenge faced here by our client's was to train the newly on-boarded associates about hazardous situations.

OUR APPROACH AND SOLUTION

The application helps new engineers to formulate concepts which are highly visual to grasp. The engineers generally feel overwhelmed with the amount of information and options present, furthermore the risks involved is very significant which creates hesitation in the mind of engineers. The application can be used for onboarding of new engineers, evaluating, and educating engineers without any risk involved.

BUSINESS AND COMMUNITY IMPACT

- This solution makes for a much easier approach for the working in complex working environments
- The solution also provides more leverage for users to learn and solve issues which may not be possible through a video





OFFERINGS Meta Events:

Inauguration in the Metaverse

QUICK OVERVIEW

Different time zones can pose a challenge when it comes to achieving a global product or service release. The launch experience often tends to be complex, one-sided with limited engagement from customers.

OUR APPROACH AND SOLUTION

Tech Mahindra serves multiple clients across the world and in most cases, we create a secure space as an offshore development center (ODC) for our clients. Generally, the clients get a view of the ODC only as photographs, but to give them a better view, we inaugurate one of our ODCs in the virtual world as an un-connected digital twin of the ODC. The clients navigate this virtual space and find their photos minted as NFTs in the virtual space as a surprise gift.

BENEFITS

Meta inauguration is a creative way to solve worldwide release problems. This secures the product from piracy and leaks before the official launch. This also makes space for community engagement. Especially in the retail sector, the space can be made even more interesting by adding gamification in the mix. It can make the digital twin of the product accessible at the time of release as a demo for instant reviews.

Through meta events, employees or customers can join from anywhere which results in higher collaboration and less operational cost.



Career Turbo and Crossword

QUICK OVERVIEW

Our Makers lab and HR team guided by our CPO has made some enterprise gamification applications for associates to gain knowledge and get out of the monotony they live in. For e.g., we realized that standard operating procedure documents (SOPs) and other information is hardly read and adhered to via emails, so we started a process of making games.



OUR APPROACH AND SOLUTION

Currently, we provide our associates a game called Crosswords to learn a new policy, or to learn about any new concept regarding an emerging technology or for increasing awareness for a deadly pandemic. Our game has been used by multiple internal teams to engage associates in a daily discussion around though fun gamification of some important concepts of discussion.

We launched Career Turbo as a game to charter their path within the organization. This has a dual effect of keeping our associates engaged along with some fun. With Career Turbo, an associate can charter a path for their career in TechM. For instance, if an associate is a software developer in Java, this game would help them clearly understand what the next steps for their career growth are, what type of learning is required to become a team lead or project manager, so on and so forth.

- Associates learn about company policy and SOPs through a gamified experience
- It has made learning easier and fun. It engages employees • and makes the learning much easier
- It takes out the pressure and stress associated with job • seeking
- Gamification of the whole process gives the user a push to • seek further and play to his/her best abilities

Customer Care: Product Support

QUICK OVERVIEW

Customer care today is done mostly using generic chat bots or call centers apart from physical spaces. These ways of customer care involve a non-uniform customer experience. Moreover, call center discussions are not pleasant scenarios which can give a feel-good factor to the client.



OUR APPROACH AND SOLUTION

Metaverse-based customer care is one way to solve this problem. It also solves the problem of customers constantly waiting in long queues before getting any support as the users can easily choose the nature of their problem and then get help from the right experts-Al based or human.

In this scenario, we have considered a multinational client with various B2B IT products and created a concept of how customer care can be done in the metaverse. A user can log into this metaverse whenever they have an issue, instead of getting in a long queue, waiting for their turn to discuss their issues.

As soon as the user logs in, they can select an avatar and it gets spawned into the bespoke metaverse for the client. In this case, we have imagined it to

BENEFITS

- Ease of access for the client with better overall experience
- Marketing space for new products and services
- Product knowledge is increased among customer bases
- Faster resolution of queries, increasing customer satisfaction
- Opportunity to cross sell and upsell products through gamification

be a futuristic looking building. Once inside, the user can speak to the first agent who is visible as an avatar. This avatar is an Al agent who has been trained as a concierge, who understands the problem and requests the user to be seated in the lounge. Based on the inputs gained by the concierge, the avatar of another AI bot, which is trained for the specific problem identified arrives in the lounge and interacts with the user. We also have an option to have another avatar join this interaction, which is driven by a human agent in case needed.

This solution was demonstrated in an innovation event for our client and was well appreciated.

A similar concept has been created for another client in the insurance domain.

Banking: SMB Offerings Marketplace in the Metaverse

QUICK OVERVIEW

Banks need a lot of real estate to create new products and services, in case they need to bring third party services in the mix. One such scenario is with small and medium businesses, who need non-allied services like HR, payroll, and taxation but it is expensive to avail these services in a dedicated mode. Banks can create products which bundle these services with the financial services to expand their business.

OUR APPROACH AND SOLUTION

There is a need to address the investment needed for creating such service bundle for banks. The investment to on-board the third parties to provide these services is miniscule in the metaverse as compared to real estate. In response, we have built a concept and showcased this in multiple forums with 24*7 accessibility.

BENEFITS

- Ability to create a marketplace of services with far less investment and global reach in the metaverse
- Monetization opportunity
- Like SMB, the marketplace can also offer other bundled services for different audiences and have a global reach



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OFFERINGS VR Engine Assembly

QUICK OVERVIEW

Training needs vary from business to business, and it is important to provide experiential training to employees. This needs a lot of investment in various factories to enable the same.

OUR APPROACH AND ITS BENEFITS

- Virtual reality provides an excellent opportunity for experiential learning. We have created this concept for an engine assembly in the metaverse with some unique features
- User can get a complete overview of the said engine by an expert in the form of an avatar
- There is color coded help as the user picks up each component and tries to place it in the correct place on the engine
- There is a built in haptic and sound feedback once the piece fits in which further helps in reinforcing the learning
- It helps in memorizing complex tasks that a person may need to do individually on the field without much support





OFFERINGS Virtual NOC

QUICK OVERVIEW

With the advent of work from home, there are some jobs which still needed working from the office, where more than one person needs to attend to a job. Although communication channels helped, it was not the best of experience. One such case was that of a network operating center (NOC).

OUR APPROACH AND SOLUTION

Virtual Network Operating Centre (VNOC) is a digital twin version of the physical NOC. Users would remain in their homes and connect to the VNOC via VR headsets. They join in as avatars and can interact with other colleagues through this platform. They can also see all the dashboards with live feeds of all required data and can take actions to ensure that the operations continue 24x7.

- Reducing of CAPEX and OPEX
- Automation of ticket creation and handling
- Remote location access
- Helps in increasing productivity







OFFERINGS Dealer-verse

QUICK OVERVIEW

To have an immersive experience for customers in virtual world for purchasing automobile, one of the biggest challenge customers deal with is to look out for various stores to check the availability of their choice of automobiles.

OUR APPROACH AND SOLUTION

Dealer-verse is an automobile dealership in the metaverse with options for a user to visit and view any of the vehicles on sale. They can customize the vehicle as per their liking from the available options, and test drive in a terrain of choice. The customers can also chat with an actual agent or an AI agent to get a resolution to their queries. This environment can be used or extended to launch new vehicles in the metaverse.

BENEFITS

- Uniformity of service
- Extended reach without investing in real estate
- Huge saving in investments





OFFERINGS Meta Telecom Store

QUICK OVERVIEW

One of the leading telecom service providers was trying to expand their reach using alternative sales channels beyond expanding retail outlets.



A retail store for a telecom service provider which provides the customer with complete store - experience in the metaverse. Right from checking out the latest phones, comparing them, and even getting a friend into the same space to help in decision making, the entire experience has been built in the metaverse. Moreover, a user may enquire about different plans and products to get the best deals in the metaverse. The solution also enabled users to interact with customer support through a chatbot.

- A significant increase in the percentage of the consumers who visited digital stores end up buying products which increases the sales of the company
- All different options of vehicles can be made available for viewing as against a physical store
- Ability to customize and view different options gives a better experience as compared to the website
- User interest increases as it helps the user to engage in a more immersive experience
- Customers can have the touch and feel of the product which makes this solution a superior option to conventional options



Smart City - Shadow Analysis

QUICK OVERVIEW

The high rises are affecting the urban environment with high percentage of shadow on surroundings that can have negative impact on others. One of the leading city development councils approached Makers Lab to identify spots where sunlight is available.

To support urbanization planning and decision-making system, we have come up with a 3D model-based digital twin of the city having shadow analysis to understand and measure the impact of new urbanization infra.

BENEFITS

A shadow analysis can help determine the areas of the drawing that will receive less sunlight or remain in a shadow during a particular time of the day. By inserting several directional light sources, each representing a different time of day, an overlapping range of shadows is created which indicates the amount of time a particular area is in the shade over the course of the day. Shadow analysis was used to plan gardens in the city.



OUR APPROACH AND SOLUTION



OFFERINGS Meta Coffee Shop

QUICK OVERVIEW

Coffee is the object of conversations, travel, careers, and passion. Due to COVID-19 restrictions, people were not able to physically visit the store and get a real-time experience of the product. It is thus natural for coffee to transition from the real world into the virtual world.

OUR APPROACH AND SOLUTION

The meta coffee shop is a state of art coffee shop in the metaverse, where it gives the consumers the option booking of coffee and sandwiches in their favourite coffee shop. Through this solution, the customer not only has the option of booking but also complete the transaction for the goods to be delivered or picked up in store. It also provides a composition of different variants of coffee and sandwiches. You can also interact with customer support through Entellio-our own IP which is a conversational framework. This provides the customer with seamless experience and with tempting delicious food which can be seen in a very realistic kind of environment.

- Greater sales reach and customer accessibility
- They provide value in the form of customer utility
- Faster product/business service launches





OFFERINGS Al Meta Human

QUICK OVERVIEW

A virtual being which aims to create a humane touch and have a new way of interacting with machines and engaging with people. This application removes the technical barrier between humans and machines and makes it more interactive. This application offers a chance to make digital interaction with customer every day which can lead to opportunities around the clock.



OUR APPROACH AND SOLUTION

- Tech Mahindra has created a Metahuman which is a fully rigged digital human. It has near-infinite variations of facial features and skin complexions, plus an array of different choices for hair, eyes, make-up, and teeth, you can create a huge variety of faces. Instead of responding to a chatbot, meta humans make conversation interactive and interesting
- Metahumans has been built as digital humans powered by • foundation models represent one of the most significant paradigms shifts in AI in decades. Technology allows the metahuman create conversations with appropriate gestures and expressions which creates essence for interactive human-machine connection
- We have created two types of metahumans. One of them can mimic the expressions on a human face, which is very useful in customer care scenarios where we can protect the privacy of the customer care agent, while providing the user an experience of a virtual face to face discussion
- The second case is that of a meta human who can be the face of the conversational AI /chatbot - not only lip sync but also express while communicating with a human
- The roadmap for this offering is to enable the Metahuman to connect with generative AI and perform the expressions as well as the lip sync for speech in real time

- Engage customers with the brand
- Deliver efficient and proactive self service
- Scale customer assistance



Video call in the metaverse

QUICK OVERVIEW

For real-time engagement in the virtual world that involves interacting with clients, building solutions with seamless experience. Most of the metaverses have the option for users to enter as avatars, but sometimes this is not very useful. In such scenarios, where we need to combine the effects of metaverse with physical presence, the user may be able to project the actual video in the metaverse

OUR APPROACH AND SOLUTION

Meta video call is a meeting taking place in the metaverse. You can observe the candidate through metaverse surroundings. People can join meetings without traveling or even leaving their homes. You will have the option to join the call via desktops, laptops and VR, AR headsets. You can ask someone to virtually move into another part of the simulation, much like stepping out in the hallway for a conversation.

- High value collaboration
- Seamless customer experience •
- HR can use it to conduct interview







OFFERINGS **AR Site Survey**

QUICK OVERVIEW

Site surveyors often have a lot of information which is difficult to capture. When the engineers go for build, many times there are obstacles which cannot be identified.

OUR APPROACH AND SOLUTION

We built a mobile tablet-based AR application which • Helps scan the premises through the in-device camera and put markers and information on the scanned map • The scanned area with the 3D objects is pushed on to cloud Engineers can scan the premises by moving around the area to show • the markers on the AR map and help them navigate and get related

- information

- Accurate information in a specified time
- No cluttering of data
- Using AR, engineers can navigate easily to the exact location





OFFERINGS **AR Warehouse Management**

QUICK OVERVIEW

Warehouse management requires a lot of labor which mainly includes manually checking of weights and dimensions of goods, manual Inventory management, and manual records generation for maintenance



OUR APPROACH AND SOLUTION

To reduce manual effort in warehouse management, Makers Lab has built two solutions:

1.. Dimensioner

Problem statement: Tier 1 US distributor of information technology products and services needed to detect package sizes remotely. A POC to detect the dimensions of packages stored in the warehouse was developed using Computer Vision

Solution: Dimensioner is a solution which uses computer vision to locate an object and calculate its dimensions in real time.

- This makes Dimensioner a combination of two different technologies namely -
 - Computer vision /Al
 - IoT
- Object dimensions are calculated by locating the objects in a live video feed
- The solution utilizes camera • calibration or a marker which is present in the frame to determine the dimensions of objects
- The solution senses a new environment, with the objects kept on a certain plane of reference, dimensions visualized on the display screen, and all this being

BENEFITS

- Reduces risk of data loss
- Smart inventory tracking
- Visualization of stock management
- Extensible to supply chain problem
- Fast object tracking
- Insightful information

E

monitored either over a mobile application or a webpage

2. Inventory management Problem statement:

In logistics industry, usually the inventory manager counts the physical assets using pen-paper or scans the assets one-by-one. While performing it the manager might get interrupted due to external reasons like phone calls or meeting. This might lead to rescanning the assets as they would lose track of assets that have already been scanned and this process is time consuming.

Solution: Multiclan AR app for inventory management Our offering Matrix Scan uses AR technology that enables user to scan multiple assets simultaneously. This application not only allows you to scan but also resumes the scan and shows how many products have already been scanned if the user is interrupted by any external reasons. This application reduces the time consumption of scanning the assets in the inventory.



OFFERINGS E-Dressing

QUICK OVERVIEW

When a particular piece of cloth or accessory garment is chosen on an e-commerce site, there are a plethora of doubts which are not addressed - how will it look on different body types? Will it suit the customer? Is the color is befitting? These doubts can be resolved if any customer tries on the piece of garment and judge, but in a virtual scenario, these remain answered.

OUR APPROACH AND SOLUTION

Our solution resolves these issues through e-dressing. E-dressing provides the customer the option to create a 3D avatar using AI which is closest to their body type - letting the customer decide the skin color, body type, height and weight. Once the avatar is chosen, a carousel of wish listed items appear at the bottom of the screen where customers can see how the chosen item would look on their chosen avatar.



BENEFITS

- AR based shopping platform enhances shopping experiences by using augmented reality
- AI enabled personalized 3D avatar creation Create personalized 3D avatar for trying on clothes to bridge the gap between traditional shopping and digital shopping
- Try on dresses with varied body measurements Added user • measurements for more "real" experience of the digital shopping
- Web and android supporting platform Get easy access on web platform by personalized avatar and AR-based android shopping experience



Insightful Words from Head of Makers Lab, Pune (AVP)



Recently, I received a direct message on my LinkedIn account from three primary school kids living in Singapore. They called themselves "The Kool Kangaroos" and indeed, they lived up to the name. This bunch of extremely enthusiastic and pepped-up kids were participating in the First Lego League and wanted my mentorship to better understand drone technologies. Over the next few weeks as I mentored them, I was intrigued by their thought process and intent to solve problems of global scale.

You may find it hard to believe, but the young team had sought out to solve for a disrupted supply chain in Canada that had occurred recently due to the truck driver's agitation. They wanted to design drone-based last-mile delivery system - complete with redesign of truck containers, drone launch and charge pads, and more. It was amazing. The domains of AI, IoT, drones, and robotics have

Pankaj Sharma Head of IoT, Drones & Robotics

witnessed exponential growth during these tough two-and-a-half years riddled with the pandemic. The need for assistance in the times of social distancing propelled and expedited the timelines of technological progress of these domains by almost a decade.

Today, almost everyone we know owns a smart device. It could be an inexpensive phone but still have a camera capable of identifying faces in pictures and boxing them in tandem—that is AI in the palm of our hands. We have smart devices in most households today. We are moving towards a world where technology will permeate every part of our existence but in a way that improves our overall existence.

Through this edition of our compendium, we talk about some of our innovations, research, and ongoing projects in these domains.

RECENT RESEARCH AT MAKERS LAB

Our Study on Therapeutic drug on 3D Human Vascular Lung Model Virtual Reality Application for Online Learning Experiences

Brief on Panchang Weather Prediction

Metaverse Database Research

Banking in the Metaverse

Quantum Security



Our Study on Therapeutic Drug on 3D Human Vascular Lung Model

QUICK OVERVIEW

COVID-19 pandemic ravaged the world and vaccines were rapidly developed as preventive measures. But there has been no targetbased therapy which can be used if infection sets in. Remdesiver and dexamethasone were not designed to combat COVID-19 but are being used clinically till better targeted therapies are available. Given this situation, target based therapies that intervene in the disease pathway are urgently needed.



Brief on Panchang Weather Prediction

QUICK OVERVIEW

Modern science can predict various aspects of weather including rainfall, but it still does not provide high accuracy when we consider longer duration predictions in the future, which are very important for agriculture. In countries like India, ancient knowledge-based rainfall predictions are being made till this day. This research paper is an attempt to predict daily rainfall based on a limited implementation of rules from various Panchangs and assessment of accuracy of these predictions in an unbiased manner.



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Metaverse Database Research



QUICK OVERVIEW

Metaverse is a very new technology for the whole world, and with that novelty the responsibility to utilize it for the betterment of our own system lies within the IT Industry. The paper focuses on two use cases that elaborates on how to collaborate and create on the metaverse, which can be explored and used for the benefit of humanity and this planet.

Read More



QUICK OVERVIEW

Metaverse is a very new technology for the whole world, and with that novelty the responsibility to utilize it for the betterment of our own system lies within the IT Industry. The paper focuses on two use cases that elaborates on how to collaborate and create on metaverse, which can be explored and used for the benefit of our race as a whole.

Read More





Banking in the Metaverse

Quantum Security

QUICK OVERVIEW

The metaverse will be an immersive version of the internet with interactive features using technologies like virtual and augmented reality, 3D graphics, non-fungible token (NFT), blockchain, haptic sensors, and artificial intelligence. All these technologies have their own vulnerabilities and security risks. With these there will be possibilities of creation of the dark web version in the Metaverse which again will have huge security risks. We try to simplify this to help you better understand what exactly these risks will be.



Tech Mahindra Makers Lab[™] Case Study Compendium I Edition 2



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