A PROJECT REPORT ON Metaverse Business Engagement Dashboard

(Submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering – Artificial Intelligence & Machine Learning)

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The Metaverse Business Engagement Dashboard is a comprehensive, interactive Power BI solution designed to empower metaverse platform owners, virtual real estate developers, and brand partners with real-time insights into user behavior, advertising performance, and revenue generation.

The dashboard integrates data from 300 active users, 500 satisfaction surveys (average score: 3.60/5), 1,000 ad impressions (268 clicks, CTR: 26.8%, 106 conversions at 10.6% rate, $29,792.57 total value), 1,500 sessions, 700 sales ($339,755.82 total), and $2,454,091.68 in virtual real estate revenue (26,973.66 sq. meters sold, avg $90.98 per sq. m) across platforms (HoloLens, Oculus, Mobile, PC) and regions. Key visualizations include quarterly satisfaction trends, monthly ad performance, regional avatar preferences, and revenue breakdown by property category (Arena: $558,197.73, Mall: $738,304.12 contributing over 52% combined) and brands (Meta: $492,077.76, Nike: $470,862.20).

Major findings reveal Oculus as the highest-satisfaction platform (3.70/5), Arena & Mall properties driving 52% of revenue, South America as the largest user region (64 users), and an average monthly revenue of ~$102K (annual run-rate ~$1.22M). The dashboard enables data-driven decisions for user retention, ad optimization, and monetization strategies in the rapidly growing metaverse economy.

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INTRODUCTION

1.1 Background of Metaverse Economy

The metaverse represents a transformative digital frontier, projected to generate $13 trillion in economic value by 2030 (Citi GPS, 2023). Virtual real estate transactions alone exceeded $2 billion in 2022, with major brands like Adidas, Nike, Apple, Meta, and Samsung investing heavily in immersive experiences, branded virtual spaces, and targeted advertising within platforms like Decentraland, The Sandbox, and Horizon Worlds.

This ecosystem spans VR/AR devices (e.g., Oculus Quest, HoloLens 2, mobile apps, PC clients), generating vast datasets on user interactions, satisfaction, sales, and revenue. However, the lack of integrated analytics hinders stakeholders from optimizing engagement and monetization.

1.2 Problem Definition

Metaverse operators face fragmented data silos:

- User satisfaction scattered across platforms without quarterly trends.
- Advertising metrics (impressions, clicks, conversions) lacking temporal analysis.
- Demographic insights (regions, avatar types) not linked to revenue drivers.
- Virtual real estate sales data unconnected to property categories and brands. This results in missed opportunities for targeted marketing, platform improvements, and revenue forecasting.

1.3 Need for Business Intelligence in Virtual Worlds

A unified dashboard is crucial to correlate user experience (satisfaction scores), marketing ROI (CTR, conversion rates), and financial outcomes (revenue per category/brand), enabling proactive strategies in a competitive virtual economy.

1.4 Role of Power BI

Power BI excels in handling multi-sheet Excel data, creating star schemas, advanced DAX calculations, and interactive visuals (e.g., drill-through, slicers, bookmarks). Its seamless integration with Microsoft ecosystems makes it ideal for academic and enterprise metaverse analytics.

PROBLEM STATEMENT

2.1 Detailed Problem Description

Develop a fully interactive Power BI dashboard that ingests the metaverse_schema_dataset.xlsx (7 sheets: Users, Sessions, Sales, Ads, Spaces, Satisfaction, RealEstateTransactions) to visualize and analyze:

- User satisfaction by platform and quarter.
- Ad performance trends (impressions, CTR, conversions).
- Demographic segmentation (regions, avatars).
- Revenue from virtual real estate by category and brand.
- Predictive insights for future growth.

2.2 Industry Relevance

Directly applicable to metaverse platforms (e.g., Meta Horizon, Roblox), VR hardware makers (Oculus, HoloLens), and brands (Nike's virtual stores, Adidas' AR campaigns). It addresses real-world challenges like optimizing $2B+ virtual land markets.

2.3 Scope of the Project

Analysis covers January 2024–November 2025 data for 300 users. Excludes real-time streaming or external APIs; focuses on static Excel integration and core BI features.

OBJECTIVES

> Visualize and compare user satisfaction trends across platforms (HoloLens: 3.46, Mobile: 3.65, Oculus: 3.70, PC: 3.61) and quarters.

> Track advertising KPIs: 1,000 impressions, 26.8% CTR, 10.6% conversion rate, $29,792.57 value.

> Segment users by region (South America: 64 users) and avatar type for targeted insights.

> Break down $2.45M revenue by category (Arena: 23%, Mall: 30%) and brand (Meta: 20%).

> Forecast annual run-rate (~$1.22M) using historical trends.

LITERATURE REVIEW & RELATED WORK

Current metaverse tools are limited:

- Decentraland Analytics: Focuses on transactions but ignores satisfaction and ads.
- The Sandbox Dashboard: Basic engagement maps, no cross-platform or revenue forecasting.

Tool/Platform	Strengths	Limitations	Why Power BI?
Decentraland	Real-time blockchain data	No user surveys or ad metrics	Broader integration, free academic use
The Sandbox	Visual heatmaps	Platform-specific, no DAX forecasting	Advanced interactivity, cost-effective
Tableau	Stunning visuals	Expensive licensing	Power BI: Seamless Excel import, DAX power
Looker	SQL-based queries	Cloud-only, steep learning curve	Easier for students, MS ecosystem fit

Power BI was selected for its DAX language (e.g., custom CTR calculations), free desktop version, and AI visuals like key influencers for metaverse trends (Gartner Magic Quadrant, 2023).

DATASET DESCRIPTION

Data Sources

Sourced from metaverse_schema_dataset.xlsx (7 sheets, ~5,000 rows total), simulating a metaverse platform from 2024–2025.

Data Structure & Key Metrics

- Users (300 rows): Demographics (Region, Country, SignupDate, AvatarType, DevicePrimary).
- Sessions (1,500 rows): Engagement (SessionStart/End, Platform, Spaces visited).
- Sales (700 rows): Transactions (SaleDate, AmountUSD: total $339,755.82, NFT/Product types).
- Ads (1,000 rows): Performance (AdShownDate, Clicks: 268, Conversions: 106).
- Spaces (100 rows): Properties (SpaceName, Brand, Category: Arena/Mall/etc.).
- Satisfaction (500 rows): Feedback (Score 1–5, Platform, SurveyDate).
- RealEstateTransactions (250 rows): Revenue (RevenueUSD: $2,454,091.68, SquareMeters: 26,973.66).

Metric	Value
Total Users	300
Total Surveys	500
Avg Satisfaction	3.60/5
Ad Impressions	1,000
CTR	26.8%
Conversions	106 (10.6% rate)
Total Revenue	$2,454,091.68
Sq. Meters Sold	26,973.66
Avg Price/Sq.M	$90.98

Region Distribution: South America (64), Asia (57), North America (52), Oceania (46), Europe (42), Africa (39).

METHODOLOGY

Data Collection & Cleaning

Imported via Power Query: Removed nulls (e.g., blank Ad dates), standardized formats (dates to YYYY-MM-DD, Brands: 'None' as category), merged Spaces with RealEstate on SpaceID.

Data Modeling (Star Schema)

- Fact Tables: Satisfaction (scores), Ads (events), RealEstateTransactions (revenue), Sales/Sessions (amounts/durations).
- Dimension Tables: Users (demographics), Spaces (brands/categories).
- Relationships: Many-to-one on UserID/SpaceID.

DAX Measures & Calculations

- Avg Satisfaction = AVERAGE(Satisfaction[Score]) → 3.60
- CTR = DIVIDE(COUNTROWS(FILTER(Ads, NOT(ISBLANK(Ads[AdClickedDate])))), COUNTROWS(Ads)) → 26.8%
- Total Revenue = SUM(RealEstateTransactions[RevenueUSD]) → $2.45M
- Category % = DIVIDE([Revenue by Category], [Total Revenue])
- Predicted Annual = [Total Revenue] / COUNTROWS(DISTINCT(RealEstateTransactions[TransactionDate Month])) * 12 → ~$1.22M

Dashboard Design & Visualizations

4 pages with cards (KPIs), line/bar charts (trends), pie charts (distributions), tables (details), maps (regions). Blue metaverse theme.

Interactivity Features

Slicers (Year, Brand, Platform), drill-through (e.g., user details), bookmarks (navigation), tooltips (e.g., exact revenue).

TOOLS & TECHNOLOGIES USED

- Microsoft Power BI Desktop (v2.135+): Core dashboard tool.
- Power Query/Excel: Data import & ETL.
- DAX Studio: Measure debugging.
- Python (via Power BI integration): Initial stats (e.g., pandas for summaries).
- Canva: Custom icons (VR headset, virtual land visuals).

LIMITATIONS & FUTURE ENHANCEMENTS

Limitations:

- Static Excel data (no live API feeds).
- No sentiment analysis on survey comments.
- Assumes linear growth; ignores external factors (e.g., VR hardware adoption).

Future Scope:

- Integrate real-time APIs (e.g., Meta Graph API).
- Add ML forecasting (Python Prophet in Power BI).
- Mobile app export for on-the-go access.
- NLP on comments for deeper insights.

CONCLUSION

The Metaverse Business Engagement Dashboard transforms raw, multi-sheet data into an interactive powerhouse of insights, revealing Oculus as the satisfaction leader, Mall/Arena as revenue kings, and untapped potential in South America. By leveraging Power BI's DAX and visuals, this project demonstrates scalable BI for the $13T metaverse—empowering decisions that drive virtual economies forward. Future iterations will incorporate AI for even deeper predictions.

ANNEXURES

Annexure 1: DAX Code Snippets

text

```
Avg Satisfaction = AVERAGE(Satisfaction[Score])

CTR % = DIVIDE([Ad Clicks], [Ad Impressions], 0) * 100

Revenue by Category = SUMX(VALUES(Spaces[Category]),
CALCULATE(SUM(RealEstateTransactions[RevenueUSD])))
```

Python

```
import pandas as pd

df = pd.read_excel('metaverse_schema_dataset.xlsx', sheet_name='Satisfaction')

print(df.groupby('Platform')['Score'].mean())
```

MEETING PHOTOGRAPHS OF TEAM