GaiaCraft

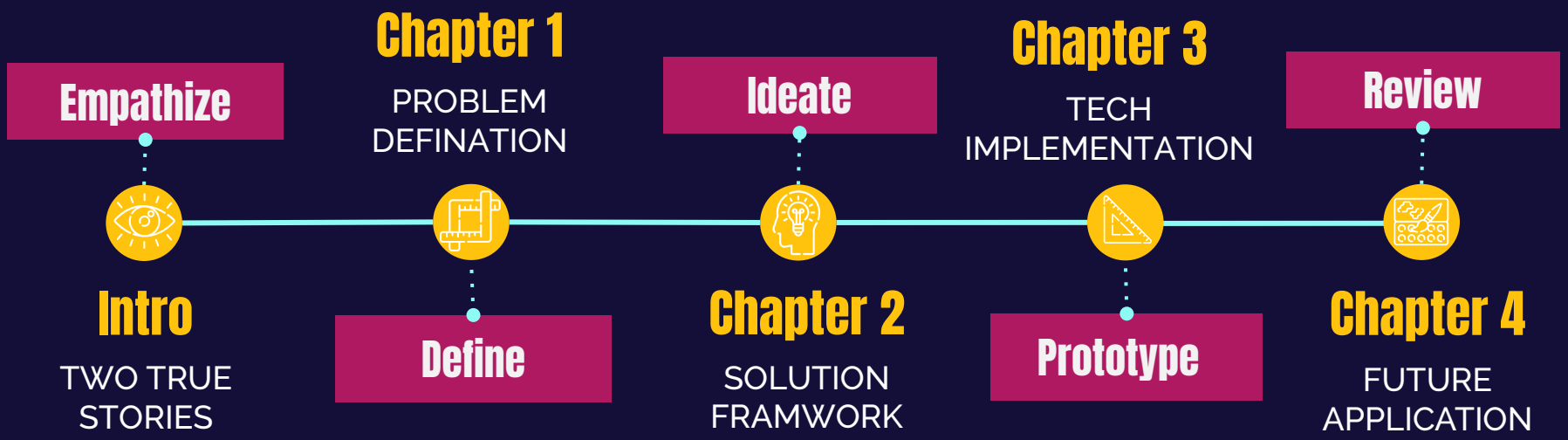
The world's first online pixel-style sustainability game with real-virtual integration

---

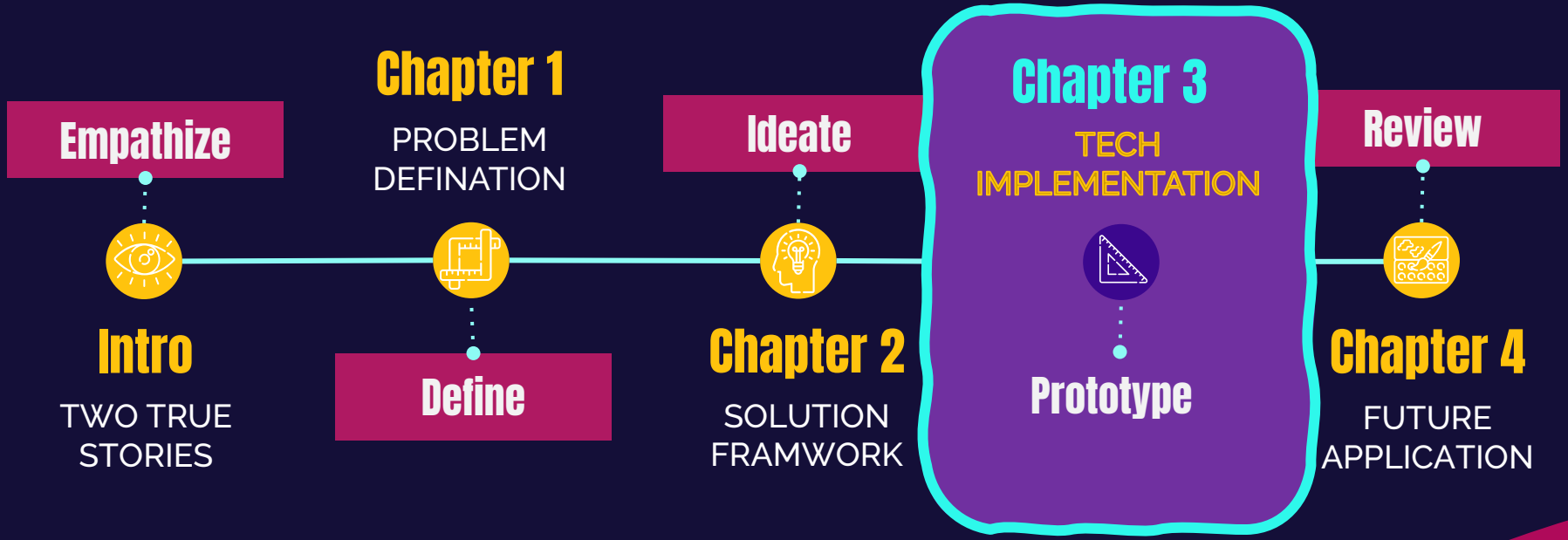
Produced by NCCU SWIM TEAM

CONTENT TABLE

Stanford Design Thinking Framwork



Stanford Design Thinking Framwork



Meet Marry and David

I'm super into sustainability and really want to save the planet, but honestly, besides my own efforts, I feel kind of helpless and like my actions aren't really getting any credit.

Marry (19)
NCCU Student

As an ESG Specialist, my role is to assist with our company's ESG development, but given that we are a small company, we're not even sure what should go into an ESG report.

David (25)
NCCU alumnus
ESG Specialist

01

PROBLEM DEFINATION

Triple Disconnections in the Era of Sustainability Anxiety

Triple Disconnections in the Era of Sustainability Anxiety

Corporate 1

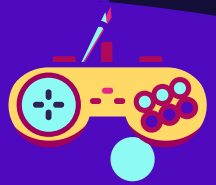
Over 98% of Taiwanese firms are SMEs lacking ESG reporting or data systems.
Although 1.6 million firms are now on ESG data platforms (*AmCham 2024*), participation is mostly passive. Corporations bear responsibility but lack accessible tools.

Government 2

Taiwan has 18 localized SDGs and 337 indicators (*BTI 2024*), yet lacks systems to engage citizens or track behavioral impact. Schools teach sustainability but struggle to make it tangible or measurable.

Youth 3

Over 50% of Taiwanese teens feel anxious about the future (*Taipei Times 2025*); 40% cite uncertainty and helplessness. Despite positive attitudes (*MDPI Sustainability*), real green actions stay low. Only 44% of global youth feel equipped with green skills (*PwC*), with East Asia below average.



How do we connect citizens and companies through gamified sustainability, turning everyday low-carbon actions into measurable impact and real rewards, while helping businesses solve their ESG reporting challenges?


GAIA
CRAFT
Start Game
Continue
Settings
Quit Game
2025 NCCU SWIM TEAM

02

SOLUTION FRAMWORK

Gamifying Sustainability: A System Linking Citizens, Companies, and Carbon Reduction

02 SOLUTION FRAMWORK

Gamifying Sustainability - A System Linking Everyone

Turn sustainable behavior into a game. People earn points for eco-friendly actions (taking public transport, reducing plastic, saving energy).
Companies provide rewards, creating a loop of action → data → incentive.

Solution Concept

For Businesses

-Sponsor challenges (e.g., "Bring self-cup 30 times = 10 points, give Starbucks").
-Gain ESG data and consumer engagement metrics.
-Co-create stories or virtual missions aligned with brand values

For Players

-Complete daily or community challenges to earn points and badges.
-Explore eco-spots like a sustainability version of *Pokémon*.
-Form teams and compete in collective carbon-reduction missions.

The GaiaCraft Flywheel

Role	Action	Benefit	Data Feedback
Players	Play, complete tasks	Points, badges, discounts	Carbon & behavior data
Companies	Offer incentives	Brand visibility, ESG data	Participation reports
Government	Support & verify	Policy outreach, education	Public impact stats

02 SOLUTION FRAMWORK

Gamifying Sustainability - Stakeholder Dynamics

Companies

Players

Rewards meet engagement: companies sponsor green missions, players earn points and benefits.

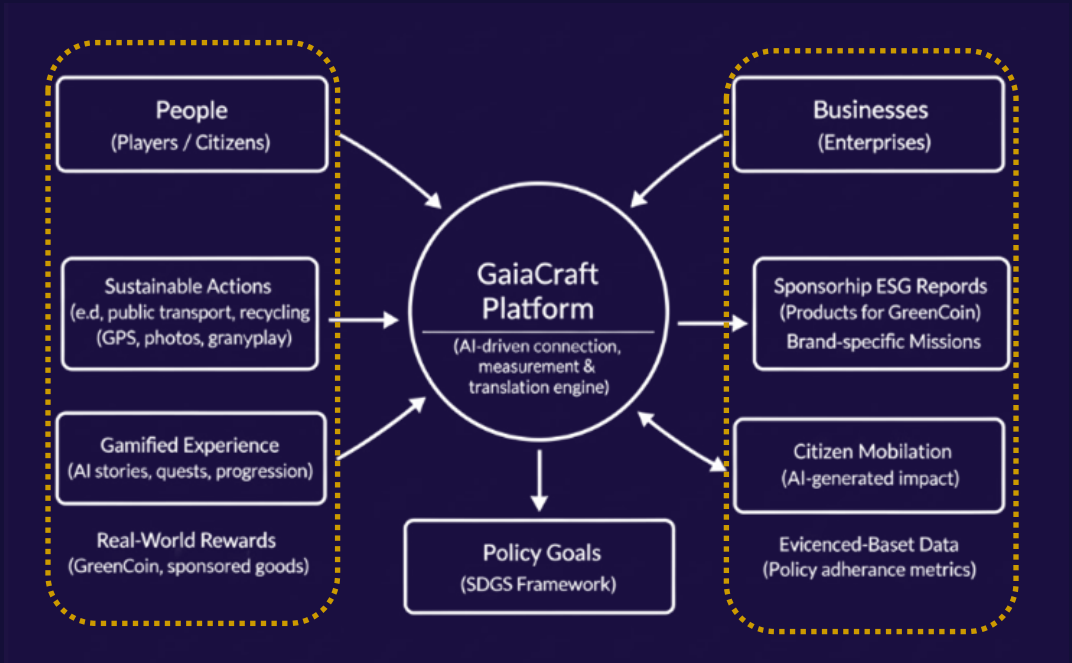
Policy and data exchange: governments set ESG rules, businesses deliver measurable actions.

Education meets action: governments promote awareness, players' actions feed real data.

Government

02 SOLUTION FRAMWORK

Gamifying Sustainability - Value Ecosystem Flow

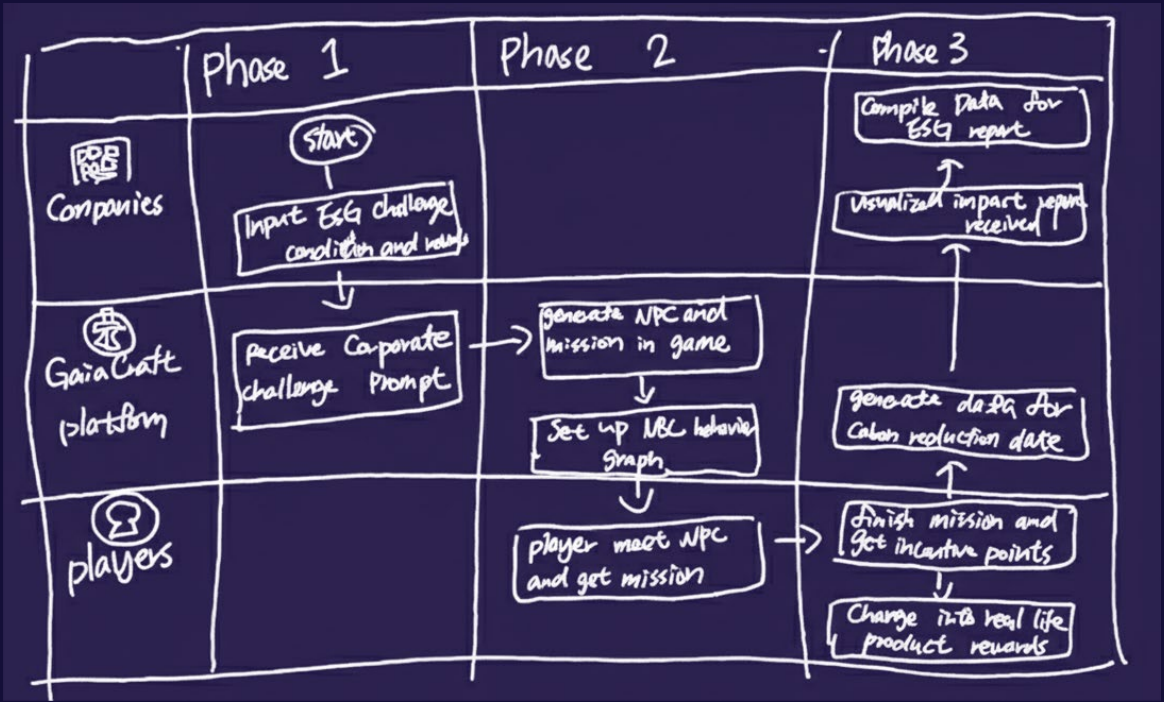


03

TECH IMPLEMENTATION

AI Integration: Challenges and Solutions

Data Flow from Game Mission to ESG Report



AI Integration: Challenges and Solutions

AI-Driven Game

Our Final Goal

1. Auto-generated NPCs: Not just appearance but dynamic, organic personalities.
2. AI-driven storytelling: Narratives that adapt to player behavior.
3. Organic memory: NPCs evolve by remembering past interactions.

BUT!!! AI hallucination is the biggest obstacle to giving games real life!!!LLMs are too general. It's so hard to keep characters consistent or remember what happened before!!!

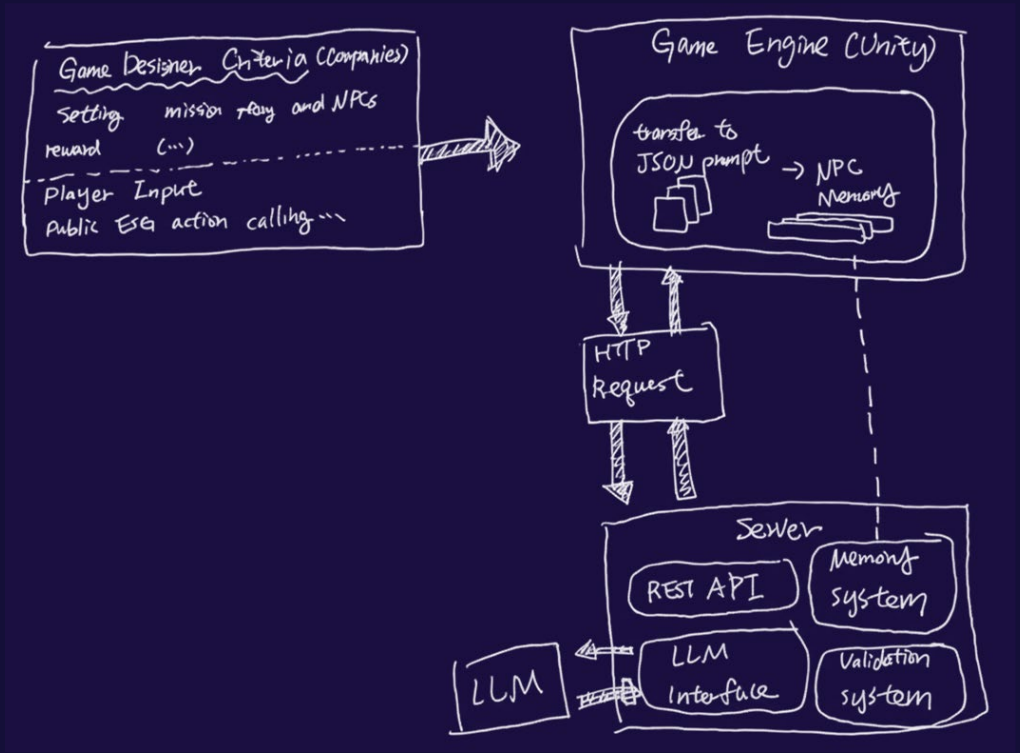
AI Characters Behavior Architecture

-Problem: FSMs and BTs are predictable but rigid; pure RL is adaptive yet costly and unstable.
-Solution (Hybrid Approach): Combine control and adaptability using:
-BDI Model: NPCs act on beliefs, desires, and intentions for goal-driven behavior./BT + RL: BT handles structure; RL provides adaptive skills like "take cover."
-Result: Hybrid models yield adaptive, consistent, and developer-controllable NPCs.

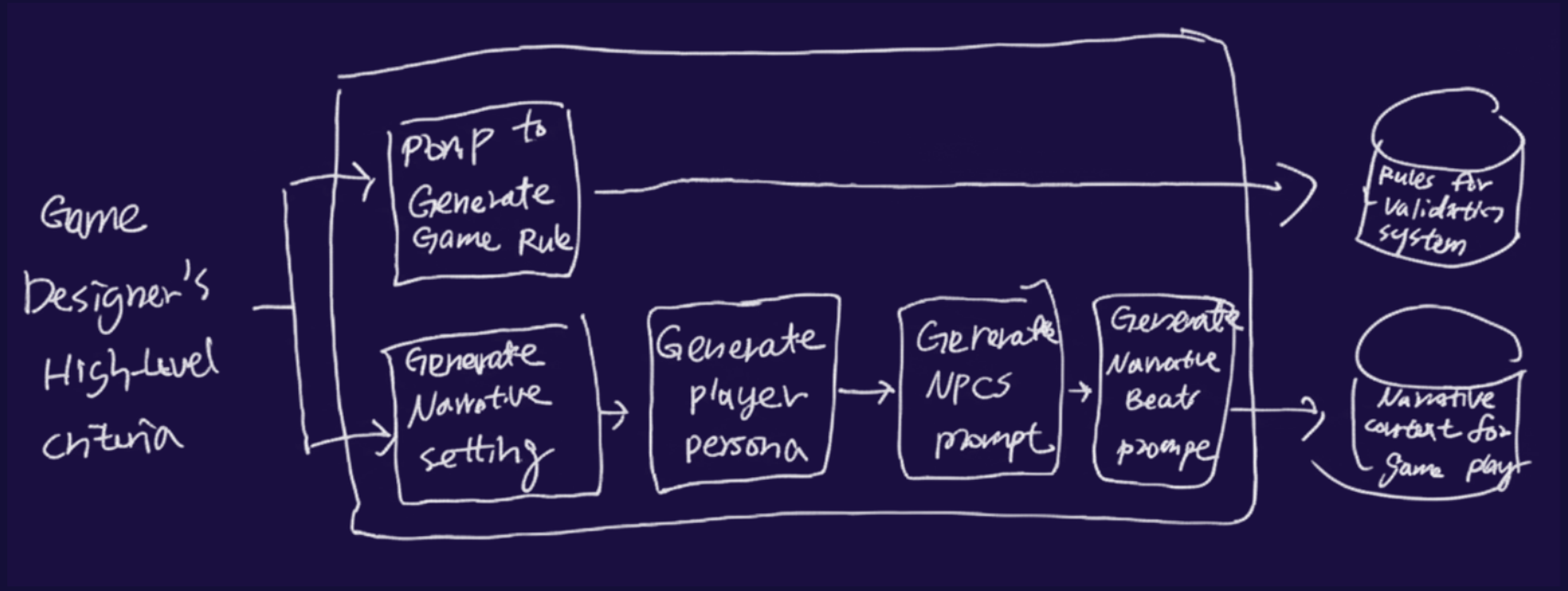
AI NPC Long-Term Memory Architecture

-Problem: LLMs' limited context windows restrict NPC memory, preventing "organic" behavior.
-Solution (Memory Stream): Extends LLMs with an external "Memory Stream" for experiences. "Reflection" is key, enabling NPCs to synthesize new insights from past memories to evolve.
-Technical Core (RAG): Stores interactions as vectorized data. Queries retrieve relevant past memories, augmenting the LLM's context for dynamic, informed responses.
-Result: NPCs gain vast, evolving memory for truly believable, organic interactions.

Game Narrative and Rule Generation System Architecture



Game Narrative and Rule Generation System Architecture



DEMO VIDEO

04

FUTURE OUTLOOK

Social Impact &
Other Application Scenarios at NCCU

04 FUTURE APPLICATION

Social Impact Assessment

Public Engagement

Engages 50,000 players and generates 3 million eco-actions, achieving an estimated 500 tons CO_2 reduction in the first year.

ESG Empowerment

Helps SMEs cut 70% of ESG reporting costs and 60% of data collection time, partnering with 50+ organizations.

Education Impact

Integrates into 20 universities and 200 courses, reaching 100,000 students and promoting sustainable lifestyles.

Policy Support

Provides over 1 million behavior data points annually to enhance government sustainability planning and carbon policy precision.

Future Application: AI Social Science Lab

Core Concept: Building a Controllable "large-Scale Virtual Society"

Leveraging the core AI technology developed for the "Gaia Craft" sustainability game, we can expand it into a powerful social science research platform.

Why It's Feasible (Built on Gaia Craft's Tech)

Beyond rule-based ABM, our AI agents use the BDI model to make adaptive, human-like decisions.
With RAG-based Memory Streams, they retain experiences and evolve through reflection, enabling long-term behavior learning.

Research Applications

-Simulate group dynamics to analyze how information, norms, or rumors spread.
-Test policy interventions within a digital twin society to forecast real-world outcomes.
-Study cooperation and conflict emergence under varying social and environmental pressures.

Practical Impacts

-Reduce research cost and carbon footprint through AI-based experimentation.
-Enable safe, repeatable, and large-scale testing of human-like behaviors.
-Provide data-driven insights for sustainable policy and social innovation.

It empowers NCCU's social science research by offering a scalable, low-cost "Social Behavior Sandbox" that overcomes the scale, cost, and ethical limits of traditional human experiments.

THANK YOU FOR LISTENING!