INNOVATION PLAN

HiveGuard



SMART
Protection

SAFE
Minds

CONFIDENT
Play

Qianhao Han
www.hiveguard.ca

Introduction

HiveGuard was inspired by a real personal experience. Founder Qianhao's older brother was forced to end his 13-year youth hockey career after a severe concussion, losing the opportunity to pursue hockey at a professional level. After a hard hit, there were no visible symptoms to stop him from playing, and repeated impacts while he stayed in the game made the damage irreversible. Concussions are not rare accidents, but a persistent and overlooked risk in high-impact sports that can harm long-term brain health and end careers. HiveGuard was created to change this. As the first smart sports helmet system built around neural safety, HiveGuard combines advanced impact protection, EEG brain monitoring, and AI analysis to deliver whole-brain protection. Its goal is simple: to make brain health visible and actionable at the moments that matter most.



Kevin He

NHL Winnipeg Jets Prospect

HiveGuard
Brand Ambassador





Problem Statement





Each year, approximately 4.2 million concussions happen in Canada and the United States, with nearly half going unreported due to delayed symptoms. In high-impact sports such as hockey and football, athletes cannot immediately assess their own brain condition due to delayed symptoms, or they may even choose to downplay the health signals to stay in the game when they are under strong performance pressure. Coaches and trainers often rely on SCAT-based sideline screening and symptom self-reporting to detect concussions, which are inherently subjective and can be inconsistent, leading to missed or delayed identification. Current helmets only focus on mechanical skull protection, but cannot answer the critical question: Is the brain at risk after impact? This lack of insight leads to premature return to play, career-ending injuries, and increased risk of long-term neurological damage. Concussions also create a major financial healthcare burden of about $3B annually in the U.S. and $1.5B in Canada. Parents, coaches and athletes need objective, real-time, and actionable guidance right after impact. This is the gap HiveGuard aims to fill.

Our Innovation

Our innovation HiveGuard is a smart concussion-prevention helmet designed to address two connected challenges: reducing concussion-causing forces and providing players with immediate insight into brain health after impact.



Problem



High Impact Hit



No Brain Insights



Subjective Judgement

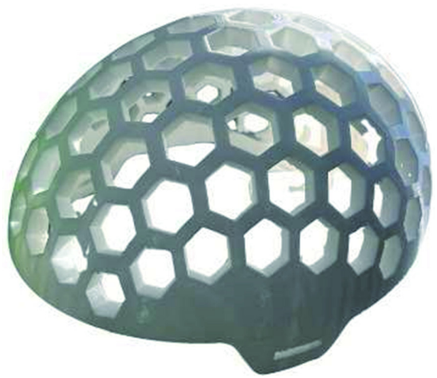


Risky Return-to-Play

Prevention

The helmet's honeycomb-patterned outer shell spreads forces outward across a wider surface area instead of concentrating them at a single point. This structure is 3D-printed in a flexible TPU (Thermoplastic Polyurethane) material with a TPMS (gyroid) infill that progressively buckles on impact, absorbing energy more effectively, especially rotational forces, a primary cause of concussions.

Honeycomb patterened shell for improved impact absorption



Warning

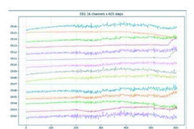
For post-impact decision support, HiveGuard uses EEG (electroencephalography) and deep learning based assessments to detect deviations from an individual's cognitive and motor baseline. When the helmet's sensors, the accelerometer and gyroscope, detect a high-risk collision or abnormal motion, a built-in EEG cap activates automatically to capture brain-signals immediately after impact.



Accelerometer +Gyroscope detect an impact



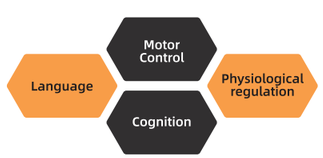
Activates helmet-embedded EEG cap





Analysis

The EEG signals are analyzed on-device by EEGConvTrans, a custom pre-trained, lightweight deep-learning model that combines a Convolutional Neural Network (CNN) to capture short-term neural changes with a Transformer to identify longer-range patterns. The model outputs a probability of altered neural adaptability across four domains: language, motor control, cognition, and physiological regulation.



Analyzes changes across four domains
Outputs a probability of altered neural adaptability

Alerting

Results are displayed in a simple app interface, providing clear next step guidance.



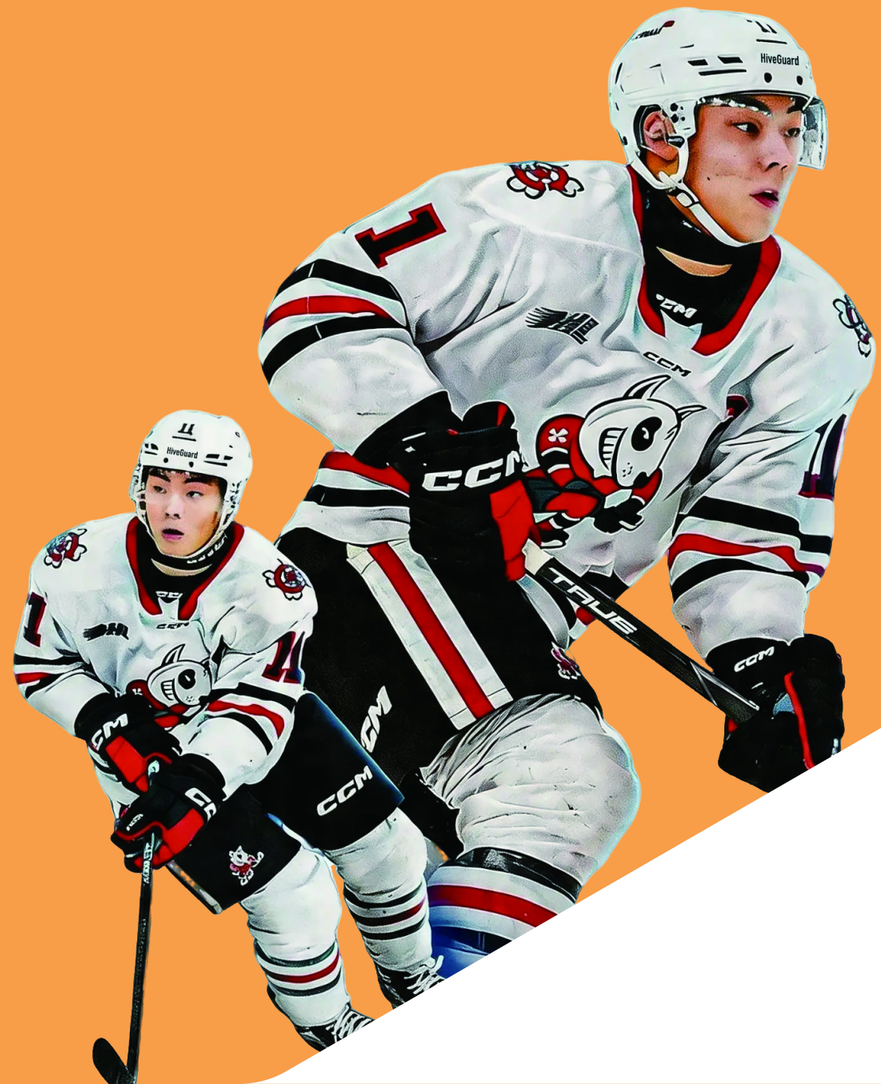
HiveGuard Mobile App
displays altered neural adaptability
recommends next steps



Red LEDs
flash when Sete tn Pleg probability> risk threshold

Unique Value **Proposition**

HiveGuard is the first smart, sports-ready helmet to combine advanced impact protection and real-time neural insight, turning return-to-play decisions from subjective guesswork into data-driven guidance. By integrating a honeycomb shell, EEG sensing, and real-time AI decision support in one device, HiveGuard has a first-mover advantage and defensible system-level integration that is difficult to replicate.



Business Model & Unit Economics

Revenue model

HiveGuard uses a hybrid hardware and subscription business model.

Table1: Revenue Model

Channel	Model Busine	Customers	Price (USD)	Gross Margin
Direct to Customer	One-time hardware revenue	Direct customers	$449	47%
B2B Teams	Bulk institutional sales	Clubs, schools, varsity teams	$349	32%
Wholesale	Wholesale distribution	Specialty Sports retailers	$329	28%
Al subscription	Monthly recurring revenue	End users	$2.99/Month	90%

Table 2: Cost of Goods Sold (COGS) per Helmet

Costs	Cost Item	Cost (USD)
At the pilot scale, the cost of goods sold (COGS) is approximately $238 per helmet. As production scales, we expect COGS to decline to $180~$200 per helmet, driving DTC margin to 55%~60%.	TPMS TPU Honeycomb Structure	48
	Helmet Shell & Padding	26
	EEG Module (16-channel)	52
	IMU Sensors (Accelerometer + Gyro)	8
	Control Board & Power	22
	Assembly & Quality Assurance	32
	Packaging & Shipping	18
	Total COGS per Helmet	≈$238

Three-phase growth and Market Size

HiveGuard adopts a phased expansion strategy: in Year 1, it focuses on the ice hockey market to complete product performance refinement and third-party validation, accumulate real-season data, and validate unit economics through a hardware sales + optional subscription model; in Years 2–3, it expands into other high-impact sports helmet categories such as American football, skiing, and high-speed cycling through OEM partnerships, enabling multi-sport growth while maintaining relatively low operational complexity; from Year 4 onward, after the sports helmet model is fully validated, HiveGuard enters the motorcycle and industrial safety helmet markets.

Our Total Addressable Market (TAM) is the global high-impact sports helmet market, estimated at $40–60B annually. Our Serviceable Available Market (SAM) narrows this focus to youth and competitive hockey in North America, representing approximately $0.8–1.2B per year. In the initial phase, HiveGuard targets early adopters within organized leagues. Assuming a conservative 1–3% penetration of SAM, our Serviceable Obtainable Market (SOM) represents $10–30M in revenue potential over the first 3–5 years.

Three-year Financial Projections and Funding

HiveGuard follows a clear path to profitability. As scale increases and unit economics improve, the business reaches profitability in Year 3, as shown in the analysis below.

Financial Projections	Year 1	Year 2	Year 3
Units Sold - Hockey Helmets / Other Sports (OEM)	1000/0	3500/1500	9000/6000
Hardware Revenue (Average Selling Price $400)	$0.40M	$2.00M	$6.00M
Subscription Penetration / Users / ARPU(9–10 months season)	50%/500/~$27	55.%/2750/~$30	60%/9000/~$32
Subscription Revenu	~$0.01M	~$0.08M	~$0.29M
Total Revenue	~$0.41M	~$2.08M	~$6.29M
Total Gross Profit	~$0.17M	~$1.03M	-$3.11M
Total OpEx (R&D, Engineering, Cloud, Marketing, G&A, Legal)	$0.81M	$1.26M	$1.90M
Operating Profit (EBIT)	-$0.64M	-$0.23M	+$1.21M

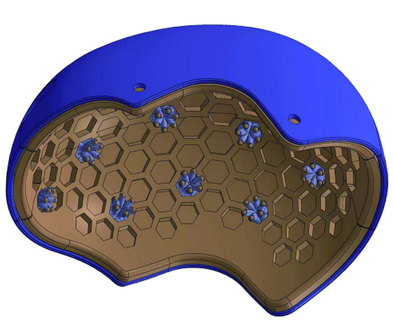
Based on the three year financial projections above, HiveGuard plans to raise $1-$1.3 million in the first round of financing. The capital will support the business through year 3, when the business turns profitable. HiveGuard seeks strategic angels and early-stage venture funds with a strong interest in sports, safety, and performance-driven innovation.

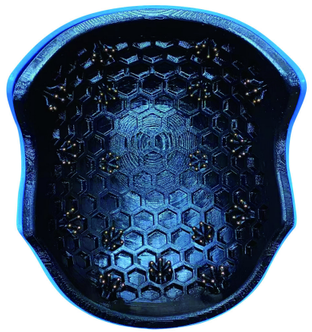
Prototype Evidence And Progress



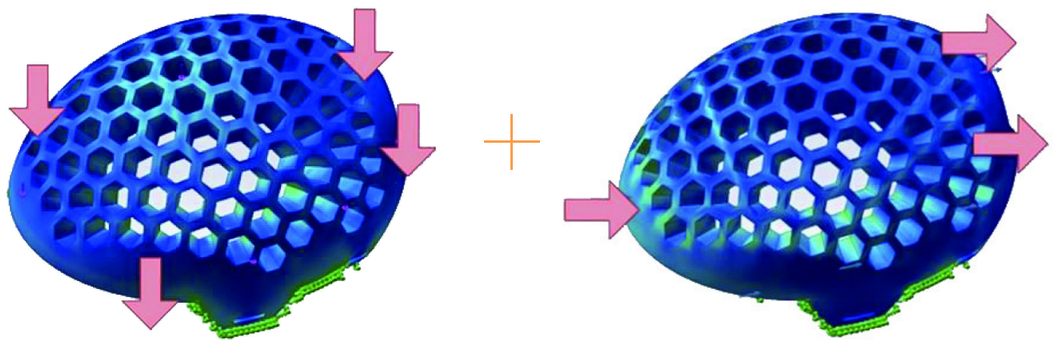
HiveGuard is more than a concept. We built a working, evidence-backed prototype with measurable technical progress, completing three hardware iterations. To validate our design, we ran steel-ball drop tests and pendulum-style side-impact simulations to approximate real collision dynamics. Results show that our honeycomb-structured shell reduced peak impact pressure by up to 40% compared to standard shells at equivalent density, translating to approximately 15-30% lower linear acceleration and 10-20% lower rotational acceleration, with the potential to reduce overall concussion risk by 20-30%.

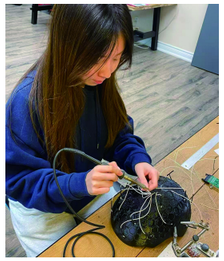
On the sensing side, we trained our deep learning model, EEGConvTrans, on EEG datasets from 10 users, achieving >95% classification accuracy for post-impact cognitive-state shifts. These results were compiled into a detailed analysis and accepted as a peer-reviewed full research paper (IEEE ICCE 2026) and demo publication (ACM/IEEE SEC 2025). We are currently conducting alpha tests with 20 users, have gathered 8 interviews and 70+ surveys and finalized a pilot agreement with the Toronto Titans hockey club for field testing on ice next season. We are also drafting a utility patent for HiveGuard's workflow and aligning our designs with CSA safety standards to prepare for formal certification.



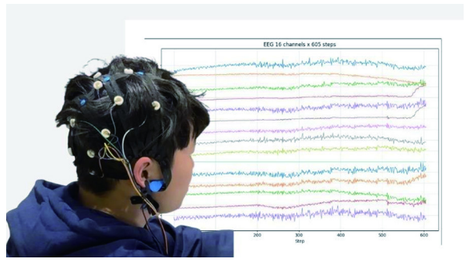


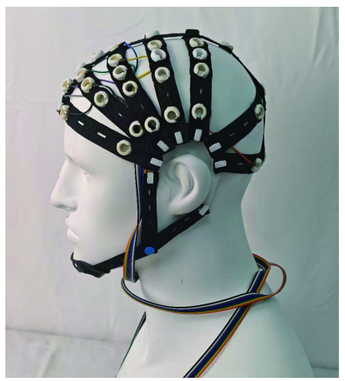
Finite Element Analysis - 500N Load















A cross-DIsciplinary Team
Bullding the Future of Sports Safety

Since 2023, HiveGuard has evolved through four years of development and three major team upgrades, building a cross-disciplinary team across engineering, AI, sports science, innovation, finance, and brand development.

Qianhao Han | Founder
8 years of robotics engineering experience; selected to Canada's AI Olympic National Team for three consecutive years. She has led HiveGuard from early concept to system integration and product definition.

Kevin He | Brand Ambassador
NHL-drafted in 2024, OHL IceDogs Captain (2024–2025), OHL Best Skater (2025), and OHL scoring leader (2026). He strengthens HiveGuard's credibility and visibility in elite hockey communities.

Juan Fuentes Fernández | Sports Innovation & Entrepreneurship Advisor
Director of the Valencia Sports Innovation Test Lab at GSIC Powered by Microsoft and Co-Chair of EBAN Sports. He supports HiveGuard in sports-tech validation, commercialization, and ecosystem partnerships.

Michael Hutchison | Sport Concussion & Brain Injury Advisor
Associate Professor at the University of Toronto, specializing in sport-related concussion, traumatic brain injury, injury prevention, and biomarkers. He supports HiveGuard in scientific validation and future clinical and sideline applications.

Zheng Zheng | Engineering & AI Advisor
Assistant Professor at Northeastern University (Toronto campus), specializing in AI, edge computing, and intelligent systems. He advises HiveGuard on AI architecture, edge deployment, and system optimization.

Haipeng Xie | Engineering & AI Advisor
Visiting Professor at the University of Toronto, supporting engineering development, system integration, and AI application strategy.

North America Market Development Advisor (U.S.) – In Progress
HiveGuard is building its advisory network for North American expansion, with a focus on U.S. football market entry, channel development, and partnerships with teams, schools, and leagues.

Research Publications & Academic Achievements
HiveGuard has established strong academic credibility through international research recognition.

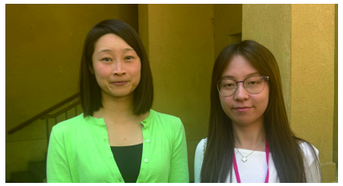
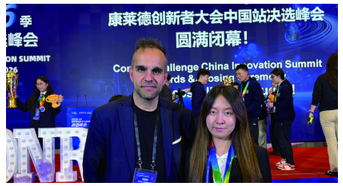
Its full paper, "Honeycomb-Inspired Concussion Protection Helmet with Intelligent EEG Feedback System," was accepted by IEEE ICCE 2026, where HiveGuard will be the only high school team presenter.

Its demo paper, "Honeycomb-Structured Helmet with Embedded EEG System," was accepted by ACM/IEEE SEC, presented in Washington, D.C. as the only high school team presenter, and won 2nd Place in the Student Research Competition.

CAD 50,000 early-stage R&D funding (2023)

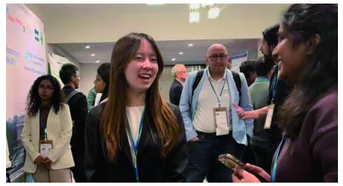
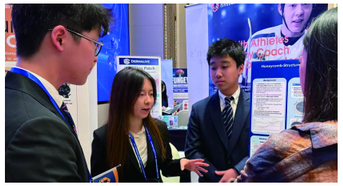








HiveGuard

Built with Athletes Trusted by Coaches Backed by Investors



Kevin He
NHL Winnipeg Jets Prospect

I've played hockey for most of my life and have seen how common concussions are at competitive levels of the sport. While I haven't personally experienced one, many of my teammates have, and I've seen how seriously they can affect recovery and performance. We follow concussion protocols through team doctors, but those decisions are usually made after symptoms appear. Hiveguard helps add an extra layer of protection by providing real-time brain insight, supporting earlier and safer decisions for player



Qiushi Han
Drafted to the OHL, Former AAA GTHL Player

I suffered a serious concussion after a hard hit and spent nearly a month isolated in a dark room, unable to go to school or see my friends. That experience showed me how difficult concussions are to recognize and why better, real-time protection like Hiveguard is needed.



Haoyun Zhao
Former AA GTHL Player

I've seen how concussions often happen when hitting starts and how players sometimes try to push through symptoms without proper guidance. Because it's hard for players to judge head injuries in the moment, tools like Hiveguard are important to help protect athletes and support safer decisions.



Nathan Wang
Former AA GTHL Player

I've been put on concussion protocol before, and I know how easy it is for players to hide symptoms just to stay in the game. Since helmets alone can't prevent concussions or help players recognize when something's wrong, tools like Hiveguard are important to put safety first and protect athletes long-term.



Chris Malkhassian
Chris Malkhassian
Head Coach of the Toronto Jr. Canadiens U15 AAA

"As a hockey coach, I've seen firsthand how concussions can change an athlete's career. Hiveguard adds real-time brain insight beyond traditional helmets, and I strongly recommend its further development."



Dawei Zhang
Senior Executive at a Fortune Global 500 company and a Top 10 global telecom operator, with 15 years of experience.

Chief Operating Officer (COO) at an IT startup with 10 years of experience.

Angel Investor in the IT sector with 5 years of experience.

I am particularly impressed by Hiveguard's ability to translate complex neurological data into practical, real-time insights for athletes and coaches. The platform goes well beyond conventional helmet protection by addressing the root challenge in concussion management: visibility. Hiveguard's integration of sensor technology and analytics represents a meaningful step forward in sports safety innovation, with strong potential for widespread adoption.



Jennifer Zhu
Portfolio Manager with 15+ years of experience in asset management, overseeing global large-cap equities and multi-asset strategies.

Former Vice President, Fundamental Equities at TD Asset Management.

What drew me to Hiveguard is its clear commitment to protecting athletes' long-term brain health. Concussions remain one of the most serious and misunderstood risks in contact sports, and Hiveguard provides a proactive, data-informed approach to addressing that risk. This is not just a product, but a system that empowers better decision-making and promotes safer sports environments at every level of play.