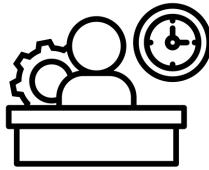


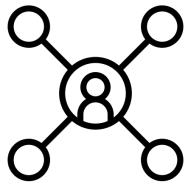
TBI Monitor for Military Personnel



MindShield



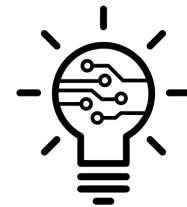
CEO:
Henry Liu



COO:
Amelia Zaripova



CFO:
Numa Shaikh



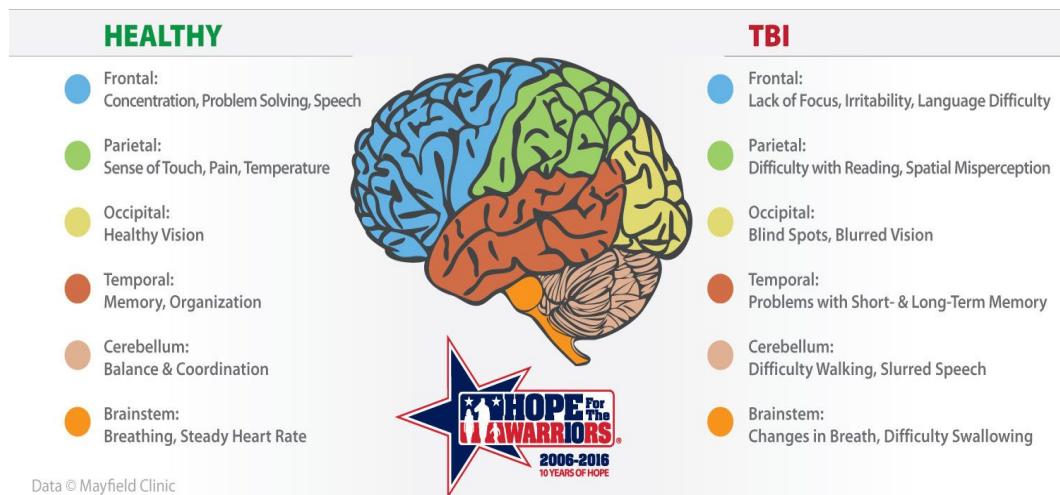
CTO:
Adarsh Raj Mohan &
Hunsi Jayaprakash



Traumatic Brain Injury Overview

- TBI diagnosis involves neurological exams or imaging tests like CTs
- Classified using the Glasgow Coma Scale (GCS) score
- Can lead to intracranial hematoma (ICH), elevated intracranial pressure (ICP), or a midline shift (MLS)
- Long-term effects can be drastic
 - highly associated with subsequent development of PTSD, depression, and anxiety

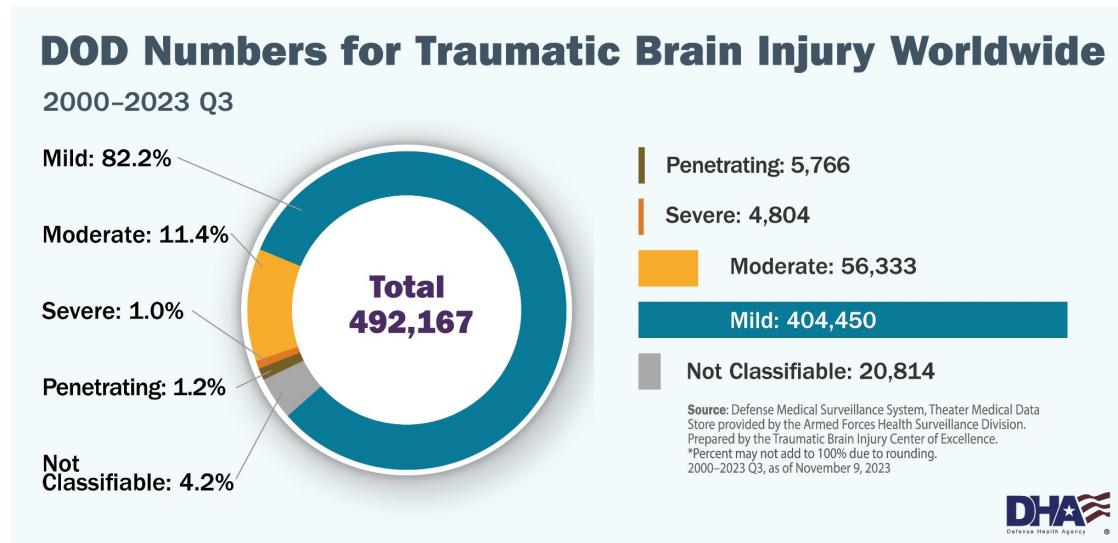
HOW TRAUMATIC BRAIN INJURY (TBI) AFFECTS DAILY LIFE





Military Issues

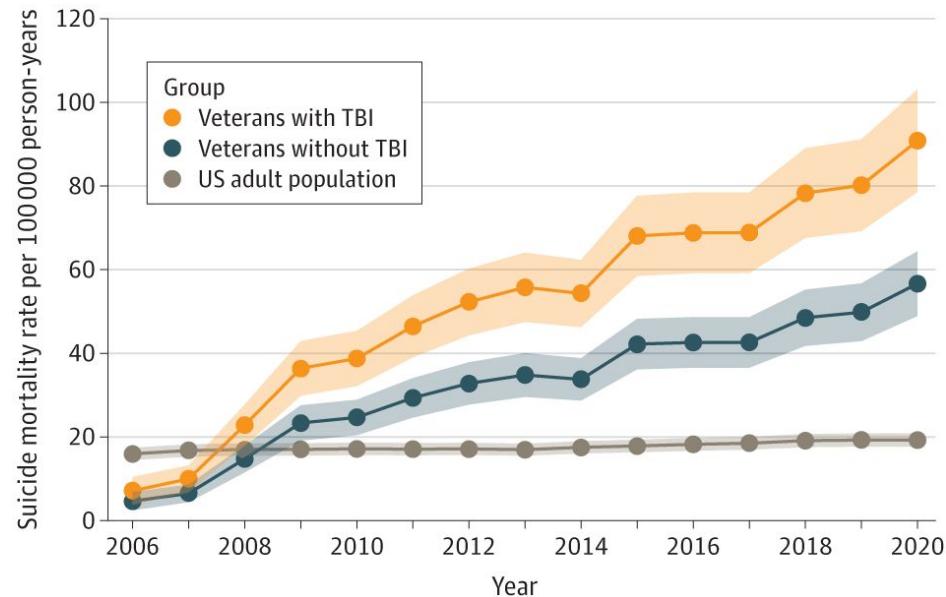
- ~22.8% Incidence of mild TBI among soldiers who participated in the Global War on Terror, with the most important cause of brain injury being long-term exposure to explosive weapons



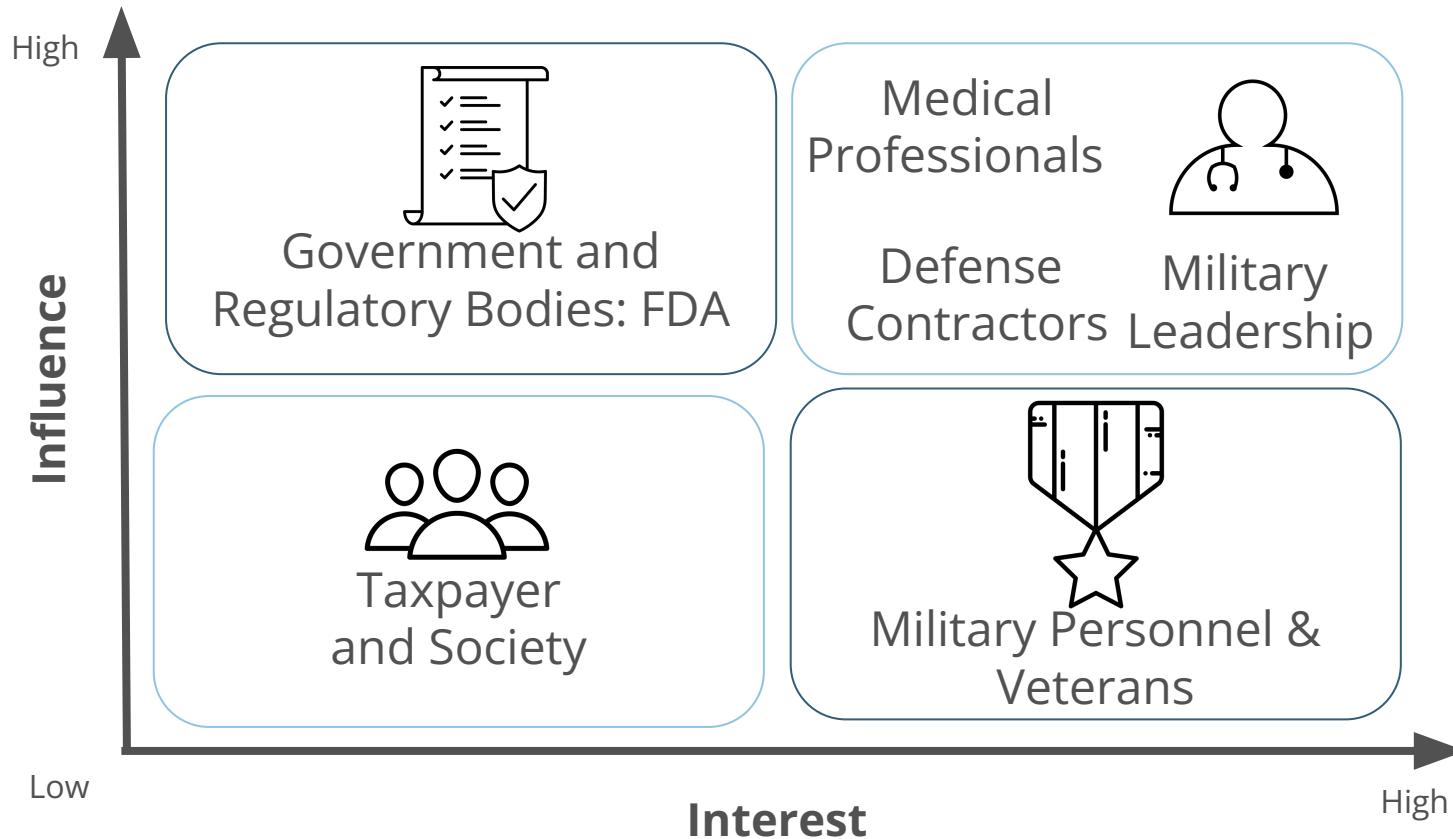


Military Issues

- Age-specific mortality rates increase with TBI severity for post-9/11 military veterans
- Can lead to symptoms such as
 - poor memory
 - sleep disturbance
 - fatiguewith 53% of patients reporting such symptoms even a year following injury
- As such, the timely diagnosis of brain injuries and regular brain monitoring of soldiers is crucial for optimizing the health of our military while preventing the costs of lost duty time, early retirement, and retraining or replacing personnel.



Stakeholders





Economic Burden & Medical Significance

Economic burden of TBI totals approximately **\$76.5 billion annually**, including:

- **Mild TBI:** ranging from hundreds to a few thousand dollars per patient for initial and follow-up care
- **Severe TBI:** costs over lifetime can exceed \$1 million per patient, including hospitalization, surgery, rehabilitation, and specialized care
- No combat helmet has the ability to fully protect the user from combat-related TBI threats
- Helmet sensor integration has been slow

Status Quo: Combat Helmets

- Modern ballistic helmets incorporate a series of suspensions that allow for the wearer's head to **withstand impacts from both blunt and penetrating forces.**
 - typically made from a hybrid aramid and kevlar fiber blend.
- Advanced combat helmet, or ACH, first fielded in 2003
 - In 2008, helmets outfitted with TBI sensors were deployed to the Middle East, with limited success
 - Role of these sensors was to collect data in order to improve the suspension design of the helmet



Status Quo: EEG Devices

- Field deployable concussion assessment device:
 - Designed to assess and diagnose concussions via EEG electrodes
 - Placed on the patient's forehead, ensuring portable and efficient neurological monitoring
- Wearable Sensing DSI-24:
 - Commercially available research-grade dry EEG system, with 19 electrodes



Patent Analysis: TBI Detection

System for traumatic brain injury detection using oculomotor tests

Pros	Cons
Portable and lightweight	Limited diagnostic scope.
Measures oculomotor response.	Requires user cooperation
Provides neurological assessment	Potential calibration issues

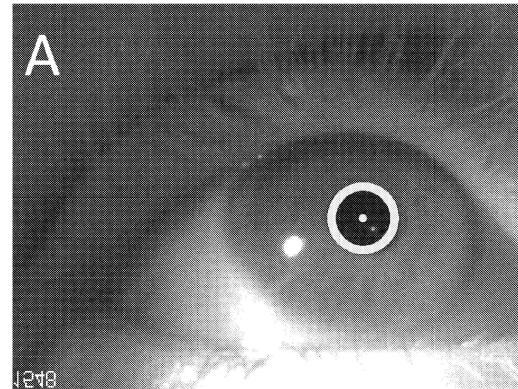


FIG. 1A

Patent Analysis: TBI Protection

Protective helmets including
non-linearly deforming elements

Pros	Cons
Enhanced impact absorption	Complexity in manufacturing
Improved head protection	Potential cost implications
Innovative design approach	Limited market adoption

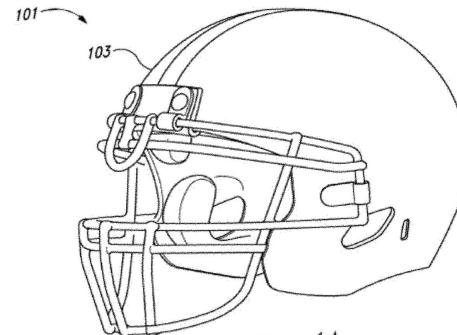


Fig. 1A

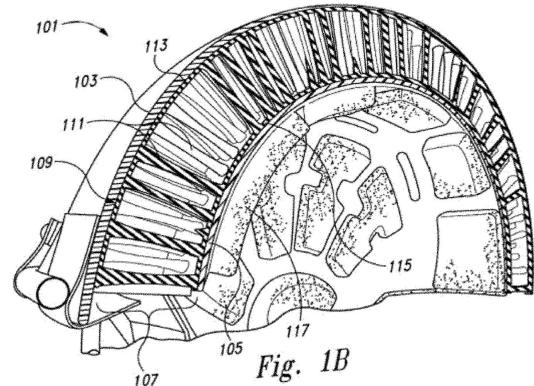
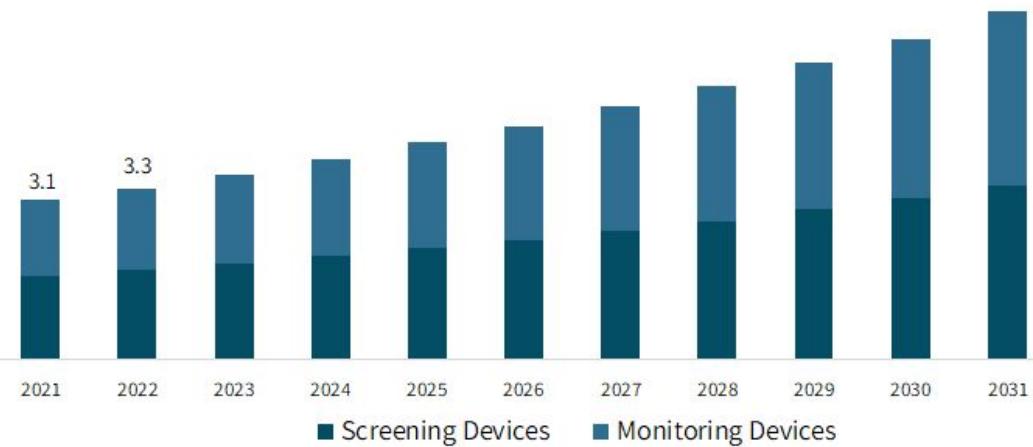


Fig. 1B

Gap in the Market

Traumatic Brain Injuries Assessment Market Size, By Product, 2021 - 2032 (USD Billion)



Source: www.

USD 3.3 billion in 2022

Estimated to reach over **USD 7.2 billion** in 2032

Demand

Comprehensive Assessments

Accurate Diagnosis

Monitoring

Treatment Planning



Addressing the Gap

Problem:

- Few medical devices allow for non-invasive EEG tracking with real-time data analysis
- Without proper TBI diagnosis or overall health monitoring, potential for recovery is severely limited

Population:

- Those at highest risk of brain injuries, like soldiers on the battlefield

Outcome:

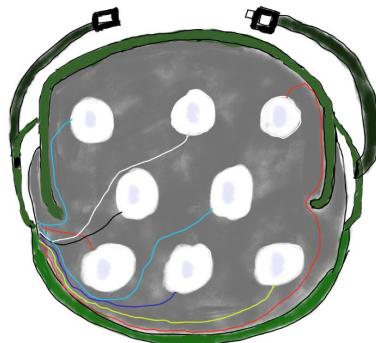
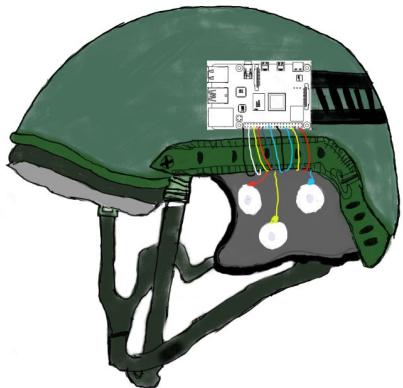
- Fully integrated device
- Easy and effective service for soldiers or military leaders to track EEG signals, TBIs, and overall health status



Problem Statement

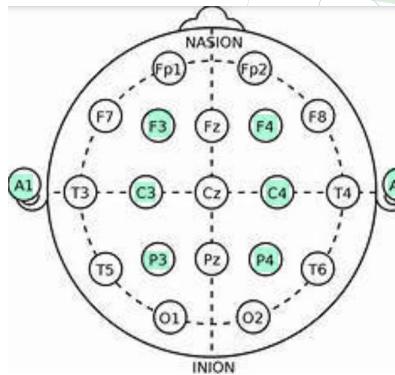
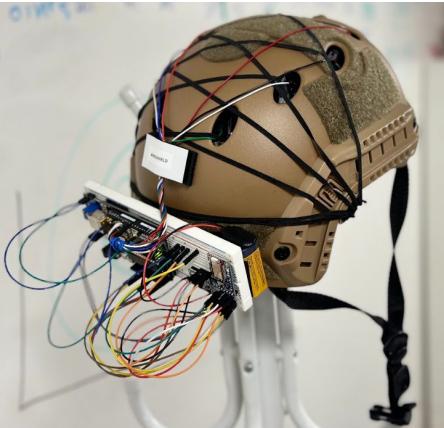
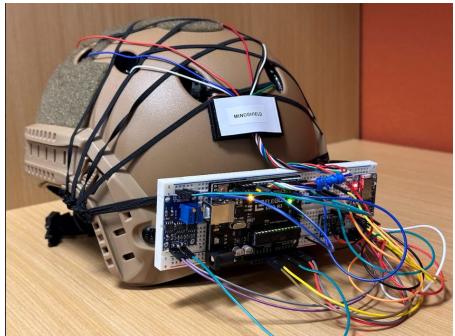
A durable, **non-invasive technology** that can be **integrated** into the **helmets of military personnel** for the purposes of **monitoring EEG signals, identifying TBIs, and monitoring overall health status**, thereby effectively reducing the severity of brain injuries.

Proposed Solution



1. Real time EEG signal processing
2. Long term EEG monitoring
3. Real time data transmission
4. ML model for TBI detection
5. High accuracy & sensitivity
6. Portability & comfort
7. Standalone, long lasting battery
8. Integration with existing military gear

Prototype 1 Design:



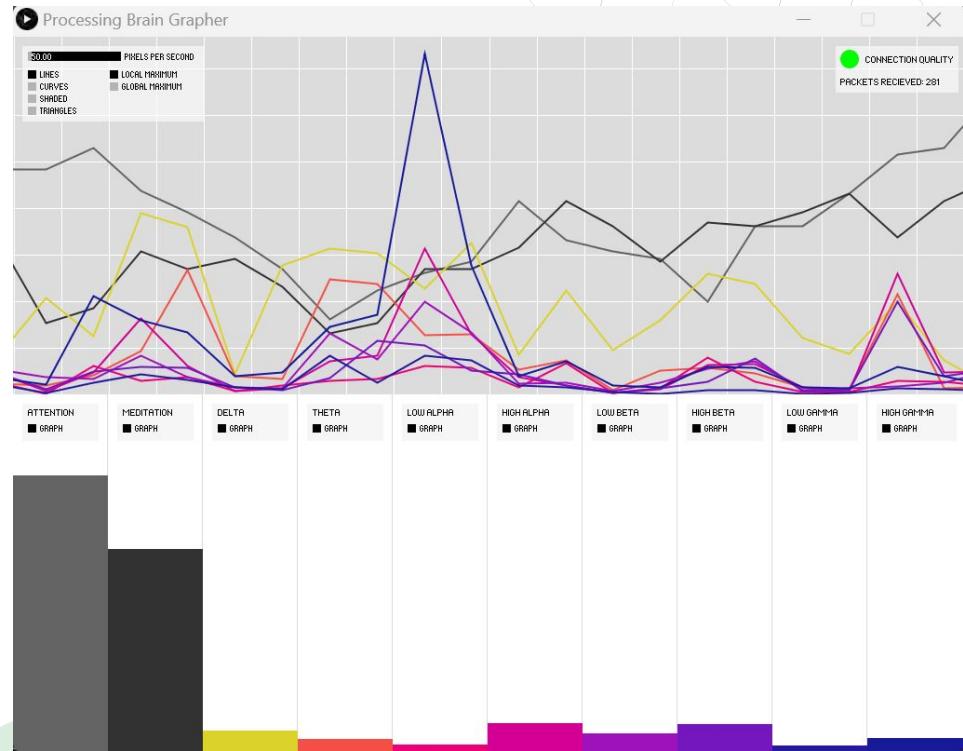
Brain Wave (Hz)	What is Approximately Measured?
Delta (1-4) Hz	Deep Sleep
Theta (4-7) Hz	First Stages of Sleep
Alpha (7-12) Hz	Relaxation and Meditation
Beta (12-40) Hz	Attention, Alertness, Conscious Reasoning
Gamma (40-70) Hz	Conscious Awareness, Happiness, Multisensory

Prototype 1 Testing:



Attention Test

Attention is estimated using Beta Waves
and other multi sensory measures

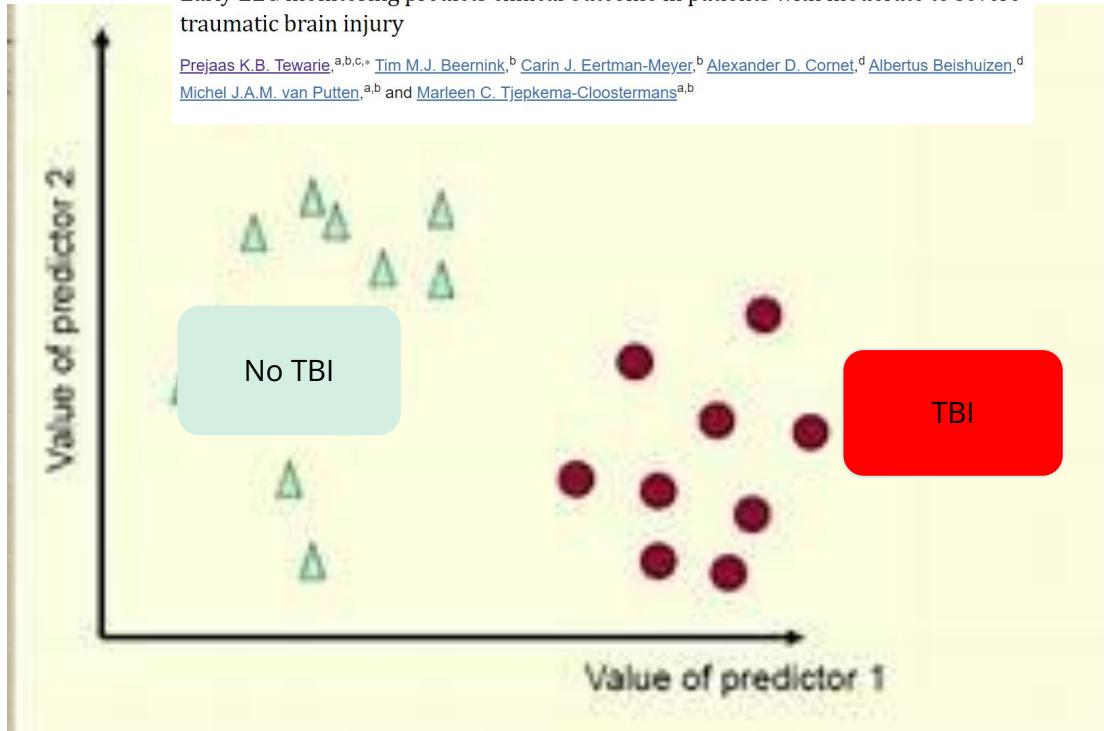


Prototype 1:TBI Classification

TBI Classification

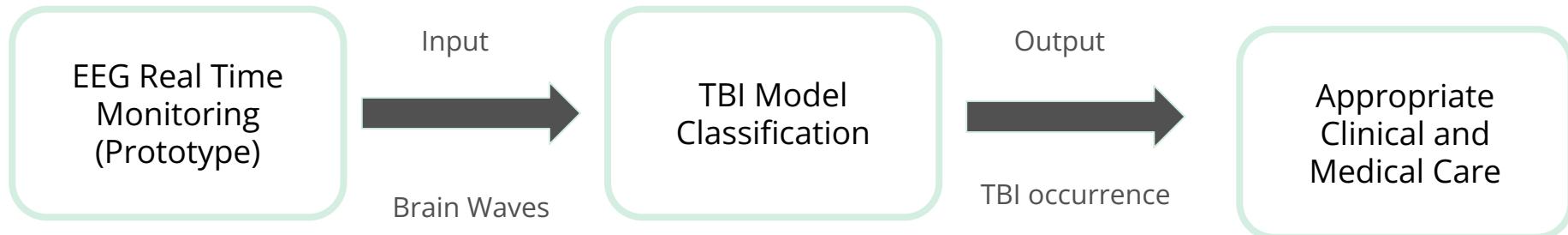
Early EEG monitoring predicts clinical outcome in patients with moderate to severe traumatic brain injury

Prejaas K.B. Tewarie,^{a,b,c,*} Tim M.J. Beernink,^b Carin J. Eertman-Meyer,^b Alexander D. Cornet,^d Albertus Beishuizen,^d Michel J.A.M. van Putten,^{a,b} and Marleen C. Tjeenkema-Cloostermans^{a,b}



~90% Accuracy
Brain Wave Metrics

Prototype 1 Proposed Pipeline:



Prototype 1:

Benefits

- Enhances soldier safety by providing immediate insights into brain health
- Facilitates rapid and informed medical responses to TBIs
- Adaptable and user-friendly, encouraging consistent use without impacting operational duties

Future Prospects

- Potential for integration with more powerful processors for enhanced capabilities
- Aims to be a part of a comprehensive system for combat wellness and real-time health monitoring

Thanks! Questions?



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