

Fall asleep with Asleep



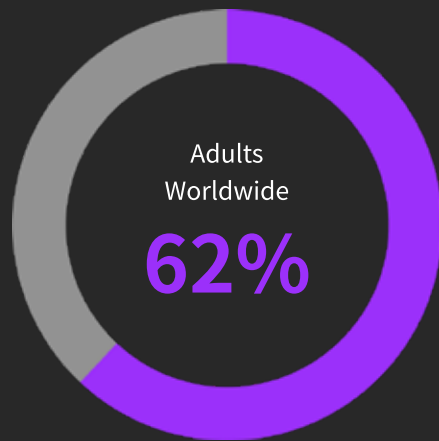
Asleep is a sleep tech solution company.

We digitalize the sleep process by conveniently monitoring, accurately analyzing, and providing all-day care for user's sleep.

Problem Statement

Worldwide Stats

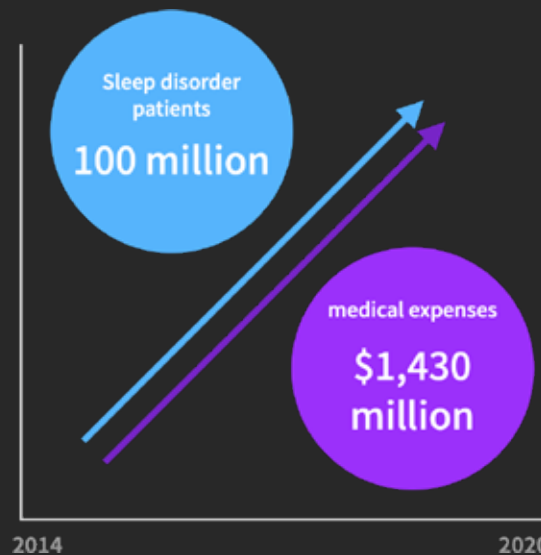
Roughly 62% of adults worldwide feel that they don't sleep well when they go to bed.



(Source: World Economic Forum 2019)

Continuously increasing sleep-related diseases

- serious sleep problems in modern society, social/ economic costs are large, estimated to be \$143 billion national economic losses in Easter Asia
- Sleep disorder patients (East Asia) : 100 million people
- medical expenses (East Asia) : \$ 1,430 million



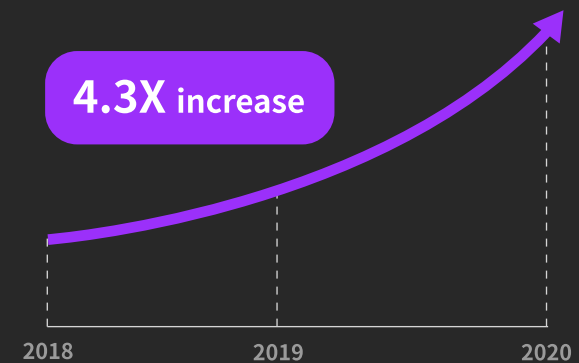
Demand for equipment, lack of polysomnography

Number of sleep disorder cases increases, but massive equipment needed for the center to build, only in the main cities where there is no accessibility and the long waiting time required

After applying for the salary of a polysomnography -> # of people
-2018 July -> 2020 Dec : 4.3X increase (East Asia)
-Average waiting time : 3-6 months (East Asia)

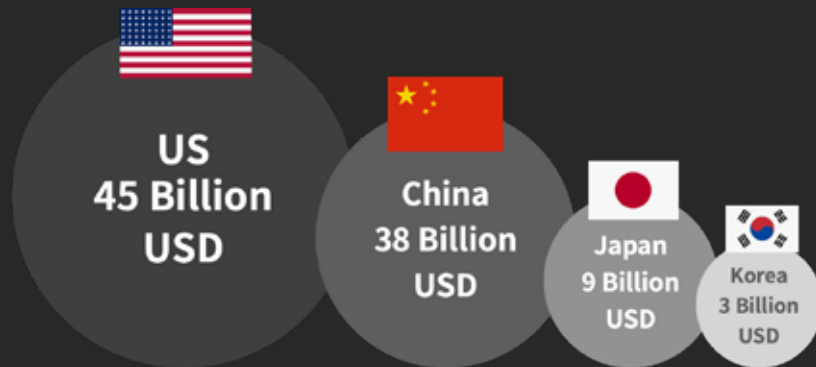


Average waiting time for the PSG
3-6 months



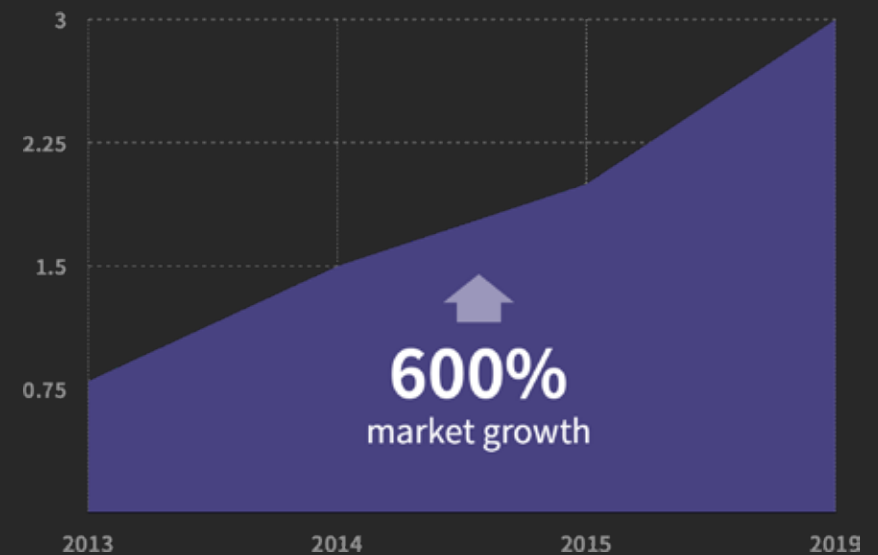
Sleep Market Growth

Domestic and foreign sleep Market Size

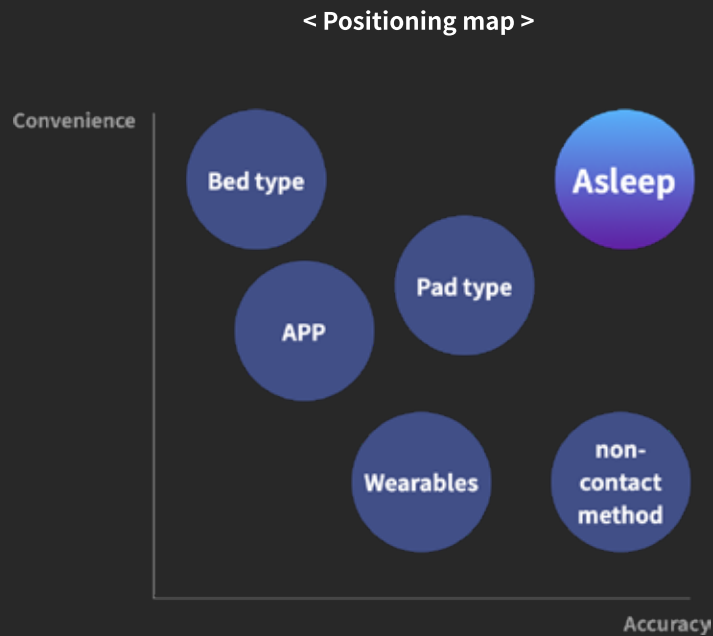


World Market Size
about 120 Billion USD

In 7 years, sleep market: 600% market growth



Competitors' limitations



Bed type

simple sleep assistance function / absence of measurement and diagnostic technology

APP

incorrect measurement due to sensor limitations, low diagnostic precision, and only night-time sleep intervention

Wearables

uncomfortable to wear during sleep

Wearables

inaccuracy of sleep condition prediction, absence of breath measurement

non-contact method

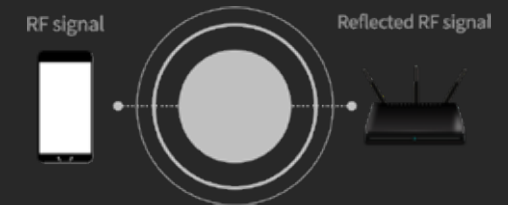
used only in hospitals due to the expensive unit price of sensors.

Differentiation & Asleep Solution

Solution 1

RF sensing based contactless sleep monitoring

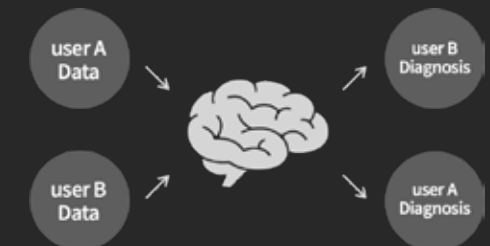
AI-based IoT solutions extract movements, heart rate, respiratory rate



Solution 2

AI based personalized sleep analysis

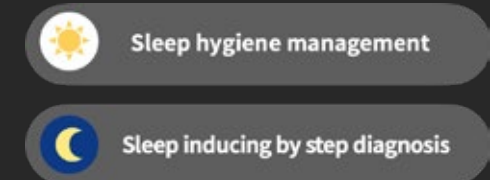
User A Data, User B data ->
User A diagnosis, User B diagnosis



Solution 3

day-time to night-time entire sleep hygiene management

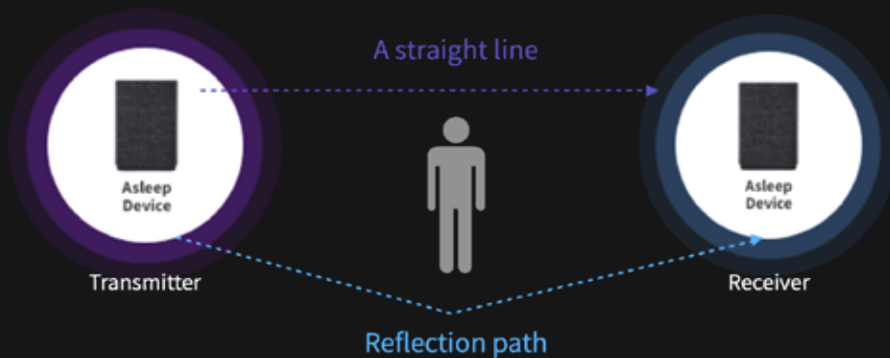
Using personalized data to provide daily sleep hygiene management



Asleep's contactless sleep monitoring device operating principle

Principle

RF signals radiated in the air by the transmitter are reflected in the human body, reaching the receiver. The RF signal reflected in accordance with the human body's motion will vary the propagation path. The receiver can analyze this signal to measure the movement of the human body



Result

A person's breathing incurs the thoracic and abdominal movement. The RF signal's amplitude and phase are affected by the movement, and thus by analyzing the received RF signal, we can measure the person's breathing pattern

Asleep's IoT research on contactless sleep monitoring device

Wi-Fi-based RF sensing technology developed for a contactless sleep monitoring device

Wi-Fi (802.11 g/n/ac/ax) with OFDM extracts channel state information (CSI) which reflects the wireless channel experienced by radiated OFDM signals

CSI represents amplitude attenuation and phase difference

- A person's general movement causes a significant change in the channel, resulting in a change in amplitude detected over a certain threshold
- A person's chest or abdominal movements cause phase difference in the signal's reflex path, and this cycle can be analyzed to extract breathing patterns

Asleep's Wi-Fi-based contactless sleep monitoring is convenient and accurate

- Affordable cost of making Wi-Fi-based solutions for other technologies



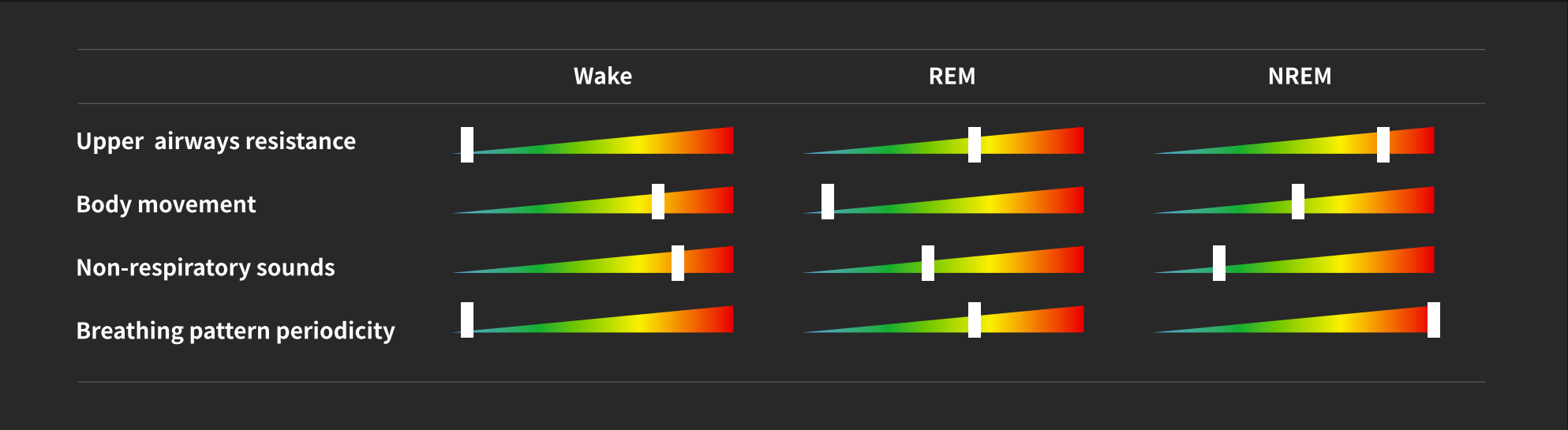
Asleep’s operating principle of artificial intelligence-based sleep diagnostic software

AI sleep stage breathing and movement pattern reading diagnosis

If the autonomic nervous system recovery has been associated with deep sleep that the autonomic nervous system is stabilized
Breathing is responsible for the autonomic nervous system, and the deeper the sleep, the autonomic nervous system is recovered and stabilized
REM is the state in which the muscles are paralyzed and physical movement is dramatically decreased
The deeper the sleep, there is less movement. Stable autonomic nervous system leads to regular breathing patterns

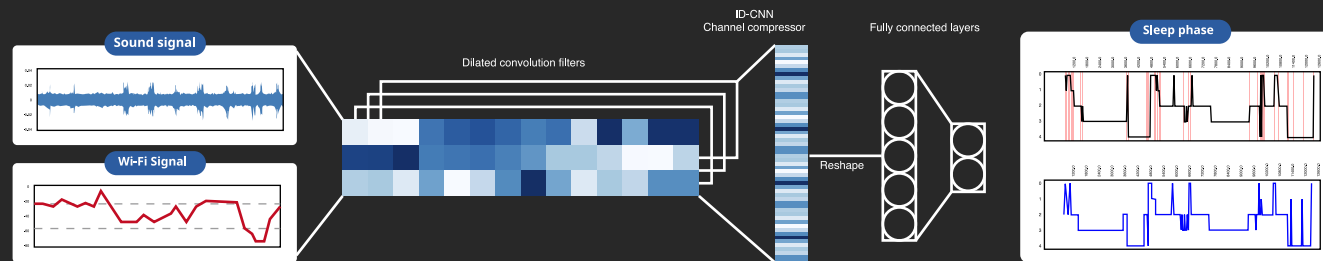
Breathing and movement features of each sleep stage

- Wake - breathing aperiodic / body movements high
 - REM - breathing periodic / body movement none
 - NRM - breathing very periodic / body movement medium
- *breathing is deeply related to the autonomic nervous system



Asleep's AI research on artificial intelligence-based sleep diagnostic software

Asleep's AI research on artificial intelligence-based sleep diagnostic software
 Automated sleep staging Artificial Intelligence Research through artificial neural networks like TCN and LSTM that process time series data
 Sleep-level auto-READ Artificial Intelligence using EEG / EMG / EOG signal = accuracy 85%
 Polysomnography Abdominal respiration-based sleep stage readings AI = accuracy 70%



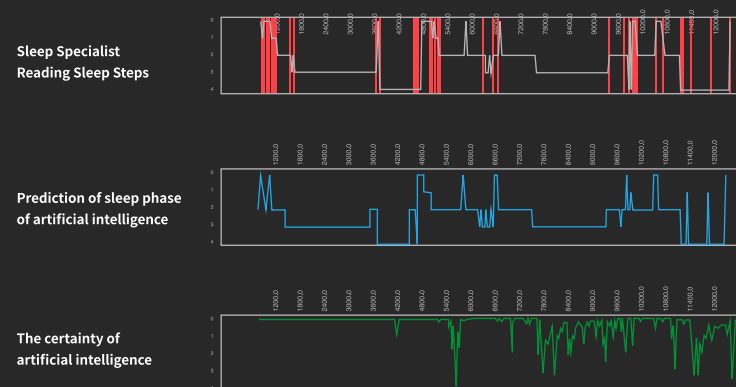
Artificial intelligence-based sleep diagnostic software research

Sleep stage diagnosis

Sound-based sleep diagnostics and artificial intelligence
 Sound in breathing and movement patterns to extract
 high precision RF sensing-based sleep diagnosis artificial intelligence

Sleep disorders diagnosis

Obstructive and Central sleep apnea
 RF sensing & sound sensor fusion diagnostics

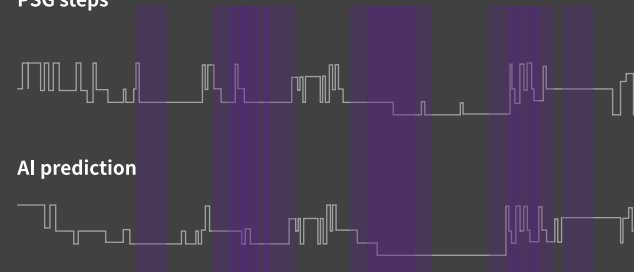


World's highest Asleep AI accuracy

PSG steps

AI prediction

Accuracy
80%



Personalized sleep hygiene management

With AI-based IoT solutions, Asleep provides personal sleep hygiene management both day-time and night-time

Maintain body enhancement for sleep

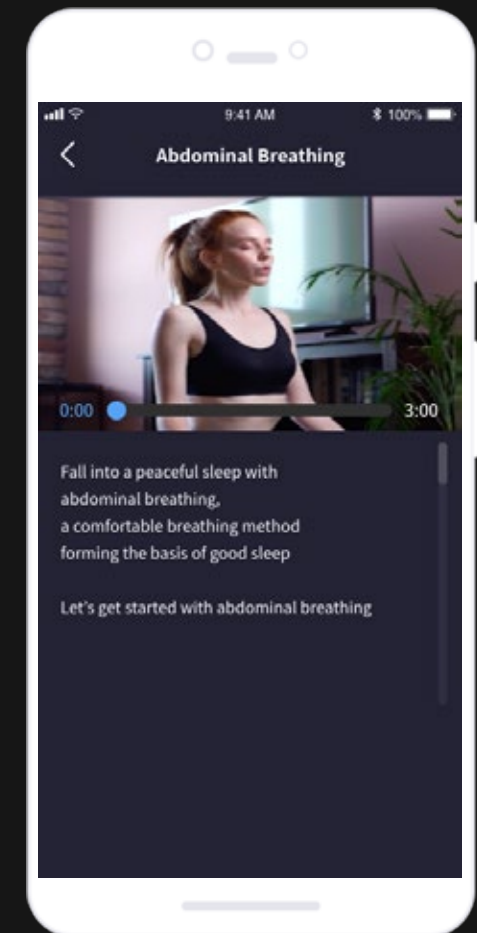
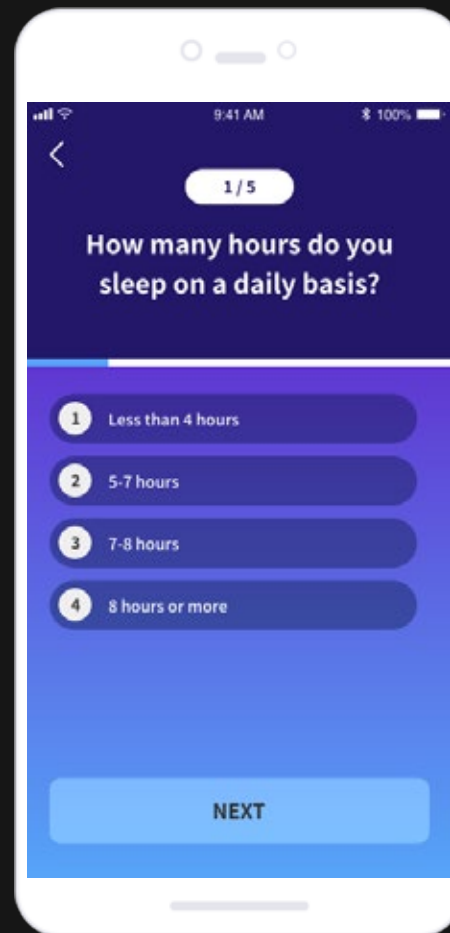
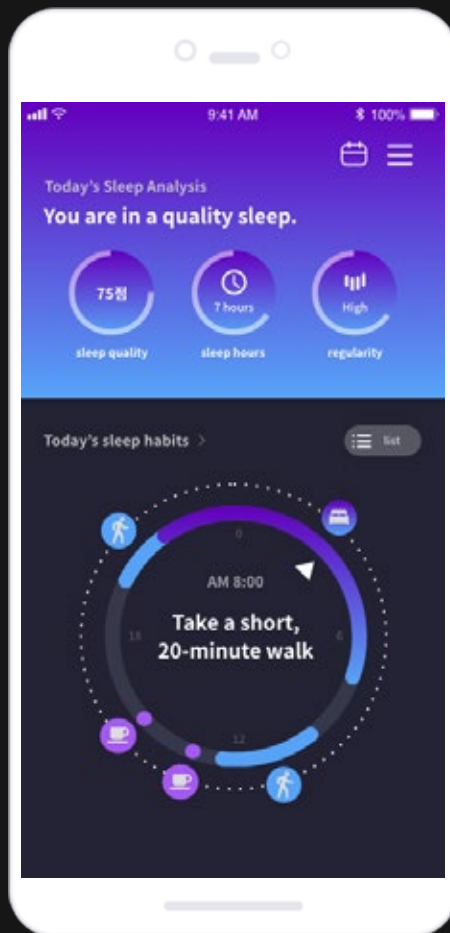
Nap after awake for 8 hours
Keep your sleeping time constant
Take a shower within 2 hours of bedtime

Sleep loss factor avoidance

Melatonin Care 6 hours before bedtime
Don't consume food within 3 hours of sleep
Create an optimal sleep environment

Circadian parameters adjustable

regardless of the bedtime, set a constant wake time
Even if waking up in the middle of the sleep, don't be exposed to light
Get some sunlight after 30 minutes of wake time




David Lee CEO

KAIST Artificial Intelligence Master's Degree
 Microsoft and Draper University experience
 Three experience as a startup executive
 Korean Artificial Intelligence contest 1st prize
 Best Director Award, Fraunhofer Institute, Berlin

History/Accomplishments

- 2020.06** Asleep Corporation Established / KAIST E5 program main entry and completion
- 2020.07** Korea's largest Sleep Center for Seoul National University Bundang Hospital and joint research and collaboration, the Advisory concluded Seoul Asan Hospital for transfer of technology-based cooperation and domestic AI voice analysis challenge ranked 1st out of 400 teams
- 2020.08** Non-contact sleep measurement, prototype development, completion and artificial intelligence-based sleep analysis solution development complete
 Collaborated with Korea's most credible insomnia specialist, Kosleep Counselor Shin Hong-bum, director of internal cooperation
 2 source technology patent complete
- 2020.09** Kakao Ventures seed investment
 Selected digital CES 2021 Eureka Museum
- 2020.10** Hanwha Life open innovation decision
 Selected as one of Top 10 companies for Korea's most influential digital healthcare company
 2 additional Source technology patent applications

Team AI


Jaden Hong
Tyler Lee
Kevin Tran

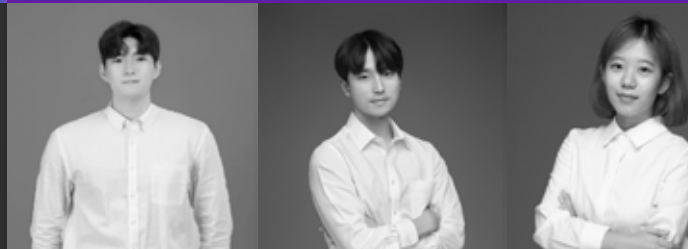
- CART-I artificial intelligence-based atrial fibrillation diagnostics-ring type device
- Robovolt Golf cart and ESS lithium battery failure and fire prediction artificial intelligence
- NAVER search engine keyword search improved for enhanced learning based on the core keyword navigation
- Poweron commercial power use data-based sales or opening and closing visual prediction services

Team IoT


Louis Jung
John Kang
Julie Oh

- Korea Research Foundation academic research paper excellence recognition at the International Conference ACM MobiCom, MobiSys, SenSys, ACM/IEEE IPSN
- IoT scheduling Protocol development
- Backscatter communication system development
- For IoT heterogeneous communication system development
- Samsung Electronics main domestic largest papers subject to human Tech in the silver award, Bronze Award

Team Strategy / Planning


Jun Park
Paul Lee
River Jeon

- Attorney remote legal Advisory start-up representatives and platform building and marketing
- United States San Francisco gym sharing startups Copa-dow rider platform build and business
- Artificial intelligence-based battery bad detection solutions business channel progress
- Medical devices of Channel variety and one life, Asan Medical Center Bundang Hospital, such as medical channel build
- KAIST tech day / CES 2021 / build promotional channels for medical devices including multiple media impressions