

NexStem



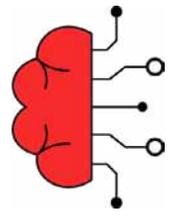
Company Profile

NexStem, founded in 2020, focuses on the development and widespread application of state-of-the-art BCI solutions that are affordable and accessible to all. NexStem's aim is to empower individuals to transcend their biological limits through sophisticated, yet innovative solutions.

For a long time, human evolution has been under the influence of nature and nature alone, however with recent advancements in the field of technology and the implementation of AI technology, it is becoming possible to continue human evolution by unlocking the mystery of the brain. NexStem aims to fully unlock the mind's potential and redefine what it means to be human by bridging the gap between man and machine through their key product, the NexStem headset. The NexStem headset is an EEG recording device that is capable of recording brainwave signals from the surface of the skull, which can be used to interpret the underlying brain state of their users.

The development of an EEG solution that can be translated from a clinical setting to the consumer domain has been the major challenge in the development of EEG-based BCI devices, as most consumer-grade headsets lack the technical prowess of research-grade equipment. Developing EEG devices that are user-friendly, affordable for widescale access, and can cope with both the complexity and volume of EEG data has limited most consumer-grade devices from truly adding value to consumers' lives. NexStem has addressed many of these issues through its hardware and signature software development kit (SDK) to create solutions that can be applied across a wide range of health and wellbeing applications. NexStem has also been developing its solutions by leveraging its unique headset and platform, including transforming its headset into a communication device for non-verbal patients. Through accruing a large amount of brainwave data, NexStem hopes to eventually recreate a digital twin of the user's brain.

Growing up, Deepansh and Siddhant, the founders of NexStem, had seen several amputees all making use of cumbersome prosthetics manipulated with strings that were often tied to the person's chest. The idea was short lived as their use was not initiative or user-friendly. Siddhant quickly realized that there were, in fact, prosthetics available which utilized EMG signals; however, they were expensive, the signals acquisition was exceptionally slow, and the user experience was poor. The next logical step was to head to



the signals' source - the brain. This is how the idea of NexStem was born.

NexStem's first device? A prosthetic arm controlled by a person's thoughts.

NexStem's first proof of concept was simplistic. If the person focused, the arm would close and when they stopped focusing, the arm would open back up. The second version took the idea to the next level and was centered around creating more control of finer motor skills. When the user thought "left," the index finger would go up, and if they thought "right," the middle finger would go up; when they clenched their jaw, the arm would reset, and if they moved their tongues, then the complete hand would open or close depending on how it was set up.

Since these early products, NexStem has grown and advanced their products extensively. Today, NexStem develops superior software solutions that can translate EEG signals at the highest quality and provide this as the premise to develop BCI solutions that are controlled simply with one's thoughts. In short, the human brain becomes a part of the Internet, inserting the human into the Metaverse.

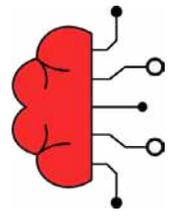
Going forward NexStem hopes to continue to improve its headset to expand its application in the consumer domain with the hope that eventually the headset will gain the efficacy and accuracy of a medical device that can be used within the clinical domain.

Flagship Product Deep Dive: NexStem Headset and NexStem Wisdom SDK.

NexStem Headset



The NexStem headset is a 16-channel EEG device that measures brainwave signals across the skull, ranging from the prefrontal cortex to the occipital lobe, providing complete coverage of cortical brain activity. Their headset design is user-centric, and designed with every day, extended use in mind. It is a lightweight product, lined with padding and memory foam to ensure user comfort throughout the day. The headset also uses dry EEG electrodes, that are polymer-based ensuring that they are soft and do not dig into the skull; compared to (more common) wet-EEG electrodes often utilised in clinical EEG devices. With such a solution, NexStem hopes that users will be more inclined to wear their headsets for extended periods, hence leading to a larger volume of collected data.

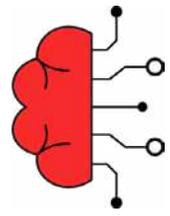


From a technical perspective, the headset offers a unique combination of characteristics when compared to other consumer-grade EEG devices available on the market today



- A high sampling rate of 1000 Hz (i.e., almost 4 x higher than most consumer-grade EEG devices on the market today).
- An over-the-head form factor that can be easily incorporated into the user's everyday life.
- Wireless connectivity and Cloud storage allow users to easily access and manage their data.
- Active electrodes to help reduce the impact of muscle artifacts on the signals.
- Polymer dry electrodes provide a comfortable user experience as well a quick plug and play setup.
- 16 channels which allow capturing of signals from the major centres in your brain.
- Real-time data acquisition reflects changes in users' brain activity in real-time.

Another major advantage with NexStem's NexStem headset is its affordability, currently, at one-third that of other EEG headsets with similar specs.



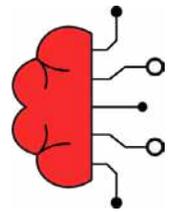
NexStem Wisdom Software Development Kit (SDK).

NexStem Wisdom is a software development kit (SKD) that complements the high-performance hardware manufactured by NexStem. The NexStem Wisdom SDK is a tool that consists of pre-trained high accuracy Machine Learning (ML) models that can be used to analyse a variety of bio signals in a single platform.

A unique feature of the Wisdom SDK is that algorithms can be developed on the platform through a drag-and-drop feature that facilitates the development of novel solutions without writing a single line of code. This feature is intended to allow neuroscience researchers to develop and test solutions, thereby fostering continuous innovation on the device. Other devices on the market provide SDK, however, they often require developers to write their own code, limiting the target audience to developers with sufficient coding experience and expertise. NexStem’s drag-and-drop feature opens the definition of “developer” to include any individual/researcher and ensures a high degree of fidelity between the researcher’s hypothesis and the final, executed algorithm.

NexStem has invested in providing high degrees of signal processing quality by developing Hardware and Software filters which can reduce the amount of noisy data often produced by EEG recordings, and therefore enhance the recorded biological signal. Overall, this is meant to improve the signal-to-noise ratio and, as well as the predictive power of the machine learning algorithms developed. Overall, NexStem’s algorithms will allow the prediction of relevant information based on a user’s unique state of mind (and thoughts).





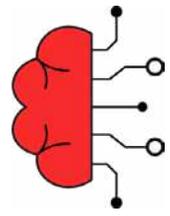
NexStem's Cerebral Palsy Communication Device (CP Product).

NexStem is currently working on developing a Communication Device for non-verbal patients affected by Cerebral Palsy. The product aims to address communication issues for the ~ 250,000 (annual numbers) of non-verbal patients in the US today.

Current Status:

As part of the NexStem Wisdom solution, NexStem has implemented a P300 speller. This is a type of BCI system that utilises EEG signals to allow a patient to spell out words by simply focusing their gaze on characters in a matrix of letters and numbers that appear on a screen. NexStem is working on improving and adapting this feature and developing a complete Hardware and Software solution for Cerebral Palsy patients.

Current communication devices on the market that try to achieve the same goal often rely on bulky, expensive equipment that measure eye muscle movements rather than brain signal data. Consequently, these devices struggle to distinguish between a person's unintentional eye blinks or movements and can therefore provide limited value to patients as they cannot accurately distinguish intention. In addition, CP can result in involuntary eye gazing and facial twitches that limit the usefulness of a device that tracks eye-gazing alone. NexStem's product will overcome that limitation by recording brain signals directly from the intact visual cortex, providing a more seamless user experience and far more accurate output.



Future development

NexStem has several aims for the near future:

Optimising the design to expand applications: Optimizing the design to ensure that users can wear the headset comfortably for extended periods. This will allow for the collection of large amounts of data that will benefit the user both in the assessment they receive and also be benefit to developers and researchers using the anonymized data to establish new solutions. The aim is to make the headset as slim as possible over time so that the headset can be worn comfortably at night allowing nightly sleep monitoring. Securing further collaborations with ecosystem partners and utilising their expertise will help to achieve this aim.

Creating a digital twin of the body: NexStem hopes to move beyond just the human brain by capturing a variety of complementary bio signals apart from EEG, such as ECG (electrocardiography), and incorporating these multiple inputs into their device to produce holistic health and wellness solutions. The next version of the NexStem which is in development will have its own OS (WisdomOS) based on Ubuntu operating system, with a graphics processing unit (GPU) accelerated filters and machine learning (ML) models embedded in its kernel, which will allow developers to develop BCI applications on the headset directly. This minimizes latency as well as speeds up the development process significantly. The v2 headset will also allow communicating with other bio-signal sensors like electrocardiography (ECG), photoplethysmography (PPG), electrodermal activity (EDA), electromyography (EMG), electrooculography (EOG) et cetera giving you real-time image of the person's heart, muscle, brain, and eye activity all in one place.

Target market

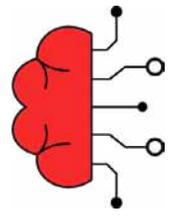
Digital Health:

NexStem solutions aim to target three main subsets of this domain:

Improving Health: Measuring EEG data can give a lot of information on a person's mental health, sleep, wellbeing, stress, and focus.

Improving Mental Wellbeing: EEG-based BCI devices can be used for neurofeedback and neurostimulation purposes helping to drive a person towards better mental health and wellbeing whilst providing a customisable approach based on a person's needs.

Assistive Technologies: These are affordable and accessible to every person who may require their use. Examples of possible applications include AAC devices, prostheses, and wheelchairs[Reference: <https://www.gminsights.com/industry-analysis/digital-health-market>].



Cerebral Palsy:

Cerebral palsy is a group of disorders that affect movement and muscle tone or posture. It's caused by damage that occurs to the immature, developing brain, most often before birth, and is the most common motor disability in childhood. Recent population-based studies from around the world report prevalence estimates of CP ranging from 1 to nearly 4 per 1,000 live births or per 1,000 children. As the disorder can affect the muscle associated with speech production, those affected often lose the ability to communicate vastly impacting their quality of life. NexStem's solutions can be targeted at improving this aspect of cerebral palsy, by utilising the headset together with the wisdom SDK. The cerebral palsy treatment market is predicted to continue to grow in the next decade, from a market size value of \$3166.82 million in 2020, to projected growth of \$4,365.01 million by 2030 [References: <https://www.cdc.gov/ncbddd/cp/data.html>] <https://www.alliedmarketresearch.com/cerebral-palsy-treatment-market-A13340>]

Success Factors

Team and Reputation

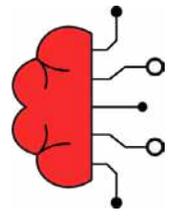
Founders:

Siddhant Dangi: is the Co-founder, President and CEO of NexStem.

Siddhant Dangi is the CEO and a co-founder of NexStem, a MedTech and robotics startup that creates non-invasive mind-controlled robotic solutions directed simply by one's thoughts. Siddhant develops the algorithms behind the development of the machine learning and artificial intelligence models the company is unlocking in their quest to insert human and machine seamlessly.

Deeply passionate about improving the quality of life of humankind, his first link to seamlessly and non-invasively integrating the brain to devices was the analysis of multivariate time-series data using deep learning models and the creation of a hand-gesture controlled system for paralyzed and differently-abled people. Siddhant's days are spent alongside his co-founder Deepansh Goyal, breathing life into the EEG data acquired from the award-winning NexStem Headset. In short, developing, designing, and architecting end-to-end Brain Computer Interfaces (BCIs).

Siddhant doesn't spend his spare time playing golf. Instead, it is very likely that along with Deepansh, they are working on how you can use just your thoughts to perfect your golf swing.



Deepansh Goyal: is the Co-founder, Treasurer, and CTO at NexStem,

Deepansh Goyal is co-founder, treasurer, and CTO at NexStem, a MedTech and robotics start-up that creates non-invasive mind-controlled robotic solutions directed simply by one's thoughts. A robotics enthusiast and self-professed geek, Deepansh spends all his time immersed in working out how to merge the human brain and technology non-invasively.

His strong entrepreneurial spirit is well applied to steering NexStem's research and development, design, and engineering efforts, as it creates life-changing advanced Brain-Computer Interfaces (BCIs).

A Bachelor of Engineering graduate from the Birla Institute of Technology and Science in Electrical and Electronics Engineering, his expertise in developing assistive technologies has played a crucial role in developing the award-winning NexStem Headset.

Partnerships and collaborations:

Divergence Neuro Technologies:

NexStem has partnered with Divergence Neuro to make the NexStem headset available in their store, with a primary focus on Canada. Divergence Neuro selected NexStem's device due to its long battery life and high-quality technical performance relative to price.

The Divergence Neuro's platform is marketed to clinical researchers to treat a variety of mental health conditions which is beneficial for NexStem as the usage of their headset by Divergence Neuro clients can provide NexStem with access to data to help improve their algorithms.

Furthermore, the high performance of the headset and SDK have attracted the attention of several notable organizations, including the University of Santa Clara's neuroscience research, Purdue University, Illinois University, Wheeler's School and MyNeurva Neurofeedback Clinics.

Funding

NexStem has raised two rounds of investment, the first one for 140k USD was led by BITS Spark Angels, a group of super angels including Raghu Sethuram (VP MSFT Azure), Rajiv Patel (President, TiE), Preethy Padmanabhan (Marketing Director, Freshworks) and Hemanshu Jain (Co-founder @ Diabeto and Khyaal).

The second of investment for 1.5 million USD was led by InfoEdge Ltd. Info Edge is a highly regarded tech-focused investment fund in India with a track record of four successful unicorn exits in the past four years.

Other investors like BITS Spark Angels and super angels like Alagu Periyannan (Founder @ BlueJeans), Utsav Somani (CEO @ AngelList India), Anand Raghvan (VP Verizon TeleHealth) and Sundi Natarajan (Founder @ Sparksoft Corporation) followed on with additional investments in this round.