

Simbex LLC

“HIT” Application Powered by Mobile Technology

“Thanks to SQL Anywhere, we’ve done things that I didn’t think were possible in a synchronizing environment. SQL Anywhere has just been incredible.”

Jeffrey Chu,
Director of Engineering,
Simbex

ABOUT THE COMPANY

- Simbex is a research and product development company whose core expertise is biomechanical feedback systems. The company develops marketable products and solutions from emerging technologies for active life improvement in the areas of prosthetics, sports injury prevention and rehabilitation. For further information visit www.simbex.com.

BUSINESS CHALLENGE

- Improve sports safety through the detection and monitoring of potentially injurious head impacts

SOLUTION

- Head Impact Telemetry (HIT) System™ powered by SQL Anywhere data management and synchronization technology

Each year, youth, amateur and professional football players experience approximately 300,000 concussions due to head impacts suffered during practice sessions and games. It is well established that concussions can cause serious brain injury. What is not known with much precision is the mechanism of concussions and the effects of sub-concussive impacts on cognitive function.

To gain a better, more quantitative understanding of the causes of concussions and to apply that knowledge to reduce their frequency, and thus reduce traumatic brain injuries, Simbex developed Head Impact Telemetry (HIT™) System to measure head accelerations (impacts) in real time during games and practices. The first and only commercially available system of its kind, HIT System uses impact sensors, processors and transmitters to transform any helmet into a head impact monitor. A key component of HIT System is SQL Anywhere.

REAL-TIME DATA COLLECTION KEY TO PROTECTING ATHLETES

“The idea for HIT System came from Simbex President Richard Greenwald and Brown University professor Joseph (Trey) Crisco,” explains Jeffrey Chu, Director of Engineering at Simbex. “The problem was that there is a very poor understanding of the biomechanical factors that contribute to mild traumatic brain injury – concussions – in sports. It’s a huge problem. From the peewee level up through the professional ranks, you see athletes on a regular basis leaving games because of head injuries. In order to protect these athletes, we need to have a lot of data about the impacts they sustain. Only with that data and the understanding we can gain from it can we learn how to protect athletes from these injuries. It was this concept that led us to develop a low cost device to record a lot of data on a lot of people over a long time to gain better grasp of the nature and sources of the problem. With a better understanding, we will take the next step – developing a protective solution.” HIT System was initially developed under an award to Simbex (R44HD40743) from the National Center for Medical Rehabilitation Research in the National Institute of Child Health and Human Development at the National Institutes of Health (NIH).

The HIT System consists of a number of components.

Each player’s helmet is fitted with a small device that consists of an advanced sensor and a wireless transmitter. The sensor continuously samples data from players’ helmets including the key signatures of impacts: peak linear acceleration, rotational acceleration, duration, location, temperature, a time stamp and more. This data is wirelessly transmitted to a laptop on the sideline, which runs several applications. The primary application is called the Hit Impact Analyzer. Should an impact on the field exceed a pre-determined threshold, HIT System sends a pager warning to the sideline medical staff to alert them to evaluate the player(s) and determine their fitness to continue playing. Importantly, the alert system is intended to prevent a more serious injury that can be sustained while playing with a concussion.

RESULTS

- Ability to develop the system on time and on budget
- Improved medical staff awareness in real-time of high level impacts that are linked to brain injuries including concussions
- Data collected by the system is being applied to the development of more effective, protective helmets and headgear

INDUSTRY

- Healthcare

SYSTEM CONFIGURATION

- Each football helmet is fitted with a battery-powered sensor and a wireless transmitter, which continuously samples and transmits data from players' helmets to a laptop PC running on the sideline
- The laptop PC runs several applications including the proprietary Hit Impact Analyzer. If player impact data exceeds a pre-determined impact threshold, The HIT System sends a pager warning to the sideline medical staff
- Data is stored in a local SQL Anywhere database and syncs with the consolidated SQL Anywhere database via Mobilink over an internet connection
- The volume of data residing on a particular team's laptop can be as much as 150 megabytes per season. Simbex's consolidated database currently contains about eight gigabytes of data

Also running on the laptop is SQL Anywhere. The data transmitted by the helmet devices is stored in this remote SQL Anywhere database. At the end of every practice or game, team personnel synchronize the data collected with Simbex's consolidated SQL Anywhere database in New Hampshire via SQL Anywhere's Mobilink data synchronization technology. This adds to the system's data repository, providing Simbex researchers a single source against which to do data mining. Simbex's consolidated database currently contains about eight gigabytes of data.

LACK OF DATA PLACED ATHLETES AT RISK FOR SEVERE INJURIES

Prior to the use of this system, concussions often went undetected when they occurred, potentially placing athletes at increased risk for even more serious injuries. For instance, HIT System can alert medical staff in real time so that they can check players for symptoms of concussion before allowing them to return to play. This may prevent the occurrence of "second impact syndrome," a condition in which a player suffers more than one concussion in a game, placing him at a much greater risk for a severe injury.

HIT System was first tested in real-world circumstances by the Virginia Tech NCAA Division 1A football team. Based on its successful performance, it is now being used by five additional NCAA Division 1A football teams as well as four high schools throughout the country. To date, HIT System has collected information on over 250,000 impacts on more than 300 players.

The potential of HIT System to prevent serious injury and to better understand the factors that lead to concussion is so great, that the technology has been purchased by Riddell, the world's largest football helmet manufacturer.

SQL ANYWHERE "HAD EVERYTHING WE NEEDED"

Simbex knew that data management and synchronization technology would be essential to the successful development of HIT System. The company evaluated solutions from Microsoft, MySQL and iAnywhere.

"After evaluating these solutions, we chose SQL Anywhere," says Chu. "Of the three solutions, it was the only one that had everything we needed and that was proven to work under the most demanding conditions. Synchronization was critical to the successful implementation of HIT System. We needed something that was robust and field proven, and Mobilink met those criteria. The SQL Anywhere database was robust as well as scalable and virtually maintenance free. It also supported our database scheme, which had a lot of stored procedures and triggers. It seemed clear to us that SQL Anywhere would not only support the initial version of HIT System, but also future versions involving the use of PDAs and embedded products."

The success to date of HIT System has led other organizations to deploy it. In addition to football teams, HIT System is being used in pilot ice hockey, equestrian, boxing and soccer head impact research. "The military is also interested in HIT System to help them better understand the injuries our military personnel are sustaining due to explosive devices in order to develop more effective helmets to protect them in the field," adds Chu.

"SQL ANYWHERE HAS JUST BEEN INCREDIBLE"

"I don't think we could have released our product on time and on budget without having the features and functionality provided by SQL Anywhere and without the consulting assistance we received from iAnywhere" says Chu. "I also doubt it would be as stable as it is out in the field. Thanks to SQL Anywhere, we've done things that I didn't think were possible in a synchronizing environment. For instance, we can do remote schema updates, and we're able to upload new software and new versions of our own software using the Mobilink procedures. SQL Anywhere has just been incredible."