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Science, Play and Research Kit (SPARK) Competition
Winner Summary

"Young Innovator" Award – Prototype Category

Nikhil Buduma (Cambridge, MA)
"Pulse6: Bringing Hands-On Chemistry Education to Life with the Sixth Sense"

Nikhil Buduma, a student at MIT, has won a "Young Innovators" award in the prototype category of the Science, Play and Research Kit (SPARK) Competition, for "Pulse6: Bringing Hands-On Chemistry Education to Life with the Sixth Sense." The competition, sponsored by the Gordon and Betty Moore Foundation and Society for Science & the Public, challenged entrants to create the equivalent of a new chemistry set for the 21st century. Winners were selected in two categories: prototypes – projects that are operational and demonstrable - and ideations – fleshed out project ideas that have not yet been developed into prototypes, but have a strong potential for development.

"Pulse6 is a groundbreaking approach to enhancing the virtual education experience through the implementation of the sixth sense," says Buduma.

Pulse6's next-generation chemistry set consists of a set of trading cards constructed from laminated cardstock, except for a central cutout, which is replaced by a rectangular piece of transparency. By using powerful image recognition technology, the Pulse6 application recognizes specially designed trading cards that correspond with various entities (both molecules as well as potential energy sources), and overlays them with a rich layer of digital information, including a 3-dimensional model that can be manipulated by the user in real time.

"My prototype addresses the challenge of making science more engaging to young people by bringing chemistry to life," says Buduma. "By allowing students to interact with 3-dimensional models of molecules and animations of reactions, students will be able to observe how chemicals affect each another in a fun and interactive way."

Virtual buttons allow the user to toggle between alternative views of the molecule under observation. By overlaying the appropriate combinations of molecular and energy source cards (i.e., their transparency images), the user will be able to explore the dynamics of how molecules react through 3-dimensional animations that can be moved around and rotated.

Simple tweaks to the application will also allow young learners to 'discover' and/or 'create' their own molecules, print out new molecular cards, and use these cards in additional reaction simulations. To provide richer experiences, later versions of this technology could be incorporated with Google Glass and haptic technology, a tactile feedback technology that takes advantage of the sense of touch by applying forces, vibrations, or motions to the user.

“I strongly believe that Pulse6 holds vast potential in encouraging students not only to explore the field of chemistry, but also to explore other scientific disciplines as well,” says Buduma.

In order to access the cards’ hidden digital content, the learner would have to download the Pulse6 chemistry set app onto his or her smartphone of tablet. Although Pulse 6 currently runs on the Android OS, Buduma plans to support both the iOS and Windows 8 mobile platforms before the first version of the product is released.

Buduma provides an example of how a young learner can explore the reactions various molecules can undergo, through clever use of the transparency: “Let’s say the student wanted to see what might happen if he reacted oxygen and water in the presence of an intense energy source. By overlapping the three cards that correspond to these three entities, the transparencies would generate a ‘new’ image, which our image recognition technology would be able to detect. The application would then play an appropriate animation on top of the card itself, demonstrating how these molecules react. The user would be able to manipulate this animation in 3-dimensional space.”

Buduma will work on designing ways to show an animation in the app’s interface instead of merely rendering the end product of the reaction being investigated.

“Perhaps the Pulse6 cards will soon replace traditional trading cards as the new ‘hip’ thing,” he says.