Fitness app connects exercisers to experts

March 24 2015, by Aaron Dubrow

Integration of Fitnet with Google Chromecast enables a big screen experience. Credit: Fitnet Corporation

Can advanced networking and next-generation applications help solve some of our nation's most pressing health problems? Can mobile devices and high-speed Internet be used to improve our health and well-being? Showing a commitment that they can, in 2012 the National Science Foundation (NSF) launched the US Ignite initiative to demonstrate the power of apps for social good.

One outcome of the program is that today you can go to the Apple or Android app store and download Fitnet, a free exercise app supported by NSF that uses the camera on your phone to automatically assess the quality of the exercise and give you a score. Fitnet can also connect you to an online personal fitness trainer who can track this information and suggest routines to try based on an individual's health goal.

This mobile app is one of many fitness apps that are finding mass audiences of individuals eager to use technology to improve their health and well-being.

But what's unique about Fitnet is that, at the same time it is marketing its current app, it is also looking to a future of faster, programmable gigabit networks, according to Kevin Hill, Fitnet's "data czar."

In 2012, Fitnet (originally called KinectHealth 3D) was one of eight applications given the distinction of "App of the Future" in the brainstorming round of the NSF-supported Mozilla Ignite Challenge, and one of 22 apps whose development was funded through the program.

The idea behind Fitnet was to develop a new kind of tele-fitness app that could leverage deeply programmable and low latency fiber-optic networks. The award from Mozilla Ignite Challenge provided seed funding to build a prototype and to demonstrate a proof of concept.

In 2013, Fitnet received an additional NSF award to advance the project

in partnership with Virginia Tech. Fitnet has also worked closely with US Ignite, a public-private partnership that promotes the development and deployment of gigabit applications, to identify critical use cases for its cutting edge technologies.

"Validation from the Mozilla Ignite Challenge, US Ignite and National Science Foundation was critical to this idea becoming a reality," said Bob Summers, chief geek and founder of Fitnet. "Our country has a health problem which advanced sensor, data and communication technology can help solve."

Part of the goal of US Ignite is to advance great ideas from the concept and prototype stage into commercial products, and Fitnet is one of the program's early successes. The app has been downloaded 280,000 times and has thousands of core users in all 50 states and over 200 countries.

Fitnet is one of a handful of fitness apps supported by Chromecast (the streaming media player developed by Google) and was among the first to be integrated into Apple's HealthKit, which allows health and fitness apps to work together for holistic monitoring.

Two key features differentiate Fitnet from other exercise apps on the market: the use of a phone's camera and image processing capabilities to interpret motion; and the ability to connect to a trainer who can monitor your progress, see how you're performing and personalize your workout plan as needed.

For now, the image processing is done locally on the phone and consequently, the assessments are not as complex as they could be. Likewise, the interactions with the trainer are asynchronous and do not include a live video feed—a function of the fact that most people don't have unfettered access to gigabit networks and unlimited data plans. But Fitnet is exploring improvements to both aspects.

"It would be a gamble to try to start a business that was focused only on gigabit Internet," Hill said. "But at the same time we know that's coming and that there are these great features that could be realized with high speed networks.

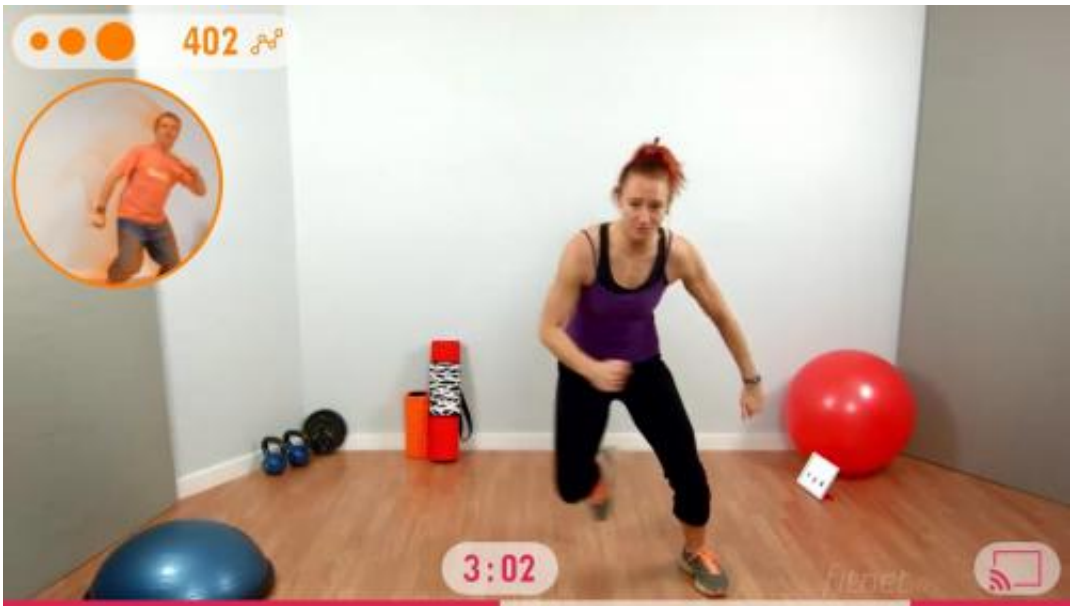
"The cool thing about the US Ignite community is the ability to do a little bit of both: to have our consumer-facing side but still push the envelope and do some really cool research."

Pushing the envelope means imagining new and better ways to automatically assess the quality of exercise using the cloud, and creating a network of remote "wired trainers" who can serve an entire community, adding jobs and helping thousands get healthier. They've begun to put the infrastructure together to test these concepts, using Virginia Tech in Blacksburg, Va., as the testbed.

A virtual lab for next-generation networking

Virginia Tech has a unique confluence of resources that make it a great place to base their pilot, Hill says.

"We've got students who want to do exercise, we've got Virginia Tech Rec Sports [Department of Recreational Sports] that is interested in how technology can impact personal trainers, and we've got great computer resources," he said.



Fitnet studio brings an on-demand fitness trainer to the mobile device at HD resolution. The device webcam provides real-time feedback using a computer vision algorithm. Credit: Fitnet Corporation

The resources Hill is referring to is the Global Environment for Networking Innovations, or GENI, an experimental, ultra-high-speed, programmable networking testbed, begun in 2007, that allows researchers to test new networking ideas at scale. Virginia Tech hosts one of GENI's 180 or so nodes.

"One of the big limits is just how much processing power we have available on today's mobile devices," said Hill. "We think we can make some significant progress by leveraging the power of a centralized server—that's where the GENI rack will be very helpful. With GENI we have access to the computer resources needed to throw the most sophisticated algorithms available at the problem."

The grant from NSF helped build the computing and networking infrastructure required to enable Fitnet and other apps with real-time

analysis and interaction to work, and to run the experiment with students and professional trainers at Virginia Tech.

"Just as astronomers band together and build a telescope that the community uses as a discipline-wide research instrument, GENI is the networking equivalent of a national instrument," said Mark Gardner, network research manager in Information Technology at Virginia Tech, and the lead researcher on the GENI grant.

"As we add more nodes to GENI, the instrument becomes more powerful and more capable, and it's set up so that once you get an account on GENI, you can run experiments on hardware scattered across the world."

While GENI sounds a little like superfast Internet service, it's more than that. With GENI, researchers get a slice of network, storage and computing resources on-demand on which to run experiments or do specialized tasks.

"The GENI infrastructure predated clouds and software defined networking and yet it has features of both," Gardner said.

Unlike most clouds, with GENI, the experimenter can program the way the network functions to make sure that the time lag between a client and trainer is low, for instance, or that computations run concurrently on hundreds of virtual machines during times of high traffic.

"And when the fitness guys aren't using GENI, it may be used for some other experiment," Gardner added.

In fact, more than 3000 researchers have run over 100,000 experiments in the eight years since GENI was established.

Adding live interaction and real-time assessments

The future app the Fitnet team is envisioning will work something like this:

- As individuals work out, the output of the exercise analysis algorithm, as well as the video of exercises, will be shipped in real-time to the web dashboard of a trainer, a fitness expert at Virginia Tech Rec Sports.
- The trainer will work with many individuals at once, doing exercises particular to their needs and interests.
- The automated exercise assessment tools will help the trainer figure out who needs help, who is bored and whose heart rate is increasing.
- The trainer will use that information to interact with each of the exercisers, judge the impact of the training and make suggestions for future sessions.

In this model, trainers are able to effectively manage and provide feedback to up to 12 people simultaneously, which could lower the price, make the services more available and also make it extremely personalized.

"In a traditional exercise class, all the people need to be doing the exact same thing," Hill said. "Here we can have each person doing a personalized workout routine and the trainer can still manage and interact with all of them."

GENI allows Fitnet, and other apps, to bring these capabilities to life for students at Virginia Tech and eventually for the nation.

Engaged fitness for at-risk populations

As they were developing the Virginia Tech project, the Fitnet team was working with a different set of users: students in the Healthy Hawks treatment program, a comprehensive family-based behavioral program run by University of Kansas Medical Center.

Healthy Hawks helps children, adolescents and their families overcome issues related to weight. The University of Kansas team was interested in being able to interact with families in a digital fashion over the course of their twelve-week program, recalled Hill.

With support from the Mozilla Foundation's Gigabit Community Fund, also funded by NSF, the pilot program provided iPads, cellular data plans, and personalized children's exercise content from local Kansas City trainers to Kansas City families.

"Using Fitnet allowed us to increase our contact time with participating families very easily," said Ann Davis, a pediatric psychologist at the University of Kansas Medical Center, and director of both the Healthy Hawks program and the Center for Children's Healthy Lifestyles & Nutrition project.

Davis and her team not only encouraged the families to use the exercise app in their homes, but when they came to meet as a group, the doctors had information about the students' exercise at their fingertips and were able to give personalized feedback. The app also allowed the group's dedicated trainer to provide coaching prompts in real-time.

"With those features, we've been able to lower the drop out rate, and increase the students' fitness outcomes," Davis said.

The second group of Healthy Hawks is now going through the program, with encouraging results.

"We're excited to work with the Heathy Hawks to be on the leading edge of the mobile-health revolution," Hill said.

Fitnet is considering other possible partnerships too, including with physical therapists and other health professionals.

"We have this disconnected world right now where you've got step counters, heart rate monitors, exercise apps. You can look at that data, but it's very hard to make decisions based on that data," Hill said. "What we hope to do is be able to centralize, organize and pass that information over to experts."

With early access to emerging networking technologies and pilot projects underway with diverse audiences, the Fitnet team believes it will only be a few years before their gigabit app is ready for market—and before the nation's broadband network catches up to the capabilities of Fitnet.

"Applications are the essential driver of new technologies," said Summers. "And health applications such as Fitnet that leverage gigabit technologies are leading the way to answering the key question: 'Why does gig speed matter?'"

Provided by National Science Foundation

Citation: Fitness app connects exercisers to experts (2015, March 24) retrieved 24 April 2024 from https://phys.org/news/2015-03-app-experts.html

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