

Smart Toilets Will Use Anal Fingerprints

Analysis by Dr. Joseph Mercola

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STORY AT-A-GLANCE

** Called "precision health smart toilets" by the scientists who developed the technology, the gadget takes a picture of your anus and a fingerprint from the toilet lever and analyzes your stool and urine*

** The information is uploaded to the cloud where artificial intelligence evaluates the data and contacts your primary care doctor if there are concerns*

** This technology, funded by the National Cancer Institute for \$6.9 million, presents multiple areas where your privacy and medical information may be compromised*

** Before adding one more wireless technology to your home, consider using these parameters to evaluate your health using information from your urine and stool*

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The idea behind smart technology is that your cellphone or appliance does the thinking for you. Researchers at Stanford Medicine have taken this to a whole new level and hope to develop a toilet that evaluates your excrement each time you use the toilet.¹

A smart device can do many of the things your computer does, such as connect to the internet, use software and adapt to fit a current set of circumstances. These technologies often include sensors, databases and wireless access to the internet.

Smart technology was a boon to improving home security systems that could be monitored through your computer and connected to local authorities. Originally, technology was aimed at making the lives of senior citizens a little easier. This was called gerontechnology and began in the early 1990s.²

By the early 2000s, smart home automation became more popular and more affordable. Currently, anyone can wire their home with smart technology using gadgets they purchase at computer stores and readily available software installed on their computer and smartphone.³

Sensors measure temperature, humidity, light and motion or noise. The control network connects devices and the computer system collects information and acts based on a set of predefined rules. These functions are essentially the basis for the new smart toilet.

Precision Health Smart Toilet Evaluates Your Waste

Stanford University announced their "precision health" toilet they claim can "sense multiple signs of illness through automated urine and stool analysis."^{4,5} This particular smart toilet doesn't automatically lift the lid or flush the toilet, but instead has been designed to detect disease markers in your urine and stool.

The product can be fitted to an ordinary toilet using tools that include motion sensors and a camera that captures a person's analprint as you sit to use the toilet.⁶ The idea to use an analprint for identification was sparked by painter Salvador Dali, who reportedly discovered "the anus has 35 or 37 creases, which are as unique as fingerprints."⁷

In an operational smart toilet, sensors and other cameras will capture waste material, detect the force and amount of urine streams and analyze what's inside your stool. With the analprint, each smart toilet will also include a fingerprint scanner located on the lever to help ensure the data is linked to the right individual.

The scientists included features to measure urine factors, such as protein levels and white blood cell count. A person's stool is evaluated using the Bristol Stool Scale and records the total amount of time it takes a person to fully eliminate. The scientists' goal is to gather enough data to spot severe health problems that would be evident in your excrement, such as colon cancer.

Once you flush the toilet, the data and images are wirelessly sent to an encrypted cloud server where it is supposed to remain private.

One of the researchers, the late Sam Gambhir, who was chair of the radiology department at Stanford at the time the study began, elaborated on the intention of the smart toilet, which is not to replace a doctor's office visit, but to monitor your waste, identify the unusual and automatically send information about anything suspicious to your physician.

Gambhir dedicated his life to finding early methods of disease detection; he passed away from cancer in July 2020.⁸ In an April 2020 Stanford press release, he was excited about the potential for gathering data through the smart toilet, saying, "The smart toilet is the perfect way to harness a source of data that's typically ignored — and the user doesn't have to do anything differently."⁹ Gambhir compared the smart toilet against other health monitoring systems:¹⁰

"The thing about a smart toilet, though, is that unlike wearables, you can't take it off. Everyone uses the bathroom — there's really no avoiding it — and that enhances its value as a disease-detecting device."

\$6.9 Million Grant to Develop Excrement Technology

Sen. Rand Paul, R-Ky., is not as impressed by the technology and doesn't believe the \$6.9 million in funds granted by the National Cancer Institute is a good use of taxpayers' money.¹¹ Each year he compiles a report on federal government waste, and in 2020 the funds for the smart toilet were included.¹²

"Researchers hope this will be another arrow in the quiver of telehealth medicine providers, but they are forgetting there's a huge difference between video-chatting with your doctor so he or she can examine your tonsils and uploading your excrement into the cloud.

What would possess the NIH to issue a grant for a toilet that takes such videos, you ask? Well, the NIH issued the original grant under the premise that a noninvasive monitoring procedure called molecular imaging could be applied to early detection and management of cancer.

Ultimately, however, no matter how good the technology is at achieving its goal, nobody is going to use a toilet that has three cameras and takes a video of the user's "analprint" to identify the user, never mind one that stores that data in a digital cloud that hackers could access. Because that's exactly what you want, right? A photo of you like that floating around in the cloud."

Meanwhile, Ghambir's team hopes to have the second prototype ready for testing by the end of 2021. On their wish list is the ability for the newest smart toilet to detect DNA and RNA in order to help track the spread of coronavirus disease and to detect tumors.

Tracking Virus DNA in Wastewater

Using wastewater tests for information about an individual or community is not new. For example, researchers at wastewater treatment plants have been testing facilities' feces and urine effluent for illegal drugs, which has helped law enforcement to track trends and to identify new drugs in communities.¹³

The process was first proposed in 2001 by the Environmental Protection Agency to raise awareness of the impact that excreted drugs have on the environment. In early 2020, data from the largest European project evaluating wastewater corroborated data from other teams indicating the cocaine market in Eastern Europe was expanding.¹⁴

In human testing since the COVID-19 pandemic began, scientists have also identified the SARS-CoV-2 virus responsible for COVID-19 in the stool of people who have died from the disease.¹⁵ In one study, scientists found the viral load in feces was higher than in the respiratory secretions of an infected patient.

They found live viruses in the feces of two other patients, which the researchers felt indicated "infectious virus in feces is a common manifestation of COVID-19," and may represent a possible disease vector.

They also noted a 2004 study following the SARS-CoV-1 outbreak, which found aerosolized feces from a faulty sewage line was a likely contaminant responsible for an outbreak in the Amoy Gardens housing complex that made 321 people sick, 187 of whom fit the spread pattern.¹⁶

In another study, researchers found RNA on eight of 22 surfaces tested in two hotel rooms after two guests later became sick with COVID-19.¹⁷ Sampling revealed the pillowcases and sheets had the highest viral load. However, despite testing the room a mere three hours after the people tested positive for the virus, no live viruses were found in the hotel rooms.¹⁸ Scientists noted that:¹⁹

"... monitoring sewage for traces of a pathogen enables effective surveillance of entire communities, providing a sensitive signal of whether the pathogen is present in the population and whether transmission is increasing or declining."

Scientists believe that wastewater surveillance may have several benefits, including:²⁰

- Surveying the dynamics of disease transmission in entire communities
- Avoiding bias of epidemiological indicators
- Collecting data from all individuals, including those who lack access to health care
- Earlier diagnostic testing
- Providing near-real-time information on disease prevalence

The Smart Toilet Will Be Smarter Than You Think

Using smart technology to evaluate your waste products raises many questions, not the least of which include access to your private medical information. In the first place, people using this smart device in their home must have their fingerprints on file with the company, since the device uses both your fingerprint and analprint to link the information with a specific individual.

Although the initial idea is to install these toilets in the home, it bears considering they may eventually be installed in public areas allowing others to track your movements each time you use the toilet and are identified through your analprint or fingerprint.

In addition, your health information will be stored in the cloud, increasing the risk it can be accessed by hackers, contributing to medical identity theft. As discussed above,

the company hopes to include technology to test for DNA and RNA in your stool and has the capability to test for drug and alcohol use, which begs the question how this information may be used.

Although the company promises your information will remain private (as discussed below) and is only shared with your personal physician, it's highly likely that health insurance and life insurance companies would find this information enticing as they determine whether to offer coverage and how much to charge. Law enforcement may also be interested in the test results.

These are only some of the potential challenges that may arise when you allow your health information to be uploaded to the cloud and accessed to determine whether information should be sent to your physician.

Are Pictures of Your Nether Region Medical Images?

This particular device also poses an obvious risk to your privacy. To this point, researchers have engaged only male participants since the fixed camera would film female genitalia.²¹ Researchers are hoping the second prototype will provide more accurate data and feature technology to reduce the risk of the "nontraditional and unusual" photos falling into the wrong hands.²²

"We understand the privacy concerns of our approach seriously from its inception. Our proof-of-concept study utilizes photo-imagery of a person's anus, which may be non-traditional and unusual compared to fingerprints. We unconditionally ensure the security of all photos and private information of our users are enforced through end-to-end encrypted data transmission.

We have employed a template matching algorithm to determine the region of interest (anus), which once fully developed and validated, will be autonomous without any human interaction. The photo-imagery of a person's anus will be encrypted by a hash function and stored on a secured device.

In this way, even if a female user's ROI is mistakenly extended to include genitalia, the resulting image is already encrypted and stored via a hash function and the reconstruction of such sensitive images is unrealistic."

It's difficult to imagine how they will be able to "unconditionally ensure the security of all photos and private information" when highly secured banks,²³ retailers²⁴ and even the federal government²⁵ have been hacked and information stolen.

How to Use the Information in Your Toilet

The size, shape and color of your stool give valuable clues as to the state of your health. It's so important, in fact, that in 1997 Stephen Lewis and Ken Heaton with the U.K.'s

Bristol Royal Infirmary teaching hospital developed what's now known as the Bristol stool chart.²⁶

The color and smell of your urine are also important indicators of your health and wellness. Your kidneys filter excess water and water-soluble waste products from your blood, getting rid of toxins and waste products that would otherwise make you ill. Each day your kidneys filter about 50 gallons of water, which equals about 18,250 gallons each year.²⁷

Amazingly, one kidney can easily handle the task.²⁸ Your urine color will change depending on your level of hydration, medication, food and supplements.

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