



Into the fire: safeguarding firefighters' lives

Prometeo uses IoT, AI to
reduce health risks

by Caroline Poser

8-minute read



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Salomé Valero, Ph.D., Engineering; Co-founder,
Prometeo Platform S.L.

No one can outrun a wildfire

According to [NASA](#) (external link), there is always something burning on earth. There may be controlled agricultural fires, fossil fuels, or wildfires started by lightning or people. And NASA would know because the organization observes actively burning fires worldwide with its Terra satellite. Sometimes there are as many as 30 fires in a 1,000-square-kilometer area per day. The end products of all this burning include a mixture of gases, including carbon dioxide, methane and carbon monoxide.

Wildfires are a growing problem. The [Climate Reality Project](#) (external link), a global network of activists leading the fight for climate solutions in Washington, DC, states that rising temperatures due to burning fossil fuels dries out vegetation, fueling bigger, more resilient wildfires.

[Wildfire Today](#) (external link) explains that firefighters are exposed to health hazards including inhaling hazardous pollutants from the combustion of live and dead



vegetation (smoke), and breathing in ash and soil dust, while working long shifts with no respiratory protection. A wildfire travels faster than a person can run.

It's a global issue—one that The Prometeo Group wanted to address with its solution to measure firefighters' toxin exposure.

NASA has measured
as many as

30,000

fires in a 1,000-square-kilometer area per day

The Prometeo team's
goal is to measure toxin
exposure of

100%

of firefighters worldwide

Addressing a real-world problem

Salomé Valero, Ph.D., Engineering, is an IT service delivery manager for a large bank in Barcelona, Spain. She is also a co-founder of Prometeo.

Prometeo offers a solution to monitor firefighters' exposure to toxins when working on wildfires in near real-time through color signals and alerts.

"We created Prometeo to address a real-world problem for firefighters," says Valero. "We help them develop individualized strategies to protect them from the cumulative effect of the smoke and toxic substances that they inhale while working on wildfires."

The cell-phone-sized devices, which include environmental sensors, are designed to be worn on the firefighters' jackets. They monitor the environment for toxins such as carbon monoxide and nitrogen dioxide, plus temperature, humidity and smoke concentration.



The values from the device are collected and transmitted over a network to a cognitive platform, where the data is processed by machine learning model. The data is distilled into a simple color-coded status on the Prometeo dashboard that the fire command center can use to monitor firefighters' smoke and toxin exposure.

Green indicates the firefighter's health is good, but yellow or red indicate caution or "return to safety." Firefighter command can take action to remove the firefighter from the fire area.

The Prometeo solution relies on multiple IBM offerings, including [IBM Cloud®](#) and [IBM Watson®](#).

A success story that began with failure



Prometeo originated as a Call for Code contest entry. Call for Code is a global program for developers and other problem-solvers to collaborate on open-source technology projects that address social and humanitarian issues. The Call for

Code initiative is the largest tech for good initiative of its kind. The organization sponsors an annual competition where winners receive cash prizes and comprehensive support to have their solutions developed and brought to market.

“I received information about [Call for Code](#) during a meeting with IBM,” says Valero. “At the bank where I work, we do a lot of volunteer activities. In addition to helping with a tech for good project, I thought it would be a good opportunity to test new IBM Cloud technology.”

Valero built a team with five friends and colleagues from the IT environment and had a brainstorming session about natural disasters in the south of Europe, and then focused on the wildfires in Spain specifically. The original idea was a solution to protect people’s homes from the risk of wildfire.

“The story of Prometeo’s success started with a failure,” explains Valero.

The team entered the 2018 Call for Code challenge, but soon realized their idea needed refinement. They hadn’t consulted the experts—the firefighters themselves. “After that experience, we said, ‘Okay, we are going to go to the fire station, to test with the firefighters,’” says Valero. Because she didn’t know any firefighters personally, Valero searched out emails for firefighters and wrote to them. She reached veteran firefighter Joan Herrera, a fire management specialist, who is a member of the Prometeo team today.

Valero continues: “My team and I went to the fire station and he told us, ‘You all know a lot about technology. But you don’t know anything about wildfires.’ It was true. He was right, and that is why we didn’t win.”

Back to the drawing board

Herrera shared his expertise about wildfires. He described his worries and his concerns about the smoke and toxic substances that the firefighters breathe constantly when they are working in a fire, including controlled burns where oftentimes firefighters don't wear masks.

"He told us stories about his job, including about losing fellow firefighters, which made a profound impression on us," Valero says. "We learned that that while his fire station kept data about each firefight, they were working manually in an Excel file, and only logging three data points (beginning, middle and end of the fire) from each firefighter. These data points were collected by a nurse following the firefighter in the field."

The Prometeo team—now including three technologists, a firefighter (Herrera) and a nurse—regrouped in Barcelona. Together, framed out and understood the problem of the impact of toxins, the protocols for firefighters and how technology could be applied to address the issue. Then they got to work building a solution for the 2019

Call for Code challenge, the focus of which was natural disasters.

"We knew that with IoT sensors and the power of AI, we could build solution to monitor each firefighter in real time," says Valero.

The Prometeo team built the prototype solution with multiple IBM Cloud services. IBM provided an IoT platform with an IBM Watson machine learning model that delivers processing, distills the information and then displays it on the dashboard in near real-time. [IBM® Cloudant®](#) provides a fully managed IBM Cloud service database, and the [IBM Cloud Kubernetes Service](#) manages the applications across multiple hosts.

[Node-RED](#) (external link), a programming tool supplied by the [OpenJS Foundation](#) (external link), is used to "wire together" the IoT hardware devices, APIs and online services. Though the original Prometeo device was created with a 3D printer, today's version is a ruggedized smartphone and smart watch from Samsung that is



worn by firefighters, who can log in to the device securely with the [IBM Cloud App ID](#) via Bluetooth.

"With this data, we know what is happening with each firefighter and we can help define individualized strategies to protect them. That is the goal of the Prometeo solution," says Valero.

When the team entered the Call for Code challenge this time, they [won the top prize](#).

Pyrrha, the open-source project



Field testing of the Samsung devices has been performed in controlled burn conditions in Spain, and field tests are continuing around the world. “We can scale easily with the IBM Cloud technology. There are data centers worldwide so we can maintain the data securely in each region,” says Valero.

Additionally, the Prometeo team has contributed an open-source project called [Pyrrha](#) (external link) to the [Linux® Foundation](#) (external link) so others can contribute and help to get the solution deployed in new locations. “There are a lot of people who need this technology, and every contribution is important,”

says Valero. Some of the short-term goals include analyzing toxin exposure over time, and updating smartphone capabilities.

With the current smart watch set up, each firefighter is able to monitor his or her own toxin exposure. “They tend to be a group that may not be the first to step aside,” says Valero. “So I think it’s important for them to see on the smart watch when the status is red.”

Ultimately, the goal is to have an open, flexible platform for each fire department to include their own requirements so they can build the strategies to protect their department.

“We expect to have big data to show real evidence of the effect of smoke, while taking into account they physical condition and cumulative exposure of each firefighter,” says Valero.

Protecting our heroes

In the next version of the Prometeo solution, the team is planning to integrate the Samsung Health API to evaluate more specific metrics from each firefighter, which could help them devise recovery strategies. For example, running on flat land and running on a hill are different and because a firefighter's breathing is different on a hill, the impact of the same amount of smoke is worse.

"In IT, when I have a bad day, it means I am in the war room because a system from the bank has failed, and the worst scenario is that I might arrive home late," says Valero. "But when the firefighting team has a bad day, it's a really bad day—as you can imagine."

Valero concludes: "Firefighters are our heroes, and even though they are very brave, I think we must use the Prometeo platform to protect them. Our dream is to have a Prometeo IoT device on each jacket or wrist of every firefighter worldwide."





About Prometeo Platform S.L.

Based in Barcelona, Spain, [Prometeo](#) (external link) is a startup formed after it won the 2019 Call for Code Global Challenge. The company offers an IoT solution to measure the toxins firefighters are exposed to when battling wildfires or managing controlled burns. The cognitive platform monitors firefighters in real time through signals and alerts on dashboards and smart devices.

Solution components

- IBM® App ID
- IBM Cloud®
- IBM Cloud Kubernetes Service
- IBM Cloudant®
- IBM Watson®

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