FIRE SENSORS
FOR SAFER URBAN COMMUNITIES

In an unprecedented collaboration, the Red Cross recently introduced simple, yet sophisticated sensors to provide early detection and warning of home fires across two informal settlements in Kenya and South Africa.

This eight-month technology demonstration reflects a dramatic leap forward in a multi-year innovation process aimed at assisting residents in enhancing traditional practices, strengthening their awareness of fire safety and capacity to respond, and designing a sustainable business model for global impact.

On a daily basis, homes in informal settlements are destroyed by fire. Causes of fires vary and include times when people cook indoors with open flames, burn trash, overextend faulty wires or try to keep warm. Rapid and haphazard community development has also forced homes dangerously close together, and once fires start, they rapidly spread throughout the settlements.

On top of this, the density of slums makes evacuations chaotic and dangerous. Pathways between homes are narrow and often blocked. Getting out of a home when a fire starts and to a safe location quickly is nearly impossible.

Today, when fires occur, residents shout, ring bells, honk horns, pound on doors, crank sirens and use social media to alert others. Some residents risk their lives to suppress the fire using blankets and buckets or knock down the structures; others douse their unaffected homes with water to stop the spread. Even if people know who to call to help stop fires, dispatch systems fail and professional firefighters have a difficult time finding and navigating through the large-scale, crowded labyrinths to find the fire.

Within minutes, hundreds of residents can be left devastated and homeless, and every effort they had made to improve their lives is erased. Very few have insurance, and after a fire, forced eviction or rent increases can occur. Many end up leaving their communities, and families are separated for prolonged periods of time.

In the wake of two particularly devastating fires that resulted in the highly-publicized death of children and destruction of hundreds of homes, community leaders in Mukuru, Nairobi and Khayelitsha, Cape Town recognized the need for improved solutions. In response, the Red Cross helped them advocate for the installation of sensors that can detect a fire early, distinguishing between smoke and flames, and sound alarms across the network via SMS and

broadcast to alert nearby residents. Through a facilitated co-design process, the leaders also saw the potential for the sensors to directly notify professional firefighters or an informal brigade of citizen volunteers, and to provide GPS data for the location of the fire, speeding the response.

According to the UN, nearly 1 billion people reside in informal settlements today. As that number grows, the Red Cross anticipates a similar rise in risks and humanitarian needs, and is therefore eager to support these community-driven priorities—not only to help make the slums "smarter" with the installation of sensors, but safer, healthier and more inclusive overtime by bringing a full complement of resilience-strengthening services.

In 2015, the Red Cross invited a team of more than 20 partners to contribute to the solution, including universities, government agencies, global corporations, philanthropic foundations, technology startups, designers, and multi-lateral and civil society organizations. Drawing on the diversity of technological, business strategy, policy and development expertise, the coalition sought to:

Define a principled innovation process and business strategy that would guide future action to ensure the residents' immediate needs and longer-term aspirations were central to all decisions, and to uphold an ethical responsibility not to create more vulnerability through the initiative;

Better understand the community dynamics and requirements, and assess whether this disruptive technology solution could adequately address the need, improve outcomes, and be sustained and expanded;

Determine whether products and businesses currently in the marketplace could meet the need; where they can improve in design, use and cost; and how they can link to the existing ecosystem, aid other research and strengthen policies;

Apply design components of the Red Cross' Home Fire Preparedness Campaign in the US and learn new techniques that could also transfer between locations;

Develop a replicable model for field innovation, specifically one that can support hyper-local needs, achieve an appropriate scale, transfer knowledge between communities and leverage the strengths of partners;

Explore what other interventions would be needed to fully protect the community from fires.

Photo by Juozas Cernius | American Red Cross
Nairobi, Kenya

Photo by Juozas Cernius | American Red Cross
Cape Town, South Africa

Within eight months, the coalition installed 2,000 sensors at the household level across two settlements in Mukuru, Nairobi and Khayelitsha, Cape Town. Because technology rarely works in isolation, the Red Cross and its collaborators took care to incorporate several other improvements to more comprehensively address this complex issue. We supported the communities with:

- Detailed GPS-identified maps that included water sources for firefighting, sensors, community response stations, schools, locations of recent fires, major hazards and other relevant data

- Fire safety education programs and drills that included children, business owners, landlords, community leaders and others

- Research on fire causes and trends, as well as policy barriers and opportunities related to both community and professional fire fighting

- Research on ways the sensor data could be leveraged to predict and address other challenges, such as urban heat waves

- Start-up ideas, like fire-resistant paint and building materials, from local innovators to address the causes of fire and support survivors' quick recovery

- Training, equipment and other support for community-led disaster response teams

- Market research to understand spheres of influence and develop an inclusive theory of change

At a rapid pace, the Red Cross and its partners learned an extraordinary amount of lessons, which validated, challenged and expanded the original hypotheses, and honed the collaborative approach to innovation. The greatest yields fall with five areas:

1

Adaptive Programming

The Red Cross leveraged this opportunity to test new approaches, engage nontraditional partners and make process improvements that challenged the status quo. Iterative cycles of focused learning enabled evidence-based decision making, supported risk taking, exercised organizational agility and replaced outdated traditions of fixed program design and standalone activities. As a result, the Red Cross was better able to design for scale, convene partners from various backgrounds, and build trust and understanding with the local communities.

2
Product Viability

During this first installation, we compared two devices and solicited community feedback on their sensing thresholds, mountings, networking requirements, notification sounds and systems, theft/tampering protections, power sources, GPS precision, weather/insect barriers, and other features. While no solution fully meets the needs of an informal settlement today, this initiative has produced a detailed set of requirements, which technology companies can use to improve their sensor designs.

3
Community Value Proposition

Even in the best-resourced environments, making safety "cool" is very challenging. And achieving satisfaction and demand for an emerging technology is a steep climb. That said, the initiative showed that an appropriately priced sensor with enhanced functionality, customization, additional safety sensors, local branding and/or a bundled design with other products like lights and cook stoves can increase community value.

4
New Complexities

Sensor technology is not a silver bullet, but it creates a platform on which to build other services, unlocks local data and networks that can strengthen both business and community systems, and expands digital literacy. As expected, the introduction of a new solution has revealed several new complexities and opportunities, including those related to data, response systems and policy. For example, the sensors hold the potential to measure a great deal more about community behavior and the environment than originally realized, and the coalition's experience demonstrated the importance of governing and securing the information carefully so that the residents are not made more vulnerable to retribution, surveillance and other risks. If, in future stages, the sensors begin collecting more data

and connecting these often isolated and ignored communities to formal infrastructure and services, data ownership, privacy protections and transfer protocols must be fully addressed. Similarly, the initiative further explored several gaps in community services and new hazards that, like fire, require a reliable response system. For example, the initiative demonstrated that the establishment of local stations and supportive policies, bringing response equipment and capabilities closer to where fires, floods and other emergencies often occur, could have a transformative impact on community safety. The coalition also determined that a dialogue between professional responders and residents would be the most critical step toward restoring the trust between them. And research teams showed that the ongoing monitoring of sensor data to help track heat waves could help mitigate the societal effects of a changing climate across the region. Addressing these linked issues will help residents advocate for their needs and make choices that will ultimately protect and improve their lives, as well as help business and government leaders better understand and serve the residents.

5
Business Opportunity

Little to no precedent exists for the full-scale deployment of networked fire sensors in informal settlements. During this installation, the coalition compared two business models, conducted extensive market research and developed a new set of hypotheses about the potential market size, existing distribution channels, revenue potential and local manufacturing options that we would like to test further in future stages. For example, a Fire Club could link preparedness measures, preventative education, and sensor technology for early detection and warning. Additionally, a reliable response team made up of community members and micro-insurance program for rebuilding could fall within the same service model. The Fire Club could be sustained through a slow-growth franchise business model that solicits community-level subscriptions, develops local micropreneurs, engages global brands in cause marketing, and integrates with public and private utilities.

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As the initiative continues, the Red Cross plans to share its learning widely and invite additional partners to help advance innovation in these under-served markets. Emerging economies offer significant growth opportunities for large and small businesses, and collaboration with the Red Cross can provide access to and understanding of the social and cultural nuances of these markets. We also encourage others to help us consider how the technology and related services can be deployed in other settings, including similarly dense urban centers in developed countries, refugee camps and schools.

If properly resourced, the Fire Sensors for Safer Urban Communities initiative can offer humanitarian and economic breakthroughs, with a leading-edge safety service, that creates true shared value for all.
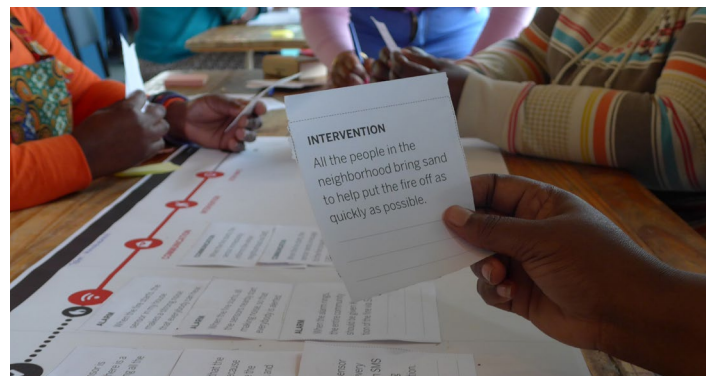
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Cape Town, South Africa

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