malaika

Home Security Sytem

Fire Response Strategies for Slum Communities
Rebecca Eveline Daum

Umeå Institute of Design
MFA Advanced Product Design

Firemen at a hotel fire in Mumbai

Introduction

The project is a cooperation with Interspiro. Interspiro is a manufacturer of respiratory protection for fire fighting, diving and work in hazardous environments. INTERSPIRO supplies respiratory protection to fire and rescue services, defense/military organizations, industries, utilities, shipping, offshore and diving companies all around the World.

As my personal passion is in the field of fire and rescue services, due to my background as a fire fighter in volunteer fire brigade, I wanted to focus on this field.

The given task in the beginning of this collaboration was, to develop a low cost SCBA set (self contained breathing apparatus), to be able to enter the market in emerging countries. From the very first analyzing of the components and productions cost of the SCBA sets, it was clear that the only possible component to limit the production cost of an SCBA set further, without risking to decrease the quality of the SCBA sets, is the harness.
So the project focus could be narrowed down even more. The task was to design a low cost SCBA harness for emerging counties, where Inerspiro currently plays no role. By that time the assuption for the reason of that was, that the prices of Interspiro sets are just too high, and if there was a more cheap SCBA set among the Intersprio portfolio, the market situation could potentially change.

Even the lowest price entry level model (~ € 500,- excluding the cylinder) exceeds the price that this market is able to pay. The price for the low cost model we are aiming for should be around € 200,- (excluding the cylinder). In comparison - an SCBA model a western world fire brigade would purchase is around € 1.500,-.

Being protected is sheer
a question of money

Being confronted with that task, I still wanted to tackle the project from a user centered perspective, rather than a cost cutting driven design approach. Considering the target markets (South Africa, India, countries of Southeast Asia, etc.) I wanted to make an SCBA set, driven by the needs of the fire service forces in that specific environments.

The goal is to allow every fire fighter access to a proper breathing protection.

„We want to fight every fire in the world.“

Nyclas Gyllbrink
Vice President Interspiro

3

Initial Research

The research started with evaluating the status quo of respiratory protection usage in fire services in the western, developed world. With a lot of background knowledge from myself serving in the volunteer fire brigade in Wagna, Austria, I visited the fire station in Umea, Sweden to evaluate their currently used equipment.

To generate some initial ideas to potentially improve the SCBA equipment for a western world usage scenario, I run an ideation workshop with my former fire brigade colleges from the volunteer fire brigade in my home town Wagna, Austria. To complete the picture of SCBA usage in different fire service contexts, I visited the Airport fire brigade of Graz, Austria

To design an SCBA set for an emerging country, the first thing to figure out is, what fire service means in different countries and what country specifics have an impact on fire service and the usage of SCBAs. Therefore I was initiating interviews with Intersprio distribution partners from the target countries, as they have an overview of the needs and demands of their clients.

The feedback of theses distributors gave a first helicopter view of the market situation in the targeted countries (competitor brands, price ranges that clients are willing to pay, problems with the current SCBA sets, wishes from the clients side, etc.)

Stefan Svensson
Associate Professor Lund University
Fire and Rescue Service Association South (Loberod),
PhD in Fire Safety Science, Former fire fighter in the Swedish Air Force,
Lund, Sweden
_____

With Stefan I had an interview about fire fighting in different cultures. He could shared insights from various countries in Africa, as well as China and the United States.

Some key insights from this conversation:

Fire fighting culture is often inherited from the occupying countries in the past.

Expectations of what fire fighter have to do, vary from the countries (stopping fire from spreading in eme rging countries vs. indoor smoke diving missions in the developed world)

In countries like Kenya, where people perceive the government as corrupt, this leads to people being suspicious towards every kind of officials

His closing words, on how to support fire fighters in emerging countries in the best way:

"...Personally, I would go for education..."

Nii Ammah Hammond
GWORLD GHANA LTD
Accra, Ghana
_____

Emmanuel Koulate
WWOD Win Wings Oil Dots
Abidjan, Ivory Coast
_____

Sergei Maslov
Interspiro sales representative for
Russia and Middle East
_____

Jimmy Croucamp
FREMTAC Fire and Rescue
Cape Town, South Africa
_____

Wim Van Iperen
Survitec Safety Solutions
Rotterdam, Netherlands
_____

Peter K. Mwai
MIPET K LTD
Nairobi, Kenya
_____

The sales representatives talked about the demand of the fire brigades in their counties, specification of equipment that the fire brigades would purchase and what kind of prices they are willing to pay.

Some key insights from the Interviews:

training level of the fire fighter is very low, therefore an error proof equipment is needed

"...training every 5 years must be enough in their eyes..."

"...what they want is the most advanced equipment, what they need is the most simple equipment..."

The market is dominated by Dräger

"Dräger is like a synonym for SCBAs"

"At this stage, I have no idea on the readiness of the market to purchase Interspiro since Dräger and Scott are of notoriety..."

Purchase driver
60 % pricing
30 % technical specifications
10 % adaptability

When looking at what differs between the countries of the western, developed world from the developing countries, one thing that influences fire services to a great extent, is the city set up.
In countries of the developing world, a fast amount of people life in informal settlements, also called slums. This was also what I found later on during the field research in South Africa and Kenya. Firefighter there are confronted with scenarios that are comparable to what a firefighter in the western world might face (fire in a structural buildings). But besides that, firemen have to deal as well with fire incidents in informal settlements. These incidents outreach the incidents in structural buildings by far, and so when it comes to fire incidents in residential areas, it is most likely that it happens in a slum.

Target Countries

1/₃ of the worlds urban population live in slums

According to the latest UN-Habitat publication regarding Urban Development and Management (November 2013), the absolute number of slum dwellers continues to grow, due to the fast tempo of urbanization.

The United Nations estimates that more than 90% of future urban population growth will be in low- and middle-income countries.

developing countries

56 %
Kenya

37,9 %
Ghana

25 %
Thailand

38 %
Philippines

emerging countries

24 %
India

25,2 %
China

22,3 %
Brazil

23 %
South Africa

11,9 %
Turkey

11,1 %
Mexico

percentage of urban population living in slums

Field Research

To get direct user feedback and insights, a research trip to South Africa and Kenya was done.
In both Cape Town, South Africa and Nairobi, Kenya, I visited different fire stations and met with fire fighters to talk about the challenges they face in their everyday work. (Interviews + tour trough the fire stations facilities and introduction to the currently used equipment) Besides an open conversations about the

country specifics in fire service, a focus of the conversations was the SCBA usage. A part of each visit was also a demonstration of the Intersprio equipment and gathering feedback on the current Intersprio products from the firemen (during this 2 weeks of research I was actually only meeting with male fire service personnel).

Adam Reineck
Head of IDEO.org
San Francisco, USA

Markos Grohman
Senior Design Researcher at frog
San Francisco, USA

To prepare my trip, to a for me still unexplored culture, I gathered some advice from two experts in their fields. Adam worked for IDEO.org in Kibera, a slum in Nairobi, and Markos, a senior researcher at frog, gave advice on research preparation and process for a big scale research - as I planned it to do.

Jimmy Croucamp
FREMTAC Fire and Rescue
Cape Town, South Africa

During my stay in Cape Town I was hosted and acompanied by Jimmy Croucamp, an Interspiro distribution partner. He served many years in the fire brigade in Johannesburg and the fire fighting profession has a long history in his family.

Etienne du Toit
Deputy Director
Fire & Rescue Services of Cape Town
Western Cape Government

Etienne represented the government perspective on fire safety services in South Africa.

Dennis Lyndon + his team
Senior Airport Fire Officer at
Cape Town International Airport
Cape Town

Dennis and his team at the airport fire brigade are representing the high-end of fire safety service in South Africa. As airports have to meet international requirements, and the type of missions at an airport are very special, their education and equipment differs from the regular brigades.

Pat Muir
Chief or Purchasing at Milnerton Fire Station
Cape Town

Dean Williams
Chief of Operations
City of Cape Town Fire Services
Cape Town

Jacques Laubscher
Chief of Training of
City of Cape Town Fire Services
Cape Town

Pat, Dean and Jacques shared insights on their specific responsibilities within the Cape Town City Fire Station regarding the usage of SCBAs.
Pat talked about the purchase process of fire fighting equipment, decision making, maintenance processes and budgets.
Jacques was teaching fire men how to use SCBAs, so he had a special understanding for usability problems and all the weaknesses of the euipment.
Dean could share his experince from missions typical for South Africa.

Keegan Newman
Station Commander
Sewes Pretorius
Station Commander Training
Breede Valley Fire & Rescue Service
Worcester

Bertus Senekal
Chief Fire Officer at Moorreesburg Fire Station
West Coast District Municipality

Keegan, Sewes and Bertus were representing the needs of rural fire stations. Wildfires are the biggest challenge during the dry summertime. Slum fires represent the most occurring fires in residential areas.

Driaan Louw
CEO Rope Access Inspection Ltd.
Cape Town

Driaan is educating rope rescue workers for all kind of industries. In this field the SCBA usage is especially challenging, his demand on equipment represents another edge of the spectrum.

Community Members
Community Center
Imizamo Yethu
Cape Town

Besides meeting with firemen and other authorities, I was also visiting exemplary informal residential ares. In Cape Town I visited the township Imziamu Yetu.

Destroyed windshield from a shack fire mission

Dennis Lyndon + his team

Pat Muir giving me a tour of the Milnerton Fire Station

Jaques Laubscher finding time to talk to be during his vacation

Access to Cape Town Airport Fire Station

Keegan Newmann and his team reviewing the Interspiro SCBAs

Jimmy Croucamp and me at the Rosenbauer fire engine

Bertus Senekal and team in Moorreesburg
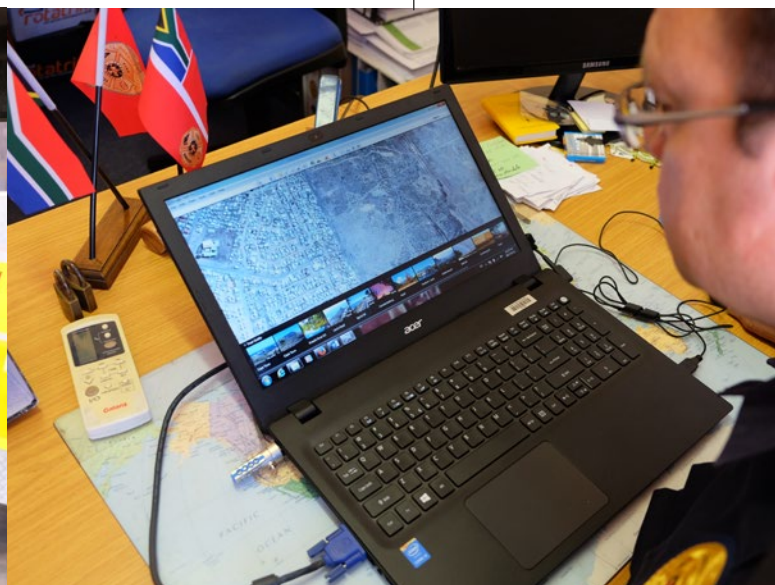

Sewes Pretorius showing me the SCBA sets in use

Talking about the latest shack fire mission and showing the area

To call the fire brigade in South Africa, you need their business card

A rope rescue trainings session

Peter K. Mwai
MIPET K LTD
Nairobi, Kenya

During my stay in Nairobi I was hosted and acompanied by Peter, an Interspiro distribution partner. He has experience with all kind of rescue equipment for public services and private industries.

Waruhui N. Itote
Fire & Rescue Instructor JIKA Airport Fire Brigade and
Training Academy
Nairobi

Itote and the team at the airport fire brigade are representing the high-end of fire safety services in Kenya. As airports have to meet international requirements their education and equipment are the most advanced within Kenya.

Peter N. Ngugi + his team
Deputy Chief Fire Officer at Nairobi City Fire Station
Nairobi

Peter and his team are responsible for the safety of the capital city of Kenya, the 3.5 million city Nairobi. With the limited resources that are available, this is a very difficult challenge for him and his team.

Mr Kahura + his team
Deputy Chief Fire Officer at Thika Fire Station
Kiambu County

Mr Kahura and his team were representing the needs of rural fire stations.

Dave Moore
Founder and executive director and
Chief Fire Officer of Africa Fire Mission
USA

Africa Fire Mission was founded in 2012 by Chief David Moore following a trip to Nairobi, Kenya. Upon learning that a city of millions of people had only 2 fire engines and 150 firefighter, David decided to help improve the public safety services available in Africa. He founded Africa Fire Mission to ensure that the fire services that exist in Africa are able to protect the public safety of their citizens and to ensure they are able to provide effective disaster relief.

Raphael Kingola
Lead Mission of Hope
Mathare, Nairobi

Raphael is the lead of Mission of Hope in Mathare. In the conversation with him I learned to get to know the community side of fire incidents in slums. He shared insights on the slum communities and its structure and dynamics.
We talked about best strategies, of how to work with the communities, and how sustainable improvements can be realized within the slum.

Community Members
Private homes in the Mathare slum
Nairobi

Besides meeting with firemen and other authorities, I was also visiting exemplary informal residential ares. In Nairobi I spent a day with Mission of Hope in Mathare, one of the poorest slums in the Sub Saharan area.

Reg Orton
CTO of BRCK
Nairobi, Kenya

I met with Reg, the CTO of BRCK, a very successful startup in Nairobi, providing connectivity to remote areas in Africa by producing Wi-Fi routers that meet the needs of the market (Wi-Fi routers among other products, like KioKit, education tablets for schools). We talked about what it means to create products for the African market.

Fire Safety Services

Summing up the insights gathered from the visits of the fire brigades in Cape Town and Nairobi, my conclusion on fire safety services and its quality standards is very different for both research destinations.

Cape Town
SOUTH AFRICA

Quality level of fire safety services
comparable to European standards

Limited financial resources but yet
all security standards are met
(decent personal safety equipment is used at
EVERY fire station)

Nairobi
KENJA

Quality level of fire safety services is **insufficient**
(education, resources)

Corruption and nontransparent resource management

no advocate for the fire fighters
(insufficient personal protection,
no SCBAs used at all in some fire stations)

Exceptions - Airport fire station and fire stations are on a
high standard

„Shack fire fighting is a beast on it's own"

Sewes Pretorius
Station Commander Worcester

Some selected quotes from the interviews in South Africa and Kenya.

"There are daily shack fires!"

"We as the fire brigade get attacked during operations in townships, or there is stuff stolen out of our fire engines"

"1 person that is saved from burn injuries safes 2 million bucks"

"The township community thinks that they have a low priority for the fire brigade"

"...they all got phones but nobody calls the fire brigade - they think there are eyes in the sky that report the fire"

"There is not yet anything sophisticated being done in this slum area besides buckets of water"

"Running to fill up a bucket of water - the fire took already over"

Mr Kahura + team, Peter Mwai and me at Thika Fire Station

No SCBAs in the fire engine, Nairobi City Fire Station

SCBA training, Thika Fire Station in Kiambu County

Peter N. Ngugi talking about the challenges for Nairobi City Fire Station

Waruhui N. Itote at the Fire Training Academy, JIKA Airport Nairobi

Tour through the facilities of Nairobi City Fire Station

What's that location?

How to access?

Where is water?

Fire Safety Service

Problem Analysis

These are the main issues when it comes to fire incidents in slum environments

Calling the fire brigade
Neither in South Africa, nor in Kenya there are standardized numbers for the fire departments. The fastest way to receive help from the fire brigade is to call the minimum 10 digit number of your local fire station. People don't know these numbers by heart. So informing the fire brigade is already the first obstacle.

No addresses
The slums ares are home to thousands of people but appear only as blank spots on online maps like Google maps. So in case the fire brigade is finally called, it cannot be clearly communicated where the incident is happening. This also results in a longer response time by the fire brigade, as they in case of fire just follow the smoke to locate it..

Traffic jams
The traffic in the urban areas of Nairobi is very dense and to get trough it, an offensive driving style has established among the citizen. Emergency vehicles with sirens and emergency lights on are not prioritized by the rest of the road users, there is no coming trough for them. This leads to very long response times.

No access
Because of the narrow alleyways in the slums area itself, fire engines cannot pass through to reach the fire origin.

No access to water
Within the slum environment there are no hydrants accessible for the fire brigade. Because of frequently occurring droughts (this is especially applicable for Kenya) in worst case not even the fire engines tanks can be filled with water.

Aggression towards firefighter
When the fire brigade finally arrives at the fire location, they are not very well welcomed by the citizens. People yell and trough stones at them and try to steal equipment out of the fire engines.
The aggression towards the fire brigade is a result of the fire brigade not being able to response (they are too late, properties is lost, lives are lost)

Poor knowledge
Lack of basic fire fighting skills among the community result in no first response actions that are done.
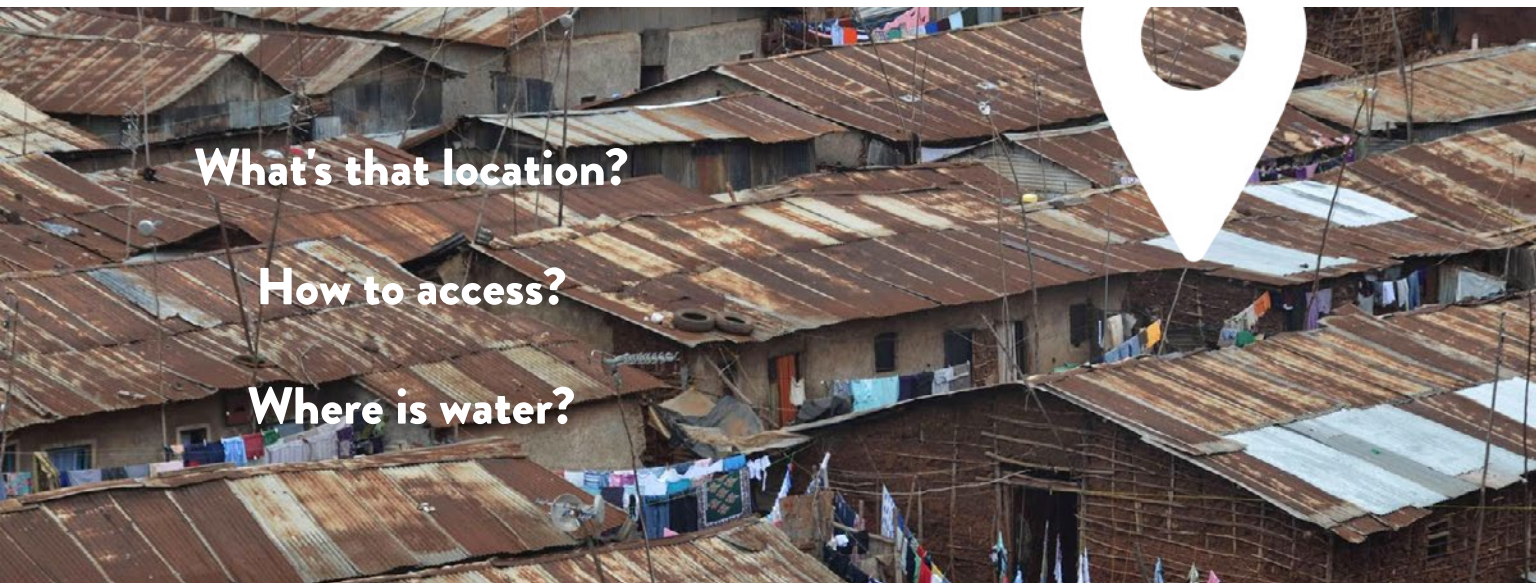
Slums

In the city area of Nairobi there are several slums, or so called "informal settlements" that host in total more than half the citizen of Nairobi.

Githurai
Muirigo / Ngumba
Korogocho
Ruai
Mathare
Kawangware
UthirRiruta
Soweto
Kibera

Kibera and **Mathare** are Nairobi's largest slums, with over 1.5 million people living here. Mathare is the slum I visited during my stay in Nairobi.
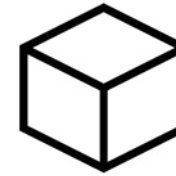
Until 2009, Kibera and Mathare appeared only as blank spots on online maps.
(until the communiy itself started to create a map of the slum themself www.mapkibera.org)

Localization is one of the big problems also for the fire brigades.
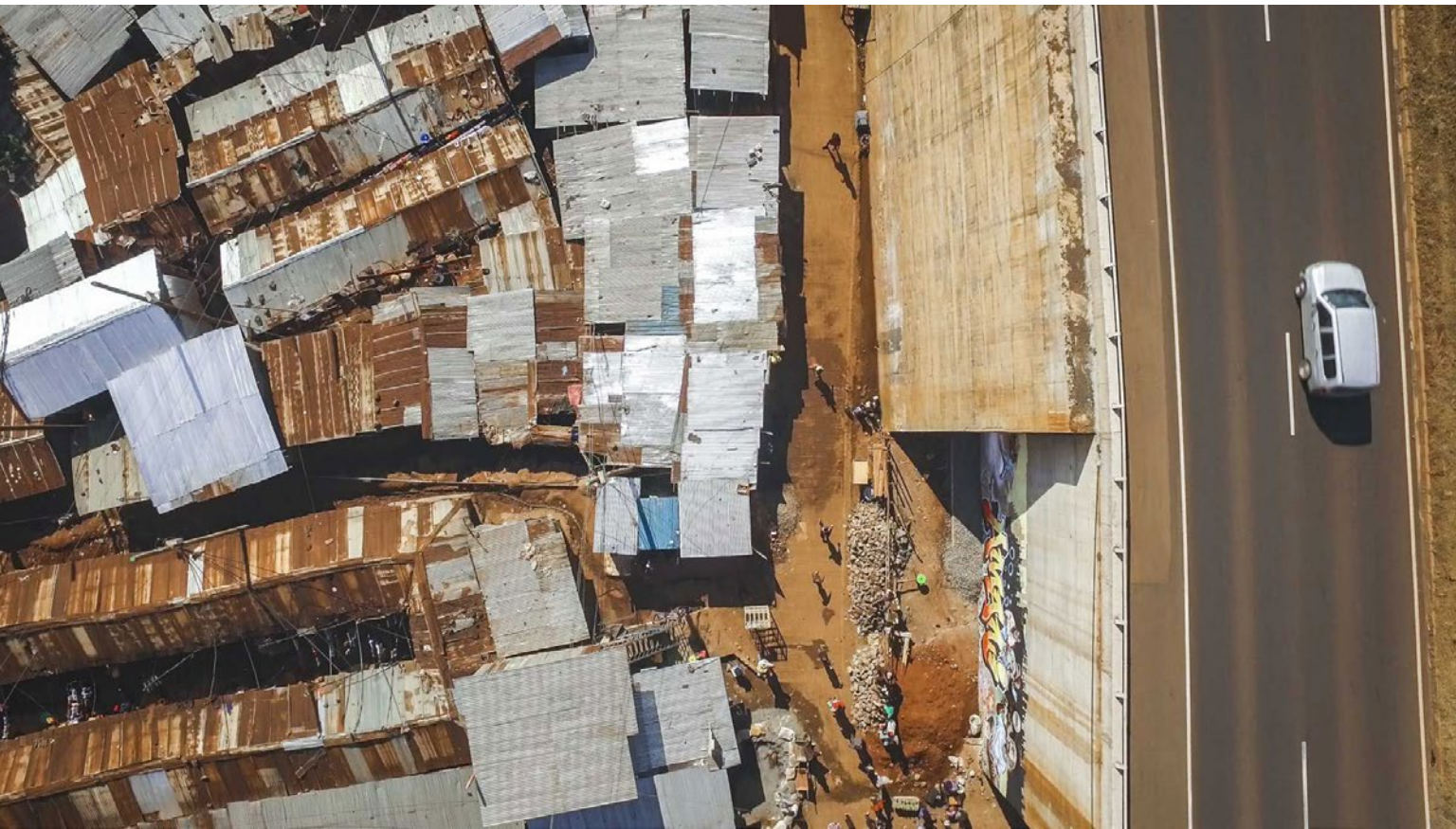
Slum Facts

A typical home in Mathare, Nairobi

3 × 4 m

wood
tin
clay

no water

maybe electricity

~ 20%

no toilet

average household size

4 people

up to 10

ownership

80 % tenants

monthly rent

1.000 - 1.500 KSH (10 - 14 €)

A typical resident in Mathare, Nairobi

50 % younger than 20 years

death cause - HIV

lives on **1 $ a day**

Fire Safety Hazards

A study from the Lungalunga slum in Nairobi revealed that 46.9 percent of participants have experienced ten and more incidents of fire within a year while 36.7 percent have witnessed between one to five. This shows that the frequency of fire incidents in the slum is high.
Fire causes from that same study:
Unattended stoves by drunken residents (44.7 percent), electric faults (17 percent), congested houses made of combustible materials and presence of kerosene.

Majority of the respondents (60.5 percent) did not know of any fire safety mechanism while a cumulative 29.8 percent had poor knowledge about fire safety mechanisms. Neighbors were the most active group in fighting fire at 72.9 percent followed distantly by the fire brigade at 16.7 percent. The challenges faced by residents when coping with fire are poor infrastructure and lack of safety equipment (25.5 percent) and little knowledge over handling of inflammable materials (23.4 percent).

Impressions from the slum visit in Mathare, Nairobi
The conditions I found matched with the gathered information from the desk research (studies).

Shorts can cause fire when people hook up the power supply lines illegally to provide their homes with electricity.

experience of **fire incidents** by slum community members within a year (Langualunga slum, Nairobi)

46.9 % .... **10 +**

Many people in slum areas are cooking inside their homes on paraffin stoves.

unattended stoves
(often - drunken residents)   **44 %**

electric faults   **17 %**

most occur between 11 in the evening and 6 in the morning, **while people are sleeping**

80% of the people who cause the incident have a to high blood alcohol level

most victims are the ones from the shack of the fire origine

People heat and cook on fire stoves (coal shop in the slum area).

Data from a study from Langualunga slum, Nairobi   Data from quotes from the Interviews with fire brigades, Cape Town

Mission of Hope School
Q&A with the "Muzungu"

Food preparation
Life happens on the streets

Not all kids are able to attend
MIH schools

Inside a slum home

Slum Facilities
Toilets and Water places

Water is distributed with
buckets

Local businesses

Beauty salon

People earn money by doing laundry

Metall sheet house walls

Often kids are unattended during the
day, when parents are working

Lot of young people who are
unemployed

Initial Concepts

Fire Detector

A fire detector is the core of all following concept directions. The core is to detect fire, alert the home owners who might be sleeping and the neighbours to react. Responding in time will save lifes and also minimize the damage, people can react and fire brigade is in best case not even needed to eliminate the fire.

There is several ways to detect fire - either by smoke, heat or the concentration of carbon monoxide in the air. Every method has its up- and downsides.
Heat detector f.e. is a cheap component, but will only trigger when a fire has already reached a certain size.
Carbon monoxide detectors are even detecting invisible danger but are expensive components.

Smoke   **Heat**   **Carbon Monoxide**

Collaterate Damage vs. **Safety of the Individual**

At the point a heat detector alerts, the person died already from the fumes (it would only be of advantage for the neighborhood to detect on heat basis only, not for the home owner)
"Most victims are the ones from the shack of the fire origin. " (Sewes Pretorisu)
So the fire detector in the concept needs to be a smoke detector.

76% of the population in Kenya relies on traditional biomass for cooking

600,000 deaths in 2012 from indoor air pollution

15,000 premature deaths each year

lower respiratory infections are **second-largest cause of death** overall, linked to 26% of all deaths reported in hospitals

(WHO study[6])

In a slum house there will be smoke, because of cooking or heating. This should not trigger "false" alerts all the time.

A smoke detector in the slum context must either make smart decisions on triggering an alert (Combination of smoke concentration + heat development) or provide different modes (daytime vs. night time, sensitive vs. insensitive), than can be set manually.
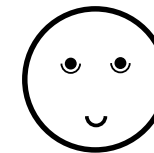
alerting mode

alerting when smoke is detected
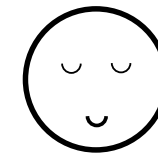
snooze mode

manual muting the smoke detector for a dedicated time frame

Community Shared Fire Fighting Equipment

A fixed mounted fire fighting stations provides people in a neighborhood with the basic equipment to help themselves.

Tools that could be provided for the community:

- fire extingushers for fire class A, B, C
- easy understandable manuals
- fire blanket
- fire axe
to open locked up shacks where somebody might be trapped, like a kid or an old person, providing an axe could also be a risk)

The station could be a gathering point in case of an emergency and could list the names of the community members who "own" this station, this also makes an evacuation situation easier (to check on who might be still missing).

Installation and introduction to the station will e done by the fire brigade. They cold host fire safety lessons, to also communicate that the slum society also has a priority for the authorities and to stregthen the relationship between them.

> *„Localization is an issue.*
> *We just follow the smoke."*
>
> Sewes Pretorius
> Station Commander Worcester

Introduction to the stations and the equipment will be done by the fire brigade.
Every station is assigned to a specific area in the slum and belongs to the people that are living in this neighborhood.
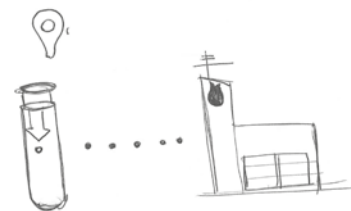
The stations allows to alert the fire brigade by simply pushing one button.
In case people don't own a phone, the phone is uncharged or they simply cannot remember the number, this allows them to alert the fire brigade in case the incident is getting out of hand.

Every stations location is known by the fire brigade and by calling the fire brigade from the station, the location information will be transmitted. It will allow the fire brigade to find the fire incident faster.

Getting the community and the fire brigade to work together against fire

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Alarm / Siren

When a fire extinguisher is taken out of the station, an automatic alarm is triggered.

This informs the neighborhood about the fire incident and allows them to get prepared for either helping to extinguish the fire, call the fire brigade or getting prepared to evacuate the slum are.

By triggering an alarm when tools are taking out, this action will be noticed by people around the station immediately. Hopefully this prevents also devices from being stolen, if somebody takes out something the station facilitator needs to get active and check for the station.

Alert Button

As people often don't know the number of their local fire brigade, a quick an easy solution to call them could be provided. (this can be done in a technical very cheap way, by implementing a standard mobile phones components into the station that has just the possibility to call the responsible station)

In case of any other crime happening in the area, this possiblity of calling an authority might also increase the feeling of security among the community.

Light

There are no street lights in a slum, which makes it a very dangerous spot during nighttime. By bringing light into the streets a safer and fearless environment can be created - also in non fire cases.

Fire Fighting Station Facilitator

There will be a dedicated person in the neighborhood that is responsible for the station. This could create a job opportunity within the community. The station facilitator has the following responsibilites:

Maintenance

Filling up used fire extinguishers, maintenance of all kinds, protecting the stations agains vandalism.

Community Manager

Keeping an overview and an eye on the neiborhood, knowing who is living in the neiborhood, helping in case of evacuation

"...people lock their kids into the shacks
when they are at work..."

"...old people having problems to escape...."

Fire "Messiah"

Spreading fire safety knowledge among the community, helping to prevent fires and helping with the usage of the equipment.

Home Fire Safety Toolkit

Every houshold wild be provided with low cost but efficent fire fighting tools, that are easy to use and don't require any maintenance.
The toolkit could be handed out as a present when a fire safety lesson, held by the fire brigade was attended.

The toolkit consists of

- connected fire detector
- fire and rescue Blanket
- throw-able and self-triggering fire extinguisher

„We as the fire brigade get attacked during operations in townships, there is a lack of understanding from the community."

Pat Muir
Milnerton Fire Station, Cape Town

By attending to a fire safety lesson that is held by the fire brigade, people will get a home fire safety toolkit as a reward.

Rewarding the people is everything!!!
(See in the business examples in the appendix, examples of how to bring people on board.)

Fire detector, lo-fi fire extinguisher and fire blanket live in every household.

Getting the community and the fire brigade to work together against fire

Disadvantages of

Regular Fire Extinguiser

Disadvantages of regular fire extinguishers

- people often don't know how to use it
- people need to approach the fire with the extinguisher but would rather prefer to run away
- it is expensive
- it needs maintenance
- it needs to be refilled after usage (fire extinguishing material + CO2 cartridge)

Alternative

Throw-able Fire Extinguiser

Bottles filled with fire extinguishing agents are very powerful in its extinguishing performance and bring other advantages

- People don't need to get so close to the fire
- No knowledge needed
- Not dangerous for the environment
- No maintenance
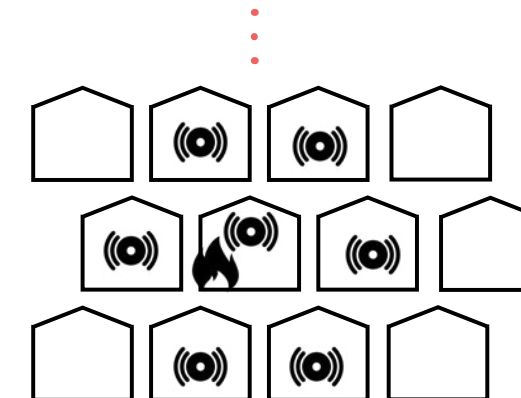- optimized performace - small indoor scenarios
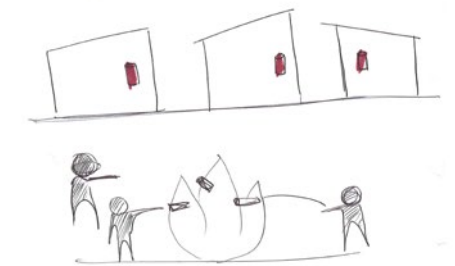- suitable for fires class A, B, C

In case of fire
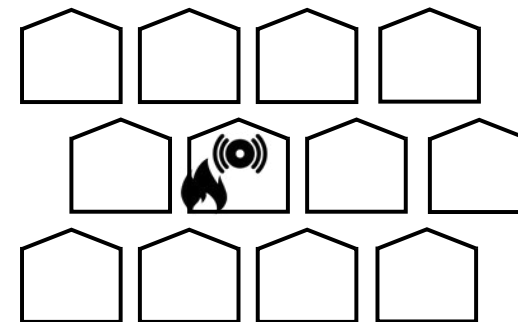
Alarm goes off in the shack of the fire origin

alert for 1 minute
time to either mute a false alarm or fix the problem yourself

Neighbors smoke detector alarms goes off
(alarms within a proximity of a certain radius)

First Fire Responder Service

There is a dedicated person in the neighborhood that is responsible for the fire safety.

Creates a job opportunity within the community.

Fire Safety First Responder Toolkit

To work as a fire responder, the person can get a starter kit containing

- simple breathing protection (escape set)
- fire extinguisher as a backpack / harness
  (or similar simple mobile fire fighting solutions)
- fire detectors for the community members / "the clients"
- a smart phone with a dedicated service app
- first aid kit

This starter - kit can be either financed by a micro loan by the person herself, or donated by an NGO
(as a job creation measure)

Service App

The smart device including the app has a central role in the
ecosystem of components

- shows alarms and matches it to the community
- is used to inform the fire brigade and other authorities
- is an education tool (teaches the fire safety responsible)
- connected to other service providers

Subscription Model / Fire Alarm Renting
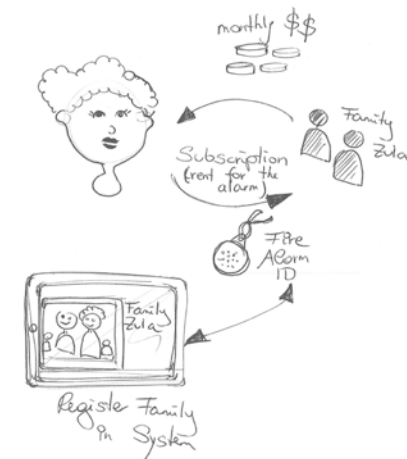
By subscribing to the safety service, the family will be assigned to a fire warden, who will be alerted in case of an incident to help out immediately.
The family will get a smart smoke detector in return for the very low monthly subscription fee (renting the smoke detector).
The wardens are responsible for the set-up and maintenance of the alerts.

In case of fire...
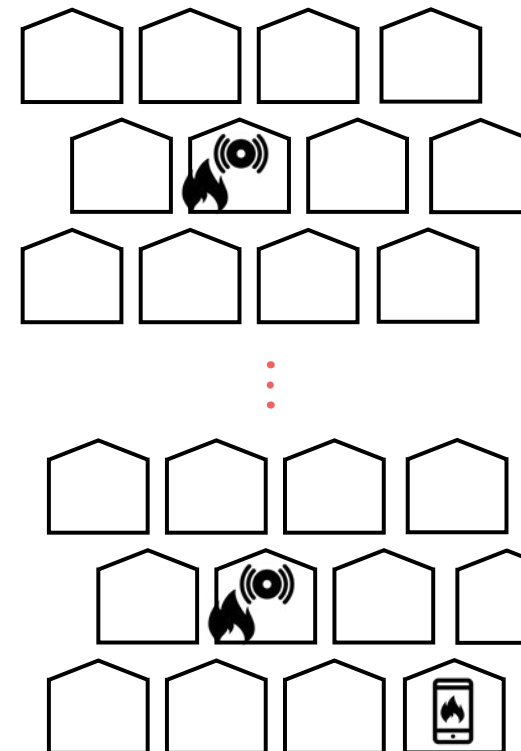
The fire detector informs the fire responder, who can react immediately.
In case of a successful job there could be a little "tip" charged by the service provider. (Not sure if a payment for help would result in fires that are set on purpose?)

malaika

Home Security Sytem

[ma: laɪ ka:]

1. Swahili word for angel
2. ملائكة , plural of Arabic word for angel (malak)

Community Alerting System

In case of a fire incident, the neighbourhood will be alerted. Together the community can help out immediately – before the situation is getting out of hand.

Official address for Everyone

Every household will be assigned its 3-word-adresse. This allows the neighbourhoods responsible fire warden to locate the origin of the fire, and share that information with the authorities if needed.

Subscirption Based Safety Service

By subscribing to the safety service, the family will be assigned to a fire warden, who will be alerted in case of an incident to help out immediately. The wardens are responsible for the set-up and maintenance of the system, educate the community and keep a good relationship with the fire brigade and authorities.

Smoke Detector

The core of the system is a smoke detector, that is adapted to the needs of a slum home.
Fire is still a source of energy in many slum homes around the world. To avoid false alerts, the smoke detector provides a snooze mode, that can be activated while cooking for example.

Access Alert

The system will also help you to protect your home from burglars. A motion sensor will detect the door being opened and will give an alert when its a not authorized person.
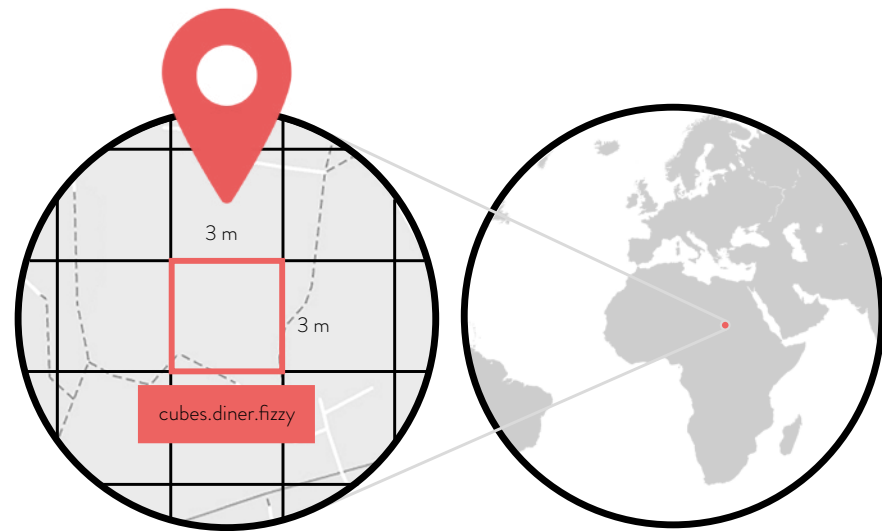
Panic Button

The device allows you to call for help if you get in a dangerous situation – at home or on the go.

Alerting System

*„Without an official address
people life off the grid"*


WHAT3WORDS

3 m

3 m

cubes.diner.fizzy

The United Nations estimates that 70 percent of the world is unaddressed, and struggles because of it. "Addresses are more than just a place where the post goes," says Charles Prescott, founder of the Global Address Data Association. "It's an indicator of who you are. It's a tool people use to distinguish human beings." Imagine applying for a job or a bank account without an address—it's near impossible. [7]

3-word-addresses are an already existing framework that allows to localize and name every 3 by 3 meter spot on earth in a more human centred way than abstract GPS coordinates.

lifetime.searches.cashew
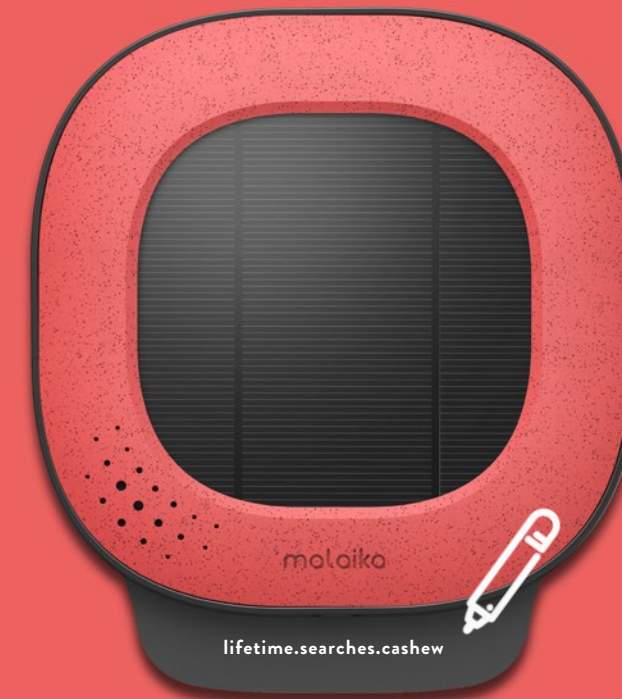
When setting up the safety system in the slum home, the 3 word address of the home will be assigned to the device (via NFC from the malaika app of the malaika service provider).

NFC

malaika

lifetime.searches.cashew
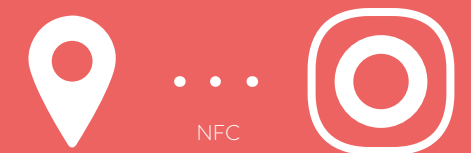
Tag to note down the 3 word adress of the home on he outside component of the devide (door sign)

Transferring data with sound

chirp.io

chirp.io is an existing framework that could be utilized to implement the alerting function.
"Chirp technology encodes data into a series of audible or inaudible near-ultrasonic pitches and tones to form a "sonic barcode". Data is encoded on a sending device before being transmitted, over the air, to a receiving device, or group of devices where it is decoded. Any device with a speaker can emit a Chirp and most devices with a microphone and a small amount of processing power can receive and decode it.

Sound is practically omnidirectional, meaning it is broadcast from a source and travels out in all directions from its origin. This makes it particularly well suited for broadcasting data in a 'one to many' network configuration to devices which may have no prior interaction or association.
Sound works completely peer-to-peer, meaning no additional connections are needed to 'the cloud' or other network services, so it works great in situation where there is no other network access."

lifetime.searches.cashew

Malaika alerts by shouting out the location of an incident into the slum neighbourhood.
Malaika transfers location information by using sound only. The 3 word adress of the home will be translated into a sound. The regular alert sound of the fire detector will carry the location data on top of it.

he sound can be interpreted by a smart-phone and the location can be detected. Help can be provided immate-riality and the location information can easily be shared with the authorities if needed.

"Help needed in lifetime.searchers. cashew"
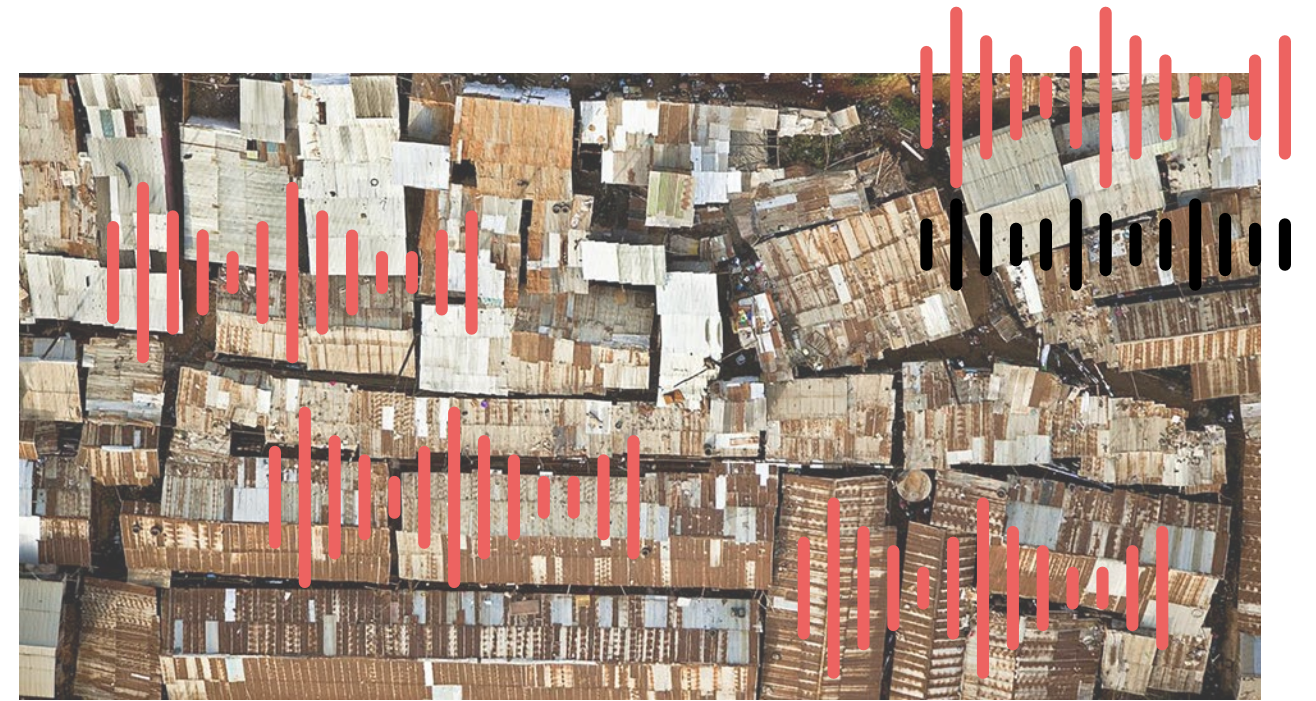

A fire incident happens in a slum home.

lifetime.searches.cashew

The homes malaika home security device was assigned a 3 word address.

The fire detector will trigger the sirene.

"Help needed in lifetime.searchers. cashew"

The sirene sound will carry the translated location data of the home where the incident happens.

Neighborhoods fire detectors will get triggered by the siren sound and start to repeat the location sound, so that the signal is carried further.
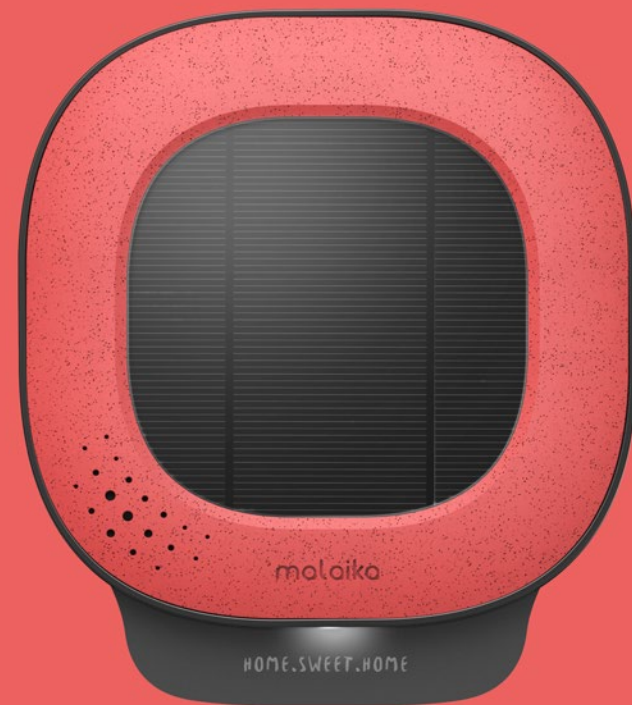
With the malaika app the location of the fire can be found out by the neighborhoods fire safety responsible who can immediately help out, or share the information with the fire brigade.

Slum Home Safety Device

Outdoor

12 V solar panel
130 DB speaker
mirophone
LED

Indoor

ionization smoke detector
batteries
bredboard, microcontroller
motion sensor
LED
piezo speaker
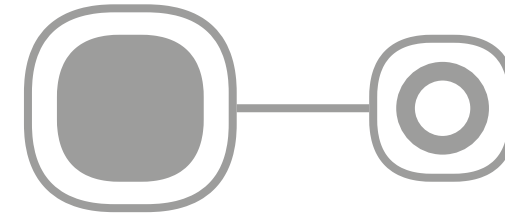
The device will life on the slum homes door.
One component will be placed on the outside
(energy source from solar panel) and
one component will be placed on the inside.

Both components are connected with a cable
through a hole in the door / wall.
The door is proposed as the best location be-
cause the device will then also work as an alarm
device (access control via motion detection.)

Outside Component

A rugged cast metall shell braces the solar panel.

Rubber patch (to even out door surfaces) and to provide an additional protections for the cable outlet from rain or other outside influences. The rubber patch seals the area up after the binders are tightened and protects the connecting cable.
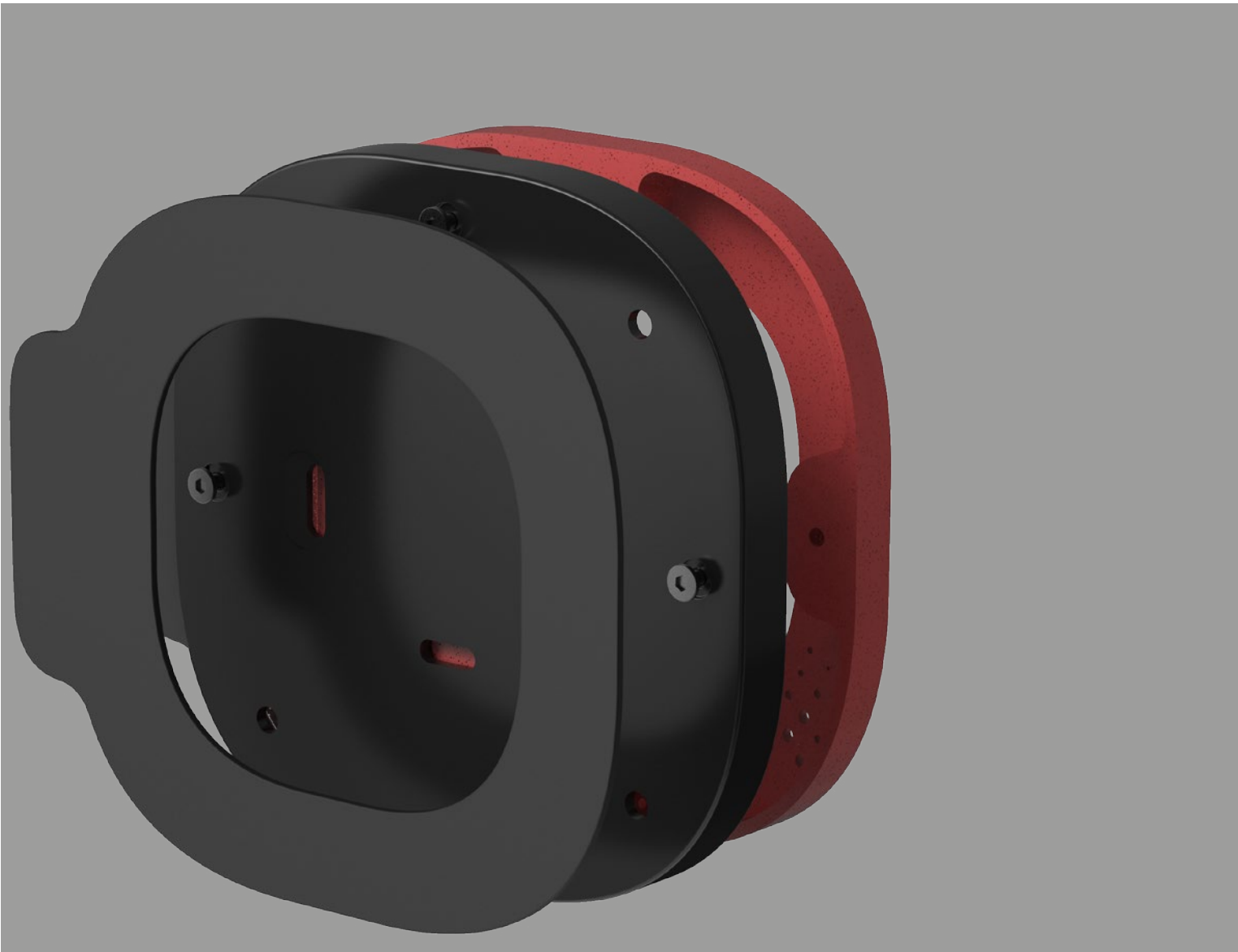
Inside Component

The smoke detector is held by a cast metal shell.

The connecting cable, as well the cable binder that are required for the mounting, find space below the plastic cap between the smoke detector and the metal shell.

It tidies up the set up and makes it hard to access the binders (vandalism protection).

Mounting and
Installation

The material the houses are made of could be everything. Doors are made out of wood of all kind of thicknesses or metal sheets. This is a challenge when it comes to mounting.

As one component is living outside, the mounting needs to be done in a way, that is hard to unmount (for exampele there should be no screws that are accessible with a drill from the outside). Also the overall construction needs to be rugged and robust against vandalism.

(Metal) cable binders offer a lot of flexibility (works for all type of doors and all kind of thicknesses.)

Both the inside and the outside device bases is a simple but robust metal frame. By tightening the cable binder, the force will be distributed over a bigger surface (in case of rusty metal or old wood this will prevent the material from breaking).

Inside
Smoke Detector

Outside
Energy creating solar panel, street
light LED and home address tag

Interface & Interaction

Smoke Detection

Core Function

Smoke Detection
in your home

If smoke is detected, the detector starts with a "friendly reminder" (a low tone sound). This allows the house owner to react, if the smoke is caused by cooking for example.

After 60 sec. the community alert will be triggerd.

30 sec. later

Snooze - 15 min.

If the reason for the alert is for example cooking in the house, etc., the alert can be turned off. After 15 min. the smoke detector will go back to an active state again. Only smoke triggered alarms can be snoozed (it is not possible to mute an access alarm or a manual triggered alarm)
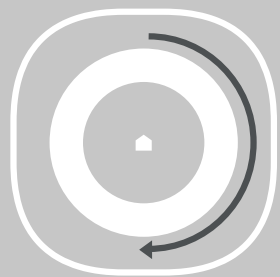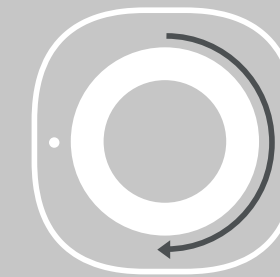
Alarm
in your neighborhood

If a detector in the neibourhood triggered an alarm, the close by alerts will start to give an alert as well.

Access Control

Motion Detector

Activate
Access Alert / Motion Detection

Turn the wheel to the key icon to active the motion detector, key icon needs to be next to the glowing LED (activation will be with a little time delay, several seconds that allow you to leave the house and close / lock the door)

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Deactivation
Access Alert / Motion Detection

Dedicated number on each device, turn the number to the LED light, leave it on the position for 10 sec. will deactivate

(a "light" safety feature, so that a burglar is not able to mute the alarm)

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Crime and violence is a big problem in slums. Women cannot visit the public bathrooms after dark, for fear that they will be physically attacked, so they become prisoners in their own homes. Malaika also works on the go and can call for help in a dangerous situation.
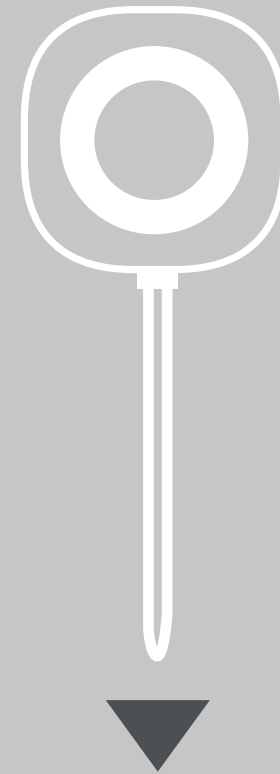
Panic Button

Manual Trigger

Panic Button

By pulling out the string, an alert will be triggered.

Device can be used in exceptional cases also "on the go".

Light

Evacuation Support

The alleyways can be dangerous and threatening places, especially during night time. Lightning up these corridors will make them less scary. In case of a fire incident, it will be easier for the people to evacuate.

## Subscription Based Safety Service

under wings
of a guardian angel

Slum entrepreneurship

The devices could be financed by a helping organization (UN Habitat, Red Cross, etc.) or in case of a first pilot fund raised (via a fund raising campaign) the follow up actions that are required will be taken over by a person, who will be "franchising" this system and provide safety service for a monthly fee / device rent
This could create a sustainable business for an engaged member of the slum community.

Slum Fire Station / Fire warden office
Franchise model

Principles
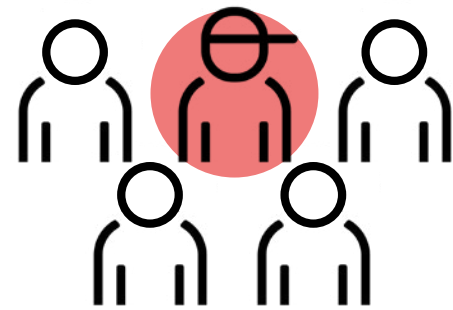
The fire warden comes from within the community. It is someone that people know and respect.
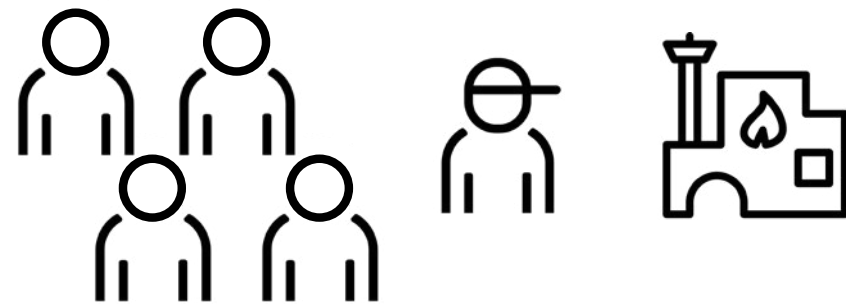
The fire warden connects the community with the fire brigade. He should also have a voice in representing the needs of the slum community.

A relationship based on trust should be achieved. The slum community needs to feel that they are a priority for the authorities as well and need the feeling of being heard.

„People need to feel ownership of an idea, then they will tackle the problem themselves! We can provide resources to realize the idea, but then they will be independent from our help.“

Raphael Kingola
Lead, Mission of Hope

Fire Warden Starter Kit

**MISSIONS OF HOPE INTERNATIONAL** **+**
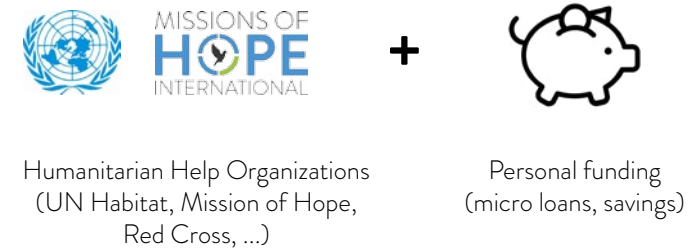
Humanitarian Help Organizations
(UN Habitat, Mission of Hope, Red Cross, ...)

Personal funding
(micro loans, savings)

The fire warden need to invest in equipment (the smoke detectors for the neighborhood, fire extinguisher, first aid kit, smart phone) . The investment should be partiality be made by help organizations, as well from the persons private saving, to ensure the commitment to the chosen responsibility.

The community members will pay a very low monthly fee to rent out the smoke detector and be part of the safety network.
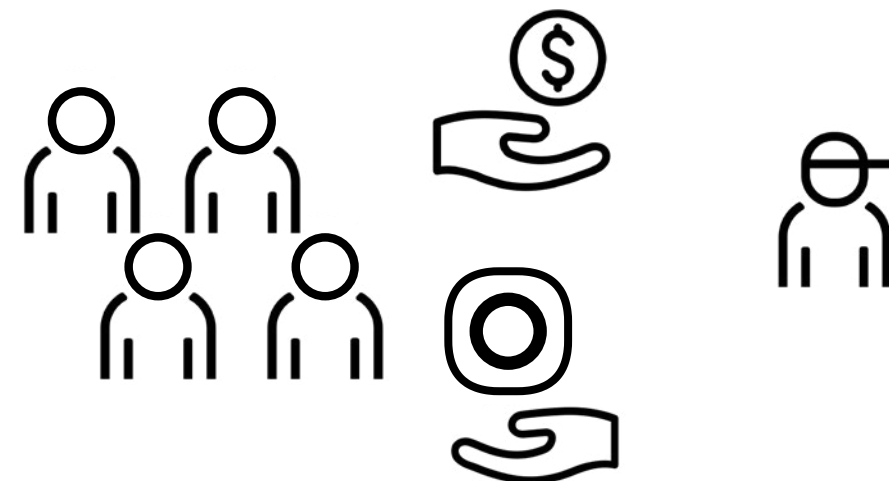
Fire Safety Curriculu**m**
Education program run by
fire warden together with fire brigade for all
subscribing community members as start-
ing point of the service. The purpose is to
spread knowledge of fire prevention and
to built trust between community and au-
thorities.

Malaika App
The app supports the process of the fire
warden and will also be available for com-
munity members in a "lighter" version.
_Knowledge
 (tutorials, fire safety / first aid)
_Organizational support
 (subscription and member management,
 maintenance plan, etc.)
_Connection to authorities
 (information sharing, escalation)

Installation and Set-up
The fire detector will be handed out by the
fire warden and will get installed in a proper
way, to ensure the best functionality of the
device.
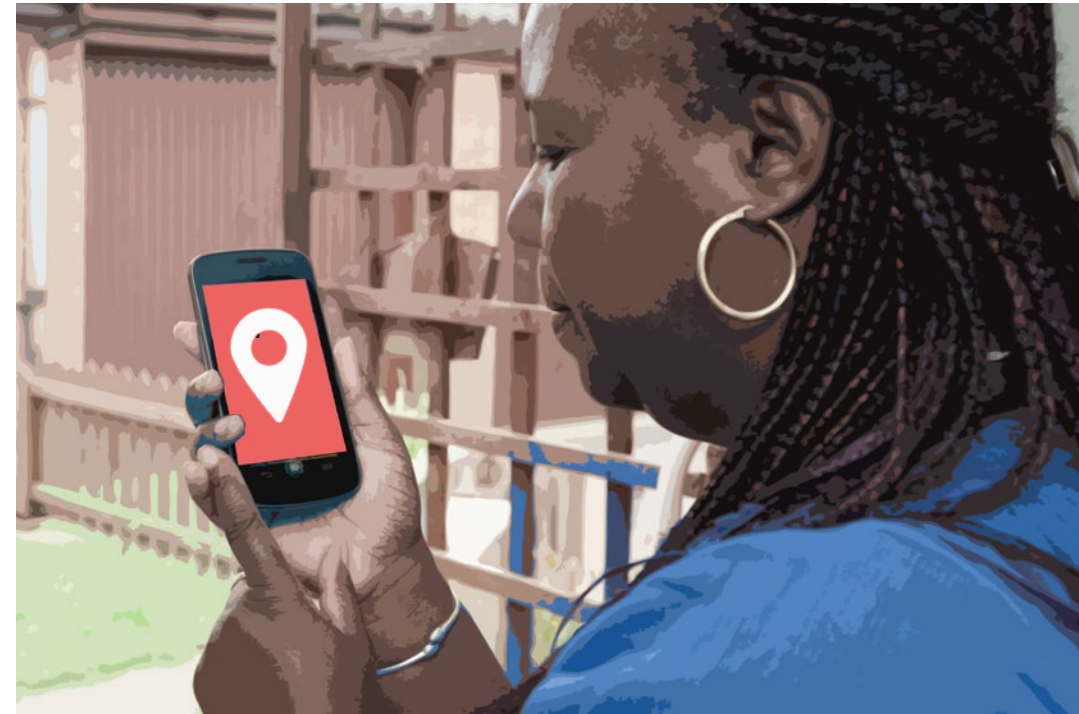
First Response
In case of an incident, the fire warden gets
the location data and helps out immediate-
ly. In case support is needed, he can easily
share the information with the fire brigade.

References

1   Slum Statistics
https://data.worldbank.org/indicator/EN.POP.SLUM.UR.ZS?view=chart

2   Dave Moore, Africa Fire Mission Intro
https://www.facebook.com/AfricaFireMission/

3   Mathare Homes
http://www.kibera.org.uk/facts-info/

4   http://www.roadmaptomathare.org/about-mathare.html

5   Mathare Residents
http://www.panairobi.net/

6   https://www.sei-international.org/mediamanager/documents/Publications/SEI-NCE-DB-2016-Kenya-Clean-Cooking.pdf

7   3-word-adresses
https://www.wired.com/2016/06/startup-wants-replace-address-three-word-phrase/

Images

Page 8   Fire fighter in India
http://www.storypick.com/firefighters-of-india/

Page 16   Drone shot from slum next to golf court
https://businesstech.co.za/news/general/127837/drone-photos-show-the-massive-divide-between-rich-and-poor-in-south-africa/

Page 22   Giraffe
https://www.kenyaembassyaddis.org/slider/giraffe-walking-in-nairobi-national-park/

Page 27   Shack Fire
https://defence.pk/pdf/threads/will-mumbai-finally-surpass-shanghai-this-year.480314/page-38

Page 29   Roofs of a slum
http://mogglog.blogspot.com/2014/06/kibera.html
http://mogglog.blogspot.com/2014/06/kibera.html

Drone shot of Kenyas slum
https://www.kenyatalk.com/index.php?threads/drone-photography-nairobi.35973/

Page 30   Photo montage basis (women assembling door component)
https://what3words.com/partners/page/4/

Page 64   Shacks
http://news.bbc.co.uk/panorama/hi/front_page/newsid_8537000/8537344.stm
https://fromrags2bitches.wordpress.com/
http://www.pxleyes.com/photography-

Page 63   picture/4d015162ea698/Train-Door.html

Photo montage basis (women & kid)
source cant be found any more, not my credits

Photo montage basis (kid)
source cant be found any more, not my credits

Page 66   Photo montage basis for the following scenarios

Page 67   Fire Safety Curriculum
https://www.yahoo.com/news/seven-killed-ne-nigeria-suicide-bombing-army-210640850.html

Page 76   Malaika app
http://www.kelleyslynch.com/publications/

Installation and Set-up
https://changecreator.com/6-lessons-every-social-entrepreneur-can-learn-from-living-goods-award-winning-success/

Fire warden with phone
https://www.androidcentral.com/georgie-smartphone-visually-impaired-now-available-uk

Page 77   All icons sourced from
https://thenounproject.com

Home - is knowing that no matter how hard times get,

someone is there for you!

🙶