Air Safety Grant

This is a co-creation document, make sure you respect the Content rules

NOTE: the text of the proposal is the last section, **Proposal text**, Everything before that is the substrate. Think of this as a flower growing in a pot. Everything before is the soil. Propose ideas in these sections to enrich the soil. Some of these ideas will be metabolized into the final text, the flower, in a concise and coherent manner, compatible with our organizational framework, our economic model, etc.

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Roles

Writer of the grant - Tibi
Facilitator Anthony

Framework and governance

This funding proposal is part of the ACES/S COVID open venture
(page has been updated, more work in progress…)

This funding proposal effort has been logged into the

- ***Legit Registry*** under Funding under way
- **Revenues and Funding** under Grants

Rules and methods for funding proposals can be found **here.**

Info about this grant

Grantee: Kanro fund (Vitalik)
Type of grants: cryptocurrency

Info about Kanro
From Binance

Three categories of proposals will be considered, with increasingly stringent levels of review. Project timelines are expected to range up to 6 months to 1 year, but longer projects are possible with appropriate justification.

- Basic proposals: typically in the range of US $10,000-$50,000. (1-3 pages)
- Mid-tier: typically in the range of US $100,000-$200,000. (3-8 pages)
- Large proposals: higher budgets, if really needed and justified. (up to 15 pages)

Review of proposals will start immediately and will continue while funds remain.
The proposals will be reviewed by an international panel of experts. A list of funded proposals will be made public. Upon conclusion of their work, grant recipients will be expected to write and make public on the Internet a report on their work and its impact. Some projects may be chosen for an impact assessment and deep review (both qualitative and quantitative), oriented towards learning outcomes, conducted by a third party.

Please note that Kanro pays grants in cryptocurrency (USDC tokens via Ethereum). Please acknowledge this in your proposal.

If the project generates intellectual property, including papers, reports, software, hardware designs, or patentable ideas, all IP must be open source and placed into the public domain.

Any publications resulting from the work must be published in open access journals. Scientific research papers should be made available as preprints prior to publication in peer-reviewed open access journals in order to make the results known as quickly as possible.

Read more on Grant proposal instructions

Some pieces of info

to be considered in the grant

Demonstrating our commitment to solving COVID-related and other public health problems in a decentralized manner.

Projects

- The Aces/s COVID project
- COVID 19 Montreal
- Robobreath

Papers

- Meeting grand challenges with participation of a different kind, by Tim Loyd from Sensorica 2020 Canadian Science Policy Center Conference Editorial,
- When thousands of citizens innovate: how policy makers can contribute, by Alena Valderrama (Sainte Justine Hospital), Tiberius Brastaviceanu (Sensorica), Fabio Balli (Concordia University)

Other health-related projects

- Breathing Games
- Open source scientific instruments - various projects

What is Sensorica?

In plain language, Sensorica is an incubator for open source projects and open ventures based on open source software and hardware development.
Sensorica can also be understood as an open innovation network with a physical lab in Montreal, Canada, created in february 2011.
In more special terms, Sensorica is a pioneer in material peer production, incubating open ventures that thrive on open source development, with a focus on solving humanitarian problems.

The project

Develop a local-first network of *safe air/environment Pods/nodes*, which are installed in closed spaces, using socio-technical validation protocols, capable of functioning in difficult socio-economic conditions, even without Internet services.

By increasing availability of information about risk, people can not only directly and immediately reduce their risk with minimal or no practical downside, **but we can also catalyze the**

improvement of infection risk by aligning incentives. Right now, nobody knows which spaces are safer and which are less safe, not even the businesses in there, or the employees. This could mobilize dramatically more resources than go into the project (they will like that, increases bang for buck, let's point that out), towards the decidedly desirable end of reducing net infection transmission. Businesses are hesitant for many reasons to take measures that reduce transmission, some of which we cannot change. But they are particularly disinclined when no one will really even have any way to verify they have done so. This could change all that.

It will build on the Meshtastic mesh network. The node is augmented with air quality sensing devices, connected (optionally) to air filtration systems, UVC, ventilation machines or other systems to actually improve IAQ, and connected (optionally) to a display, which can display levels of safety of a closed environment. People can interact with the entire network by directly connecting to any Pod/node, using mobile technology. A central server can also be optionally implemented to serve info in real time over the web.

From a utilitarian standpoint the network has these basic functions a) **collect** data b) **analyze** (evaluate risk using an internal model and input data c) **distribute** raw data and information to anyone that wants it, and the calculated news-you-can-use actual risk figures and d), **control air quality** through a module that can take the risk data, make decisions and issue commands to devices to upregulate IAQ or reduce net risk, by bringing in new air, filtration, UVC, limiting occupancy, signaling encouragement to mask or distance, and other measures.

The finalization of the exact design of this sensing node is part of the work that will be done. This sensor package has many uses, and the building operator can use the data directly, providing valuable information regarding the operation of a building. In case of a pandemic outbreak, this information can be expected to be remarkably valuable in regulating and limiting transmission.

Pods/nodes collect local data and publish to the entire network over the Meshtastic mesh network and, with the option to be made available on the Internet. The same data / information is also served via a map/viewer on the website (much like breathesave.xyz), and an App.

Data sources include the following, but the system will be modular, allowing future expansion:

- User reports (including personal and mobile co2 sensors and observations of functioning filtration and UVC equipment provided by people),
- The occasional actual inspection, especially during initial phases and system setup.
- The owner of the business or institution, or employees.
- Information from the sensor hardware suite. See below.

Technical aspects

Some general features

- Costs less than $350 CAD in parts and labor at first, less later on.
- Use a Raspberry Pi model 4 B with 4 GB ram. That's enough to run everything including some machine vision, I think. Almost all programming is in Python.
- Briefcase-sized.
- Smaller components 3d printed, larger container a standard enclosure.

Sensing

For the integration of air quality sensors we will build on Sensorica's [Sensor Network] project, which produces open source sensing nodes for an industrial IoT application.

Sensors on the device. We envision a self contained device, for practicality. Data can be accrued with separate nodes, smart-building style, but that is not the plan right now because that gets complicated and expensive quickly without adding much value.

- Measure proxies for air safety/ventilation, filtration and UVC per person, including objective metrics like CO2, and also accept input over MQTT from devices like filter appliances and UVC emitters to verify their functionality
  - **Particulate sensor + smoke release device**, to determine actual net ACH in a space by measuring the decay rate of particulate pollutant levels after a deliberate release of harmless particles. Combined with measurements of the volume of a space, clean air delivery rates from all combined sources can be determined with good accuracy in real world scenarios (there is a reference I found for this - anthony). The sensors are readily available, and the release device is reasonably easy to develop, with a can of canned smoke of the type used for testing fire alarms. The canned smoke has to be replaced every year or something, if a detection round is done once per day. It could be done less often.
  - **CO2 sensor**. This is an easy win. NDIR I gather is the best?
- **Low cost UV sensors** are available that can detect the operation of germicidal UVC emitters in a room, verifying they are turned on, and approximate power levels. This can be combined with an initial inspection to verify radiation intensities (fluence levels), and kill volume. We propose adding a parabolic reflector and possibly a small filter to increase sensing quality and sensitivity, so the device may simply point into the room and adequately detect reflected light of the relevant wavelength, rather than being shined upon by the light, and is not affected by sunlight.

The system is modular and can be expanded on in the future. The next most tempting options are:

- **Camera with machine vision** on the rbpi, to
  - determine occupancy levels. This has obvious privacy implications and requires it to be situated with a good view etc. Important to note that the data will be

discarded after relevant figures are computed, for privacy. The best way to retain privacy is to not collect intrusive data. The system must have reasonably good security to prevent eavesdropping of course.
    - detect the use of masks, if it is being employed or not and by what fraction of building occupants. This affects the modeling considerably. Processing has to be done locally, this is a good reason to use a full raspberry pi.

Longer term we may be able to transition to the use of a raspberry pi Zero to cut costs.

Networking

Describe the mesh network and how we connect the Sensor node to the network node.
Preferably with examples of actual hardware that rea ready to roll, i.e. a modem like device data in data out.

Data analysis / modeling

Is an actual hardware device, but through modularity the software can be run on another machine if desired. The modeling sub system is exactly the same as on the central server. It can be run by the building owner for decentralization/reliability. Almost all of the programming is done in Python.

For Modeling:

- Can be a Raspberry pi 4 model B with 4GB ram, power supply, and case and Meshtastic module, no special hardware.
- Is networked using Meshtastic, and is also in communication with the central server.
- It connects to a local wifi network as well, for internet connection and user interaction.
- Collects information from the sensing nodes, and also user input through a web page on the local wifi network, regarding the volume of the space, etc. to improve modeling.
- Accesses publicly available information such as wastewater data and infection prevalence, and information regarding the actual impact to quality of life years of being infected. Some of this information is available automatically directly from the source, some will be input by us manually, remotely, into the central server, and downloaded by the modeling node from there.
- Estimates directly usable “news you can use” metrics such as Qalys lost per minute spent in a space, using a model which includes the decay of viral viability over time with CO_2 and humidity, ventilation, number of individuals in the space, the volume of the space, and other factors.
- This digested information and raw sensor data (unless opted out of) is shared with the central server
- Serves a web page or two for status indication, to dispense advice, and configuration.

For Reaction:
The historical and latest risk/harm estimates, time of day and other inputs are combined with user-changeable settings to upregulate or downregulate ventilation and UVC equipment, to achieve a set level of risk. This includes:

- Energy recovery ventilators such as the one Anthony is designing (over MQTT and meshtastic or wifi as the hardware layer)
- Filter appliances (over MQTT and wifi or meshtastic as the hardware layer) such as the one Anthony is designing
- UVC emitters, such as the one Nukit is designing/producing right now.
- Dispensing advice to the owner/occupants of the building to increase masking, open windows (a last resort reaction system for ventilation), limit building occupancy and other measures, by text message or email and a web page served by the modeling node.

Display

The central server

- Does the same as a modeling node, but under supervision of the team to get the best results.
- In addition, it serves a web page with a map which shares information on exactly what the historical risk levels and the present risk levels of different building volumes in which specific sensor nodes reside. So it's based on sensor node locations. Like weather stations.

Optional: display node:

- This is just a raspberry pi Zero connected to a screen. It simply displays a web browser with the right web page at all times. It can be the web page from the central server, or from the modeling node, so specific to the building or the whole city etc.

Some building owners may prefer to keep the information private, which they can do, but then they have to pay full price for the hardware and service.

Installation

- Installation must be done by a technician to ensure good results, at first. After the details are worked out it may be set up by the building maintenance personnel, shop owner etc.

Development process:

- Tibi has a lot to say about this. For the most part, we build one working system , make a better one, till it's good enough, and then build more!

Budget

Budgets should be realistic, and may include several options depending on different funding levels (e.g. "we could do this with $15k, but for $35k we can do that etc.).

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Note that indirect costs are not allowed.

See **budget spreadsheet**

General methodological approach

Our methodology is relying on **social innovation and new competence building**[1] with human aspects at the heart of the process. We recognise the value of the radical innovations introduced by open source communities and close the gap between technology development and social practice. Through our network, we will gather multidisciplinary competencies within our collaborative environment, where diverse stakeholders can interact (including researchers, innovators, technology developers, SMEs, and open peer-to-peer communities). We will foster a sustainable decentralized ecosystem, engaging all the relevant agents, skills and resources, inspired by successful peer-to-peer communities, FOSS and open design projects on global level[2].

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[1] Lundvall, B. A., Johnson, B., Andersen, E. S. & Dalum, B. (2002) National Systems of Innovation and Competence Building, Research Policy, 31(2002): 213-231.
[2] The proposed ecosystem structure has been observed in well-documented cases from the field of FOSS, open content, open design and open hardware

- Lakhani, K.R., & von Hippel, E. (2003) *How open source software works: free user-to-user assistance*.
- Research Policy, 32: 923–943; Mateos-Garcia, J. & Steinmueller, E. (2008) *The institutions of open source software: Examining the Debian community*.
- Information Economics and Policy, 20: 333-344; Dafermos, G. (2012) *Authority in Peer Production: The Emergence of Governance in the FreeBSD Project*.
- Journal of Peer Production, 1 (1), 1-12; Harhoff, D. & Lakhani, K.R. (2016) *Revolutionising innovation: Users, communities, and open innovation*.
- Cambridge: MIT Press; Scacchi, W., Feller, J., Fitzgerald, B., Hissam, S., & Lakhani, K. (2006) *Understanding free/open source software development processes*.
- Software Process: *Improvement and Practice*, 11: 95–105;
- Benkler, Y. (2006) *The Wealth of Networks: How Social Production Transforms Markets and Freedom*.
- New Haven, CT: Yale University Press; Pazaitis, A., Kostakis, V. & Bauwens, M. (2017) *Digital Economy and the Rise of Open Cooperativism: The Case of the Enspiral Network*.
- Transfer: *European Review of Labour and Research,* 23(2): 177-192.

We envision this ecosystem to be structured in three layers:

- **A productive community**, an open network of innovators and designers who engage in fluid forms of cooperation, gathering resources, including knowledge, skills and technology.
- **A series of entrepreneurial coalitions**, market-oriented entities that build upon the collaborative work of the productive community to introduce ready-to-market solutions, which address real needs, while remaining economically viable.
- **A stewardship association**, caretaker, enable cooperation across the ecosystem, arbitration, protect and co-manage the shared resources, facilitate networking, interaction and cross-pollination, manage potential conflicts, provide coaching and mentoring and assist the overall capacity building in the ecosystem.

We plan a series of open innovation rounds that consists of 4 stages:

1. Requirement specification and publishing
2. Support and monitoring
3. Solution development and implementation
4. Evaluation and lessons learned

The proposed overall process is **open-ended and iterative**. Parallel innovation tracks will be established, *remixing* the varied knowledge generated in all of the tracks by all of the actors. These tracks are established by **Open Innovation Calls**, which lead to the creation of enabling spaces, i.e. social, physical, as well as technological realms for joined knowledge creation[3]; and enabling solutions, i.e. "systems that provide cognitive, technical and organizational instruments so as to enable individuals and/or communities to achieve a result, using their skills and abilities while regenerating the quality of the living contexts."[4] We **utilize principles and methods from Design Thinking and Participatory design (PD), Participatory Action Research (PAR) approach in particular, along with the Human Centred Design (HCD) paradigm**. We adopt the six qualities[5] of a human-centred systems design:

- The design is based upon an explicit understanding of users, tasks and environments
- Users are involved throughout design and development
- The design is driven and refined by user-centred evaluation

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- For a concise overview see: Bauwens, M., Kostakis, V., Troncoso, S. & Utratel, A.M. (2017) *Commons Transition and P2P: A Primer. Published by The Transnational Institute*. Available here

[3] Peschl, M.F. & Fundneider, T. (2014) Designing and enabling spaces for collaborative knowledge creation and innovation: From managing to enabling innovation as socio-epistemological technology. Computers in Human Behavior, 37(2014): 346-359.
[4] Manzini, E. (2007). Design research for sustainable social innovation. Design research now, 233-245, pp. 240.
[5] ISO standard 9241-210:2010 Ergonomics of human-system interaction Part 210: Human-centred design for interactive systems

- The process is iterative
- The design addresses the whole user experience
- The design team includes multidisciplinary skills and perspectives.

The HCD approach is prominent in supplying socio-technological solutions. Both HCD and PD are asserted to complement technological-led development, reorienting the technology development with the human aspects.[6] Best results are received when the design process fosters bottom–up and long-term collaborations among diverse actors. In our approach, HCD relies on acts of infrastructuring:[7] building and supporting fundamentally relational socio-technical systems or solutions, and fostering forms of prototyping and experimentation in a collaborative processes[8]. Design Thinking integrates human aspects to the core of the design process[9]. Its practice involves three thinking spaces that are active simultaneously rather that sequentially:

- *Inspiration*, for problem and solution space exploration;
- *Ideation*, for generating, developing, and testing ideas; and
- *Implementation*, for bridging the project space to the lifeworld of people.

Contrary to top-down planning and execution, the design process is being put forward by "working with local partners who serve as interpreters and cultural guides."

Our choice of design methods will be guided by PD theory. Participatory methods have been well proven in several disciplines, from social sciences, psychology, and management to design practice. We are to introduce the principles of PD for sensitizing for the political aspects and power differences among the stakeholders, and employ methods to support infrastructuring that will empower involvement and encourage emancipatory stewardship to all actors alike.

The PAR approach will be adopted in order to successfully orchestrate our iterative innovation phases and the multi-disciplinary interaction. This action-based, experiential approach aims to empower diverse communities and influence the higher level institutional structures, by shaping a favorable environment for co-creation "with people rather than for people."[10] Bottom up approaches, like PAR, are considered to be more effective in producing relevant solutions and practices, especially in emerging and niche areas engaging different layers of multi-stakeholder

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[6] Steen, M. (2011). Tensions in human-centred design. CoDesign, 7(1), 45-60.
[7] Karasti, H., Syrjänen, A.L. Artful Infrastructuring in Two Cases of Community PD. Proc PDC 2004.
[8] Björgvinsson, E., Ehn, P. & Hillgren, P.A. (2012) Design Things and Design Thinking: Contemporary Participatory Design Challenges. Design Issues, 28(3): 101-116.
[9] Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. Development Outreach, 12(1), 29-43.
[10] McIntyre, A. (2008) Participatory action research. Los Angeles, CA: Sage.

involvement, as they assimilate the specific needs of the interested parties[11]. PD and PAR follow similar trajectories in relation to participation, but have different strategies and goals in the process[12]. PAR, as a recursive process, includes a spiral of adaptable processes[13] . Various "types" of PAR have been proposed by different scholars. However, they all utilize a systematic process of recurring phases, namely: (a) planning, (b) action and observation; and (c) reflection and evaluation of the results, which are fluidly braided within one another in continuous spirals.
Our entire project will be construed as an integrated PAR cycle, with the aim to set-up, experiment and expand a sustainable recycling ecosystem, as well as to reflect and summarize the lessons learned throughout the whole cycle to influence recycling and the related policies. Moreover, our tasks will respond to three recursive PAR processes: planning; action and observation; and reflection and evaluation. These steps are directly

a) linked to a set of activities (e.g. workshops, hackathons, design competitions, coaching and mentoring, etc.) which in every relevant cycle will ensure that the participating third-parties are engaged;
b) offer insights and ideas on the design of the Open Innovation Calls; and
c) establish opportunities for knowledge exchange, reflection and learning.

Nevertheless, as all methodologies have limitations[14], we will imbue the participatory and action based methods, as analyzed above, with quantitative elements, through a mixed-methods approach combining quantitative and qualitative analysis[15]. Results from the diverse methods will be triangulated in order to have a more complete picture, and as a way to overcome specific methods limitations.

In summary, on one hand qualitative analysis will be based on consultation with the relevant stakeholders and in-depth analysis in facilitated environment, combined with on-field observation[16] and reflection in the context of the selected sub-projects. Personal involvement of the stewards during the monitoring and evaluation will ensure that theoretically informed practice is developed.[17] On the other hand, quantitative analysis will focus on data

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[11] Fors, M. and Moreno, A. (2002). "*The benefits and obstacles of implementing ICTs strategies for development from a bottom-up approach*". Aslib Proceedings, 54 (3): 198 - 206. Fraser, E., Dougill, A., Mabee, W., Reed, M. and McAlpine, P. (2006). "*Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management*". Journal of Environmental Management, 78 (2): 114-127.
[12] Foth, M. & Axup, J. (2006) *Participatory Design and Action Research: Identical Twins or Synergetic Pair?* In Jacucci, G., Kensing, F., Wagner, I. & Blomberg, J. (Eds.) Participatory Design Conference 2006: Expanding Boundaries in Design, August 1-5, Trento, Italy.
[13] McIntyre, A. (2008) Participatory action research. Los Angeles, CA: Sage.
[14] King, G., Keohane, R. and Verba, S. (1994). Designing social inquiry: Scientific inference in qualitative research. Princeton, NJ: Princeton University Press.
[15] della Porta, D. and Keating, M. (2008). Approaches and methodologies in the social sciences: A pluralist perspective. Cambridge: Cambridge University Press.
[16] Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. Development Outreach, 12(1).
[17] McTaggart, R. (2001). Guiding principles of participatory action research. In C. F. Conrad, J. G Haworth, and L. R. Lattuca (Eds.), Research in higher education: Expanding perspectives, pp. 263-274. Boston: Pearson Custom Publishing.

collected from the selected sub-projects, using KPIs and scoreboards carefully developed in relation to the various impact areas.

Community engagement and participation

One of the main challenges is to successfully reach out to engage researchers and developers, so that they involve themselves in the sub-projects. To address this challenge, our starting point will be the partners' personal networks and institutional connections, guided by the project's radical approach aiming to change the current economic structures, rather than merely producing new technology or regulation. Following a snowballing process, the project's vision will expand and include an ever-growing range of views and aspects to develop in a coherent manner. This way we will put forward a mission-oriented, yet participatory and inclusive process. Our framework is greatly influenced by the works from Erik von Hippel[18], concerning lead user approach, and Patricia Seybold[19], on lead customers, which both focus on the percentage of interested parties necessary to leverage a collaborative design process. The lead users and lead customers have a deep understanding of the domain, are driven by intrinsic motivation to the task, and are thus willing to devote their time and effort to the development activities. Lead users and customers are critical towards the underlying values and the conditions for the participatory activities.

The project will accommodate the expectation of the participants taking into account the premise that lead users also have high expectations on the results of the work they are involved in.[20] PD practice is an asset in the idea generation phase as in providing opportunities for "participation at the moment of decision."[21] Conflicting values of diverse actors involved are to create disputes. By following a PD mindset we will resolve the conflicts through participatory exploration by negotiating values with the participants[22]. We will offer opportunities for "up-streaming" for the top innovators: a possibility for influence to the premises of their design and development work, to which these "champions" can most often not reach without institutional support. Hence, our project will allow innovators and user communities access to formulation of governance and policies for their respectful domain and achieve informed consensus together with the other partners, as well as a shared sense of direction and priority in the process.

This collective intelligence will be mobilized to fine tune the content and requirements of the Open Innovation Calls, with our role being to attune, based on our respective expertise and rigorous management structures of the project. Moreover, ideas, insights and relevant tools developed in the context of the sub-projects, will be fed into the design of the successive

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[18] von Hippel, E., 2005. Democratizing innovation. Cambridge, MA: MIT Press.

[19] Seybold, P.B., 2006. Outside innovation: how your customers will co-design your company's future. New York, NY: Collins.

[20] von Hippel, E., 2005. Democratizing innovation. Cambridge, MA: MIT Press.

[21] Sanders, E. B-N. & Stappers, P.J. (2008) Co-creation and the new landscapes of design. Co-design, 4(1): 5-18. pp. 8

[22] Iversen, O.S., Halskov, K. & Leong, T.W. (2012) Values-led participatory design. CoDesign, 8(2-3), 87–103.

stages, with all the involved parties (e.g. on-going sub-projects) directly involved in the definition of the topics and aspects of the upcoming stages. Based on our prior experience, the evaluation and selection of the sub-project proposals will follow straightforward and lightweight procedures.

Experimentation, stewardship and support

Partners focus on the provision of stewardship and support to the sub-projects. The selected sub-projects will be granted access to testbeds and a series of support activities, including joint workshops, hackathons[23], and design events. This will create the opportunity
for people to get to know each other and work intensively together in a collaborative environment. Additionally, a steward will be assigned for each of the sub-projects, who will monitor the sub-projects and provide coaching and mentoring where needed.

Moreover, the structure of the Open Innovation Calls is designed to encourage people to combine their efforts in recursive stages. Several themes of the Open Innovation Calls will be dedicated to issues concerning social innovation and cross-cutting aspects, such as social mobilization, finance, open protocols and IP and knowledge regimes. This is intended to harvest innovative ideas with regards to new socio-technical and economic options that will contribute to the coherence and sustainability of the ecosystem as a whole. The stewards may also provide cross-thematic connections between projects that work on complementary solutions for a certain area, in order to assist knowledge sharing and maximize cooperation and sustainability potential.

Evaluation, learning and sustainability

The results of the sub-projects are evaluated. This will be carried out with a combination of field observation[24] and self-evaluation[25] based on systemic validation and human-centred elements of technology development, using participatory methods. In Particular, we will attempt to go beyond traditional minimum viable product (MVP) testing and foster the creation of new forms of ownership and compensation through a limited number of integrated sub-projects.
Finally, we will address a number of cross-cutting themes through the whole project, thereby indirectly supporting the creation of a wider ecosystem across all sub-projects, and potentially beyond. Simultaneously, all the relevant lessons from the experimentation will be fed to

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[23] Galloway, A., Brucker-Cohen, J., Gaye, L., Goodman, E., & Hill, D. (2004, August). Design for hackability. In Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 363-366). ACM.
[24] Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. Development Outreach, 12(1).
[25] Burns, D. (2006). Evaluation in Complex Governance Arenas: The Potential of Large System Action Research. In B. Williams, & I. Imam (Eds.), Systems Concepts in Evaluation: An expert anthology. US and Canada: EdgePress/American Evaluation Association. Vetter, A. (2017, in press) The Matrix of Convivial Technology - Assessing Technologies for Degrowth. Journal of Cleaner Production, available online 6 March 2017. DOI: https://doi.org/10.1016/j.jclepro.2017.02.195.

formulate policy proposals, inform new economic models, technical regimes and standards, and take measures to disseminate the project's vision, methods and results to a broader audience, to foster a human-centric development paradigm. This way, with the development of the project's activities the participating sub-projects will be enabled to frame the conditions under which they can support and strengthen their cooperation, which is expected to act as leverage for the expansion of the ecosystem.

Project sustainability

Describe the economic model including the growth or propagation model.

The economic model behind this operation is inspired from Sensorica's decade long economic model for open innovation and material peer production. We believe that we can build a highly scalable and viral model by implementing principles of p2p economics, which are also fully compatible with widespread models in the blockchain domain. More below…

Explore how we can use existing web3 functionality to make this more streamlined. See the credentials system explained below and talk about payment system or transactions.

There is no central platform to maintain.

Adoption

Building operators are incentivized to adopt an air quality Pod for various reasons

- Safety of employees and customers
- Better productivity by providing and maintaining healthy air
- Market differentiation: add care and safety to the brand of space or business

Organizational model

Innovation, fabrication, installation and maintenance

First, this air quality and safety system is open source. Resources will be made available to allow anyone to fabricate and maintain.

The venture ensures continuous innovation. To make it sustainable, the venture will offer local fabrication (devices and kits), installation and maintenance services, on demand, in exchange for payment. The revenues generated go to those directly involved in these service activities

and a portion of it will be captured by those who continue to innovate. In order to ensure that this percentage of revenues goes to innovators, credentials will be issued by the group of innovators to service providers. This is an incentive based on perceived quality of service. Thus, customers will be looking for service providers with credentials that they can trust more, and the transaction will be reported to the innovation group. Service providers are incentivised to respect this norm to gain the cooperation of innovators, in case they need to solve wicked technical.problems that they encounter in the field, or in case they need to extend the functionality of the Pods, based on customer feedback and demand.
Some individuals will provide service outside of this agreement, but they will not be able to benefit from the credentials system validated by innovators and without being able to benefit from the loyalty of innovators when needed.

Other Notes

We should discuss obvious objections and how to address them. The reality is that most businesses and organizations will resist anything that even reminds people of covid-19, however my counter to this is that that applies to all anti-epidemic measures, including Germicidal UV and filtration, masking, you name it. We should do it anyway, not just for covid-19, but also so we are ready for whatever comes next.

One argument could be that if the population develops its own sound mechanisms of defense we could avoid top-down measures that are destroying social fabric and the economy. This is directly in line with the Access COVID proposal that Sensorica advanced during the pandemic, putting the population in charge of measures, with oversight by governmental agencies.

We will probably have to pit businesses against each other to get them to adopt it. Those who get a good rating will get free positive advertising, basically, to a certain community, and data about their building. To be honest it doesn't sound like it's going to be accepted very well and it would be good to get some traction there. They fund filtration and UVC stuff and energy recovery ventilation though so maybe we should focus on the reality that **verifying** that is important. It must not only be done but be known to be done. And businesses are going to be even less inclined to actually make improvements if nobody can even know! This aligns the incentives and will increase uptake of the actual IAQ improving measures. It completes the loop. It's a missing piece of the puzzle. It's an important part of the engine of change. Governments and universities etc. can also use them to monitor functionality of their systems in an automated way. GUV tubes wear out, filters clog, machines break or get unplugged. Building sensing IOT stuff is definitely a seller. This is just grassroots building sensing basically, with the data being shared and processed and given meaning in a certain context of relative infection prevalence etc.

We should discuss the revenue model, even if it's not self-sustaining we should probably be charging the space the sign is in some. The signs won't be trivially cheap with all those sensors and dev work. The devices could be relocated every week to get figures with blank periods of a few weeks in between, perhaps, to stretch the budget for hardware. Each space gets a week of monitoring then 3 weeks off or something, randomized, unless they invest in renting the sign all the time?

Mesh Network options

- **[Meshtastic](https://meshtastic.org) - used by Toronto mesh, perhaps a good idea to connect with them.**
- Nimble - large broadband
- Reticulum

Is https://www.helium.com/ still a good option honestly?

We need surveillance and data but we can't depend on the government* **and we don't' want to give them the opportunity to shop in surveillance measures with a powerful excuse like pandemic mitigation***. There have been several efforts like breathesafe (list them esp the best ones) to try to do this kind of thing. **We are kicking it up a notch with an actual low cost hardware device to reliably collect data**, and which is also a measurement instrument for indoor air quality.
Better list all data sources explicitly. Make it clear we are open to integrating new data sources. When we stitch it all together, reliability and accuracy and durability go up.

Roles of core group participants

Edderic:

- Handling API for Breathesafe to receive information
- I could also help with occupancy using facial/body detection using video input
- I could reach out to COVID-safe communities to see if we can get them to put pressure on businesses to adopt our technology

Anthony:

- Hardware and firmware and sensing stuff.
- Some admin stuff for sure, there is alway lots of that, we will have to divvy that up.
  I can do some install/inspecting early stages, I'll be in Montreal and can bike around and talkt to people, troubleshoot, make sure things are working, this goes hand in glove with hardware deve cuz you gotta see your stuff in the field and make sure it's good.

Tibi:

Organization, supervision, recruitment, hardware design and development/testing.

We can describe it as a **2 year pilot project**. I think 2 years is more reasonable, you can't do stuff like this much in 1 year. But we have milestones that will be reached in 6 months and 1 year.

A role of inspector/installer would probably be needed.

Some ideas

Having a mesh network with data about the spaces the hardware nodes are placed in, can allow us to aggregate data and analyze risk, from occupancy and risk profile/rank spaces.
Data collection + Mathematical model to calculate average cost (risk) to an individual of being in a specific space. Gotta be news you can use type stuff. Compare it with other risky factors - quality of life minutes lost (like quality of life years, QALYs, which have good precedent in the medical world as a guide for decision making)
Data sources: bluetooth, WiFi, near field, microphone, camera (with machine learning for occupancy or similar), the sensor suite, input from humans with a reputation system to improve reliability, the human inspector. What else? **We should list the data sources, leave nothing to the imagination.**
Can also calculate the risk of someone being infected, if their location+time data were combined with historical data from the system, which they can do themselves on their own device for good privacy.

Mesh networks advantages:

- No internet connection, eases config/setup, resiliency.
- Data privacy and security (maybe, depends how it's done).

So we have a node, with sensing capabilities, mesh networking capabilities, with the air cleaning/iaq improving devices, and measures like occupancy regulation.
Marking spaces, rate, green check mark, reputation.
Talk about accountability and auditability in the proposal.

Anthony's suggestions for the proposal

-it's useful to note and gives the project an air of respectability to point out that this project is very similar to the arpa-H system, but without actual bio-sensing, instead we use far cheaper sensors and information. It actually goes beyond that system in important ways, too: the data doesn't stay in the building, it has many other uses and we put it to use. We accept UVC, which they do not. It is much lighter weight and may be used in many contexts where the arpa-h style system is not economical, and these all add up quite a lot. IT requires much less coordination and organization to deploy, more of a decentralized market mechanism. Probably more reliable than a bio sensor esp when things get complicated in society.

Proposal text

See the template/instructions
See also a proposal that we already got approved, so that's a successful one.

The following information should be included:

1. Date of proposal

2. What is the objective of the project?

The vision of the Safe Air Network (SAN) is to build button-up capacity of local communities to measure and maintain high standards of air quality and safety in indoor environments, which will make societies more resilient when facing an airborne pathogen outbreak, such as the COVID-19 pandemic, or H5N1. This capacity can obviate the pressure or apparent need for institution-driven top-down measures during such events, which are not generally good for dealing with complex situations, have severe downsides, and may become impossible to implement for political reasons.

Objectives

In short, our proposal is to build a p2p technological and economic infrastructure for sensing and control of air quality and safety in indoor locations, with a focus on airborne pathogens. The deployment and servicing of this infrastructure will be guaranteed by a novel economic model, based on tested and proven p2p economic primitives. Our approach for sustainability provides resiliency, low capital requirement, rapid deployment capability and low overhead.

Development objectives

1. **Develop a sensing and control Pod** for air quality and safety, to be used in indoor environments. The system is modular and can be expanded on in the future. The next most tempting options are:

- The Pod contains a suite of **sensors** for real time air quality and safety measurement.
    - Measure proxies for assessing the efficiency of appliances that are installed within a closed environment, such as ventilation, filtration and UVC. Also accept input (perhaps over MQTT) from these appliances.
        - **Particulate sensor + smoke release device** to determine actual rate of air exchange or filtered
        - **CO2 sensor**, ex. NDIR
        - **UV sensor** to detect the operation of germicidal UVC emitters in a location.

    - **Camera with machine vision** (potential future development), to
        i. Determine occupancy levels in a closed environment, while preserving privacy of occupants.
        ii. Detect the use of masks inside a closed environment, while preserving privacy of occupants.
- The sensors are connected to a **minicomputer** (ex. Raspberry Pi), which provides computational power for real-time safety assessment.
- The Pod provides various types of **interfaces** to control air quality regulating equipment that are normally used in indoor locations, based on computed and acceptable risk figures, optimized for power efficiency. Internet of things protocols (ex. MQTT) will be implemented.
- The Pod has a **display** that provides real time and historical data and information about air quality and safety, such as compliance with ASHRAE 241, Control of Infectious Aerosols.
- The Pod is an open source DIY hardware device that can be fabricated with only basic training and tools from source code.

Develop a modeling and analysis module, which can be run by the building owner for decentralization and reliability. Almost all of the programming is done in Python.

For Modeling:
- Can be a Raspberry pi 4 model B with 4GB ram,
- Is networked using the same Meshtastic mesh network, and can also connect to a central server via a local wifi network and the Internet.
- Uses data and information from the sensing Pod, as well as from user input through a web page on the local network.
- Accesses publicly available information such as wastewater data and infection prevalence, and information regarding the actual impact to quality of life years of being infected.
- Estimates directly usable "news you can use" metrics such as Qalys lost per minute spent in a space, using a model which includes the locally measured and estimated decay of viral viability.
- Able to communicate analysis results and raw sensor data (if consented by user) to the central server.
- Serves a web page for status indication, to dispense advice, and configuration.

For Reaction:
The historical and latest risk/harm estimates, time of day and other inputs are combined with user-changeable settings to upregulate or downregulate local appliances, to achieve a set level of risk. This includes:
- Energy recovery ventilators such as the ~~one Anthony is designing~~ (over MQTT and Meshtastic or wifi as the hardware layer)

- Filter appliances (over MQTT and wifi or meshtastic as the hardware layer) ~~such as the one Anthony is designing~~
- UVC emitters, such as ~~the one Nukit is designing/producing right now.~~

Through the local display, the system dispenses advice to the owner/occupants of the building to increase masking, open windows (a last resort reaction system for ventilation), limit building occupancy and other measures, by text message or email and a web page served by the modeling node.

For the development of the Pod, we will build on Sensorica's Sensor Network project, which has produced open source sensing nodes for an industrial IoT application.

The Pod will be integrated with a mesh network node using the Meshtastic network.

3. **Build a local-first Mesh Network** of sensing and control Pods to allow aggregation of information from different locations across a geographical region. This will form a *local first ecosystem of air quality and safety*, providing the capability of cross-regional coordination of public health responses in case of an airborne pathogen outbreak. In normal times, the aggregated information will allow building operators to exchange best practices for maintaining air quality and safety, and inform the population about risks in particular indoor locations.

The mesh network connects all the Pods together within a given geographical region, forming a local-first air quality and safety monitoring and control ecosystem. Pod users can elect to share their local data over the mesh network for scientific or public health monitoring purposes, anonymously or not. The network has the ability to store and aggregate the shared data that is gossiped to produce safety, trust and reputation scores (about a particular location), building a foundation for public analytics and predictions. The mesh network can be bridged to the Internet, providing the ability of integrating disjoint regions into a larger region (various parts of a municipality or different municipalities). Various indoor environments can be ranked in their air quality and safety.

4. **Build a browser-based user interface** that allows the public to connect to the *local-first* network by connecting to any Pod at a specific location, to verify air quality and safety, trust and reputation scores of a specific location, to read analytics and predictions for the entire local ecosystem and to augment information of a specific location with ratings and other types of user feedback.

Sustainability and dissemination objectives

Deploy an *open venture* using Sensorica's Open Value Network (OVN) model for material peer production that provides the scalability and sustainability of the SAN to mitigate the risk of contamination with airborne pathogens.

During the course of this project we intend to seed the network with at least 50 Pods, in the city of Montreal.

Organizational context

The project will be carried out within Sensorica, an incubator for open source projects and *open ventures* based on open source software and hardware development. Sensorica can also be understood as an open innovation network with a physical lab in Montreal, Canada, created in february 2011. In more special terms, Sensorica is a pioneer organization in *material peer production*, incubating *open ventures* that thrive on open source development, with a focus on solving humanitarian problems. See a collection of articles and scientific papers written by others about Sensorica.

Demonstrating Sensorica's commitment to solving COVID 19-related problems in a decentralized manner

Past projects

- Aces/s COVID - project
- Robobreath - project
- COVID 19 Montreal - broader initiative

Papers published by Sensoricans related to COVID-19

- Meeting grand challenges with participation of a different kind, by Tim Loyd from Sensorica 2020 Canadian Science Policy Center Conference Editorial,
- When thousands of citizens innovate: how policy makers can contribute, by Alena Valderrama (Sainte Justine Hospital), Tiberius Brastaviceanu (Sensorica), Fabio Balli (Concordia University)

Current health-related projects and initiatives

- Breathing Games
- Open source scientific instruments - various projects

3. Why is it important? (what will it do for COVID-19)

During the COVID-19 crisis, governments all over the world took a top-down approach to implement measures that had various unintended negative consequences on the lives of citizens, on businesses, on supply chains and the economy as a whole. Complex problems require solutions that are designed to deal with complexity. Institutional measures of top-down control are not well-suited for such situations, because they can never take into consideration the contextual reality of all agents in a society. This proposal suggests a button-up stigmergic approach to implement local-first measures that are better adapted for any agent and any context. It empowers local agents to collaborate and deploy resources for improving air quality and safety within their own indoor environments, with direct feedback from space users (and clients, in case of local businesses). The vital link to governmental and civic agencies is preserved.

Our group is familiar with such patterns of open, participatory and stigmergic innovation and deployment of infrastructure. To demonstrate this point, we can cite Sensorica's Acces COVID project that was deployed at the height of the COVID-19 crisis -xxx link to project xxx. The same pattern can be seen in Sensorica's proposal of a participatory recycling scheme, which was communicated to the City of Montreal in xxx date xxx.

While directly addressing the capacity of local communities to respond to airborne pathogen outbreaks, this project also helps building operators to provide clean and healthy air in normal times, adding Quality of Life Years to the people using the building, and reducing sick leave. [plug a statistic about productivity and public health related to bad air]

This project can also be seen as a vector to deploy critical communication infrastructure, by increasing the adoption of mesh networking technology, increasing even further the resiliency of local communities in case of Internet cutoff caused by natural or man-caused disasters.

4. What is the method and steps to accomplish the objectives?

We use the Sensorica organizational structure, which is described as an open value network (OVN). Sensorica was created in February 2011 around a makerspace located in Montreal. The initial objective was to build an economic layer around the open source mode of innovation. Our activities focused on open source hardware development, helping contributors to such projects to fund development and sustain the dissemination of their creations through non-market channels. Thus, within Sensorica we don't organize around open projects, but open ventures, to underline our capacity to go beyond the design and prototyping of a specific open source hardware device, to stimulate adoption and provide ecosystem services such as repositories of source code, training and support, together with templates for the creation of local business units.

Inheriting from the open source development model, with the open venture economic layer, Sensorica is a well-suited environment for participatory innovation, glocal production and dissemination that can process complex and wicked problems, building solutions from the ground-up, with input from local agents, well-adapted to their local contexts of operation.

Over the years, Sensorica's model has acquired an international reputation, with numerous mentions in academic papers, books and appearances at international events.

Activities are clustered in Work Packages.

The project deliverables will be developed within the **Deliverables Work Package** using Sensorica's agile methodology, which is separated into three interlocking steps:

- **Design considerations**: A metadesign process to build shared understanding about the technical objectives, to identify key characteristics and features of deliverables and to reach a consensus on the hardware and software tech stack.
- **Design**: Formalization of technical goals, creation of hardware and software designs
- **Prototyping**: Implementation of software designs and materialization of hardware designs.
- **Testing**: through testing of prototypes in the lab as well as in real use environments.

On the venture side, we will organize work into three other Work Packages

Capacity Building Work Package

Maintain innovation and production capacity at an optimal level throughout the lifecycle of the venture. Since open ventures rely on crowdsourcing resources and talent, this Work Package is designed to funnel these resources into productive activities. We will use Sensorica's methodology that involves:

- **Outreach**: Communication (broadcast through social media or targeted) about the venture, spread excitement and signal needs
- **Onboarding**: Facilitate the integration of newcomers into the venture
- **Orientation**: Help contributors to navigate the venture, cluster of activities, tasks, governance processes, etc.
- **Support**: Unblock contributors in their daily tasks.

Packaging Work Package

Turning prototypes into finished products and producing user support documentation.

- **Material deliverables**: Package software and hardware as an easy to fabricate, stable and safe to use artifact.
- **Digital deliverables**: Produce proper documentation of all deliverables, including fabrication instructions, user and maintenance manuals. Produce peer reviewed publications to ground the technical aspects, the safe and secure use of deliverables in scientific rigor. These digital deliverables are offered in a way that makes them incorruptible, to serve as canonical references.

Dissemination Work Package

Stimulate adoption and provide support and continuity for adoption. Create a network of nodes that gain the capacity of locally using, fabricating and maintaining the venture's deliverables.

Process Maintenance Work Package

Consists of ongoing activities that streamline the entire operation, akin to project management in traditional organizations. We rely on a mix of planning and stigmergic collaboration. We use Sensorica's online platform for issuing tasks and capturing participant's contributions. We also use Sensorica's venture governance template, applying meritocratic access to key decision making processes, based on the level of participation. Process Maintenance activities are overseen by core participants, in accordance with the venture's governance, which feeds from recorded contributions.

A portion of the grant will be used for the **Deliverables Work Package** to incentivize development activities and to purchase essential materials or services.

- Participants are paid on a weekly basis according to Sensorica's benefit redistribution scheme, which relies on logs of activity within Sensorica's NRP-CAS (Network Planning and Contribution Accounting system), evaluated against the development planning and stigmergic signals for development. Distribution is overseen by core participants.
- Purchasing needs are evaluated against the Design consensus and based on the needs that emanate from Prototyping and Testing activities. Purchases are overseen by core participants, with veto power of the co-signatories of this proposal.

  Note that the venture will also benefit from design and prototyping resources provided by the Sensorica network and the Sensorica Montreal lab (a makerspace). More details are provided in the budget section.

Another portion of the grant funding will be reserved for the **Packaging Work Package**, which paves the way to the Dissemination Work Package. The allocation follows the same scheme as described above, overseen by core participants, with veto power of the co-signatories of this proposal.

Another portion of the grant will be used to establish the **Dissemination** network, which is also related to the perennity or the long-term sustainability of the venture. A portion of that will be used to incentivize Dissemination activities (outreach, training, etc.) and another portion will be used to lay down the infrastructure to support adoption and scaling (ex. repositories of canonical designs, coordination and transactional systems, etc.). The allocation follows the same scheme as described above, overseen by core participants, with veto power of the co-signatories of this proposal.

> Note that we intend to deploy a p2p infrastructure, based on locally owned sensing nodes, interconnected through mesh networking, which is locally supported by every agent. This is a highly scalable infrastructure with no need for centralized resources (similar to blockchain-based infrastructures like Bitcoin, Ethereum, etc.).

Once the Dissemination infrastructure is in place, the network will grow and shrink according to the incentives that are provided by its functionality. Some of these incentives come from the need to differentiate oneself from other users in terms of providing safe and healthy air. As information is aggregated from participating nodes, the local display will be used to provide direct feedback to people who use the indoor space, together with a score that compares the location to other participating locations in the region, benchmarked to official standards (provided by public health institutions and civil society organizations).

Since this air quality and safety system is built on top of a generic mesh networking capability, some adopters may respond to incentives that are generated by other features that may be added on top of this network in the future,which are outside of the scope of this grant proposal.

When it comes to oversight or monitoring of activities, as the venture uses Sensorica's collaborative infrastructure and methods, all the tasks, contributions of participants and transactions are accessible in real time. This is part of the transparency features of the Sensorica network, which has become a standard in all blockchain-based operations and web3.

The accountability of the venture is provided by Sensorica's time-tested accounting practices, which has allowed the network to successfully interface with private companies, public institutions and even governmental agencies.

More on the perennity of the venture

There are two important categories of roles in the venture, **innovators, service providers,** and **verifiers**. The *service providers* offer local fabrication (devices and kits), installation and maintenance services, on demand, in exchange for payment. The *innovators* will continue to improve the system, based on feedback from users and from *service providers*. The *verifiers* validate claims of air quality and safety produced by SAN operators. The revenues generated by the *service providers* while offering these *ecosystem services* are split between them, the *innovators* and the *verifiers*. In order to ensure that a percentage of revenues goes to the *innovators* and *verifiers*, a credential distribution mechanism will be implemented: the group of *innovators* will issue credentials to *service providers* (a mark of accountability, quality, security), creating a reputation score that will preferentially drive economic activities towards those *service providers* that play by the norms of the network. Knowing that *service providers* operate in a dependency relation with *innovators* and *verifiers*, they are incentivized to gain the cooperation of *innovators*, in case their clients/users ask for adaptations or improvements of local nodes. On the other side, *innovators* rely on *service providers* to bring feedback for further development and to generate revenue. Some individuals will provide service outside of these norms, but they will not be able to benefit from the credentials system validated by *innovators* and will not be able to benefit from the loyalty of *innovators* when needed, i.e. they will operate at disadvantage and their impact will be marginal. Sensorica offers templates for such game theory-based operations.

The venture is open and can be replicated in other regions. We will provide help for disseminating not only the deliverables of the venture but also of the venture itself. All local ventures will feed from the same commons and infrastructure.

5. How much will it cost? (with breakdown)

Open budget spreadsheet

Support roles / labor			
Main Task	Man Hours	Rate	Total
Outreach	200	45	$9,000
Orientation Coordination Facilitation	100	45	$4,500
Animation	30	45	$1,350
Administration	60	60	$3,600
Accounting	30	60	$1,800
Project responsible	20	60	$1,200
Total			**21450**

Summary	
Support roles / labor	$21,450
Hardware dev / labor	$61,500
Software dev / labor	$61,500
Materials / purchase	$50,000
Others	$5,000
Network Fees	$19,523
Grand Total	**$199,450**

Development milestones/ labor

Hardware dev / labor				
	Main Task	Man Hours	Rate	Total
Understand	Build shared understanding among sponsor and developers	100	25	$2,500
Discover	Research the best technologies and equipment for the hardware	50	30	$1,500

Software dev / labor			
Main Task	Man Hours	Rate	Total
Build shared understanding	100	25	$2,500
Research the best software for aggregating	50	30	$1,500

Design	Design and document the architecture of the hardwareand software for the nodes	500	50	$25,000		Setup and document the software solution	500	50	$25,000
Prototype	Prototype the components, assemble	500	50	$25,000		Configure and run the software	500	50	$25,000
Test	Test and debug the prototype	150	50	$7,500		Test and debug installation	150	50	$7,500
Produce	Fabricate	500	25	$12,500		Package	500	25	$12,500
Totals		1200		$61,500			1200		$61,500
								Total	**$123,000**

6. What is the timeline? (with milestones, if applicable)

Work Packages	Role	Start	End
Work Package 1 - Project formalization		**week 0**	**week 0**
Create a digital environment for the project, create Project Governance, request Custodian Agreement, sign Agreement with Sponsor.	Project responsible	0	1
Work Package 2 - Building capacity		**week 0**	**week 5**
Maintain project page	Administration	0	5
Create communication materials and communication strategy	Communication	0	5
Map pools of talent	Administration	0	5
Outreach campaign	Communication	0	5
Onboarding, orientation, facilitation and coordination	Guide	0	5
Work Package 3 - Process maintenance (administration, animation, facilitation, coordination)		**week 1**	**week 12**

Maintain communication with Sponsor	Project responsible	1	12
Keep track of spending and keep the burning rate within the budget	Administration	1	12
Maintain a creative and energetic work atmosphere	Animation	1	12
Provide help or technical support	Tech support	1	12
Plan and keep track of development to respect the project's deadlines, maintain the direction towards the project's objectives	Project responsible	1	12
Work Package 4 - Deliverables (hardware and software design, prototyping and testing)		**week 2**	**week 12**
Building understanding	Development	2	3
Discover	Development	3	4
Design	Development	3	6
Prototyping / revised design	Development	5	10
Testing	Development	10	11
Production / Installation	Fabrication/Installation	11	12
Materials and third party services	Purchasing	12	13
Work Package 5 - Wrapping up		**week 11**	**week 12**
Documentation and reports, assembly and user manuals		11	12
Work Package 6 - Dissemination pipeline		**week 2**	**Week 12**
Build relations with third parties / users, NGOs		2	12
Produce templates: funding proposals		3	4
Assist in funding proposal writing and deposition		10	12

7. Short CVs (½ - 1 pages per person) and statement of why the proposers are qualified, in particular summarizing prior related work, even if unfunded.

External documents with CVs of main contributors as well as a short description of Sensorica.

Edderic Ugaddan
Owner, Breathesafe LLC, Rumford, RI — 2023-present

- Designed and sold the LaminAir (https://breathesafe-llc.myshopify.com/products/laminair), a 3D-printable, independently tested, open-source personal air cleaner that uses laminar flow, capable of producing a protection factor of ~10 (i.e. 90% reduction of aerosols) when used about 12 inches away from the face. See report here: https://tinyurl.com/laminair-report | *Fluid Dynamics, OpenSCAD, Experimentation, Data Visualization, Python, Pandas, Matplotlib, Seaborn, Calculus*
- Designed and implemented www.breathesafe.xyz, a tool to assess airborne transmission risk in different venues. It helps people who want to protect themselves from airborne pathogens such as immunocompromised and disabled people, to find safer venues, using a Wells-Riley model. Users can see how risk is affected when environmental (e.g. improving ventilation/filtration) or social mitigations are taken (e.g. masking). Example analytics page for a venue: https://www.breathesafe.xyz/#/analytics/124 | *Optimization, Risk Modeling, Probabilistic Modeling, Bayesian Statistics, Full-Stack Engineering with Ruby on Rails and Vue.js*