HUBiquitous

THE RISE OF TECH HUBS IN AFRICA

Funded by
the European Union

Dossier 1:
The Rise Of DIHs
In Africa

Dossier 2:
Enablers For IoT
In Africa

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Meet The 15 Champions
Hubs Changing Africa

Dossier 4:
Challenges And
Opportunities For
IoT TechHubs In Africa

Editor: Corentin Dupont, Innotec21 GmbH, Germany
Authors: Daniel Chinagozi, Innovation Growth Hub | Fiifi Baidoo, CloudPort | Prince Banini, Innotec21 | Corentin Dupont, Innotec21 GmbH | Servane Fauvet, Orange | Lucia Gomez, InnEürope | Moetaz Helmy, AfriLabs | Mohammad Nahin Islam, Waziup e.V. | Mramba Makange, Dar Teknohama Business Incubator | Joseph Shitote, Innotec21

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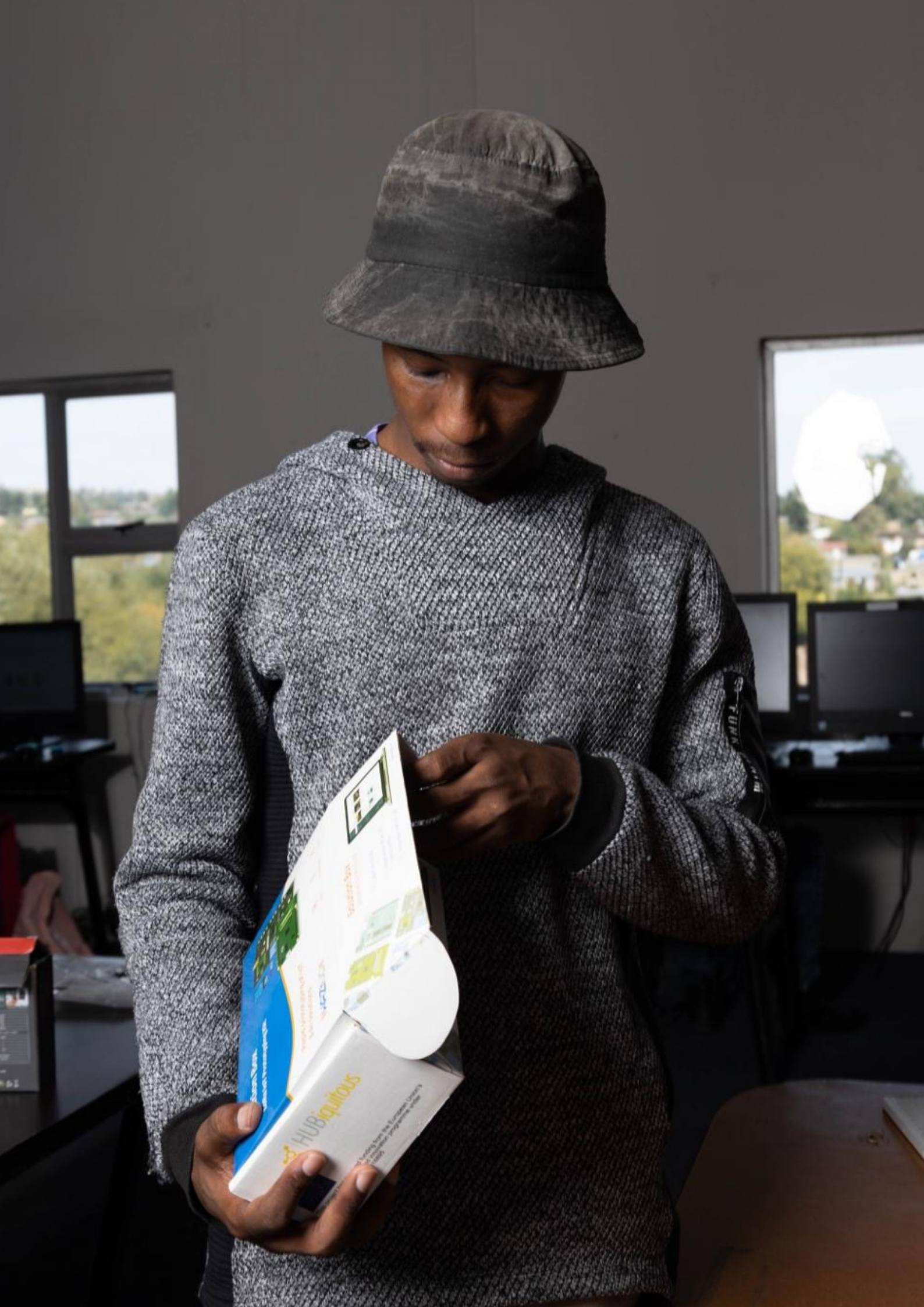

HUBiquitous

Foreword

Dr-Ing. Md Abdur Rahim
CEO of Waziup e.V. and Technical Leader of the HUBiquitous project.

The digital transformation in Africa is based on local and human-centered innovation. The young entrepreneurs and talents are a part of this change: they are an important asset for the African local innovation ecosystem. The ecosystem needs the young, but at the same time the young also expect from the ecosystem reliable job and employment opportunities. Innovation in Africa means harnessing local human and natural resources and developing a cost-effective alternative for local business.

The mission of the HUBiquitous project has been to support distributed and decentralized Digital Innovation Hubs (DIH) in Africa in different countries. Although the HUBiquitous project started in 2021, it is built on the previous two EU initiatives H2020 Waziup and H2020 WaziHub. Due to the remarkable results of H2020 Waziup, a non-profit association (Wazup e.V.) was founded in Germany in 2019 to continue to further develop and sustain the results. For Waziup e.V, HUBiquitous was the most important project due to our strategic interest in DIHs development in Africa.

Waziup e.V. has developed an online digital lab called Wazilab, **which is a real success story for HUBiquitous.** This is a virtual IoT solution lab design for African tech hubs, talents and entrepreneurs for fostering innovation and skills.

We has been able to leverage the HUBiquitous results with other AU-EU initiatives. Thanks to HUBiquitous, Waziup e.V. has now been part of more than 10 AU-EU projects and initiatives such as Erasmus+ YouthTeamUp, Erasmus+ VocalizeIoT, Horizon Europe KijaniBox, Horizon Europe KijaniSpace, Horizon Europe SEADE, etc.

HUBiquitous is a successful project which results are already making an impact in Africa. The project will create a long-term impact for African youth, digital innovation hubs and ecosystems. I am thankful to the European Commission for funding this initiative and also our European and African partners, allowing us to realize this highly ambitious vision. I thank our Hubs partners, startup communities for supporting us in realizing this vision.

Abdur Rahim

Dr.-Ing. Abdur Rahim,
Managing Director

The mission of the HUBiquitous project has been to support distributed and decentralized Digital Innovation Hubs (DIH) in Africa in different countries.

Dr. Corentin Dupont,
Technical Director of Innotec21 and Coordinator of the project HUBiquitous

The HUBiquitous project ended in June 2024. As the project started back in January 2021, I can tell you one thing: it's been quite a journey! We learned many things along the way, sometimes the hard way. We started writing this magazine because we wanted to share some feedback and lessons learned based on this experience.

In this magazine, we will highlight four aspects of our experience with DIHs in Africa, that we grouped in four "dossiers". First, we will first show you in Dossier 1 the HUBiquitous "model" for building the technical capacity of DIHs. The model includes a precise methodology for taking the hubs to higher grounds in terms of technical capacity and outreach. The project also created several "Enablers" for supporting Digital Innovation Hubs. These enablers have a shared objective: building the capacity of the Hubs across Africa on advanced technologies. You will find them in dossier 2.

We then embark to meet the 15 DIHs that were selected for the HUBiquitous last big program, the "TechHub Catalyst Program". You will find them in Dossier 3. We conclude in Dossier 4 by opening on the perspectives and challenges in four important African countries: Egypt, Ghana, Tanzania, Nigeria and Kenya.

I hope you will have the same pleasure reading this magazine than we had writing it!

Corentin Dupont

Dr. Corentin Dupont

It's been quite a journey! We learned many things along the way, sometimes the hard way. We started writing this magazine because we wanted to share some feedback and lessons learned based on this experience.

DOSSIER 1: The Rise Of DIHs In Africa

Ideas

DIGITAL INNOVATION HUB

Products

Dossier 1:
HUBiquitous: The Rise Of DIHs In Africa

About the Authors:

Corentin Dupont
is CTO of INNOTEC21 GmbH.

Servane Fauvet
is Innovation Manager at Orange Labs

Lucia Gomez
is Senior European Project Manager at InnEürope

Digital Innovation Hubs are more and more important in Africa... But what does HUBiquitous bring to the table?

HUBiquitous is a project funded by the European Union aiming at creating a joint Africa-Europe Startup & Innovation Ecosystem for long-term collaborations and partnerships. The project had the ambition to increase the technology level and capacity building of 30 local Digital Innovation Hubs/Tech Hubs in Africa. The Digital Innovation Hubs (DIHs) are one-stop-shops that help companies become more competitive with regard to their business/production processes, products or services using digital technologies.

The HUBiquitous project prioritized comprehensive training in IoT technologies, blending virtual sessions with immersive in-person workshops. In this Dossier, we prepared several articles to help you understand better.

First, the HUBiquitous Tech-Accelerator and IoT Certification Program (see page 7 and 11), aims at building the capacity of the participants in cutting edge technologies, such as IoT and AI. These initiatives were designed not only to enhance innovation but also to foster sustainable technology growth within local communities.

The community engagement was bolstered by the "IoT Certification Courses" and hackathons organized by the hubs (see page 14). These activities were designed not only to cultivate local talent but to stimulate innovation within the community.

Finally, the "HUBiquitous Innovation Week" in Europe provided a pivotal platform for successful hubs, offering them the opportunity to showcase their success stories and MVPs. (see page 16). We wish you a nice reading!

The HUBiquitous Model: Catalyzing the TechHub Growth

The TechHubs need to build their capacity for innovation… HUBiquitous has a model for that. Follow the guide.

By Corentin Dupont

The "TechHub Catalyst Program" was a program aiming at elevating African Tech Hubs (DIHs) to a higher level of proficiency in cutting-edge technologies. It was a great success: more than 120 hubs responded to our call for applications. We selected the 15 best hubs from 13 different countries. We then trained them on the HUBiquitous advanced technologies (see Dossier 2). After the Train the Trainers was finished, they were all able to replicate the model in their own countries, training their own students (see the article in this Dossier). At the end, more than 250 HUBiquitous Certificates were awarded to their students.

In this article, we want to show you the model that allowed this success. The objectives were:

- **Enhance IoT Capabilities:** The program sought to significantly improve the technical skills and infrastructure of the participating Tech Hubs, enabling them to leverage IoT technologies effectively.
- **Develop Sustainable Services:** By promoting the creation of sustainable, value-added services, the program aimed to provide long-term benefits to local communities and economies.
- **Foster Innovation and Growth:** The program empowered Tech Hubs to drive technological innovation, develop entrepreneurial skills, and stimulate local economic growth.

Catalyst Program Process:

Train the Trainers

IoT Certification Program

Certificates

The methodology involved three phases to achieve these ambitious objectives:

Phase 1: Train-the-Trainers and Managers

The program began with intensive IoT training for the hub personnel through a combination of virtual sessions and an in-person workshop. The workshop took place in Arusha, Tanzania for one week. All 15 hubs were present. This training covered the use of cutting-edge technologies and delivery of essential pedagogical and business skills.

The "Train the Trainers and Managers" strategy ensured that the knowledge and skills acquired by the trainers and managers could be scaled to the hubs easily and exponentially which allowed the training of a large number of participants.

Attendees at the HUBiquitous Train the Trainers

Phase 2: IoT Certification Course and MVP Development

With the trainers and managers newly acquired competencies, the hubs launched an IoT Certification Course in their hubs and incorporated a hackathon to stimulate hands-on learning and innovation (see the article in this Dossier). More than 400 participants registered for the IoT Certification Course.

The hubs also developed or improved two Minimal Viable Products (MVPs), an industry MVP and Startup MVP. This formed the Tech-acceleration program as the hubs developed a work plan from their MVP developments that they would use to support interested industries or StartUPs to develop their IoT solutions. Please see the Article in this Dossier and Dossier 3.

Phase 3: HUBiquitous Innovation Week

The "HUBiquitous Innovation Week" was an event organized to enable Africa-Europe cooperation among DIHs. During the program, we had two Innovation weeks: one in Kigali, and one in Berlin. This promoted fruitful partnerships between African DIHs and European counterparts but also paved the way for further collaboration and investment. By spotlighting the innovative solutions developed through the program, the Innovation Weeks fosters cross-continental relationships and serves as a catalyst for impactful connections. You can see the HUBiquitous Innovation Week in the Article on page 16.

In a nutshell

By integrating all these elements, the HUBiquitous model accelerates the development of business ideas through an intensive support system. This includes guiding MVP development with a focus on business strategy, conducting design thinking sessions, and aiding in the creation of business plans and value propositions. The program's holistic approach not only improved technical proficiency but also provided critical entrepreneurial skills, fostered a collaborative and supportive ecosystem for technological advancement and economic development in African communities.

The Hubiquitous Model Phases
Phase 0: Call for DIH applications and Onboarding
Call open (1 month)
Selection process (2 weeks)
Onboarding and Agreement Signing (2 weeks)
Phase 1: Train the trainers and Managers
Train the trainer's online session (1 month)
Train the trainer's physical workshop (1 week)
Phase 2: IoT Certification Course and MVPs
Short IoT certification course (1/2 month)
MVP acceleration (1/2 month)
Phase 3: HUBiquitous Innovation Week and Program Closing
Innovation Week (1 week)
Final Review and Program End

Certification ceremony at Impact School, Lesotho

The first accelerator program and the TechHub Catalyst program, designed to foster innovation, provide crucial support to startups,

Accelerate The TechHubs: Higher, Faster, Better!

Everything you need to know (and more) about the HUBiquitous Tech-Accelerator Program.

By Lucia Gomez

As part of the HUBiquitous project, several Tech Acceleration Programs have been launched, designed to foster innovation and provide crucial support to DIHs. The accelerator program was designed for DIHs, giving them continuous mentoring, training and support to refine their ideas, create prototypes, and form a plan for transition to market.

Participants also had access to advanced technology and resources in their local DIH, along with online learning platforms offering technical and business courses. The program facilitated networking through MeetHub (see page 29), connecting entrepreneurs with mentors, potential partners, and investors, as well as organizing hackathons and in-person events to foster collaboration and showcase innovations.

The HUBiquitous Tech Accelerator Program has several objectives:

- **Enhanced Innovation Capacity:** the program sought to equip entrepreneurs with the knowledge, skills, and resources necessary to innovate effectively. This included training in disruptive technologies such as IoT, electronics, and communication technologies.
- **Promoted Joint Innovation:** collaboration between African and EU participants was pivotal, fostering synergies and knowledge exchange across borders. This not only enriched the projects but also facilitated cultural and technological diversity in solutions.
- **Boosted Investment Opportunities:** by guiding startups through the process of developing viable products and business models, the program aimed to increase their attractiveness to investors. This was achieved through mentorship, coaching, and exposure to potential funding sources.

Hub leaders following a HUBiquitous "train the trainer" program in Tanzania

Program highlights

The HUBiquitous Accelerator Program goes through 5 units, each of them lasting from 1 to 3 weeks. During the program, you will learn everything from basic electronics to Artificial Intelligence. We will also cover IoT boards and Arduino programming, together with radio communications. And more!! Most courses are supported by a video, using the WaziLab (see Dossier 2).

The Accelerator content and schedule

A video support lesson

Mentoring and Coaching

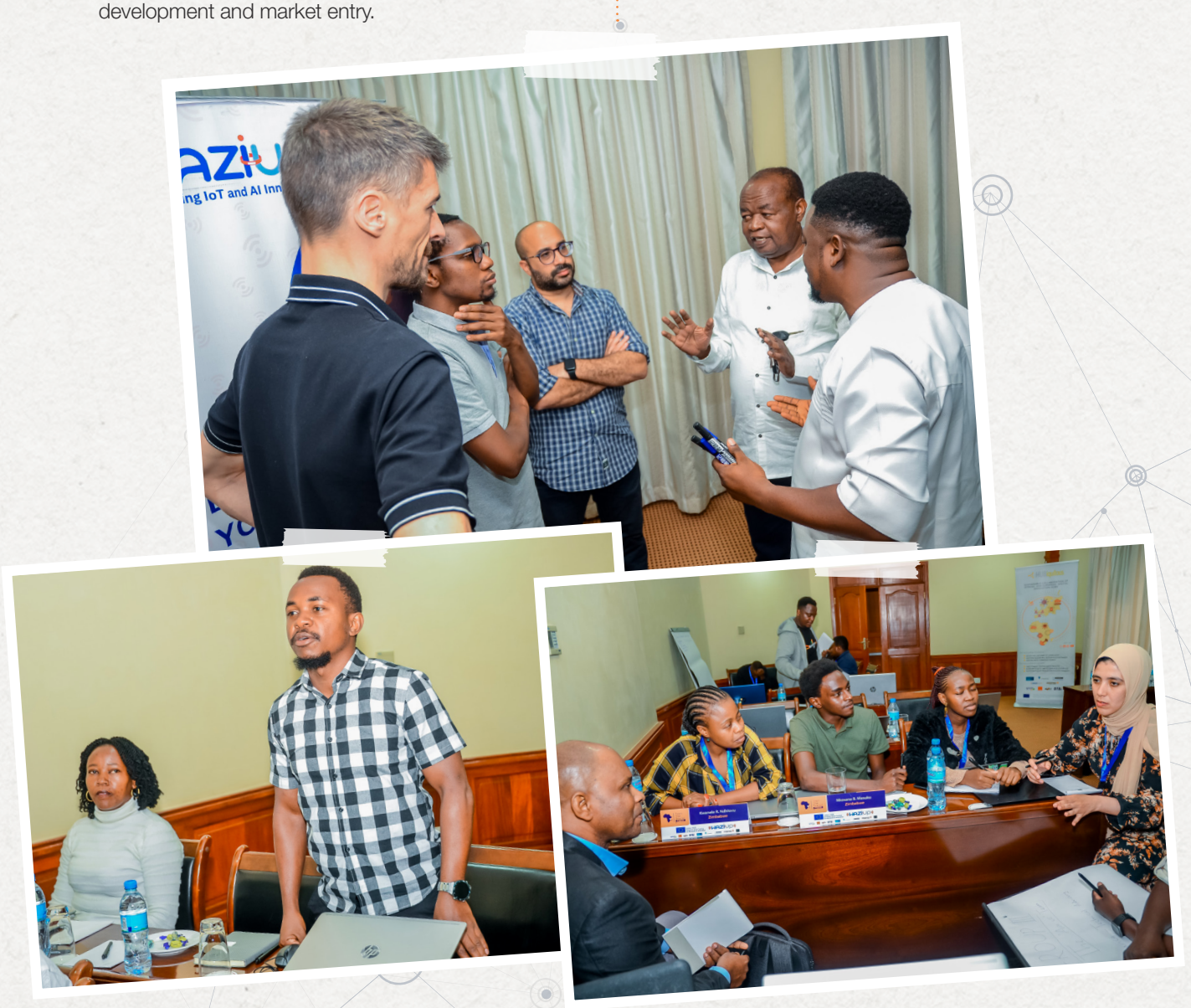
Technical Trainers provided continuous guidance throughout the program, helping entrepreneurs refine their business strategies, prototype their products, and prepare for market entry. This personalized support was crucial in navigating the challenges of early-stage development.

Mentoring and coaching were pivotal throughout the programs, providing continuous support and guidance from specialists. Experts in business model development and go-to-market strategies offered invaluable insights, while technical sessions on IoT fundamentals and AI tools equipped innovators with essential skills for product development and market entry.

Networking and Collaboration

The program facilitated networking opportunities through platforms like MeetHub (see Dossier 2), connecting entrepreneurs with mentors, potential partners, and investors. These connections not only expanded their professional networks but also opened doors to collaborative ventures and market opportunities.

In conclusion, the HUBiquitous acceleration programs have not only advanced technological innovation in Africa but also fostered a resilient and interconnected tech ecosystems!



Participants and trainers at the TechHub Catalyst Program, Tanzania

Portfolio: IoT Certification Program

At the end of HUBiquitous “IoT Certification Program”, a certificate was awarded to participants. Smile, it’s photo time!

By Corentin Dupont

The objective of the “IoT Certification Program” was to put into practice the knowledge gathered by the Trainers and Managers during the previous phase of Train the Trainers. During this phase, the Hubs launched a short (max 1.5 month) IoT certification program. They **selected 25/30 persons** for IoT training and organized **one hackathon**. The IoT certification programs were run through the WaziLab platform. At the end of the IoT Certification Course, **a certificate was awarded to the participants in each hub.**

A total of 470 participants were selected in the various hubs, and 250 certificates were awarded to the students successfully finishing the program. Here is a sample portfolio of the best IoT Certification ceremonies in the HUBiquitous project… Enjoy!

caption: *Karakeeb MakerSpace certificate awarding (Egypt)*

Sciency Makerlabs certificate awarding ceremony

EU-Africa: A Winning Partnership For Hubs

EU-Africa partnerships boost the competitiveness of both continents. Let's do some networking.

By Servane Fauvet

Launched in 2014, the EU-Africa Innovation Partnership is an Initiative of the European Commision. This partnership aims to enhance collaboration in research, science, technology, and innovation between Europe and Africa. It focuses on areas such as agriculture, health, energy, and digitalization, which are crucial for sustainable development and economic growth.

Renowned for its vibrant start-up scene, Berlin provided an optimal setting for cultivating cross-continental relationships and synergies.

Through the EU-Africa Innovation Partnership, the European Commission has supported various programs and projects. For instance, it has provided funding for research and innovation through the Horizon 2020 program. This has enabled African researchers and innovators to participate in collaborative projects with their European counterparts, fostering knowledge exchange and capacity building. HUBiquitous is part of these collaborative projects.

The EU-Africa Innovation Week

Following this vision, the "HUBiquitous Innovation Week" in Europe provided a pivotal platform for successful hubs, offering them the opportunity to showcase their success stories and MVPs. This event not only facilitated fruitful partnerships with European counterparts in Brussels and Berlin but also paved the way for further collaboration and investment. By spotlighting the innovative solutions developed through the program, the Innovation Week fostered cross-continental relationships and served as a catalyst for impactful connections.

In Berlin, from Saturday, May 25th to Sunday, June 2nd, the European Innovation Week aimed to immerse participants of the Catalyst program and HUBiquitous partners into the dynamic landscape of Berlin's innovation ecosystem. Renowned for its vibrant start-up scene, Berlin provided an optimal setting for cultivating cross-continental relationships and synergies.

Collaborating with entities like Re:Publica, GIG Global Innovation Gathering, and Betahaus, the European Innovation Week curated a diverse range of activities. Moreover, the Soft Landing Day, organized in partnership with Betahaus, facilitated seamless integration and networking within Berlin's innovation ecosystem, leveraging Betahaus's expertise in fostering connections and creating business ecosystems.

HUbiquitous also had the opportunity to be part of the annual GIG event, where it hosted a comprehensive workshop. With keynotes, TechHub Catalyst Program presentations and TechHub pitches, this session encapsulated a multitude of insights, innovative ideas and practical knowledge. Ultimately, it highlighted the transformative impact of the TechHub Catalyst Program on business growth and technology innovation.

Workshop at Re:Publica in Berlin

Why does networking matter for African Digital Innovation Hubs?

Networking plays an important role in the development of African digital innovation Hubs. First, networking supports the exchange of ideas and knowledge. Through the physical training in Arusha, Tanzania, participants were able to learn from each other, share best practices, and above all gain insights into new trends and technologies through hands-on IoT practices.

The networking paradigm is at the core of the HUBiquitous TechHub Catalyst Program. The links created during the physical training which is reflected by a dynamic WhatsApp group could lead to the development of joint projects among DIHs to tackle complex challenges more effectively. Highlighting and promoting DIHs efforts and achievements through HUBiquitous dissemination and communication media such as this magazine potentially opens doors to new business opportunities and could support startups and entrepreneurs to grow their ventures.

Lastly, networking helps raise the visibility and reputation of African digital innovation hubs. Through their physical participation in the Berlin Innovation Week, three of our champions were able to showcase their work, attract attention, opening doors to global opportunities and collaborations.

> The networking paradigm is at the core of the HUBiquitous TechHub Catalyst Program.

The team behind the European Innovation Week

Dexter

Nkosana Wutolengwa-Sumasugu, alias "Dexter"

Hello, my name is Nkosana Wutolengwa-Sumasugu. I'm from Zimbabwe. I'm the founder of a hub which is called Science in Africa.

So we're basically building STEM and robotics learning infrastructure for students across southern Africa. And we've been part of the HUBiquitous project which has allowed us to basically learn how to build infrastructure and be able to actually experience different ecosystems.

For instance, we were part of the HUBiquitous Train the Trainers in Tanzania and now we are actually in Europe for the HUBiquitous Innovation Week doing an ecosystem tour of different hubs. This has allowed us to capacitate our own hub and launch new services where we are realizing lost revenue and see how we can then scale forward".

Moses

Hello, my name is Moses Mwangi Kang'ethe, I am a student in a Kenyan university called Dedan Kimathi University of Technology, and I do Mechatronics Engineering.

Besides being a student, I'm also a hub manager for a ***hub in our university called DeKUT Innovators Club,*** *that is short for Dedan Kimaki University of Technology Innovators Club.*

We successfully applied into the HUBiquitous program in order to increase our capacity and as of this moment, ***I can say everything is thumbs up.*** *we were able to go to Tanzania for a workshop where we were taught on our business model and sustainability for our hub. Before that, we had a training on IoT where some of our trainers were trained. This will allow us to train the next generation for our hub and increase the capacity within the students.*

Moses Mwangi Kang'ethe

Besides the university students, we also have outreach programs to the secondary schools in Kenya. The HUBiquitous program has really come through with providing a platform where we will be able to train the students better and they can refer to us any time.

The HUBiquitous program also gave us access to amazing hardware resources. In the name of the trainers and mentors, we just want to say thank you for that. I've been able to connect with so many people through the HUBiquitous program, and we are going to increase our capacity as a hub in Kenya, and possibly spread out to Africa.

HUBiquitous have enabled us to partner with big industries and have projects. That earns us money, we become sustainable. I would also like to thank the European Commission. If I were to go to the other side of the world like America, I would compare the HUBiquitous program to a state like Texas. Because HUBiquitous "takes us" to the next level.

Hélène

Hélène Omoyikombe

Hello everyone, I am Hélène Omoyikombe. I come from the RDC, the Republic of Congo, especially in Bukavu, where I am from. I am the Tech Project Manager of the Full Development Agency Group, which is a social enterprise that manages waste in Bukavu (it generates 896 tons of waste per day).

We started integrating new technologies, for example, the Internet of Things and artificial intelligence to manage this waste. And it was then that we had the chance to apply for the project of HUBiquitous, which helped us a lot, ***since we had the difficulty of having the components in time to develop certain projects.***

We have used the HUBiquitous ***Solution Box,*** *with the WaziCloud, WaziGates, and some development cards, with which we have developed the Lava AI system, which integrates artificial intelligence and the Internet of Things in the system of black soldier fly breeding. This system helps a lot of breeders and entrepreneurs who are engaged in this breeding. It also helps in the breeding of chickens, pigs and fish, because the fly or larvae are proteins that are necessary for animal feeding.*

I can't forget to mention that this project also helps us to train some young people, especially students who know absolutely nothing about this technology, IoT. We have young people, students from different fields who have applied to this training that the HUBiquitous project offers, especially students in agronomy. They are much more motivated to integrate this technology into their agronomic projects.

I am very grateful for this project. I don't know how to say it, but I am very excited. It has helped us a lot in different ways. Informing students, informing the Bukavian population to go to another level of knowledge. It helped us to develop two projects, one of which is the AI tree and Factory Sense. So, thank you very much, thank you to the European Union, thank you also to RDC. Thank you very much.

DOSSIER 2: Enablers For IoT Development In Africa

WaziLab

Solution Box

MeetHub

Dossier 2:
Enablers For IoT Development In Africa

About the Authors:

Mohammad Nahin Islam
is Developer at Waziup e.V.

Prince Banini
is Hardware and Training Consultant at Innotec21 .

Fiifi Baidoo
is CEO of CloudPort

As a DIH, you have the community… And we have the tools! Here are 3 tools, or “enablers”, developed specifically for African DIHs.

WaziLab is an innovative IoT training platform designed to empower individuals with the knowledge and skills necessary to excel in the rapidly evolving field of the Internet of Things (IoT). By integrating hands-on training with theoretical knowledge, WaziLab ensures that learners are well-prepared to develop and deploy IoT solutions in real-world scenarios (see page 22).

To bolster local innovation capabilities, each participating hub was equipped with a Solution Box package (see page 26). This initiative aimed to establish or enhance existing IoT labs, providing essential resources and infrastructure for prototyping and testing new technologies. If you open the box, you will discover a range of cutting-edge IoT components.

Finally, Meethub provides a central hub where IoT stakeholders across Africa can connect, collaborate, learn, and drive meaningful change (see page 29).

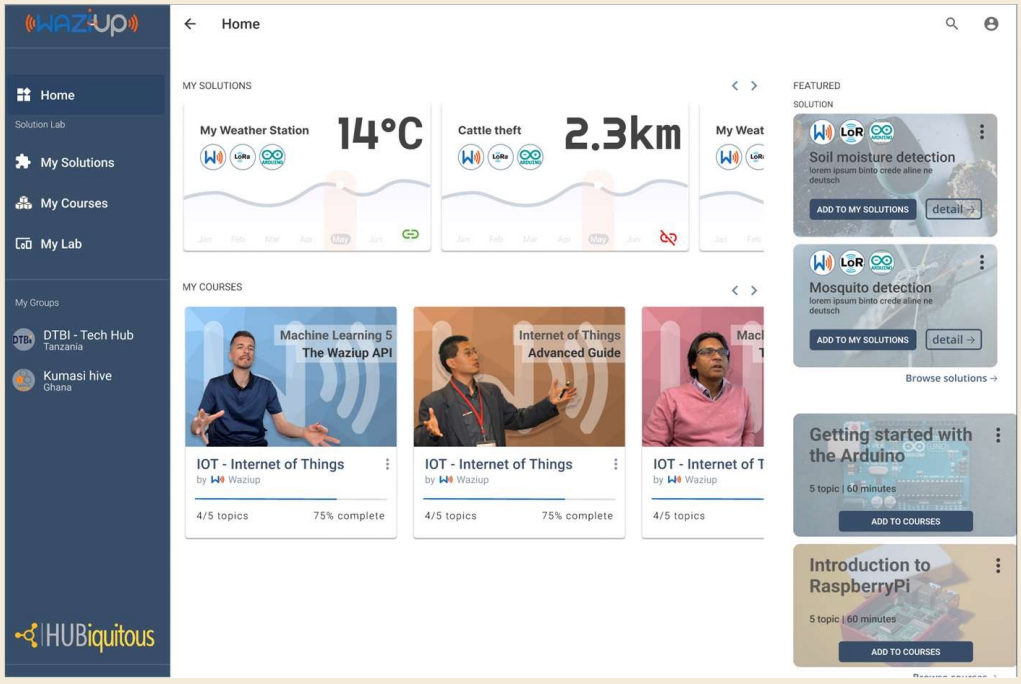
The WaziLab: IoT Training Revisited

The WaziLab is an online platform for DIHs, and this is where the magic happens

By Mohammad Nahin Islam

WaziLab is an innovative IoT training platform designed to empower individuals with the knowledge and skills necessary to excel in the rapidly evolving field of the Internet of Things (IoT). The platform's primary aim is to provide accessible and comprehensive education on IoT technologies, fostering both technical proficiency and creative application. By integrating practical, hands-on training with theoretical knowledge, WaziLab ensures that learners are well-prepared to develop and deploy IoT solutions in real-world scenarios. Here's how different groups interact with the platform:

- **Students** can access structured courses and learning materials, participate in virtual labs, and attend workshops to gain practical experience.
- **Educators** can use WaziLab resources to enhance their curriculum, incorporating IoT concepts and projects into their teaching.
- **Hobbyists and Makers** can explore IoT projects and tutorials, using the platform to experiment with new ideas and technologies.
- **Professionals** like tech-hubs, organizations, vocational and non-vocational training centers can take advantage of advanced courses and certifications to train and upskill and stay current with the latest IoT trends and technologies.



Screenshot of the WaziLab online platform

On the WaziLab, users can build IoT “solutions” from A to Z: the platform proposes tutorials to build the hardware, radio communications and web app parts of a full IoT application. The platform complements the tutorials with theoretical knowledge provided with video courses. It also manages the hardware for building the application, in a dedicated “lab” section.

It is important to mention that this platform is already deployed online. African countries’ youth from TechHubs and universities are using this platform.

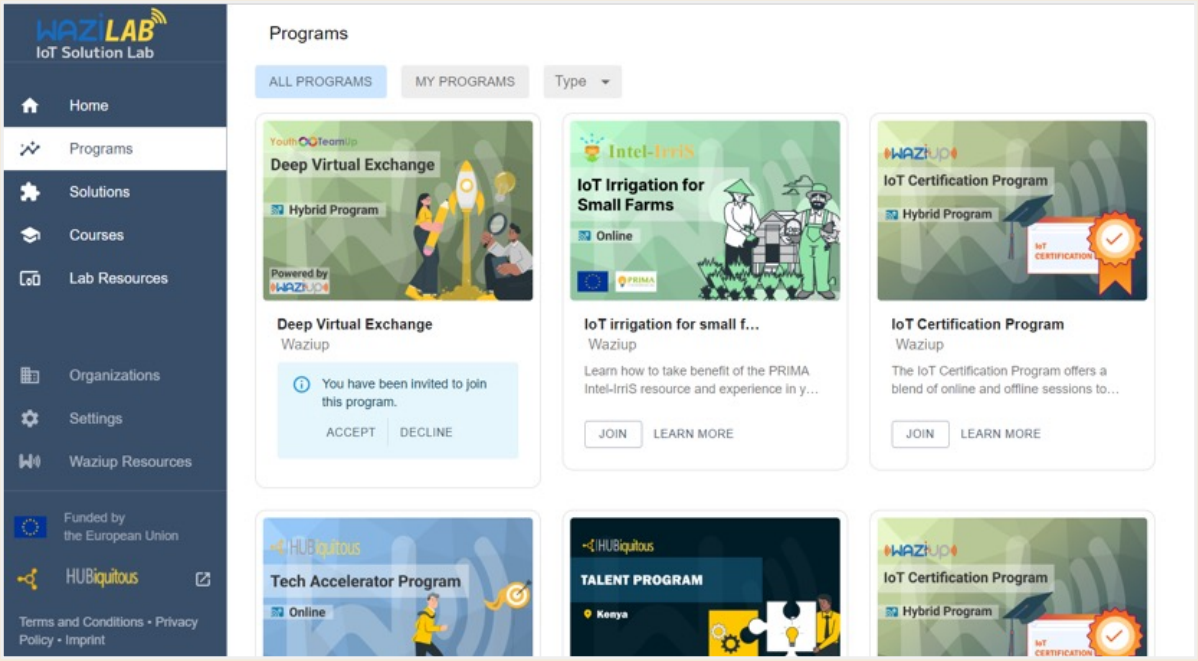
IoT Training materials

The WaziLab online learning platform contains material for IoT training, in the form of courses, tutorials and videos. At the time of writing, the platform contains 24 IoT courses (with video), 6 solutions and 40 hardware components. This material covers all the basics of IoT needed to develop an IoT solution, such as hardware, radio communications, IoT data analytics and Web app development. The courses are designed considering the needs of more practical IoT knowledge.

WaziLab Programs

WaziLab programs combine courses and events on a timeline. Each program is sectioned into a series of units and each unit holds a number of courses and events. User-progress is tracked for each course and calculated for the unit and program. WaziLab offers two main types of programs: hybrid programs and online programs. These are further categorized into certification programs as well.

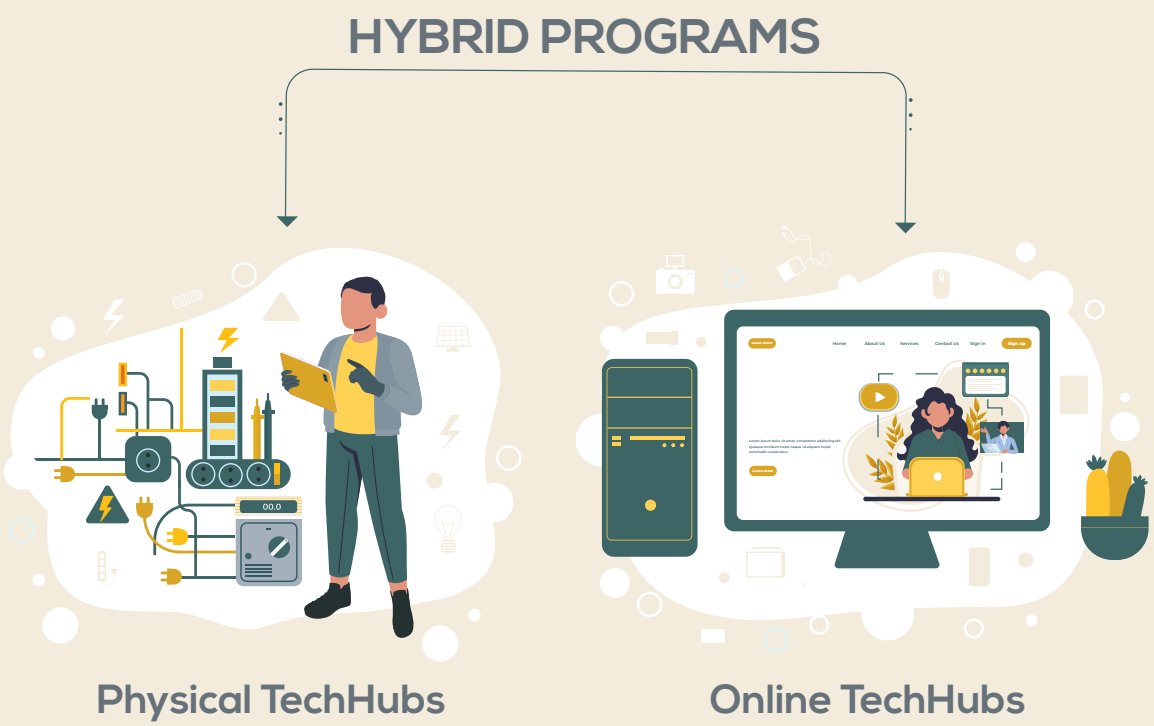
- **Online Programs:** consists of online courses, IoT solutions, webinars, and interactive modules that cover both fundamental and advanced IoT topics. Virtual labs enable learners to experiment with IoT setups in a digital environment.
- **Hybrid Programs:** These combine online learning with on-site training. They may involve certification but not necessarily. The hybrid approach allows for practical, hands-on experience with IoT devices and development kits in addition to theoretical online learning.
- **Certification Programs:** These can be either hybrid or online and culminate in a certification upon completion. They provide structured learning paths and assessments to validate the learner’s proficiency in IoT technologies.



Programs on Wazilab Platform

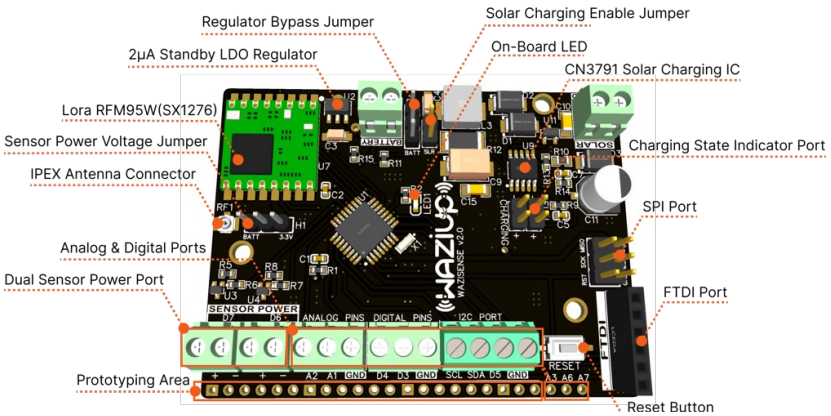
The Hybrid Lab concept

WaziLab is based on the Hybrid Solution Lab concept. It is a physical and virtual coupled lab space. In the physical lab, students can get the know-how of IoT with real, concrete prototypes. The online platform comes as a support for remote students and online learning for the theoretical aspects. This is what we call **“Learn by Doing”.**



The Hybrid Solution Lab

The lab should already contain basic equipments, such as classroom equipment, and lab equipment such as solder stations and possible 3D printers. The project provides specific IoT hardware, such as development boards, sensors and actuators, that will allow the learners to build their own prototypes (See the Article on Solution Box). Waziup has also developed its own development boards (see picture). This hardware will allow participants to build MVPs in a very wide range of domains, such as agriculture, smart cities, transport, health and energy.



Overview of WaziSense v2 board


Waziup
AgriBox
WAZIup


WAZIup
Smart
City Box
• Arduino Nano 33 BLE Sense
• Wifi capable boards


GreenBox
Energy Solution Box
WAZIup

The Solution Box: Set Up Your IoT Lab In A Week!

We have everything packed in a nice box: let us present to you the Solution Box.

By Prince Banini

The HUBiquitous Solution Box is a set of hardware and software technologies that can be used in the rapid development and deployment of low-cost efficient and sustainable IoT solutions. The idea is to propose an innovative technological & business package comprising 3 essential support elements: hardware prototyping kits & software templates, training contents (both technical and business-oriented contents) and business support templates.

There are several variants of the Solution Box for businesses. Those are called “Application Business Boxes”, or ABBs:

The AgriBox: a Solution Box tailored for building solutions for the agricultural sector.

The CityBox: a Solution Box tailored for building solutions for Smart Cities.

The GreenBox: a Solution Box designed to enable green energy applications and environmental monitoring.

The objective of the Application Business Boxes is to provide users with a means to rapidly prototype and bring products to life by combining software and hardware components in a plug and play manner.

The Solution Box is targeted at people looking to explore the field of IoT in a professional capacity. It is also ideal for people with the adequate engineering background or time to learn the skills required for building an IoT product. The target audience includes:

- **IoT Startups and Companies** looking for a quick way to prototype and deploy application specific IoT products for market testing/piloting/research purposes.
- **IoT Hobbyists/Enthusiasts** looking to develop solutions to improve or learn a new skill.

Solution Boxes

Content of the Solution Box

As an example, a startup or company wants to know whether an idea for an automatic IoT fish feeder will work. This company will use Waziup technologies from the Application Business Box to rapidly develop a functional MVP. This will allow them to test the market before investing more funds into research and development of the fish feeder. The startup or company can be at different stages of development of their prototypes:

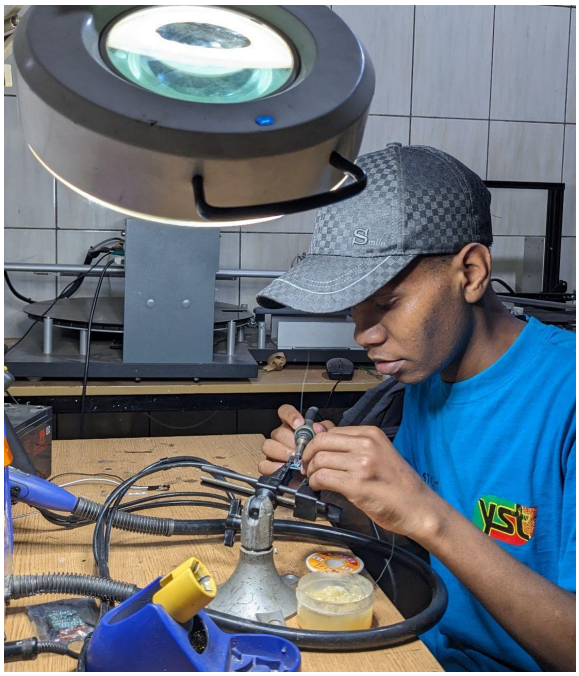
- **Ideation:** Startups in the idea stage but with some technical/engineering background and clear objectives.
- **Prototyping:** IoT startups with a working or functional prototype or MVP.
- **Growth Hack:** Startups with already existing solutions or products they want to improve on by adding IoT components.

The following Figure shows the content.

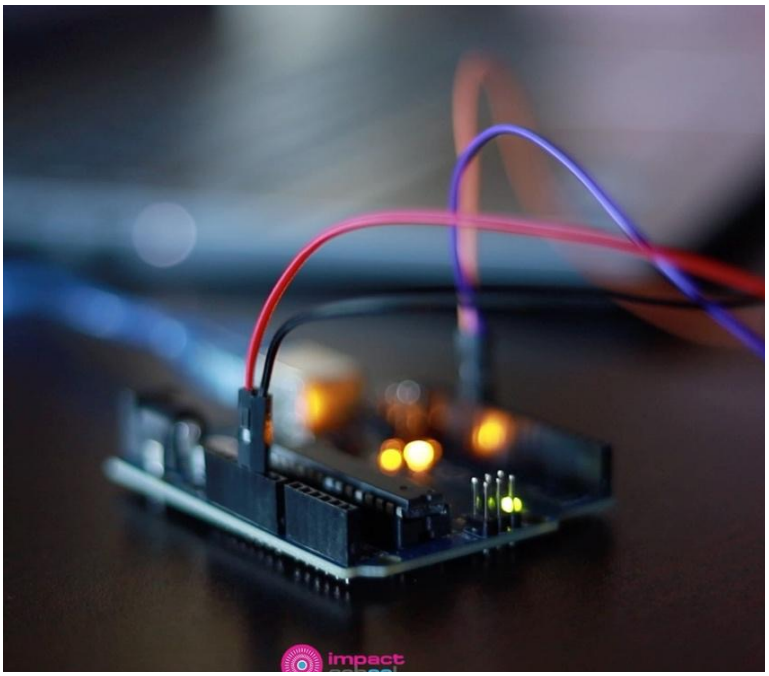
The MVP DIY Kit content leaflet

With this kit, the user is able to realize a huge range of solutions, such as Automatic Irrigation, Fire Smoke Detection, Animal health monitoring, Automatic Water Level Controller. You can find those solutions on the WaziLab. The Solution Box has been shipped to all the hubs involved in the various HUBiquitous programs. It has served for the training of more than 400 persons so far.

A hub leader working with the Solution Box



A student working with the Solution box



The WaziDev, a part of the Solution Box

IoT Communities And Meethub

Come and Connect with fellow hubs, IoT Professionals and Tech Investors…Let's Collaborate!

By Fiifi Baidoo

The transformative potential of the Internet of Things (IoT) in Africa is immense. It promises solutions to challenges in agriculture, healthcare, energy, and beyond. As an entrepreneur who has witnessed the rise of the digital age in Africa, I've seen firsthand how technology can empower communities, drive innovation, and create a lasting impact.

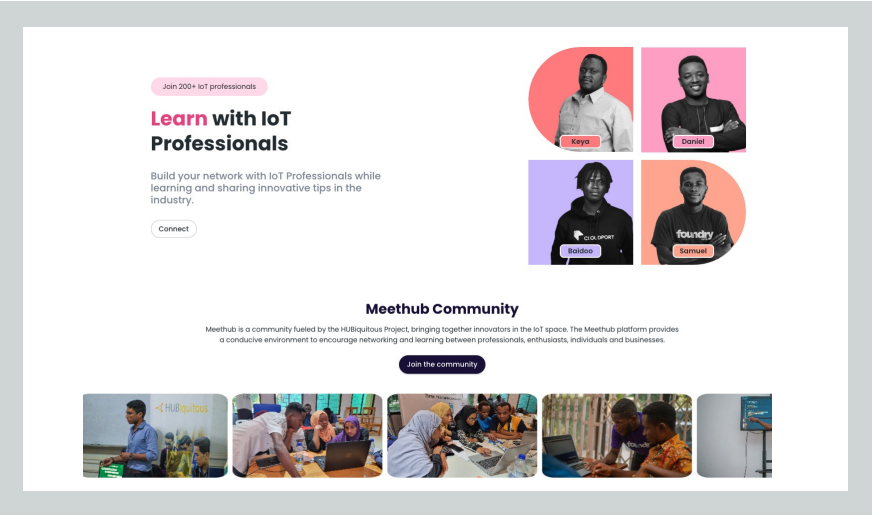
The African IoT landscape is rich with potential but often suffers from fragmentation. This disconnect leaves many brilliant innovators and startups struggling to access the resources, funding, and technical expertise. **Meethub is the answer to this call for connection.** This purpose-built digital platform bridges the gaps by providing a central hub where IoT stakeholders across Africa can collaborate, learn, and drive meaningful change. At its core, Meethub is designed for the people who are shaping Africa's IoT future:

- **Tech Hubs:** Organizations nurturing the next generation of innovators and entrepreneurs.
- **Startups:** Young companies developing cutting-edge IoT solutions for local challenges.
- **Developers:** The technical minds building the software and hardware that power the IoT revolution.
- **Researchers:** Academic institutions and individuals pushing the boundaries of IoT research.
- **Investors:** Individuals and organizations seeking to invest in promising IoT ventures.
- **Government Agencies:** Policymakers and regulators shaping the legal and regulatory framework for IoT adoption.

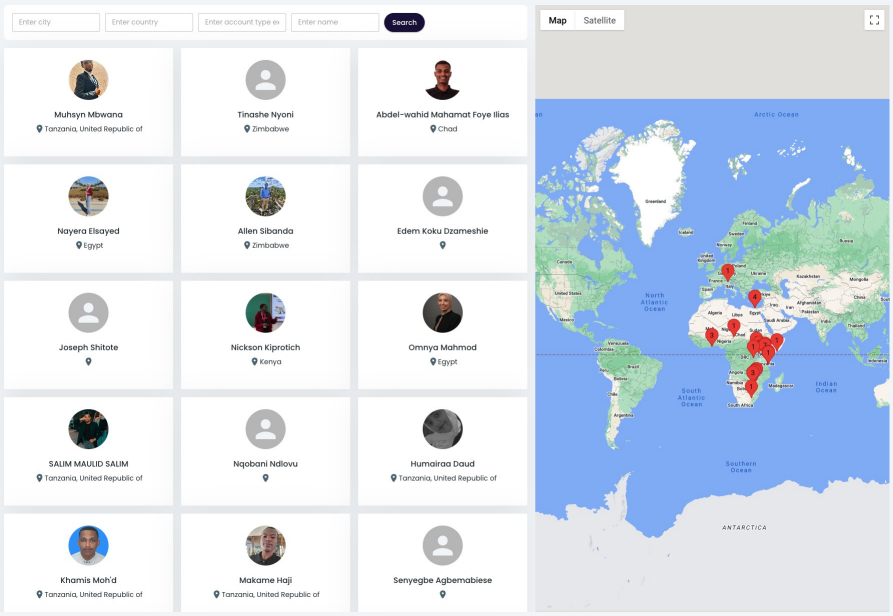
I've seen firsthand the power of community in the African tech scene. It's why hubs like iSpace in Ghana, IGHub in Nigeria, and District in Egypt are thriving, and projects like CrowdSense GAS by Logic Hub and the Smart Water Dispenser are becoming a reality (see Dossier 3). They're not just talking about IoT; they're actively building solutions that address local needs – from smart irrigation systems for farmers to air quality monitoring systems for urban areas.

Imagine a vibrant online community where you can connect with like-minded individuals who share your passion for IoT innovation. Meethub is designed to be that space – a virtual meeting place for tech hubs, startups, developers, researchers, investors, and policymakers. It's where ideas take flight, partnerships are forged, and dreams become reality.

> Imagine a vibrant online community where you can connect with like-minded individuals who share your passion for IoT innovation.



Meethub homepage



Meethub ensures that the IoT landscape is innovative but also inclusive, sustainable, and accessible to all.

Meethub profiles page

Building a Vibrant Community and Collaboration

A platform like Meethub is only as powerful as the community it fosters. That's why we're committed to building a vibrant and engaged network of IoT enthusiasts across Africa. We'll utilize dedicated social media channels, newsletters, and a blog to keep everyone connected and informed about the latest developments in the field. Meethub plays a multifaceted role in fostering a sustainable and impactful IoT ecosystem in Africa:

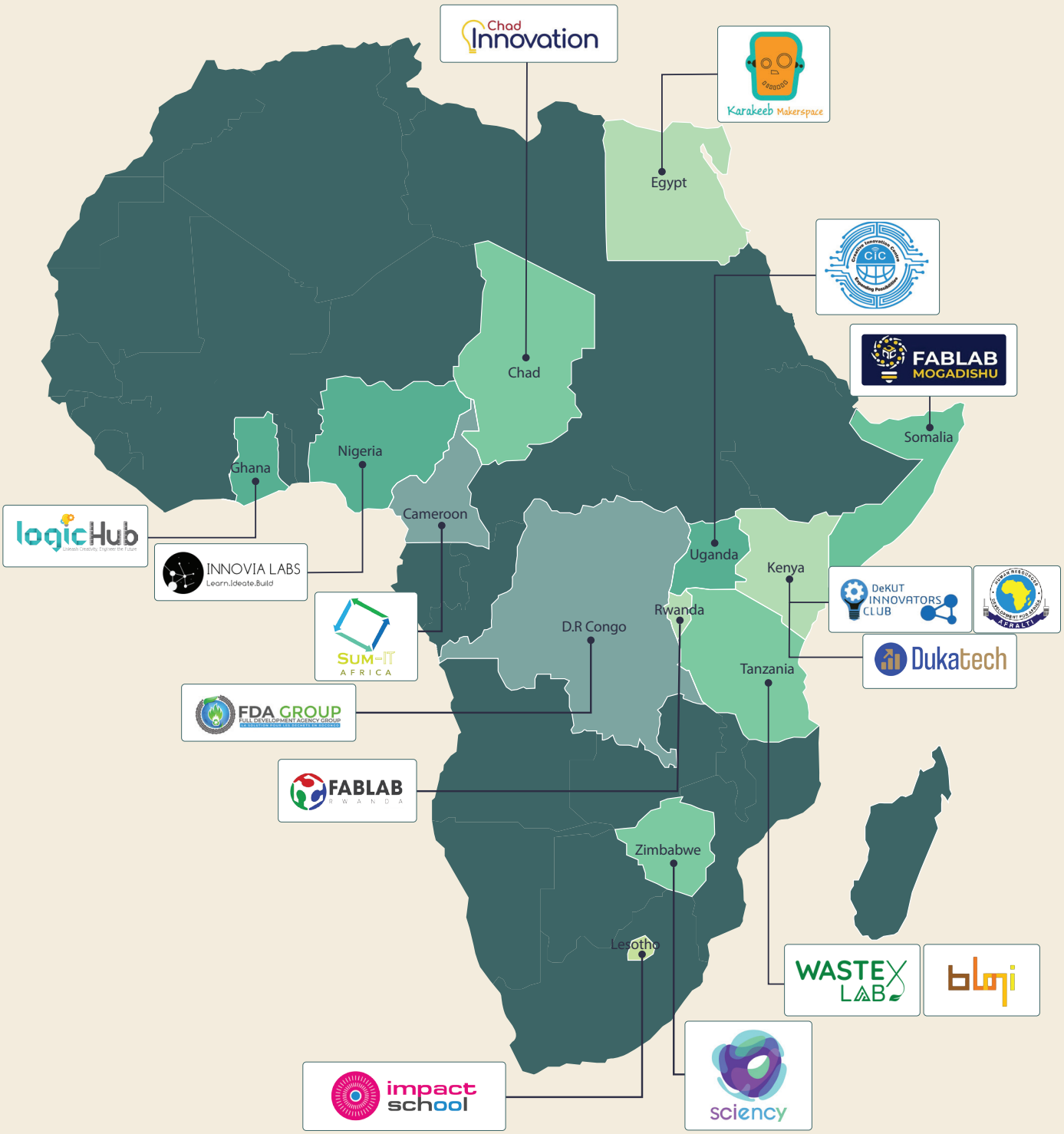
- **Capacity Building:** Meethub provides access to high-quality training and mentorship opportunities through partnerships with programs. This empowers African innovators with the skills and knowledge to develop cutting-edge IoT solutions.
- **Driving Innovation:** The platform is a launchpad for innovative projects, offering visibility and facilitating connections with potential investors or collaborators.
- **Sustainable Growth:** Meethub creates a virtuous cycle of collaboration and knowledge sharing, where successful projects inspire and empower others. This community-driven approach ensures that IoT innovation is not just a fleeting trend but a sustainable economic and social development engine.

Imagine another scenario where Kenyan agricultural experts partner with South African data scientists to develop a precision farming solution, or Nigerian energy innovators collaborate with Ghanaian hardware specialists to build a smart grid system. Meethub makes these collaborations possible, accelerating innovation and amplifying impact.

Meethub's vision extends beyond individual success stories. It's about fostering a self-sustaining IoT ecosystem in Africa, where collaboration, knowledge sharing, and community-driven initiatives fuel continuous growth. By engaging policymakers and financial institutions, Meethub ensures that the IoT landscape is innovative but also inclusive, sustainable, and accessible to all.

Join us on this exciting journey as we build the future of IoT in Africa, one connection at a time. Whether you're a seasoned professional, an aspiring entrepreneur, or someone who believes in the transformative power of technology, Meethub invites you to participate actively in this thriving community. The future of IoT in Africa is bright, and the collective power of its people is shaping it. Let's connect, collaborate, and create a more connected and prosperous future for our continent.

DOSSIER 3: Meet The 16 Champion Hubs Changing Africa



Dossier 3:
Meet The 15 Champion Hubs Changing Africa

Tech hubs are changing Africa. For you, we gathered 15 African hubs in this Dossier, and asked them to describe their profiles, their prototypes and how HUBiquitous supported their activities. Without further ado, let's discover them.

FDA GROUP
FULL DEVELOPMENT AGENCY GROUP
LA SOLUTION POUR LES DÉCHETS EN RDCONGO

Bukavu, Democratic Republic of Congo

The LarvaAI prototype

About us

The Full Development Agency Group (FDAG) is a social enterprise located in Democratic Republic of the Congo. It is focusing on sustainable waste management and environmental protection initiatives. Our hub specializes in providing comprehensive training courses that specifically target the Internet of Things (IoT). Additionally, we actively participate in the development of embedded systems projects that have significant impact on various sectors, such as agriculture, waste management, health, and education. Our primary focus is providing educational services, which includes overseeing mentorship programs from their inception to the financing stage. Our commitment lies in providing guidance and support to initiatives that have the potential to bring positive transformations in these industries.

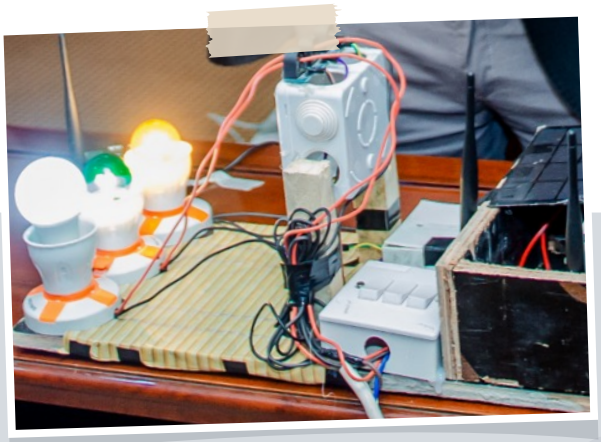
MVPs

Our ongoing MVP development project is called LarvaAI. It is a prototype for growing Black soldier fly larvae, piloted by AI. Those larvae are useful for recycling organic waste and generating animal feed. The prototype monitors key environmental data such as temperature, humidity, and light levels. FDAG have utilized their learnings and materials from HUBiquitous to develop and implement the monitoring system. This proactive approach has enabled them to gather valuable insights into optimizing BSF larvae growth in organic fertilizer production. Moving forward, integration with LoRa technology holds promise for providing a reliable data transmission method, particularly in rural areas with limited infrastructure. Leveraging the WaziLab learning platform has been instrumental in understanding the potential of LoRa technology for their project's success.

Contact: louangennl@gmail.com | **Website:** https://fdag-drc.com

WASTEX LAB

Zanzibar, Tanzania



ZecoNotify early prototype

About us

WasteX Lab is an innovation initiative focused on specific and provides leadership, best practices, research, innovation support, and/or training. The lab is the one which benefited from the HUBiquitous program which enabled the lab to establish a special stream of IoT innovation mentorship services. Its core business ranges from training, mentorship programme, software development activities and data collections, with a vision to provide geospatial data services and students and outside communities innovation services. Currently, the lab has mentored more than 200 youth with more than 10 innovations currently housed in the Lab. The lab has 3 permanent and 7 temporary employees. It also has the advisory board under the chair of University Vice Chancellor.

MVPs

Sciency Makerlabs is advancing an MVP called ZECOnotify, an IoT-based solution designed to detect faults in electrical grids, send real-time alerts, and provide data visualization to improve grid efficiency and control. Currently at Technology Readiness Level (TRL) 4, ZECOnotify has been significantly improved based on insights from the HUBiquitous Tech Hub Catalyst Program. Initially, the system used a GSM module for sending SMS and internet connectivity, which was not energy-efficient or cost-effective for rural and remote areas. It also relied on an Arduino board and the ThingSpeak cloud platform, which offered limited features.

Post-improvements, ZECOnotify now employs Wazigate for long-range communication and WaziDev as the sensor node microcontroller (part of the Solution Box). This upgrade enhances the system's capabilities by using WaziCloud, which provides comprehensive features and services, including LoRa and remote gateway control. Future plans include incorporating predictive analytics to optimize grid monitoring and fault detection further.

Contact: abubakar.bakar@suza.ac.tz | **Website:** https://wastex.suza.ac.tz/

sciency

Bulawayo, Zimbabwe

About us

Phenomenon Technologies, Trading as Sciency Makerlab is an innovative hub focused on revolutionizing education in Africa through robotics and Internet of Things (IoT). Our core business revolves around developing and delivering robotics courses and IoT-based learning experiences. Our hub is dedicated to fostering a culture of innovation, creativity, and problem-solving among students, preparing them for future careers in STEM (Science, Technology, Engineering, and Mathematics). We aim to bridge the digital skills gap and inspire the next generation of inventors, engineers, and entrepreneurs while providing them with access to cutting-edge technology through our robotics kit and courses. We currently have 14 employees through our Maker spaces in Botswana, Zimbabwe and South Africa.

MVPs

We developed an IoT-based robotics kit, which is strongly supported by our local industry partners. The kit integrates cutting-edge IoT technology with robotics, allowing users to create smart, connected devices and systems. It empowers learners to explore the realm of IoT through hands-on projects and real-world applications, enhancing their understanding of how interconnected devices can solve complex problems.

Contact: 263775671894 | **Website:** http://www.sciency.africa/

Creative Innovation Centre

Arua,
Uganda

The Egg incubator

About us

Innovia Labs is an Open Access, Social Enterprise Hardware Fabrication Laboratory, and MakerSpace, Designed to Self-Proliferate and introduce S.T.E.A.M (Science, Technology, Engineering, Art, Mathematics) and Digital Manufacturing to young Africans to help turn their ideas into great products.

At Innovia Labs, we provide Laboratory access, equipment/ Machinery, reverse engineering/ prototyping services with incubation and acceleration for Hardware, Deep Tech, and Digital Manufacturing Technology companies within the African Tech. ecosystem.

MVP

We developed the Tubim Box, a monitoring system for Renewable Energy solutions. With HUBiquitous, we were able to use IoT into our 1 KWh Energy boxes, so usage can be tracked. This prototype has proved to be a great help for monitoring energy consumption for the low-revenue households. Our prototype is at the level of market validation.

Contact: +256773229168 | **Website:** https://cictech.online/

FABLAB RWANDA

Kigali, Rwanda

About us

FabLab Rwanda is an innovative space where members collaborate to transform ideas into tangible products, focusing on hardware and electronics. The hub emphasizes the integration of hardware skills with software knowledge, fostering capacity building in design, engineering, electronics, fabrication, and high-tech innovation. With a community-driven approach, it aims to accelerate Rwanda's competitiveness in these technical fields.

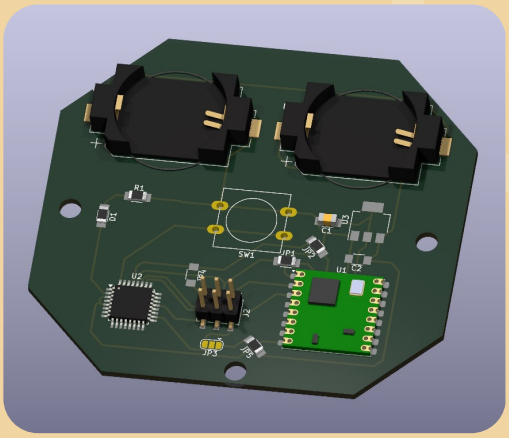
Additionally, FabLab Rwanda serves as a model for national leaders, showcasing a grassroots approach to technical education and innovation that transforms traditional industries into digital fabrication pioneers. Overall, it plays a pivotal role in advancing Rwanda's position in the Internet of Things era.

MVPs

We are developing the Irondo Panic Button, a monitoring system aimed at community night patrol guards to ensure quick emergency responses. It allows households to alert local community security (Irondo) during emergencies. It uses LoRa communication to send alerts, received by WaziGate (part of Solution Box) and displayed on a dashboard.

For integration into our prototype, we have tested the LoRa technology using the Solution Box components. The intent was to get a practical maximum distance LoRa communication can reach since our country is full of mountains, and in the end, we did get a distance of less than 1 kilometer of transmission but this was also due to the lack of a long and strong antenna in terms of power supplied.

The Irondo Panic Button MVP



The Irondo Panic Button MVP (LoRa chip visible)

Contact: +250788228838/+250789276080 | **Website:** https://fablab.rw/

INNOVIA LABS
Learn.Ideate.Build

Lagos,
Nigeria

About us

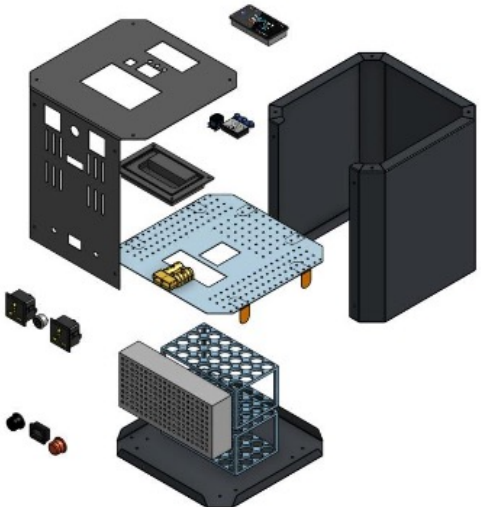
Creative Innovation Centre (CIC) is a Youth Led Organization located in Rhino Camp Refugee Settlement in Uganda. It was founded in 2020 by a group of dynamic and like-minded creative youths who are advocates for digital literacy and technology.

CIC focus is to create a peaceful platform to generate and share new creative and innovative ideas to address the most urgent and pressing needs of the youths through engaging them in peer-to-peer learning, rehabilitation and mentor-ship on education and Hands on skills (vocational skills).

MVPs

We developed an Egg incubation machine which uses IoT technology to monitor the data both inside the egg incubator and in the poultry house. It uses sensors from HUBiquitous Solution Box and solar energy which conserves the environment as well. The information such as temperature variation, humidity and air quality in the smart poultry house is sent to the cloud and monitored remotely in the farmers mobile app and computer. The data can be retrieved after sometime for comparison and future development of the system.

Tubim Box



Contact: philips@innovialabsafrica.com | **Website:** https://www.innovialabsafrica.com/

DeKUT INNOVATORS CLUB

The UMEME SENSE prototype

Nyeri, Kenya

About us

Dekut Innovators Club is a dynamic training and StartUp center dedicated to empowering students from day one on campus. Specializing in technical skills like IoT, robotics, and AI, as well as essential non-technical skills such as pitching and proposal writing, we nurture innovation and entrepreneurship. We guide students in transforming their ideas into products, aiding in funding opportunities, and fostering alumni mentorship.

Through annual innovation challenges, we cultivate a culture of creativity and problem-solving, ensuring a legacy of groundbreaking innovation and collaboration. This sense of community and continuity ensures that our impact extends far beyond the confines of campus, creating a lasting legacy of innovation and collaboration.

MVPs

UMEME SENSE is an innovative energy monitoring solution designed to revolutionize energy management across industries. Using LoRa technology (provided in the Solution Box), UMEME SENSE provides real-time insights into energy consumption, enabling businesses to optimize usage, reduce costs, and enhance sustainability. With strategically placed energy meters and advanced data analytics, including machine learning algorithms, it predicts peak consumption periods, identifies inefficiencies, and recommends optimization strategies. Through our partnership with Highlands Drinks Limited, we are in the prototyping phase and aim to increase energy efficiency at the facility.

Contact: otukosheila@gmail.com | **Website:** https://innovators.techsolvehub.co.ke/

logicHub
Unleash Creativity, Engineer the Future

Accra, Ghana

CrowdSense ENV prototype

About us

Logic Hub is a vibrant and forward-thinking technology and innovation center. Our core focus lies in nurturing IoT development, providing training opportunities, and fostering collaboration. With a dedicated team of ten members, we're at the forefront of creating locally developed IoT sensors and devices. Our mission is to empower individuals and organizations by unlocking the immense potential of the Internet of Things (IoT). At Logic Hub, creativity converges with technology, and we're passionate about equipping people with the skills and tools to drive innovative solutions.

MVPs

CrowdSense ENV is a pioneering, low-cost, AI-powered air quality monitoring system, marking a significant first as the indigenous product of its kind in West Africa. It offers unparalleled precision and measures nine critical environmental parameters, including PM1, PM2.5, PM10, temperature, humidity, pressure, noise, UV, and light intensity. Designed for versatility in home and industrial settings, CrowdSense ENV is a vigilant protector of public health by providing real-time alerts on harmful pollutants.

CrowdSense ENV utilizes advanced Cloud analytics for deep data insights and accurate environmental monitoring. It combines LoRa technology with cellular networks for unmatched, reliable connectivity, allowing real-time access to environmental data from any location. This revolutionary product was developed through strategic partnerships with local industries and environmental agencies, focusing on improving industrial air quality management and promoting environmental conservation.

Contact: samuel@afrilogicsolutions.com | **Website:** afrilogicsolutions.com/logic-hub

Karakeeb Makerspace

Alexandria, Egypt

About us

At our Maker Space, our primary focus is on fostering a vibrant culture of making and fabrication within our community. Specializing in hands-on workshops utilizing machines like laser CNC and 3D printers, we cater to a diverse range of age groups, from 5-year-olds to individuals aged 60, nurturing creativity and practical skills. In collaboration with schools, we design learning journeys that seamlessly integrate STEM methods into the curriculum. With a team of 16 employees and dedicated volunteers, our hub is a dynamic space where making and education thrive. Additionally, we actively promote the culture of making by integrating embedded systems and utilizing platforms such as Arduino, Raspberry Pi, and ESP32. Through engaging workshops and educational programs, we empower individuals to explore the vast possibilities of these technologies, fostering creativity and innovation within our community. Our overarching goal is to ignite a passion for making and learning, creating an inspiring journey through the dynamic world of embedded systems.

MVPs

Animation Station is an innovative project that harnesses the power of IoT to simplify the creation of stop-motion movies. This interactive platform utilizes IoT technology to streamline the animation process, allowing users to produce stop-motion content with ease. By integrating buttons and automated functionalities, Animation Station enables users to navigate the stop-motion creation process effortlessly. Once the animation is completed, the IoT components automatically facilitate the seamless uploading of the produced content to YouTube, providing a user-friendly and efficient solution for aspiring animators and creative enthusiasts. – already commercialized

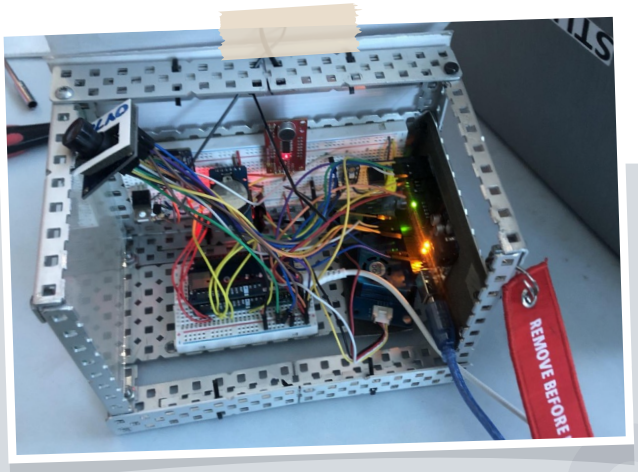
The MVP currently under development at our hub is a Smart Water Dispenser designed to promote sustainability and reduce the consumption of PET bottles. This innovative device leverages IoT technology to enable users to subscribe to a certain amount of water. Users can then access any of our dispensers, which are equipped with smart features to display the remaining amount of water available in their subscription and the validation date for their subscription. This IoT-enabled Smart Water Dispenser aims to provide a convenient and eco-friendly solution for individuals looking to minimize their environmental impact while staying hydrated.

Karakeeb presenting their prototype

Contact: rabab.hma@gmail.com | **Website:** https://karakeeb.co/

impact school

Maseru, Lesotho



Cube Satellite prototype

About us

Impact School's primary mission is to instill technology education from basic levels to employee up-skilling in Lesotho. It aims to prepare Lesotho to compete on the global tech stage through world-class tech programs. The school primarily benefits unemployed and underemployed youth, unemployed tech graduates, career switchers and anyone looking to up-skill in the technology field.

We offer a range of programs and initiatives, including coding, space technology, robotics and electronics classes. Notable initiatives include the ROS (Robot Operating System) program which is an Industrial robotics program, the first in Lesotho, and the launch of a CubeSat (satellite prototype, the first to offer space technology in Lesotho). The school has partnerships with Holberton School allowing it to offer relevant and attractive courses to the employer such namely Machine Learning, Augmented & Virtual Reality, System Programming & Blockchain & Full-Stack Web Development and a recruitment company called Magellan AI in Florida, USA for graduate job placement opportunities across the globe.

MVPs

We are working on a Cube Satellite prototype project. While the primary focus of this project is related to space technology, it also incorporates IoT elements. The Cube Satellite is equipped with sensors and communication modules that enable it to collect and transmit data from space, including information about its location. This is the first Cube Satellite project in Lesotho. The HUBiquitous Train the Trainers in Tanzania was beneficial for us for planning the next steps of development of the Cube Satellite

Contact: nkentsocledimo@gmail.com | **Website:** www.impactschool.or

Afralti IoT Hub

Location: Nairobi, Kenya
Type: Tech Training Center
Contact : lmabele@afralti.org
website: https://www.afralti.org/

AFRALTI IoT Hub is a Tech Training Center based at the African Advanced Level Telecommunications Institute (AFRALTI) in Nairobi, Kenya.

Dukatech

Location: Nairobi, Kenya
Type: Innovation Hub
Contact : +254743800904
website: https://www.dukatechnologies.co.ke/

Dukatech Solutions is a leading community driven skills development and talent acquisition platform that is based at Kenyatta University(Chandaria Business Innovation and incubation Centre),Nairobi Kenya.

Chad Innovation

Location: Location: N'djamena, Chad
Type: Incubator, Techtrainingcenter/ Makerspace
Contact: hamidkhayar@chadinnovation.org
website: https://chadinnovation.org/

A tech hub, which advises, supports, trains and incubates players in the digital ecosystem to promote and advance innovation and entrepreneurship in Chad.

Chad Innovation

Location: Douala, Cameroun
Type: ESO,Digital Transformation Center
Contact: executive@sumitafrica.org
website: https://www.sumitafrica.org/

We are an enterprise support center, we provide support to startups on digital transformation, market research and expansion, business development as well as training and consulting.

Buni Innovation Hub

Location: Sayansi, kijitonyama in Dar-es Salaam, Tanzania
Type: Tech Training Centre
Contact: dg@costech.or.tz
website: https://www.costech.or.tz/bunihub

Buni Innovation Hub under Tanzania Commission for Science and Technology (COSTECH) focuses on coordinating and supporting the Innovation ecosystem in Tanzania.

FabLab MogadishuHub

Location: Mogadishu, Somalia
Type: Fablab
Contact : abdullahcadceed@simad.edu.so
website: https://fablab.simad.edu.so

FabLab Mogadishu, part of SIMAD Innovation Lab, is the largest university-based digital fabrication space in Somalia.

DOSSIER 4:

Challenges And Opportunities For IoT Techhubs In Africa

Dossier 4:
Challenges And Opportunities For IoT TechHubs In Africa

Did you ever want to have first-hand experience feedback about the growth of IoT in Africa? In this dossier, we asked five experts from five different African countries to share with us a picture of IoT in their countries. They provide an exciting perspective that includes both current opportunities and challenges and future projections. We'll travel to Egypt, Ghana, Tanzania, Nigeria and Kenya: please sit down, relax, and enjoy the trip.

About the Authors:

Moetaz Helmy
is Chairperson at AfriLabs

Daniel Chinagozi
is CEO at Innovation Growth Hub

Fiifi Baidoo
is CEO at CloudPort

Mramba Makange
is Finance Manager at Dar Teknohama Business Incubator (DTBi)

Joseph Shitote
is Project Manager at INNOTEC21

We asked five experts from five different African countries to share with us a picture of IoT in their countries.

IoT Ecosystem In Egypt

By Moetaz Helmy

> **The HUBiquitous Catalyst program has enhanced our hub technical skills with Waziup cutting edge technology, this has been transformative for us! It allowed us to develop IoT consulting services and enhanced our capabilities to design and implement solutions to Egypt's unique challenges**
>
> *Rabab Hassan, Cofounder of Karakeeb Maker Space, Alexandria, Egypt.*

The internet of Things (IoT) ecosystem in Egypt has seen significant growth and development in recent years:

- **Infrastructure and Connectivity:** The Egyptian government, through initiatives like the 'Digital Egypt' program, has been investing heavily in the country's IT infrastructure, including the establishment of local data centers, cloud computing facilities, and smart city initiatives. Egypt also focuses on the deployment of 5G networks, expansion of high speed internet and IoT based solutions.
- **Startups and Ecosystem Support:** Egypt has emerged as a hub for IoT startups, leveraging the country's growing pool of talented engineers, developers, and entrepreneurs. This is mostly built around the use of existing IoT solutions for smart home, agriculture, and manufactures.
- **Applications and Adoption:** Egypt has seen the adoption of IoT technologies across various industries, driven by the potential to improve operational efficiency, enhance user experiences, and address pressing societal challenges.

In the smart city domain, IoT-enabled solutions are being implemented to enhance urban infrastructure, optimize traffic management, and improve public service delivery. The new administrative capital deployed IoT-based streetlights, waste management systems, and parking management solutions to enhance the overall experience. The agricultural sector has also benefited from IoT technologies, with the deployment of IoT-enabled sensors and irrigation systems to optimize water usage, monitor crop health, and increase productivity. IoT applications are being explored in industries such as: healthcare, manufacturing, and energy, contributing to improved operational efficiency, asset monitoring, and resource optimization.

Challenges

Despite the promising growth of the IoT ecosystem in Egypt, the country still faces some challenges that need to be addressed. These include the need for further investment in IoT-specific skills and talent development, the harmonization of regulatory frameworks to support IoT innovation, and the strengthening of cybersecurity measures to protect IoT devices and networks.

IoT Policy and Regulations

Since the start of the project in Egypt, we faced issues in **importing our IoT components** which are heavily restricted in Egypt by the National Telecom Regulatory Authority (NTRA) and can only be imported in very specific cases like Academic reasons or by military applications by the ministry of defense. This includes components like GPS, LoRa and Antenna .. etc To overcome this issue, we partnered with a university but the NTRA requested to apply the project only in the university campus to make sure that the applications are controlled under the supervision of the university. We worked on plan B and changed some of the components to ensure that we can apply it in different locations outside the university and ensure fair geographical distribution across Egypt.

IoT hubs in Egypt

IoT hubs in Egypt are primarily owned by the government or inside universities. This includes hubs like American University in Cairo, Nile University and Benha University. We can also spot companies that own IoT labs inside the Smart Village like Orange R&D but cannot really commercialize it in Egypt. As for HUBiquitous, we decided to work with maker spaces in Egypt that are owned by young entrepreneurs as the need was clear for such projects to build their capacities and maintain their sustainability. We worked with 3 hubs that are present in 3 different geographical places:

- **Cairo:** FabLab /San3aTech
- **Alexandria:** Karakeeb
- **Upper Egypt:** Athar

HUbiquitous Contributions

We have been actively engaged with the IoT ecosystem in Egypt across the period of the project this included:

- We worked with 49 members from 29 entities to publish the IoT Egypt Guidelines based on the regulatory framework that was published by NTRA in 2022.
- We customized the solution Lab to fit the local ecosystem and the current regulatory framework.
- We built technical and human capacities for 3 local hubs through the talent and catalyst programs in Cairo, Alexandria and Upper Egypt.
- We trained over 10 trainers and around 200+ entrepreneurs and startups MVP over more than 5 bootcamps.

IoT Success Stories in Alexandria

During the catalyst program organized by our partner Karakeeb in Alexandria, we were very proud to witness success in different IoT solutions that have been developed by our students like: Emergency response system for people with disabilities, Electric ScareCrow, Child protection, Smart power Guard, Smart Irrigation system.

Project's Sustainability

The sustainability of the program is ensured through a multi-faceted approach designed to maintain momentum and continue growth after the initial project period:

- **Ongoing Support and Mentorship:** We will continue to provide technical support and business mentorship to the teams, helping them further refine their projects into scalable, market-ready products. This includes regular check-ins and access to troubleshooting resources.
- **Integration with Academic Institutions:** Collaborations with universities and research centers will be pursued to integrate successful projects into academic curricula, providing real-world applications for students and ongoing development opportunities for projects.
- **Competitions and Continual Learning:** To keep the innovation pipeline active and engage new talent, annual hackathons and competitions will be organized, providing a platform for new ideas and solutions to emerge and gain support.

Ghana's IoT Ecosystem: A Rising Tide Of Innovation

By Fiifi Baidoo

Ghana's technology scene is on the move. Forget flashy apps and fleeting trends – this is about a digital transformation that's setting the stage for a genuine technological revolution. The Internet of Things (IoT) is not just a buzzword in Ghana; it's a real-world tool for solving pressing challenges and building a stronger, more sustainable nation.

We're not talking about futuristic refrigerators ordering your groceries (although, admittedly, that's pretty cool). We're talking about how connected sensors, smart devices, and intelligent systems are harnessed in Ghana to tackle issues like agricultural optimisation, energy efficiency, and healthcare access. IoT isn't just about technology – it's about improving lives and livelihoods.

Ghana's IoT Ecosystem: A Collaborative Engine for Innovation

Central to Ghana's IoT growth is a vibrant network of hubs, each with unique strengths, working collaboratively to drive innovation and economic development.

- **iSpace:** A beacon for startups in Accra, iSpace provides co-working spaces, mentorship programs, and a particular focus on empowering female entrepreneurs. Through initiatives like WAZIUP and the WAZIHUB programs, iSpace actively nurtures local talent and fosters a thriving IoT ecosystem.
- **Kumasi Hive:** This innovation hub in Kumasi is where hardware dreams become reality. Kumasi Hive equips young entrepreneurs with the tools, knowledge, and support to develop cutting-edge IoT hardware solutions tailored to local needs.
- **Logic Hub:** Based in Accra, Logic Hub is a knowledge Centre for all things IoT. They train Ghana's next generation of IoT professionals, develop locally-made sensors and devices, and champion collaboration across the tech community.
- **Foundry Camp:** A problem-solving powerhouse, Foundry Camp takes a "People and Problems First" approach to entrepreneurship. They empower innovators to create real-world solutions that address pressing challenges faced by Ghanaian communities.
- **CLOUDSCH:** Education is key to technological advancement, and CLOUDSCH is leading the charge. They offer accessible training programs on cloud technologies, IoT, and automation, ensuring that businesses and individuals have the skills to leverage these powerful tools.

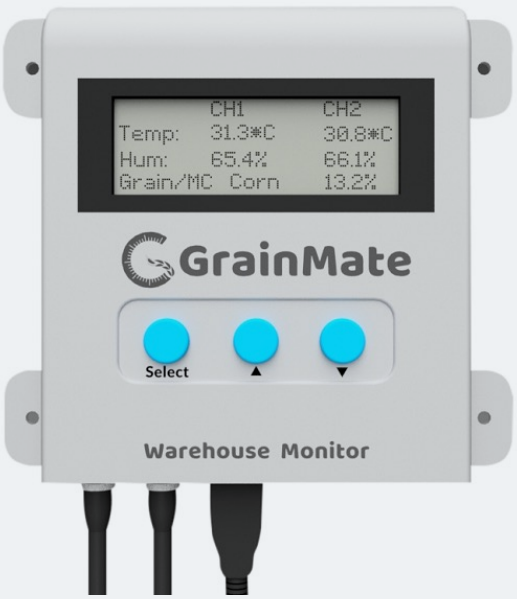
This isn't just about individual brilliance – it's about collective impact. Ghana's tech scene thrives on collaboration, with hubs, organizations, and companies like CLOUDPORT working together to build a stronger, more interconnected ecosystem.

The European Union's Horizon 2020 HUBiquitous project has been crucial in accelerating Ghana's IoT development. By equipping local tech hubs like Logic Hub with resources, training, and infrastructure, HUBiquitous is building a sustainable foundation for long-term growth.

Real-World Impact: IoT Solutions Made in Ghana

Ghanaian innovators are not just dreaming about the future; they're actively shaping it with practical IoT solutions:

- **CrowdSense GAS:** This AI-powered system enhances safety and efficiency at fuel stations by monitoring gas concentrations in real time.
- **Smart Water Dispenser:** This IoT-enabled device encourages sustainable water consumption and reduces plastic waste.
- **Farmerline:** Empowering farmers with mobile technology and data to improve yields and access essential services.



GrainMate by Sesi Technologies

- **Sesi Technologies:** Developing smart irrigation systems to conserve water and boost agricultural productivity.
- **Kofa:** Revolutionizing energy access and transportation with electric motorcycles and battery swapping stations.
- **Wahu:** Providing sustainable, locally-built electric vehicles for cleaner last-mile deliveries.

These solutions are a testament to Ghana's ingenuity and resourcefulness, demonstrating the power of IoT to drive positive change. This is the kind of innovation that's going to change the game for Ghana. It's about taking technology out of the labs and into the streets, farms, and homes where it can truly make a difference.

While challenges like the digital skills gap and access to funding remain, Ghana's IoT ecosystem is brimming with potential. With continued support, investment, and collaboration, we expect to see even more innovative solutions emerging from this vibrant tech community.

The Ghanaian tech scene is open and welcomes collaboration from startups to established businesses, researchers to students. Join us in building a brighter, more connected future for Ghana—one powered by its people's ingenuity and the transformative potential of IoT.

IoT Ecosystem In Tanzania

By Mramba Makange

The adoption of the Internet of Things (IoT) in Tanzania is progressing in sectors like agriculture, healthcare, and smart cities, despite significant challenges such as limited infrastructure, high costs, and a lack of technical expertise.

- In agriculture, IoT is revolutionizing precision farming with technologies like soil moisture sensors and drones, while livestock monitoring is enhanced through GPS collars.
- In healthcare, remote health monitoring devices and telemedicine services are improving patient care in rural areas, offering remote consultations and diagnostics crucial for underserved regions.
- Smart city initiatives in Dar es Salaam, Arusha, and Zanzibar leverage IoT to enhance urban management, with smart street lighting systems conserving energy and reducing costs, while waste management solutions optimize collection routes and monitor bin levels for efficiency.

The Tanzania Commission for Science and Technology (COSTECH) and the Dar Teknohama Business Incubator (DTBi) Limited play pivotal roles in promoting IoT in Tanzania. DTBi supports startups and tech hubs such Buni hub, Bongo Tech, SUZA in Zanzibar, and SIDO in Arusha working on IoT solutions by offering incubation services, including mentorship, access to funding, and networking opportunities.

A notable initiative by DTBi is the prepaid water meter piloting project with the Rural Water Supply and Sanitation Agency (RUWASA), which aims to improve water management and billing systems in rural areas using IoT technology. These smart water meters allow for efficient monitoring and control of water usage, reducing wastage and ensuring fair billing.

Piloting of Prepaid Water Meter in Musomera, Handeni District in Tanga in 2022

The handbook

DTBi, in collaboration with the HUBiquitous projects funded by the EU, facilitated the development of the IOT ecosystem in Tanzania. Moreso, the HUBiquitous project supported developing a handbook on Africa's innovation ecosystem. The HUBiquitous Handbook provides a comprehensive understanding of the Africa innovation ecosystems in digital technologies and the available opportunities for building innovation networks that leverage the collaboration between African and European start-ups and other interested actors.

This handbook provides practical information about local, national, regional, and Africa-Europe innovation ecosystems. It aims to enlarge the portfolio of partners for cooperation and collaboration, focusing on disruptive Artificial Intelligence (AI), Internet-of-Things (IoT), and Big Data technologies within the innovation ecosystem. The actors include Digital Innovation

Hubs (DIHs), incubators and accelerators, start-ups and entrepreneurs, funders, government and agencies, academia/R&D, SMEs, cooperatives, and Civil Society Organizations.

The target audience for this handbook includes both practitioners and researchers in the areas of innovation, disruptive technology, entrepreneurship, management, economics, and policy-making. This handbook is also useful to a wide range of innovation ecosystem actors. In short, for anyone interested in understanding the issues regarding Africa-Europe digital innovation ecosystems, this is a must-read handbook.

Challenges and opportunities

Challenges in the IoT landscape in Tanzania include expanding broadband infrastructure, ensuring data security and privacy, and building technical expertise. Limited infrastructure and high costs hinder widespread adoption, while the lack of technical expertise affects the development and maintenance of IoT solutions.

Data security and privacy are critical concerns that need addressing to gain user trust and ensure safe IoT deployments. To address these, the government of Tanzania, through the e-Government Agency (eGA) and the Tanzania Communications Regulatory Authority (TCRA), is actively working to ensure the proper growth of the IoT ecosystem. These bodies oversee the development and implementation of regulatory frameworks and standards that support IoT growth while maintaining security and efficiency.

Despite these challenges, there are significant opportunities for growth. Government initiatives promoting digital transformation, public-private partnerships, and increasing interest from tech startups present potential avenues for expanding IoT applications. Education and training programs are crucial for building the necessary technical expertise, while the growth of mobile and internet penetration, supported by strong mobile network operators.

IoT Ecosystem In Nigeria

By Daniel Chinagozi

The ICT sector in Nigeria contributed a whooping 18% to the nation's GDP in 2023. This is up from 11% in 2021. This became clear for us when we saw the impressive response to our program "call for applications": out of 113 applications received, 35% came from Nigeria. However, a cursory assessment of the applications showed that half of the applications were not related to the program, ranging from light industries in the clothing, digital advertising and food industries.

Number of Applications per Country

Number of applications received for each countries: Nigeria leads by a large margin

> The 20 hubs that passed the quality check had experience of more than 3 years, had already set up an IoT lab and had already trained between 40-50 participants.

A good portion of the population has access to **reliable internet, power and a mobile phone.** These three factors are the fundamental ingredients for successful deployment of an IoT solution and thus portraying a huge potential for a thriving IoT setup in the country.

The 20 hubs that passed the quality check had strong IoT applications. In particular, most of them had an experience of more than 3 years, had already set up an IoT lab and had already trained between 40 - 50 participants and more. Their minimum viable product was at an advanced level which only required a small addition to the Technology setup as an IoT enhancement.

Innovia Labs, a participant of the TecHub Catalyst Program (among the 15 selected), presented an advanced version of an anti-poaching, anti-banditry and anti-kidnapping system. This shows the level of advanced technologies that the hub is exposed to and the potential capability of most of the hubs in Nigeria.

IoT Ecosystem In Kenya

By Joseph Shitote

Kenya is known as the East **African Regional ICT Hub** with well established undersea fiber optic cables providing high-speed and reliable connectivity in the region. In 2023, the Government of Kenya announced the establishment of **1450 ICT** hubs across the country. While this was a bold move, a sampling study from the HUBiquitous project has shown that **only a handful of these hubs are Tech-enabled** and that they have the facilities and hardware to support the learning of emerging Tech such as IoT and AI.

The HUBiquitous project through the TecHub Catalyst Program rolled out an initiative to enhance Tech Capacity in these hubs and received overwhelming response from the Kenyan region. This showed that indeed, the existing hubs acknowledged this gap and that they were eager to address it.

The beauty of the Kenyan Technology ecosystem is that, **the distribution of ICT Hubs is almost in all parts of the country.** The country's move through the promulgation of the constitution in 2010 enabled the devolution into counties and thus development and access to services at county level as opposed to the centralized model of government.

Additionally, the enactment of the Kenya Vision 2030 that aligned with the Millennium development goals and Sustainable Development Goals worldwide provided a roadmap which counties could use to enhance the given services at county level. These acted as the main catalysts and drivers of a vibrant technology community in the country. Reports show that **ICT tops as the key job provider in Kenya at 28.4 percent.**

The direction is right. The mindset of the leaders and the youth is also right. A proper framework just needs to be set for hands-on training and certification programs in the hubs. The model already applied to the hubs by the TecHub Catalyst program can be emulated by responsible public and private bodies to ensure the proper and strong application of Iot and AI skills in the region.

With minimal budget, AFRALTI-IoT, DeKUT Innovators Club and Dukatech showed **a total of 365 applications received when the program was launched in their hubs.** Limitations in funding only enabled 35 persons of this number to be trained as the 1st cohort of the program. A second cohort can be done with an even smaller budget and funding bodies should be available to support these hubs to sustainability levels.

Hardware provisions/difficulties

The local set up is also limited in hardware provisions. **Only 5 known electronic shops serve the entire country** for the main IoT electronic parts and their accessories. There is a gap in this sector and our experience has shown that some of the contributing factors is the logistics of moving a small item such as a sensor from Europe, Asia or America to Kenya.

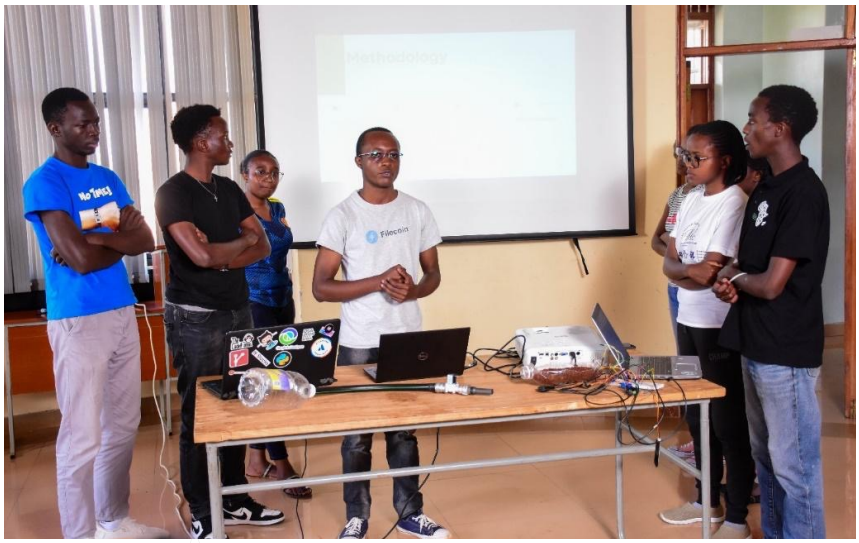
For instance, it took 14 working days to ship a box of electronics - The Solution Box - from Germany to the 3 hubs in Kenya. **It also cost just above 200 euro to retrieve the box from the customs. Lithium - ion batteries could not be shipped together** with the Solution Box as it has been curbed as hazardous and highly explosive for air transport. While the stocks were low in the shelves of the 5 available local retailers, if there was no surplus in the hubs, it would need another 2 months to get the materials necessary for local assembly of an IoT solution.

Manufacturing in Kenya

A call for enhancing local production is thus imminent. WAZIUP e.V., a partner in the HUBiquitous project consortium, has made effort to produce the main

controllers called the WaziDev, WaziSense and WaziAct and the gateway communication module, WaziGate, in the Kenyan industries to promote local manufacturing and reduce the cost of production and logistics.

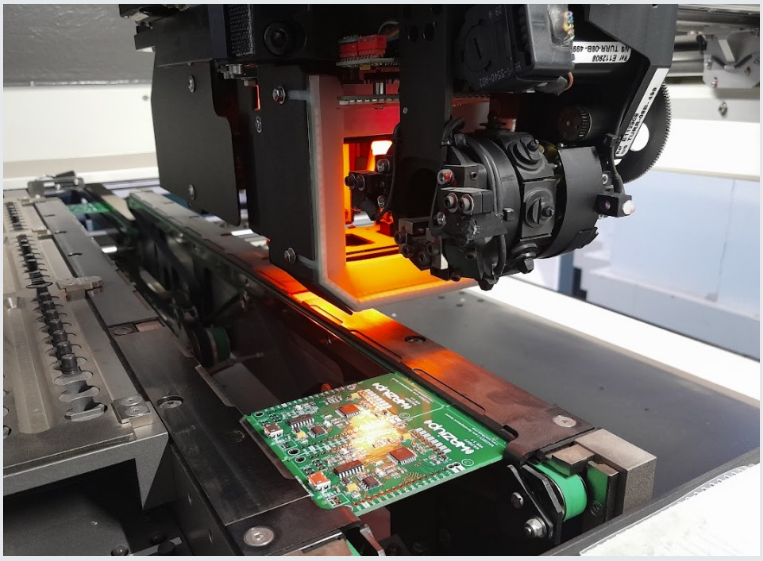
The local manufacturing initiative by WAZIUP e.V. is, however, not sufficient. The delays in the raw materials are still a logistical and time lapse problem. Also, since the production of the respective hardware is not consistent i.e. the frequency of the production of WaziSense for example is not known, the local industry can not anticipate the raw materials and purchase them in advance.



Group presentations of Minimum Viable Product (MVP) at DeKUT innovators Club

HUBiquitous programs

Out of all hubs applying for the HUBiquitous "TecHub Catalyst program", a whopping 15 of them were Kenyan. This shows that the Kenyan IoT ecosystem is strong and dynamic. The hubs proposed sustainable services such as IoT consultancy and commercialization of products and services. They can also serve as a local distributor of the **Solution Box** in the country and surrounding regions.



Production of the WaziDev at PhinaLabs in Kenya

Conclusion

As a country with 80 percent of the population being the Youth, and youth that tolerates only good governance and policies that work to enhance service provision and equal opportunities, hubs can also take on the streets to amplify their voices on the services they would like to implement and thus catalyze the entire country to adopt or take part in these services.

The youth need a consistent source of income, the government needs to resolve the debt situation. Enhancing the services proposed by these hubs is a solution to the unemployment blight on both direct job entry and opportunities for self-employment. Empowering the hubs by the government by helping them mitigate the roadblocks for implementation of the services will help more youths have income who will eventually feed the tax basket.

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www.hubiquitous.eu

corentin.dupont@innotec21.de