

Finally, X-ray medical imaging within the reach of developing countries

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In developing countries, many hospitals have become cemeteries of medical equipment. Several radiology systems, often sent by international aid, may never be used due to the climatic conditions and the instability of electricity networks. In a matter of weeks, they become

useless. Besides, the lack of qualified personnel or spare parts rapidly dispels any hope to make them work. Yet, the lack of access to radiology in many developing countries is a serious public health problem, whether for TB screening or the care of road traffic injuries.

GlobalDiagnostiX is the first medical radiography device specifically designed for developing [countries](#). Its total cost of ownership, including purchase and maintenance over 10 years, is 10 times cheaper than the existing equipment. A fully functional prototype was unveiled in Lausanne on 9 March 2015. It was designed under the leadership of EPFL's the Cooperation & Development Center.

The Center's EssentialTech team is in charge of the project and manages its various stakeholders. Indeed, four EPFL laboratories, ten research groups from the University of Applied Sciences Western Switzerland (HES-SO; fields of health, engineering and design), the Paul Scherrer Institute, CHUV, the EssentialMed foundation and the Swiss Tropical and Public Health Institute worked in close collaboration with the University Hospital of Yaounde (Cameroon), the University Research Center on Energy for Health Care in Cameroon, and other local stakeholders.

Reliable and cheap mechanics

The device is specifically designed to resist harsh tropical climate and the consequences of high temperatures, humidity and dust. It includes an examination stand which was designed to avoid any electrical controls. It can move up, down, and turn depending on the body part to be X-rayed. It is only composed of mechanical, solid and stainless constituents. A subtle and robust mechanism facilitates its handling while preventing errors that could lead to shocks or bad radiographies.



The GlobalDiagnostiX device uses no electric control for exposing the right body part of the patient. Credit: Alain Herzog / EPFL

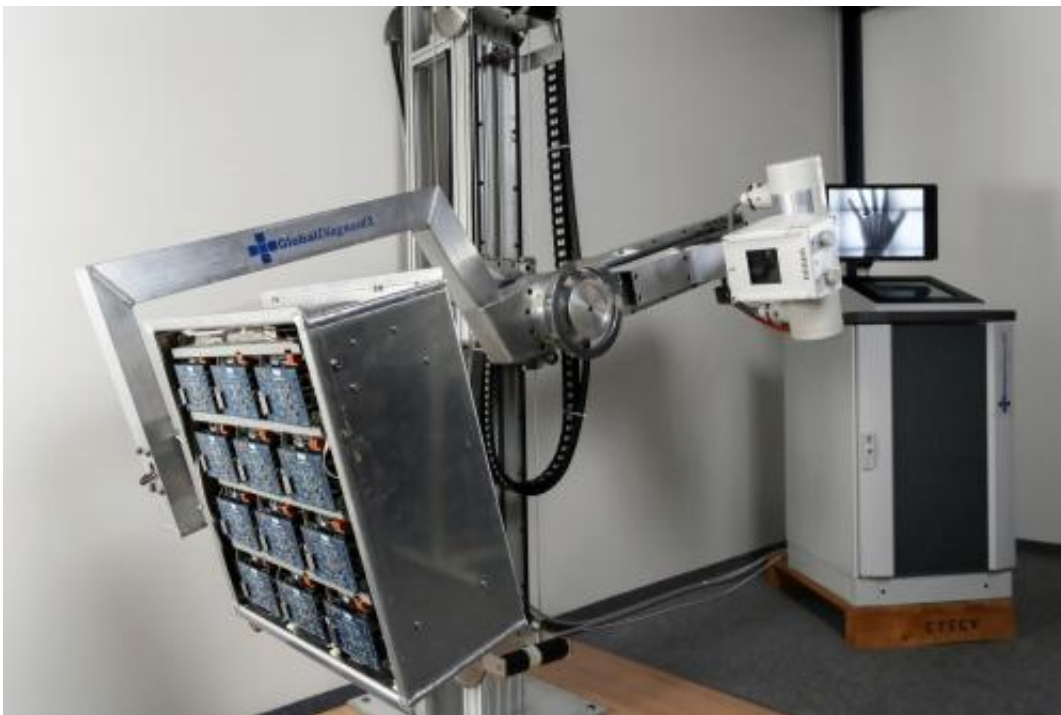
Keeping costs as low as possible: a composite image sensor

The radiographic image sensor has been completely redesigned to withstand shocks as well as the temperature and humidity. Very cheap, it is based on an array of twelve CMOS sensors whose images are assembled by the machine's software. These sensors are commercially available and their cost is moderate; thus they can be easily replaced.

Resisting the unstable electrical network: power supply facing the worst conditions

The latest development is probably the most important: resistance to often inadequate or undersized electrical networks. Indeed, to operate an

X-ray emitter, a power supply whose tension is able to briefly reach 150'000 volts is required! The power module will provide this voltage without overloading the hospitals' network, whose total consumption in [developing countries](#) is often lower than a single X-ray machine's. It also implements an innovative energy storage system, allowing the entire system to operate for several hours even without an external energy supply.



An array of 3x4 CMOS sensors records the X-ray image. The device's embedded software stitches them together, seamlessly. Credit: Alain Herzog / EPFL

And the research continues. First objective: raising funds - just under 2 million francs - for testing the first prototype's reliability and improving its design, aiming at the creation of a second version by next year.

Entrepreneurial approach, costs divided by 10

Designed to specifically meet the needs of hospitals in developing countries, GlobalDiagnostiX must leave the lab and get on the ground. A social business model has been created for this purpose. It will aim to make radiography not only accessible in developing countries but also in a self-sustainable and scalable way. The company's business model, as well as its industrialization and deployment strategies, were developed with many stakeholders, such as potential customers and partners, in Switzerland and Africa.

The project has received the support of Pascal Hundt, head of the Assistance division at the International Committee of the Red Cross. He underlines the enthusiasm of Jeffrey Sachs, economist and Ban Ki-moon's consultant at the UN, for whom "X-ray diagnostic imaging is an essential tool in primary healthcare for diagnosing conditions such as trauma or tuberculosis that represent a great burden in developing countries. Yet X-ray diagnostic imaging is still unavailable to two thirds of humanity. Project GlobalDiagnostiX is an inspiring and exciting initiative to develop an innovative, robust and affordable x-ray diagnostic system specifically adapted to the needs of low-income countries."

Provided by Ecole Polytechnique Federale de Lausanne

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