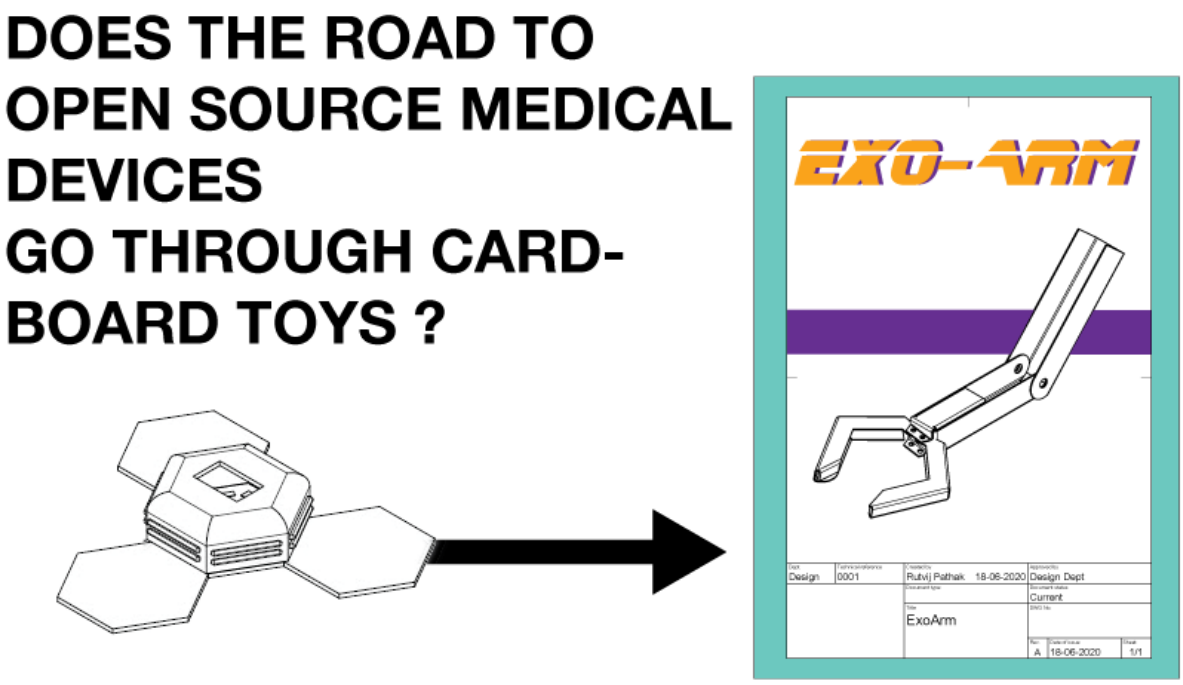
HelloHealth- From Devices to Toys, the road to self - healing.



Introduction

Medical devices don’t work well or don’t work at all once you take them out of their environment, (e.g. the hospital), but when we are providing healthcare services in the farthest reaches of the world, you need medical devices that work in those circumstances and at a cost which makes it possible for them to reach who need them the most. In India, 63% of the population is still living in rural areas, and on average they have to travel 100 km for healthcare assistance. I want to see a world where every citizen has access to healthcare no matter where they live.
State of healthcare in rural India is abysmal. Present scenario Indian rural health care faces a crisis unmatched to any other social sector. Nearly 86% of all the medical visits in India are made by ruralites with the majority still travelling more than 100 km to avail health care facility of which 70-80% is born out of pocket[1] .
HelloHealth is a project which aims to bring accessibility to healthcare to the underserved communities of the world. This project aims to aim to tackle the challenge of accessibility by using a combination of low-cost medical devices, a distributed manufacturing network, this will be done using the FabLab Network by designing the devices out of standard electronics inventory and a community to develop and expand it which will be an online repository on Wikifactory which will act as the central node for

the community to gather and discuss and maintain the designs and codes required to make these devices.

A fab lab (fabrication laboratory) is a small-scale workshop offering (personal) digital fabrication.
A fab lab is typically equipped with an array of flexible computer-controlled tools that cover several different length scales and various materials, with the aim to make "almost anything" This includes technology-enabled products generally perceived as limited to mass production.
The number of labs in India has grown exponentially over the past 10 years to a total 65 labs which will increase in the future making the technology to make these devices more readily available. The Lab will not only be a point of manufacturing the devices but a point of care center for the people in need.

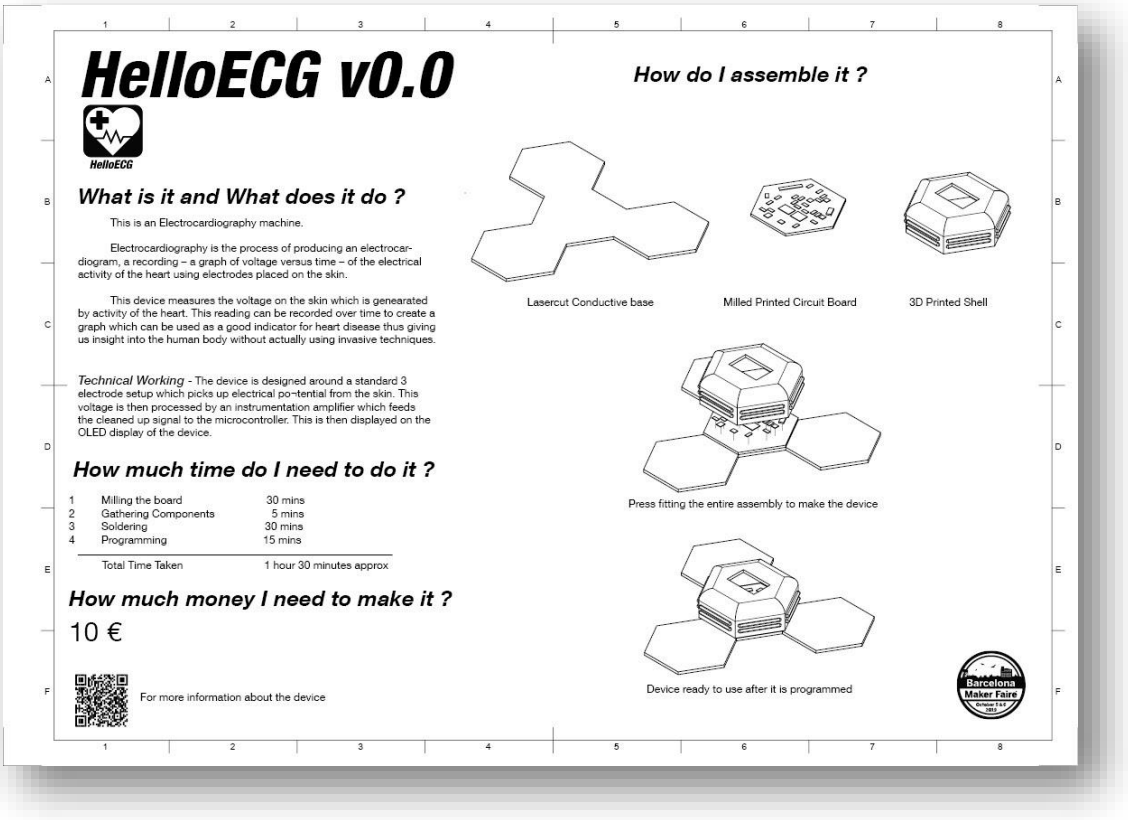


Figure 1Speculative blueprint of the an ECG Device which coudld be made with a combination of process of 3D printing, Laser Cutting and PCB milling.

Following is the illustration of the prototypes which were generated are the breaking down of medical devices into its constituent process which can be replicated in standard lab machines and with standard inventory of electronics and materials. Illustrated in the picture is the laser cut base which can act as wearable electrode. The PCB is designed to be made on a PCB milling machine to be soldered easily. A 3d Printed Shell which encases the electronics and electrodes.

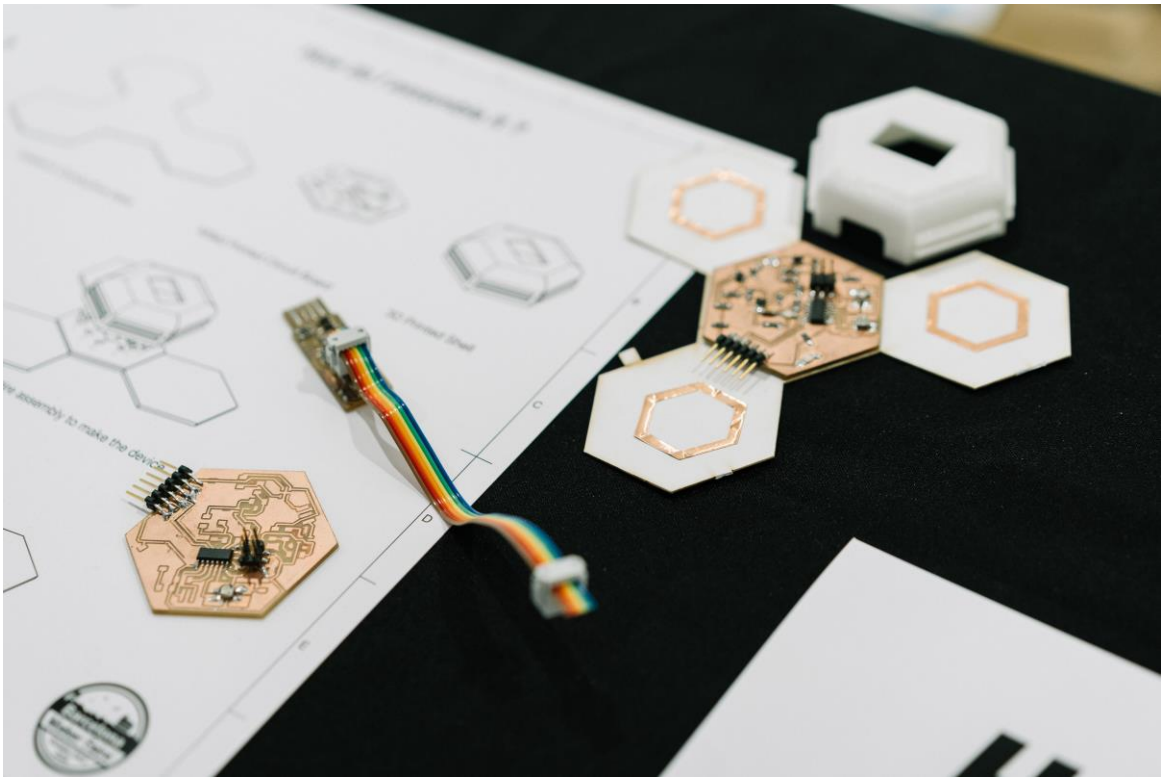


Figure 2: Project Exibited at MakerFaire Barcelona 2019

The path to open-source healthcare will be a long one. The project started in the FabLab Community Thus I'm taking the path through STEAM education as the barrier to entry is the lowest here and also easiest to build a community around. The project is divided into 3 phases first is "awareness"-(STEAM Education) which will be students of age 12 +.Phase 1 delivers a future community of self-care practitioners who are aware of their health. Phase 2 is "Engagement "which is where STEAM Education will be pushed further into the curriculum of universities and degree programs. Thus getting more and more highly skilled users in the community. University students / Future engineers which already be familiar with the platform. These users can develop more and more efficient and better software and hardware for the overall community.
Phase 3 is the combination of the first 2 phases where the project uses the data of communicating something technical and complex to a relatively inexperienced /unfamiliar audience in Phase 1, with the advanced technical capabilities of the Phase 2. To make standalone medical devices which are easy to operate and technically capable. This leads to resilient devices which can be easily communicated and replaced. The project will have different stakeholders in different stages of the project. Phase 1 will be engaged with Students and schools to develop curriculums and practices to generate awareness about Health and self - care. Phase 2 will be engaging with universities and engineering colleges which will bring in highly skilled students and community members. Phase 3 will be partnering with NG0's and organizations which are working in Last Mile Healthcare Organizations which already have the people network ready.

The path towards Open Source Healthcare:

A combination of low-cost medical devices, a distributed manufacturing network, and large community support can make a significant difference in bringing accessibility to healthcare to the world. My project, ***HelloHealth***, contributes to this ongoing larger effort by assessing the applicability of packaged biomedical sensors in a set of tools and applications to stimulate learning and self-awareness in a community of practioners.

My approach to this problem has been targeted at two aspects - one that the prototype will stimulate natural curiosity and learning through simple, clean design and that engagement with the prototype will organically lead to the creation of communities of learners and instructors. I tested in a real-world scenario by creating cardboard toys with biomedical sensors for children between 10+ to create an engaging learning environment using a superhero narrative wherein the children learn about the functioning of their own bodies and create awareness about their own health. Early pilot experience suggests that not only was this a joyous activity, but it also has the potential to lead to the formation of communities with definite future development tracks based on experience and feedback, enriching learning experience with custom curriculum

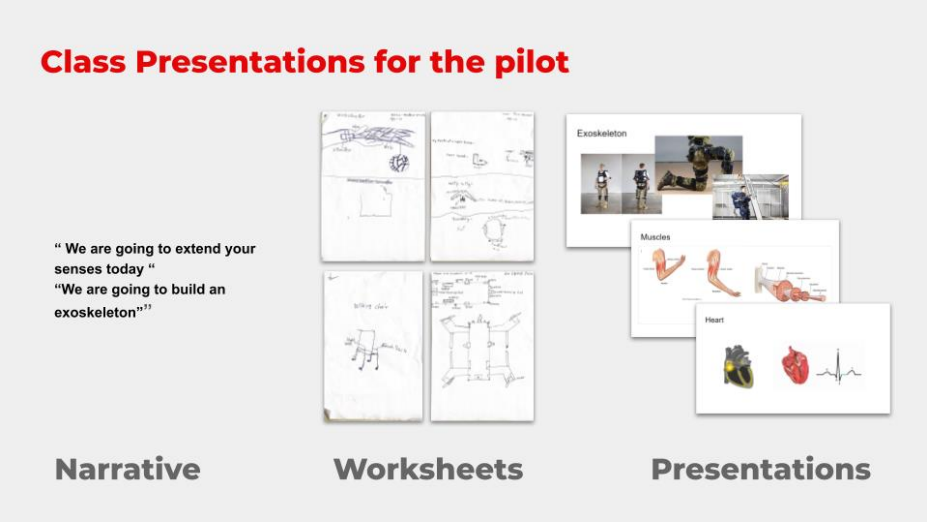


Figure 3: This is class presentation slides and worksheet which were generated by the students

The goal of the project is to introduce students to the integrated STEAM curriculum in the context of biomedical engineering with an awareness of their health. Students participated in activities that encouraged them to develop a perspective based on different branches of STEM. Biomedical Engineering was the chosen topic. The project is organized around CS, Engineering, Art and Design, and Bioengineering. , Students worked on a project based on these approaches and developed artifacts to “extend their senses”

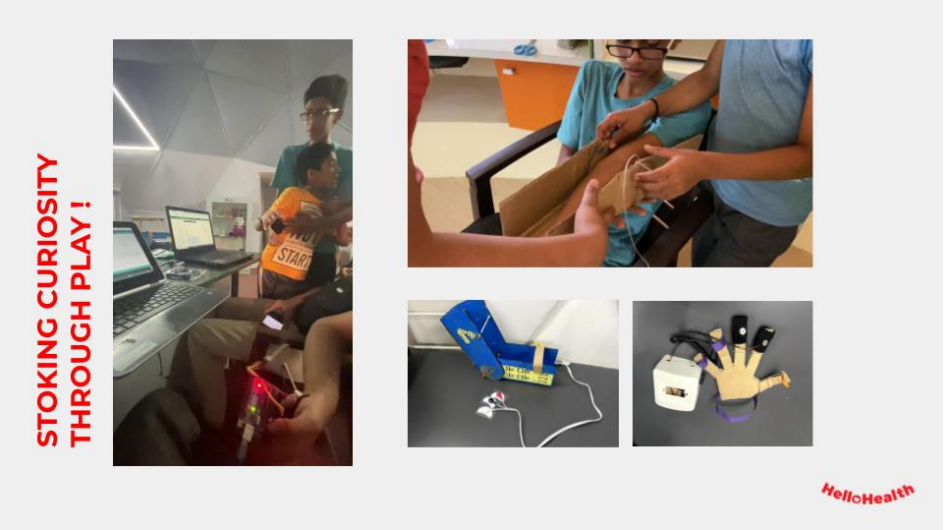


Figure 4: Students participating in the pilot

Science and Engineering have the power to solve problems beyond socio-economic cultures. In today's world, we face calamities that are beyond geographical boundaries. The context of environmental and health issues is important for these communities because it is easy to relate with but also makes an impact on a global scale. No other topic could have been more apt in tese current times. To be more specific about the different aspects of our bodies were chosen.

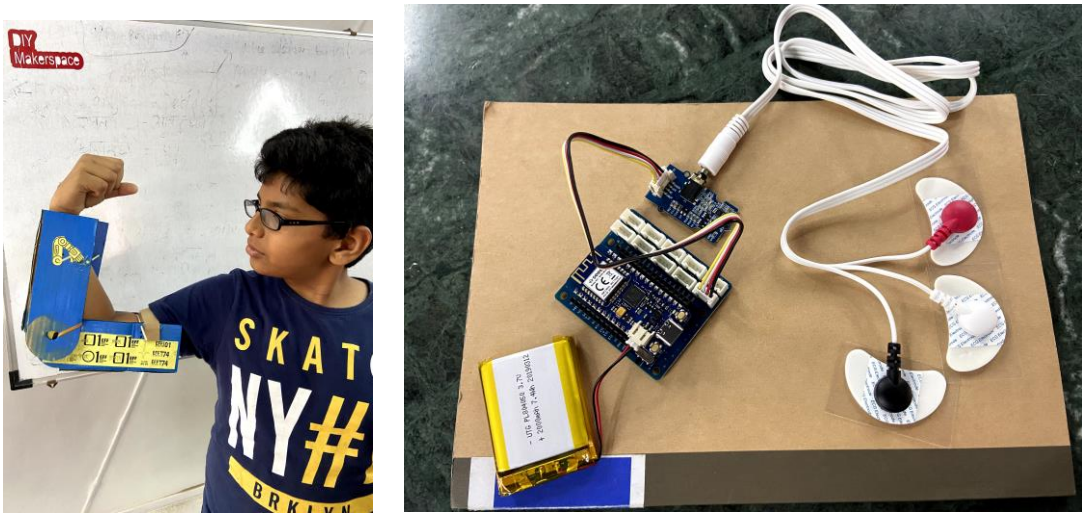


Figure 5 and 6: Version 1 of the EXO- Arm designed by the students at the end of the pilot . The sensor assembly which is on the outside of the students arm to detect muscle movements of the students.

The goal of the project was to come up with an artifact that every group can possess and it had to be something that they can proudly present at the end. Cardboard was selected as the medium because it was easy to perform the experiments. The set up required was easy as compared with other materials. As mentioned, this project helped the students realize how STEM is a great tool to understand the complex workings of the body.

The main criterion of success of the project was beyond imparting the knowledge and making of the artifact. Its goal was to develop keen interests amongst the students in the field of STEM, not merely as a part of the curriculum but something which they can pursue as a career and also generate awareness about their own health practices. It was also explained that the knowledge gained over here is not only essential for the would-be scientists or engineers but to everyone who wishes to excel in their fields. This is because the essential qualities of leadership, teamwork, presentation, and critical thinking are essential in the professional world. There were few heartwarming reactions from the students who said they were excited about what they could “see” through those sensors.

Proposed Design Solutions and Interventions:

Figure 6: Proposed Web Platform to show the folding instructions of the cardboard artefacts to be used during activites.

Figure 7: A STEM Education kit designed to teach children about healthcare using Biomedical Sensors.

The approach of the product which will be used is to create cardboard toys for the students to create an engaging learning environment. Where there will be electronics development boards and biomedical sensors that will be deployed. This is done through a narrative in which is about superheroes and augmenting one's senses which can be a powerful narrative tool that can be used to further learning in this dimension.

I truly believe that arming the next generation with awareness about their own health would be the way we stop future pandemic before they happen, and providing them with the tools to empower them to vanquish them.
