IMPACT LABS NIGERIA

INTRODUCTION/ ORIENTATION

CURRENT ENGINEERING PROBLEM IN NIGERIA

Engineering education does not emphasize hands-on experiential learning

+

Several problems affecting communities

→

Opportunity to teach hands-on engineering design and impact communities in a sustainable way

MIT D-LAB: DEVELOPMENT THROUGH DIALOGUE, DESIGN, AND DISSEMINATION

D-lab classes at MIT
D-lab Development
D-lab Design
D-lab Energy
D-lab Education
D-lab Waste
D-lab Health
...and many others
16-20 MIT students

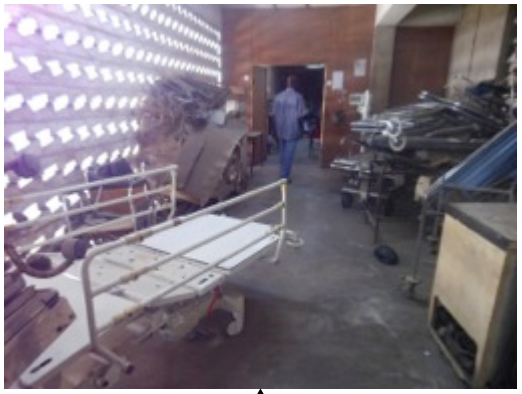
Design projects

i.e. Solar water heaters
Biodigesters
Charcoal stove

Travel, On-the-Ground Research, Implementation

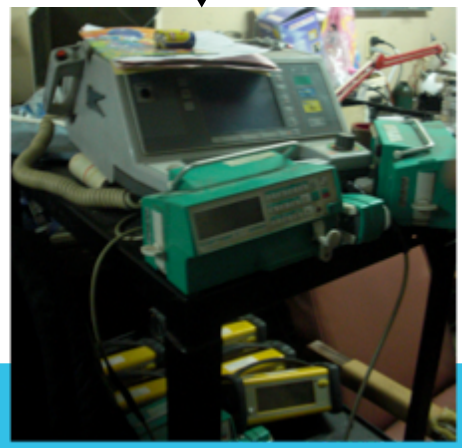
LET’S BREAK SOME ICE!

EXAMPLE: THE WASTELAND OF MEDICAL EQUIPMENT

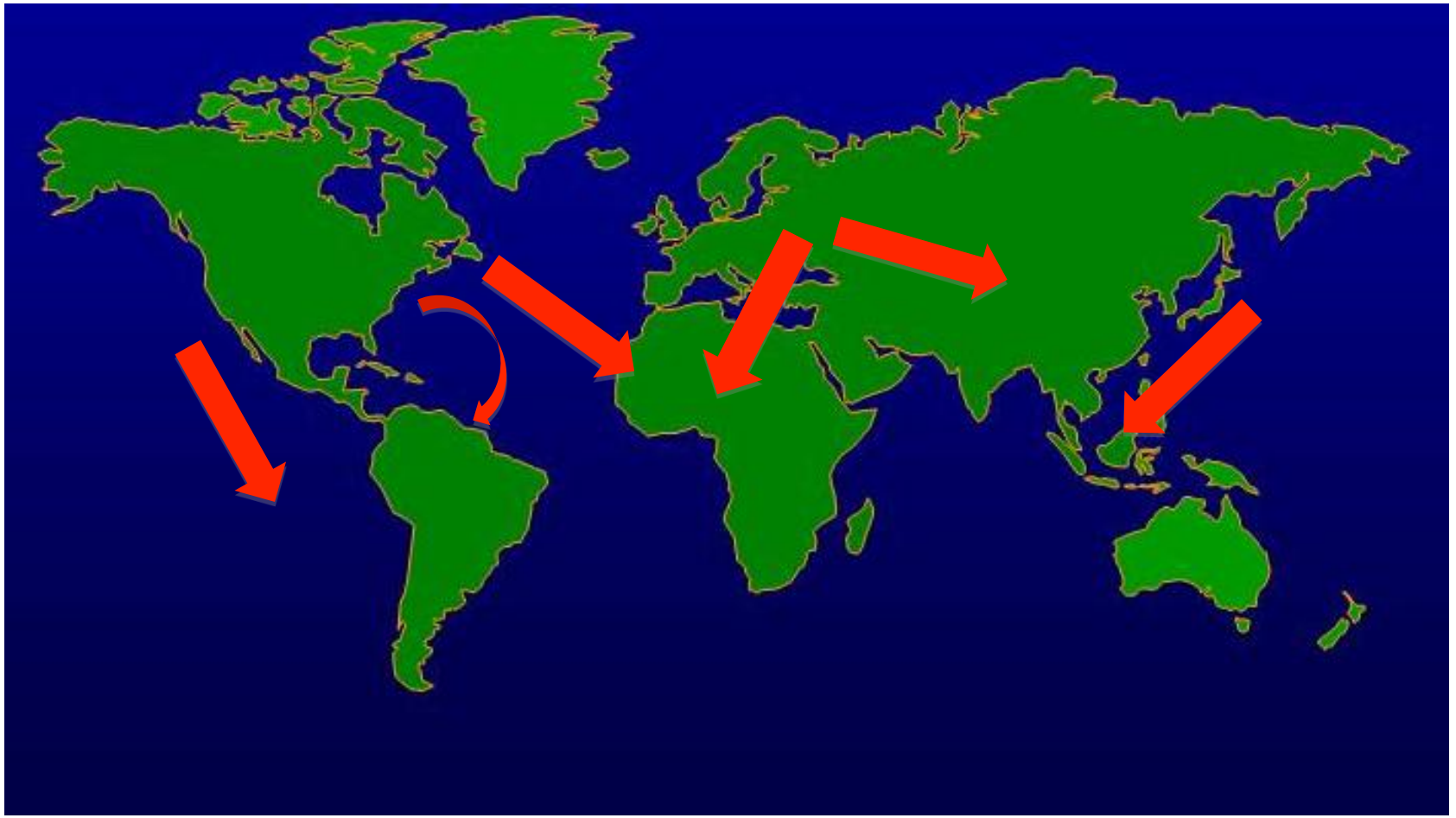


Nigeria

Nicaragua

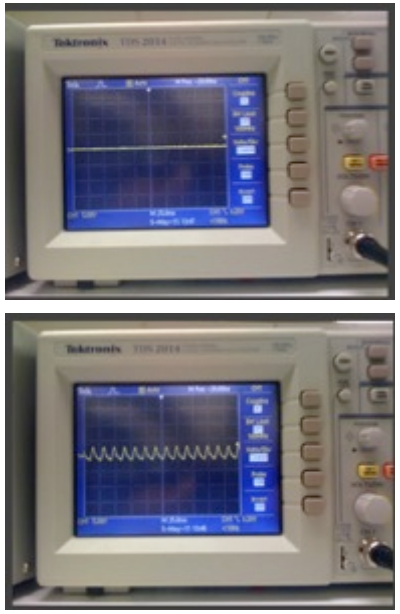


ONE-WAY FLOW OF TECHNOLOGY AND SOLUTIONS



USING A NEED TO IDENTIFY AN OPPORTUNITY

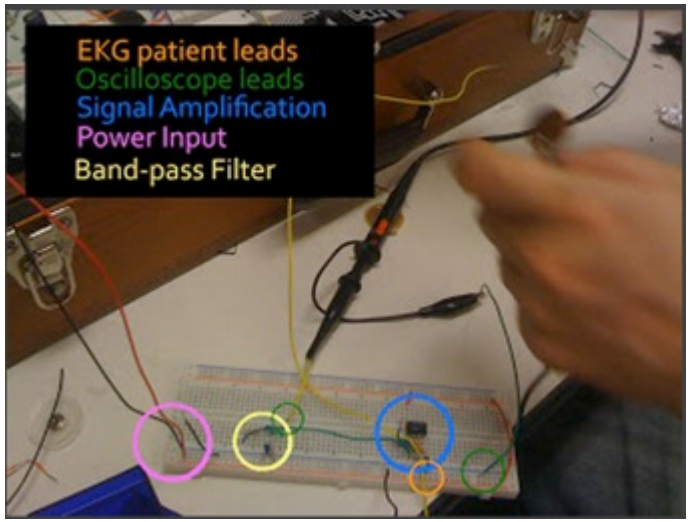
Standard EKG machine



- Function subject to availability of electricity
- Inability to identify sources of malfunction

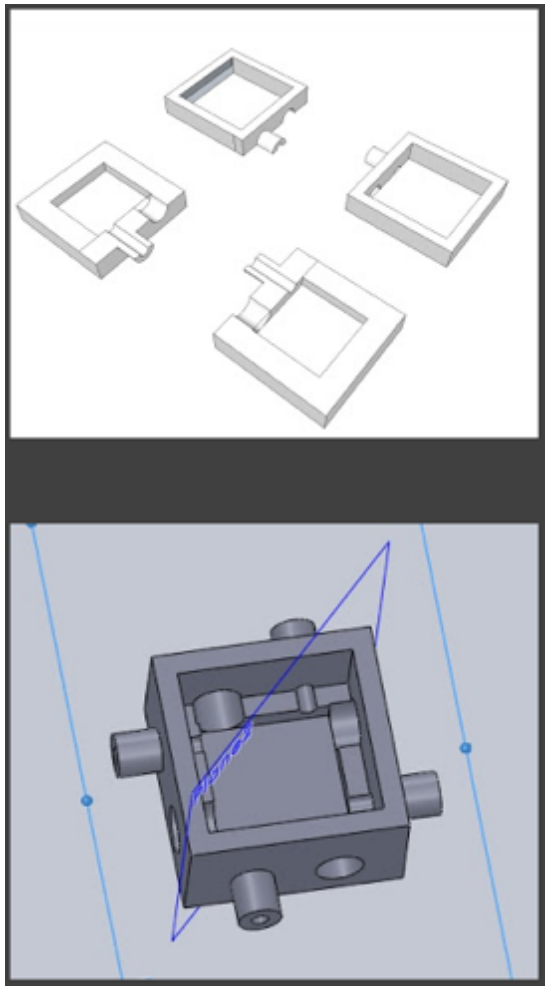
VS.

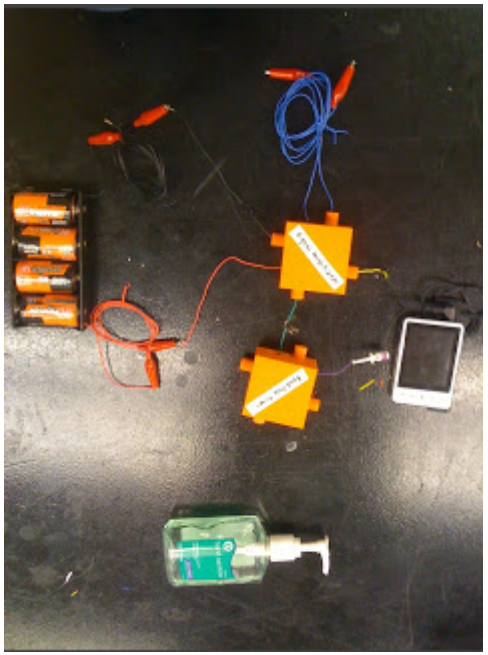
Modularization of EKG functions



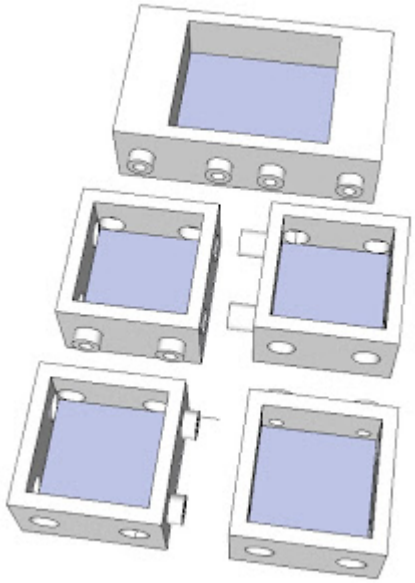
- Battery-powered
- Indicators identify broken parts, and modularity allows for easy replacement

INITIAL DESIGN AND PROTOYPE





SECOND DESIGN ITERATION AND FINAL PRODUCT



NO INVENTION IS COMPLETE WITHOUT PRESENTATION…

MONICOR: An Adaptable, Modular Electrocardiograph (EKG)

Team: David Ku, Mureji Fatunde, Michelle Lu
http://dlab-ekg.blogspot.com/

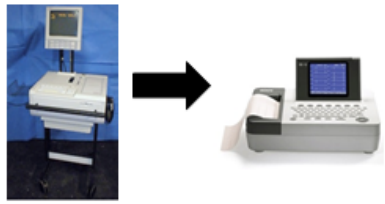
Problem

While EKGs are present in most major healthcare facilities, they are often extremely large, bulky and complicated machines that are difficult and prohibitively expensive to repair. During our time in the field, we came across an EKG machine in the Ocotal hospital that was no longer functioning and was simply waiting for the appropriate repairs. Later, at a rural health center outside of Ocotal, we spoke with a physician who articulated the desire for an EKG and other tools to allow him to diagnose heart problems. This opened our eyes to the fact that smaller, more remote facilities are also interested in this technology but lack the appropriate resources to obtain and use them. Through our project, we intend to address this need for cardiac diagnostic tools. Our challenge is to create an EKG that allows health practitioners at all levels to be able to use, modify and fix as needed.

Background

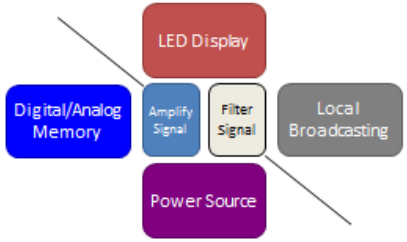
Cardiovascular Disease is one of the leading causes of death worldwide, but its impact is even higher in the developing world, where access to long-term consistent care is the exception rather than the norm. The WHO has estimated that CVD is responsible for 2 DALYs lost /100 capita per year. In Nicaragua, CVD is the single leading cause of death among noncommunicable diseases. This class of illness has a global presence, and the EKG has been recognized as an essential tool for performing advanced heart diagnostics.

Current Technologies/Predicate Devices



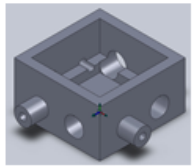
Marquette Electronic Devices (1982) — Edan Instruments (2010)

Design Specifications
(self-containing modules)



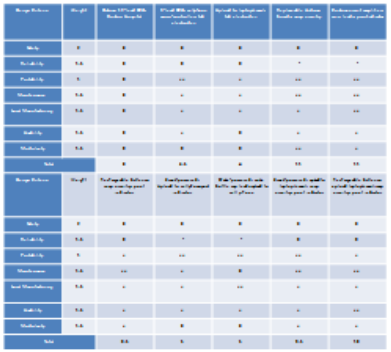
Our Solution: MONICOR

Our primary goal is to build a device that health practitioners in the developing world will not only be able to use, but also be able to manipulate. Thus, our design strategy was to take a vintage technology and add smart design/tech to come up with a new solution. We are breaking the EKG down into modular components and using 3-D printing techniques to build interlocking blocks that will join them together. Each block represents a single element of functionality in the entire device. It is essential that we make these parts robust, cheap, and replaceable so that the device can be repaired when any individual element fails. We are using thermochromic paint as an indictor to alert the user of the EKG which component may need to be swapped out.



We are enhancing the technology by making it connected and smart. We are adding modular components to interface with computers and mobile devices and are considering adding some arrhythmia recognition to the EKG as well. In the long-term, we would like our device to be totally locally manufacturable. By making the EKG so easily changeable we think that local innovation will be encouraged when users of our device come up with new developments that we never imagined.

Pugh Chart



Medical Device Compass Chart

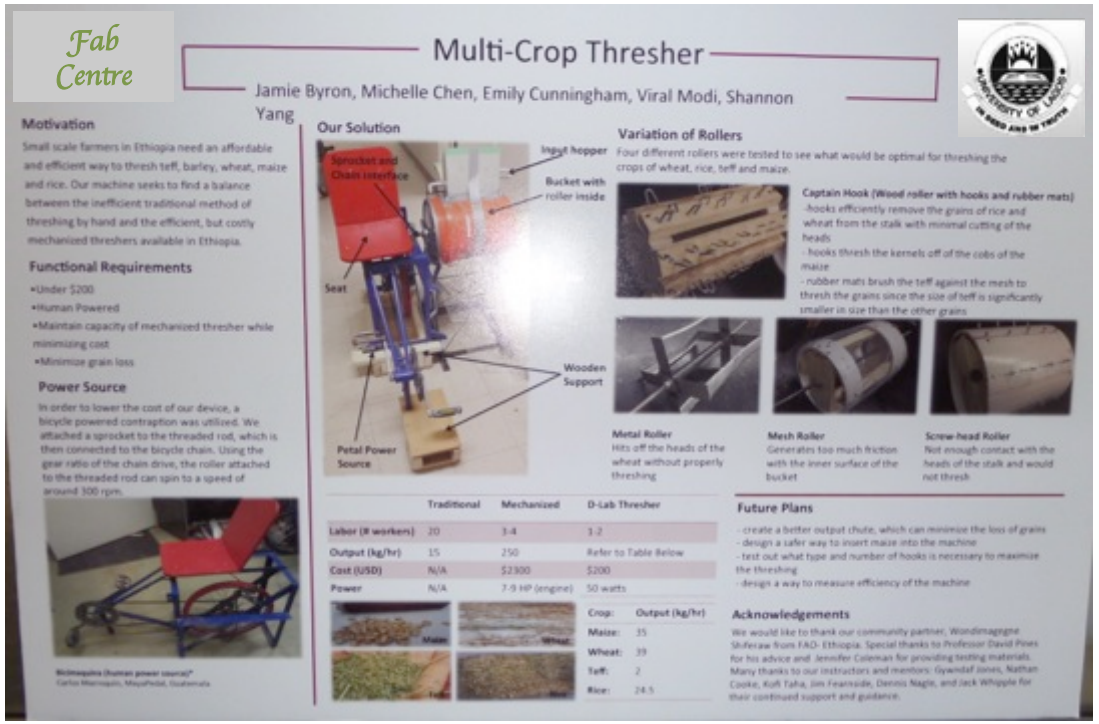
Future Work

- Enable cell phone upload via Bluetooth
- Automate detection of common arrhythmias
- Increase local manufacturability

WEST AFRICAN HEALTH TECHNOLOGY PROJECT

HOW CAN WE EXTRAPOLATE THE D-LAB MODEL?

1. Help locals identify problems in affecting their communities, teach design methods
2. Provide resources to local students to find engineering solutions
3. Implement and provide remote support to projects



Fab Centre

Multi-Crop Thresher

Jamie Byron, Michelle Chen, Emily Cunningham, Viral Modi, Shannon Yang

Motivation

Small scale farmers in Ethiopia need an affordable and efficient way to thresh teff, barley, wheat, maize and rice. Our machine seeks to find a balance between the inefficient traditional method of threshing by hand and the efficient, but costly mechanized threshers available in Ethiopia.

Functional Requirements

- Under $200
- Human Powered
- Maintain capacity of mechanized thresher while minimizing cost
- Minimize grain loss

Power Source

In order to lower the cost of our device, a bicycle powered contraption was utilized. We attached a sprocket to the threaded rod, which is then connected to the bicycle chain. Using the gear ratio of the chain drive, the roller attached to the threaded rod can spin to a speed of around 300 rpm.

Our Solution

Sprocket and Chain Interface
Input hopper
Bucket with roller inside
Seat
Wooden Support
Petal Power Source

Variation of Rollers

Four different rollers were tested to see what would be optimal for threshing the crops of wheat, rice, teff and maize.

Captain Hook (Wood roller with hooks and rubber mats)

- hooks efficiently remove the grains of rice and wheat from the stalk with minimal cutting of the heads
- hooks thresh the kernels off of the cobs of the maize
- rubber mats brush the teff against the mesh to thresh the grains since the size of teff is significantly smaller in size than the other grains

Metal Roller
Hits off the heads of the wheat without properly threshing

Mesh Roller
Generates too much friction with the inner surface of the bucket

Screw-head Roller
Not enough contact with the heads of the stalk and would not thresh

	Traditional	Mechanized	D-Lab Thresher
Labor (# workers)	20	3-4	1-2
Output (kg/hr)	15	250	Refer to Table Below
Cost (USD)	N/A	$2300	$200
Power	N/A	7-9 HP (engine)	50 watts

Crop:	Output (kg/hr)
Maize:	35
Wheat:	39
Teff:	2
Rice:	24.5

Future Plans

- create a better output chute, which can minimize the loss of grains
- design a safer way to insert maize into the machine
- test out what type and number of hooks is necessary to maximize the threshing
- design a way to measure efficiency of the machine

Acknowledgements

We would like to thank our community partner, Wondimagegne Shiferaw from FAO- Ethiopia. Special thanks to Professor David Pines for his advice and Jennifer Coleman for providing testing materials. Many thanks to our instructors and mentors: Gwendaf Jones, Nathan Cooke, Kofi Taha, Jim Fearnside, Dennis Nagle, and Jack Whipple for their continued support and guidance.

WHAT IS IMPACTLABS?

ImpactLabs brings **hands-on education** to passionate young people who want to learn the usage of engineering to make their communities better places to live

This year's session has three goals:

1. Students will learn concepts from our team of Nigerian engineering students
2. Students will build their own projects and document the process for future students
3. Students will present and implement their projects within their home communities

EXAMPLES OF HOMEGROWN SOLUTIONS ARE ALL AROUND US – KELVIN DOE

https://www.youtube.com/watch?v=XOLOLrUBRBY

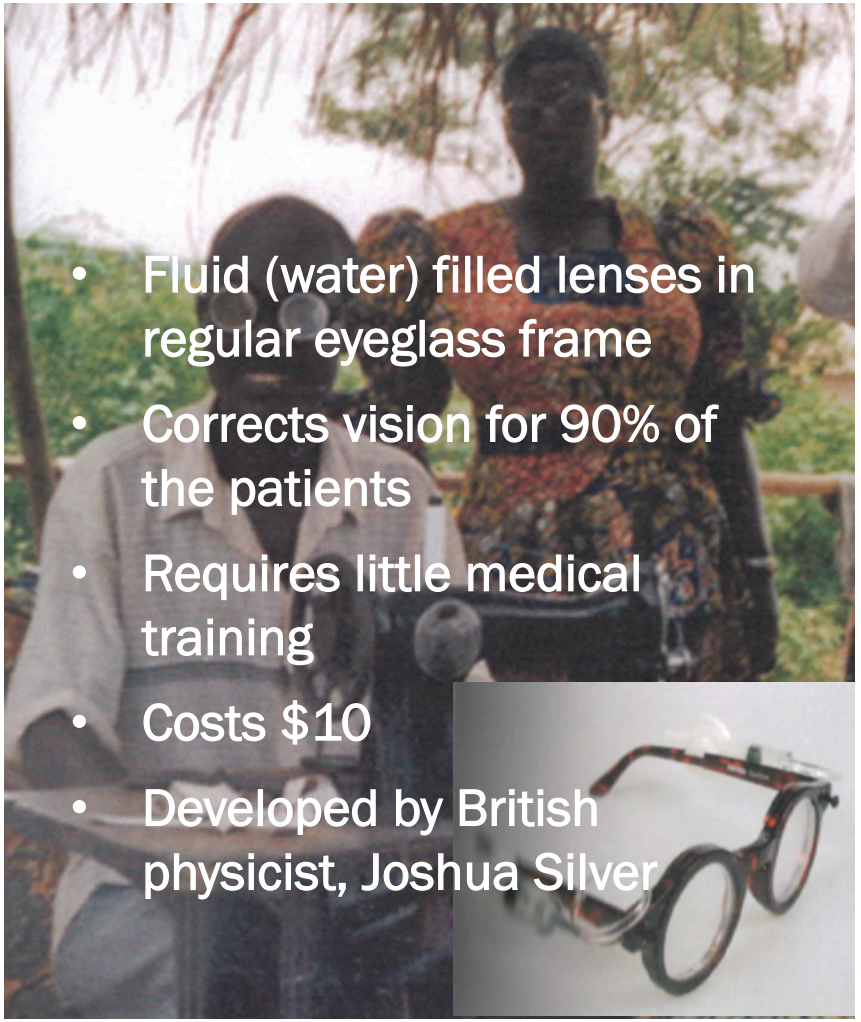
EXAMPLES OF HOMEGROWN SOLUTIONS ARE ALL AROUND US – DR AWOJOBI

ADAPTIVE EYECARE

WHO estimates that 1billion people (10% children) have an unmet need for vision correction

Most of these people do not have access to proper eyecare, or cannot afford the costs.

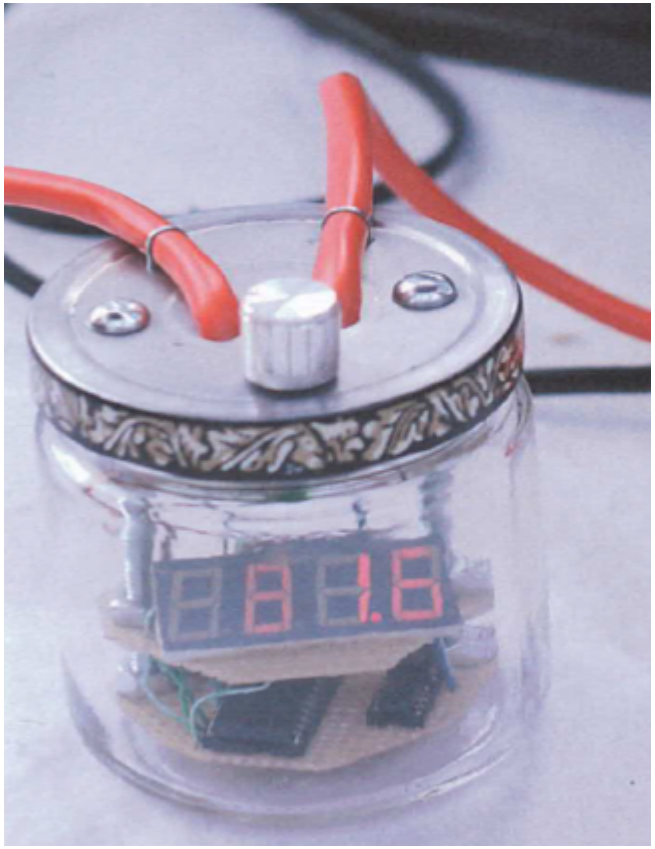
What does an affordable, easily-adaptable eyeglass-substitute look like?



Credit: Design Revolution

ENERJAR

Measures the power used by household appliances. The system consists of a circuit board, potentiometer, LED display , microchip and standard power cord. Developed by 2nd year students at the Washington University in St. Louis.



Credit: Design Revolution

DISCUSSION

1. What do you see in common from the three examples?
2. Does any one particularly strike you? Why?
3. What examples of innovation have you seen or heard of in your school or community?

WHO ARE WE?

JOY

MIT ’13

NWIKE

MIT PhD ‘15

MUREJI

Harvard ‘12 (MIT D-Lab ’11)

TUNDE

MIT SM ’15 ‘15, PhD ‘17

WEEK 1 OVERVIEW

- Background concept
- Lesson/ demo
- Guest speaker
- Discussion

	Activities	Major milestones
Monday	Orientation/ introduction Energy Corn sheller	
Tuesday	Water Solar water heater unit Bola Akeju- WeCyclers	
Wednesday	Biomass Bag biogas digester Omowunmi Afolabi- NPHDA Brainstorming session	Project teams finalized
Thursday	Charcoal briquetting Career paths Brainstorming/ planning session	
Friday	Group planning session Team project discussion	Group project ideas and budgets approved

Week 1 goal: Build familiarity with Impact Labs' mission and basic conceptual foundation that will be applied to group projects

DOCUMENTATION PROCESS

- Purpose:
  - Learn skills necessary in instructing others in creating a product
  - Help others understand the steps used to make your final product
  - Maintain full public and private record of your design process

Notes

- During each day, you should take notes and draw diagrams for what you did. This is easiest to be done immediately after you have finished working, as you will have the process fresh in your minds. Pay particular attention to
  - Date
  - Materials Used/Approximate cost of materials
  - Approximate amount of time used for each step
  - Challenges that came up
  - Questions you have for the facilitators

Photographs

- An important part of the design process is not only to have physical drawings of your designs, but also to include photographs of what you were actually able to build.
- In taking photographs, be sure to label or make note of different parts and materials used.
- A photographer will be taking pictures of you all as the process is going on, so try to focus more on taking step-by step pictures of your work so they correspond to your notebook and cloud documentation.

CLOUD DOCUMENTATION

- If someone in your group is more used to programming or prefers that method, WordPress allows you to both edit/write in text, as well as in HTML

- Tumblr gives you more flexibility of design in your documentation, with a simple way of documenting your process

- Blogger is similar to WordPress in its documentation style

- If you are not as familiar with the other tools and want to usesomething familiar, we advise you to create a Facebook group

DOCUMENTATION GUIDELINES

- You must show your hardcopy notes and pictures to one of your facilitators at the end of each day
- Please select one of the four cloud documentation formats to record your group's progress online
  - Please create a private account (or Facebook group) and provide the login to your teammates and facilitators to monitor your progress
  - You may use part of your building time to have at least one team member documenting your process
  - We expect your group's cloud documentation to be updated at least every other day once you are in your final groups. We will be checking!
- Format for each entry:
  - Title related to what you did for the day
  - At least 3 photographs with a brief description
  - A detailed description of what you did since the last entry
    - Comment on whether or not you accomplished all goals from the last post (see next)
  - An outline of what you intend to have accomplished by the next post
  - Improvements that you think can be made to your product

HAPPY DOCUMENTING!!