Neonatal Incubator

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February 12th, 2020

Team Members

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Introduction of Project

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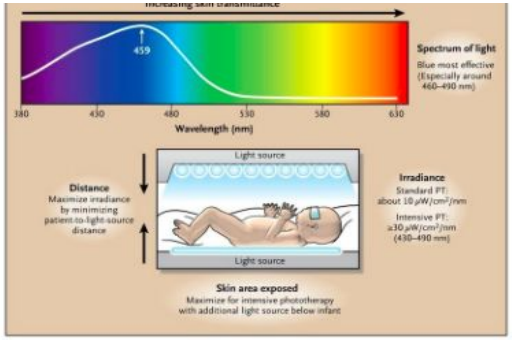
Background:

In Ghana, it is challenging to maintain and procure funds to purchase commercially available incubators and blue light therapy equipment most of which is produced outside the country.

Introduction of Project

Concept:

- Provide and demonstrate a prototype neonatal incubator incorporating blue light therapy
- Design must be manufacturable in Ghana and should be cheaper than the available commercial options
- Prompted by Dr. Okyere-Frempong, administrator of ~200 employee hospital in the Ghana Capital
- Design should provide essential functions of a neonatal incubator and should also be transportable for use in rural regions of Ghana
- Design must be locally maintainable, and materials and components should be locally sourceable



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Initial Research - State of the Art

Average Cost:
GE Giraffe: $2,500 - $13,952.00
Dräger Caleo(used): $3,400 - $5,500
Dräger Isolette: $2,950 - $3895

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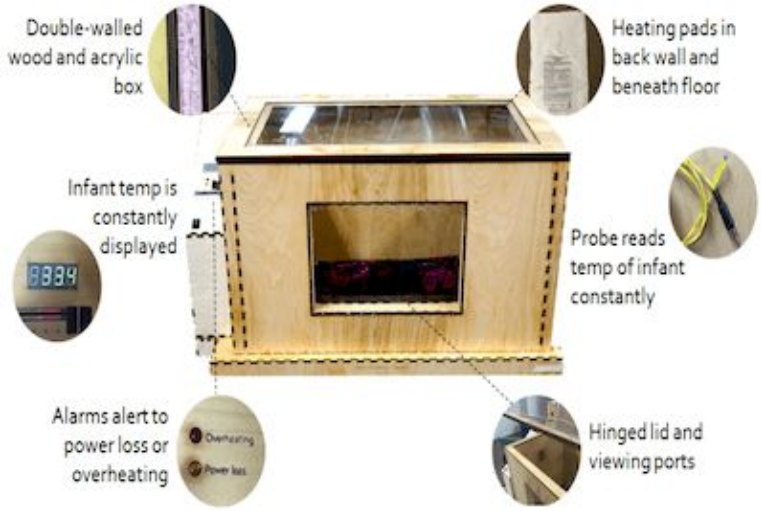
Initial Research - State of the Art
Low cost incubators



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Identification and Ranking of Possible Features

1 - Absolutely Necessary	2- Extras	3- Completely new

- **Sensors**:
  - Temperature
  - Humidity
  - HR
  - O2 Saturation
- **Mechanical Capacity**:
  - Capacity to be on a stand
  - Hand access to baby
- **User interaction**
  - Instructions Manual
  - User interface
  - Calibration system
- **Electrical Requirements**
  - O2 Filter
  - Motor Powered Fan
  - Exhaust Fan
  - General Illumination
	- **Sensors**
	  - Apneia
	  - Weight
	- **Electrical Requirements**
	  - Backup Battery
	  - Interchangeable Power Supply
	  - Redundancy + Maintainable Electrical Components
	- **Mechanical Capacity**
	  - Inclination
	  - Detachable Hood
		- Dual Chamber
		- Heat Cleaning
		- Blue Light Incorporation
		- Cabinet space
		- BP Sensor

Sources of Information

James Stubbs
Medical Device Company Executive & Investor
Professor - Ga Tech Biomedical Engineering

Matthew H. Merves, MD
Assistant Professor of Pediatrics
Division of Neonatology Emory University School of Medicine

Irma Raquel Tabares, MD
Pediatrician Neonatologist
PROCAREN UCI-NEONATAL
Caldas, Antioquia, Colombia

Matthew Khoory
Co-founder mOm Incubators

Susan Zachariah, MD
Ghana Pediatrician Specialist
Korle-Bu Teaching Hospital, Accra

Theophilus Ofori
Biomedical Engineer
Korle-Bu Teaching Hospital, Accraa

Alfred Selorm Betepe
Manufacturer
CEO Seloart Group

Main Takeaways

- The main necessity of an incubator is as a source of thermoregulation.
- Humidity is a plus but not entirely necessary.
- Quick access to the baby is essential
- Important considerations for devices in Ghana
  - Power outages can be as long as 6 hours long
  - Transportation compatible
- Fabrication options available in Ghana
  - Laser cutters
  - Vacuum Forming
  - Metal Bending

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Final Project Proposal

We will design and construct a neonatal incubator that is appropriate for travel in a vehicle. It's main purpose will be the thermoregulation of the patient and the monitoring of the patient's basic vital signs. It will be manufacturable with the local resources available in Ghana.

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Current Status - Materials and Cost

Bill of Materials	Price per unit	Units	Price total
Plexiglass	$273.33	1	$273.33
Cabinet Hinge	$2.00	4	$8.00
Large Hinge	$3.40 per 2	1	$3.40
Small Hinge	$2.18 per 2	1	$2.18
Latch lock	$6.65	4	$26.60
Hasp Lock	$5.00	6	$30.00
Large L-bracket	$2.98	2	$5.96
Handle	$6.38	2	$12.76
PVC pipe	$1.98 per 10 ft	1	$1.98
90 deg electrical PVC	$0.94	1	$0.94
Aluminum	$307.80	1	$307.80
Fan	$7.00	2	$14.00
Heater	$90.00	1	$90.00
Raspberry Pi 4	$35.00	1	$35.00
Monitor	$79.95	1	$79.95
Ambient Temperature sensor	$9.95	2	$19.90
Patient Temperature Sensor	$9.95	1	$9.95
Humidity Sensor	$9.95	1	$9.95
Heart Rate Sensor	$24.90	1	$24.90
O2 Saturation Sensor	$20.63	1	$20.63
		Total Price	**$977.23**

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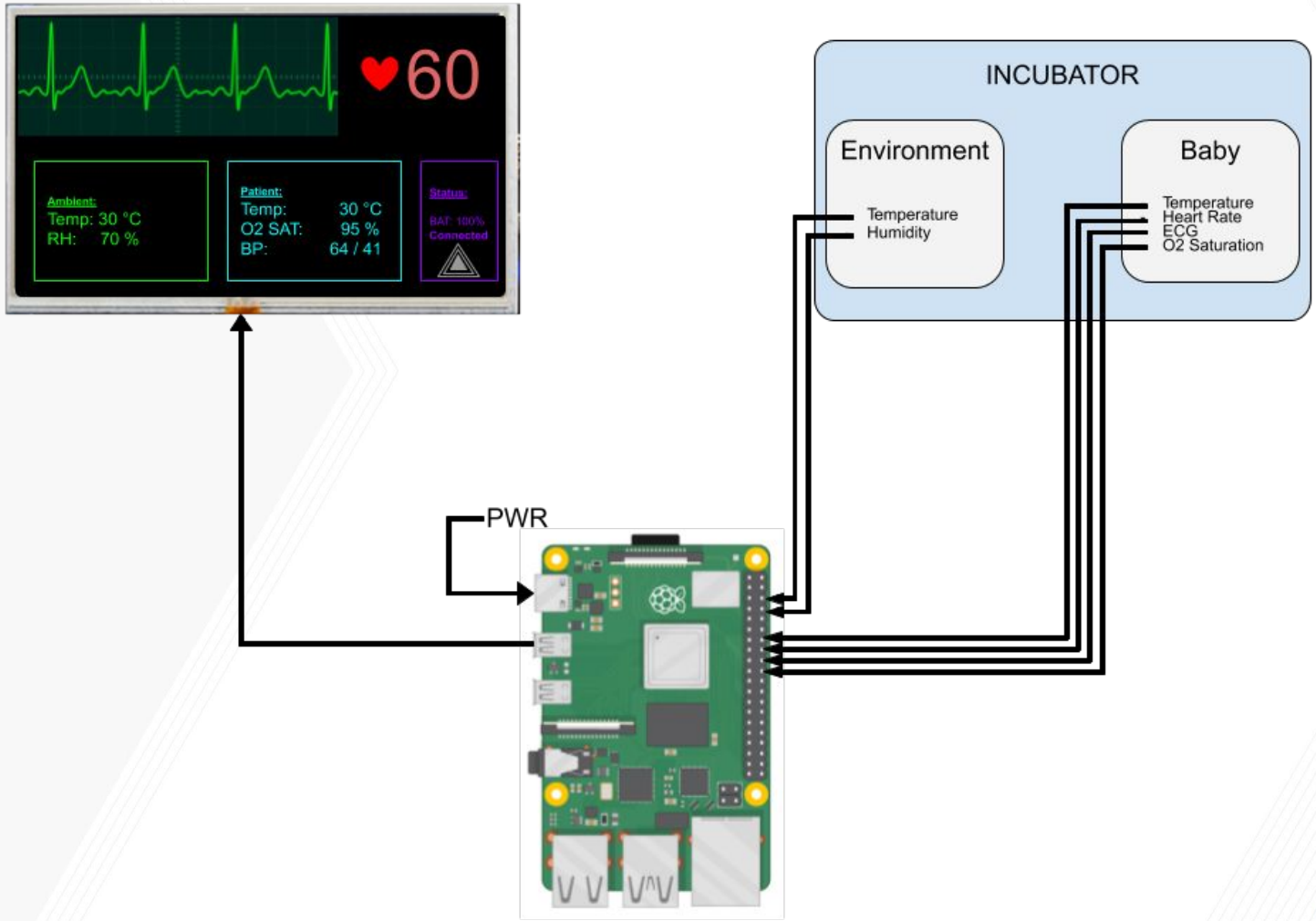
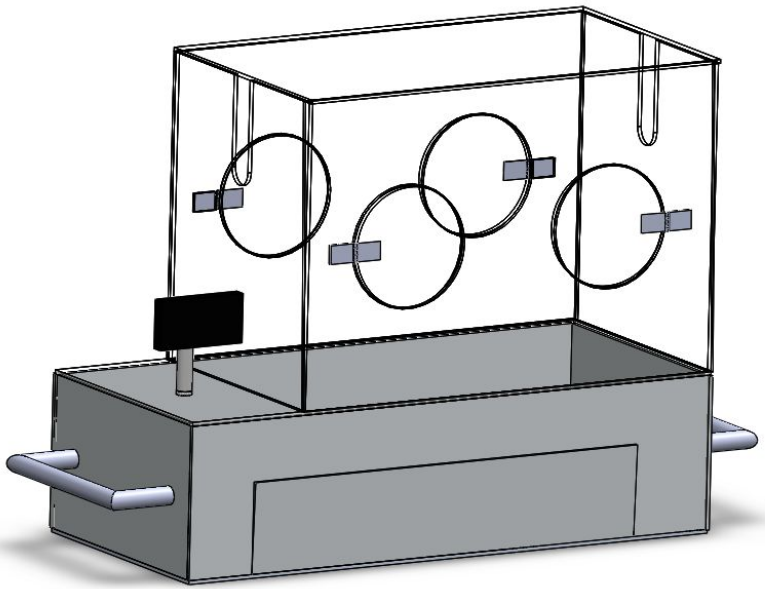
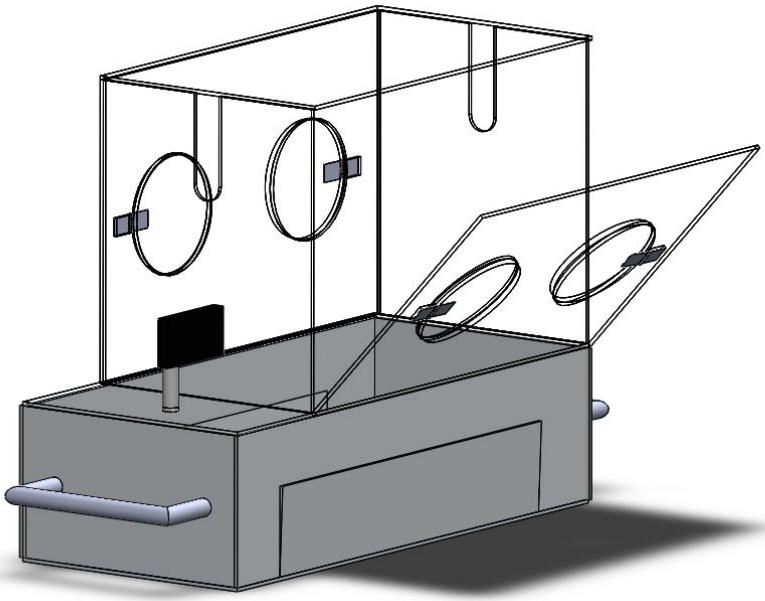
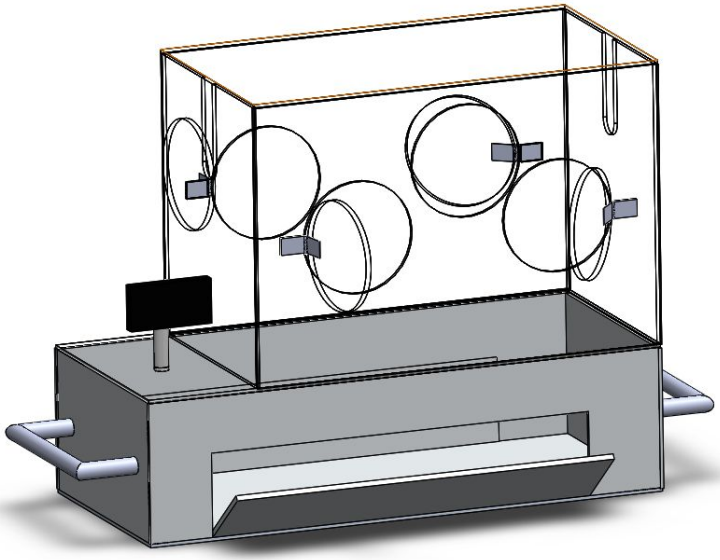
Current Status - Monitoring System



Current Status - Design







Questions?

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