

# **GLUCOSE MONITORING DEVICE**

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# Objective / Background

Colorimetric test strips and an accompanying app for diabetics in Kampala within constraints of cost, manufacturability, and user-friendliness

# Background



**4.2% or 63,297**

Diabetic Prevalence and Diagnosed Diabetic Population



**\$287.62**

Average Household Income

# Design Criteria

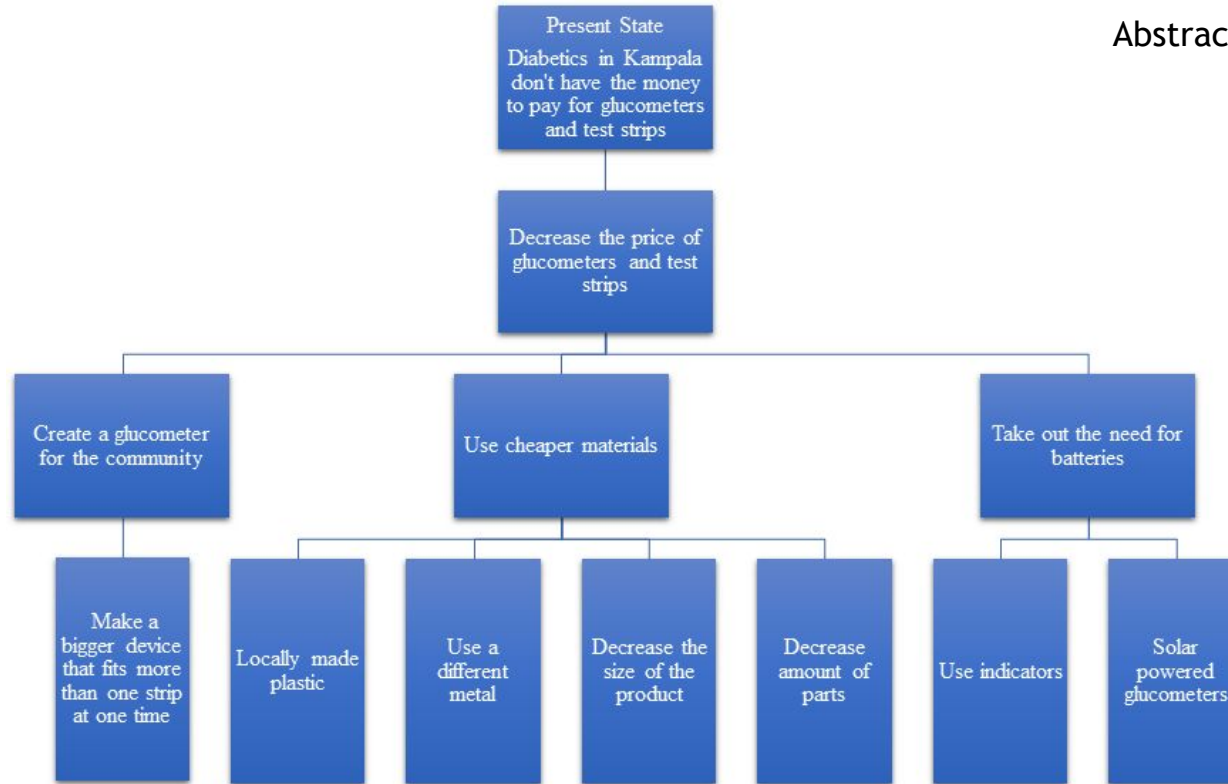
- Cost
- Functionality
- Usability
- Locally reproducible

# Glucose Testing Process

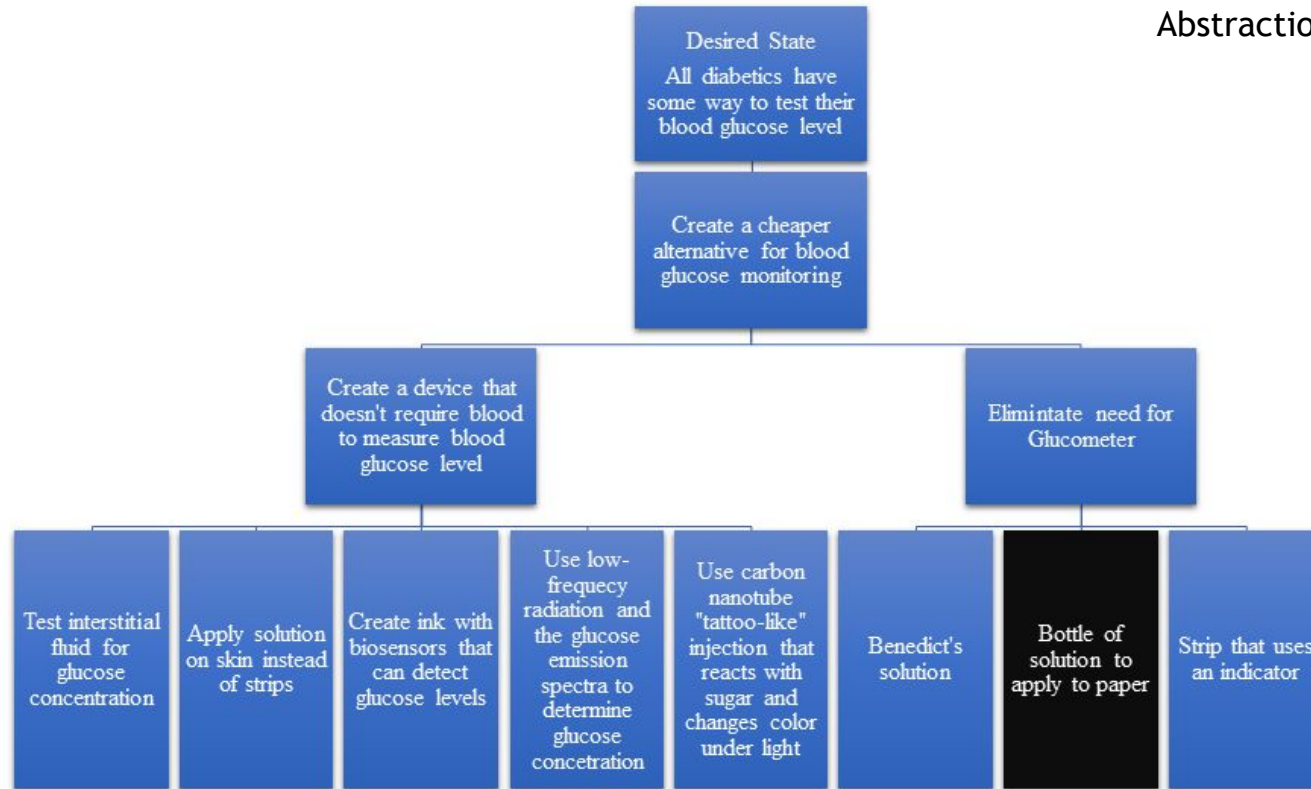
Blood is placed on a strip and changes color based on the concentration of the glucose.

# Methodology/Solution

- Colorimetric test strips with emphasis on:
  - Different Enzymes & Indicators
  - Improved Image Processing
  - RBC Separation



**Figure 1A: Duncker Diagram (Present State)**



**Figure 1B: Duncker Diagram (Desired State)**



# Decision Matrix

	Cost	Portability	Performance	Ease of Use	Sustainability	Locally reproducible	
Weighting	100	50	100	85	60	70	Total
Design Alternatives							
Bottled Solution	9 900	9 450	9 900	7 595	6 360	5 475	3680
Community glucometer	5 500	0 0	9 900	8 680	6 360	4 280	2720
Carbon nanotube tattoo	1 100	9 450	9 900	8 680	8 480	0 0	2610

# Proposed Design

## Indicators:

- Iodine-starch (control), Redox, Acid/base

## Primary chemical reaction:

- Glucose oxidase, Yeast

## Software:

- Control (eliminate RBC color and lighting)
- Statistical analyses

# Proposed Design

## Other improvements:

- Glass Fiber Mesh
- Different Papers

## Models:

- Glucose solutions
- Marker and paper optical calibration

## Occam's Razor

- Reject Glucometer for Test Strips
- Reject Centrifuge for Glass Fiber Mesh

# Detailed Approach

- Create standardized glucose solutions
- Systematically test all pairs of reagents and indicators
  - Test an indicator with each indicator, at same glucose concentration, for every glucose concentration
  - Repeat for every glucose concentration
- Take picture for future analysis



control



indicator 1



indicator 2

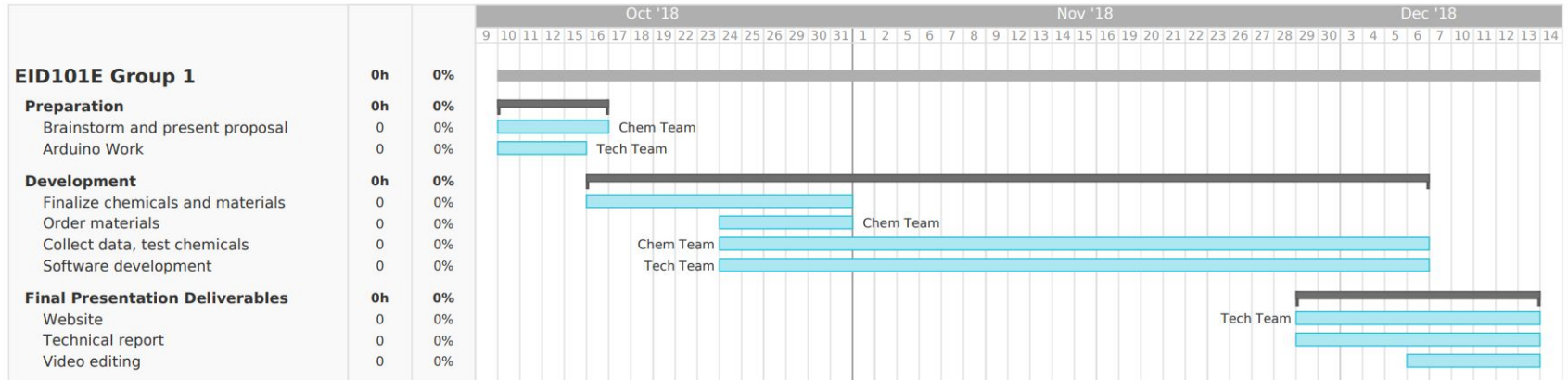


indicator 3

Do once for every reagent at every glucose concentration, take picture

# Cost Analysis

Item	Cost of Item
Chemicals/Materials	<\$0.01 per strip
Software and Information Distribution	\$0



**Figure 2.2A: GANTT Chart**

<b>Role</b>	<b>People</b>
Leaders / Primary spokespeople	Vincent, Emily, Peter
Note-taking	Amy
Designing, modeling, prototyping (chemicals)	Catherine, Emily, Peter, Vincent
Designing, modeling, prototyping (data analysis and software)	Amy, Jon
Webmaster	Jon, Peter
Technical Report	Jon, Vincent, Catherine, Amy

**Figure 2.2B: Primary Responsibility Chart**

# Challenges

- Finding a non-toxic, low-cost, locally sustainable alternative chemical indicator
- Accurately and reliably analyzing the color to determine blood glucose concentration



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