



Designing an Anthropometric Measurement System for Hospitals in Malawi

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Areas of Research

- Countries
 - Malawi
- Organizations
 - Baobab Health Partnership
 - KCH



Diseases

- HIV/AIDS
 - Wasting
 - WHO Staging
- Malnutrition
 - Acute
 - Chronic
- Obesity



Diagnostic Tools

- Anthropometrics
 - General Population
 - Height
 - BMI
 - MUAC
 - Hip to Waist Ratio



Diagnostic Tools

- Anthropometrics
 - Babies/Children
 - Head Circumference
 - Length



Treatments

- Antiretroviral Therapy (ART)
- Therapeutic Nutrition
 - Nutritional Supplements
 - Diet



Treatment Issues

- Measurement Error
- Lack of staff
- Difficult Record Keeping



Design Questions

- How can intra and inter operator error be reduced for anthropometric measurements?
- How can the system deployed at KCH better collect and transfer data without paper or unnecessary transcriptions?



Idea for error reduction

- channel measurements directly into Baobab System
 - Bar-code scanning measurement tape
 - Retrofit other measurement devices for scanners

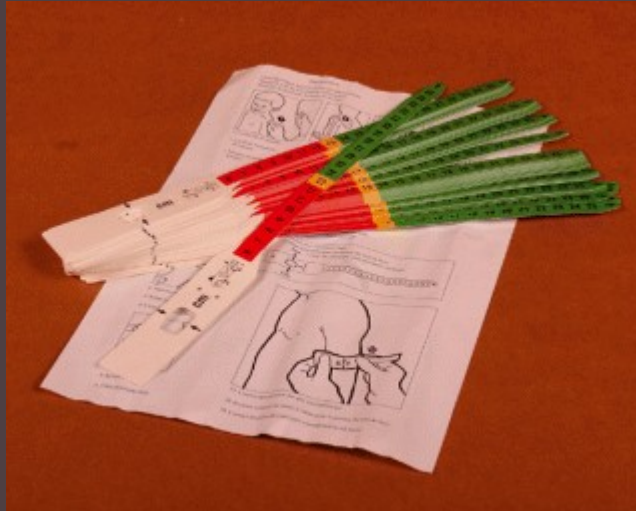


Domains

- Anthropology
- Engineering
- Medicine



Precedents



Precedents

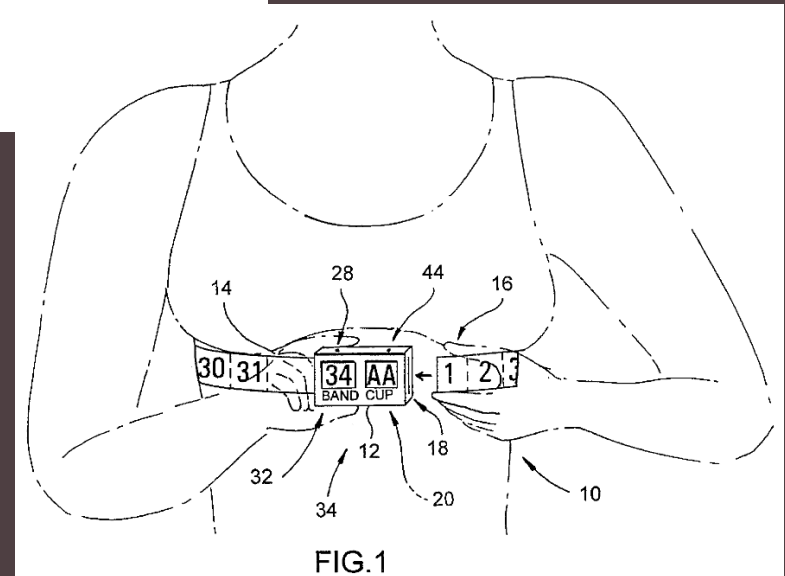
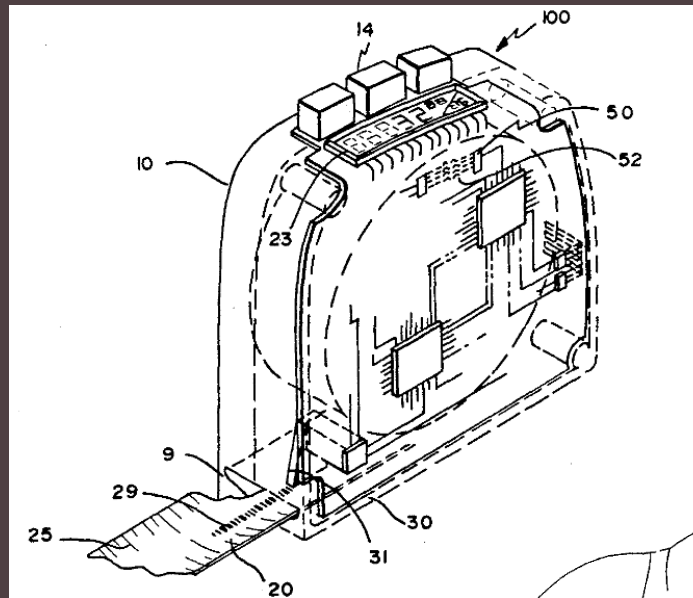
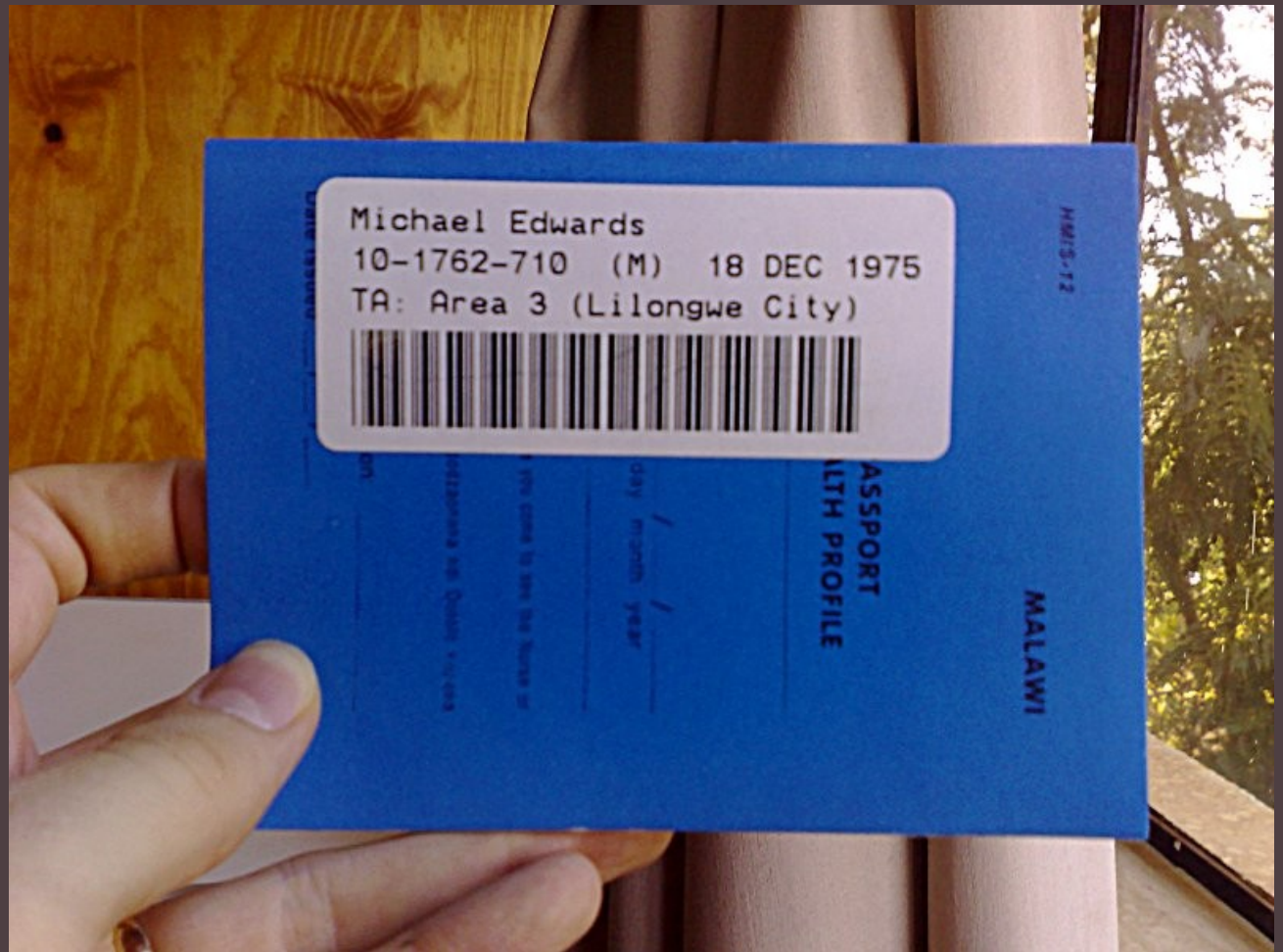


FIG.1

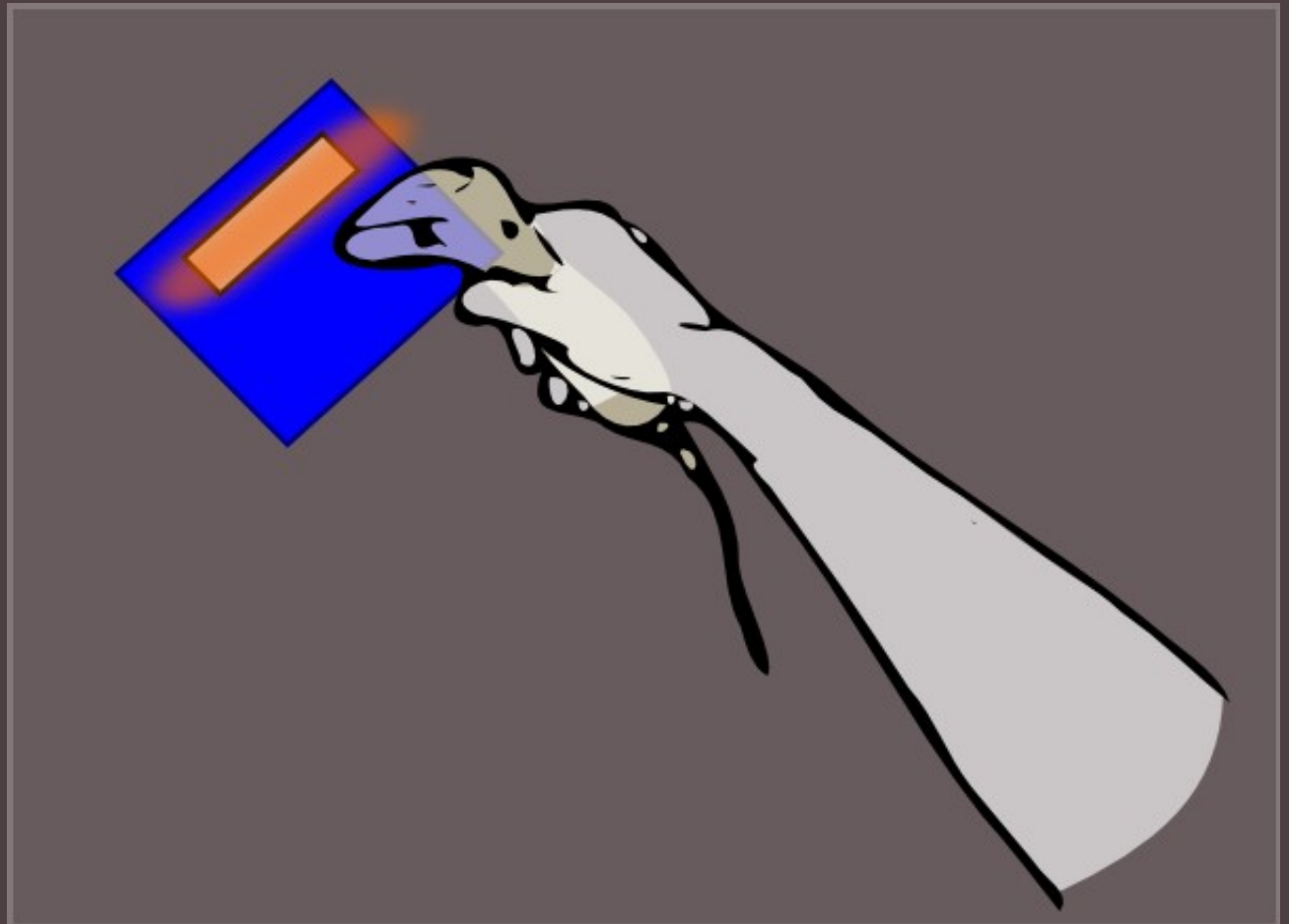
The Baobab Appliance



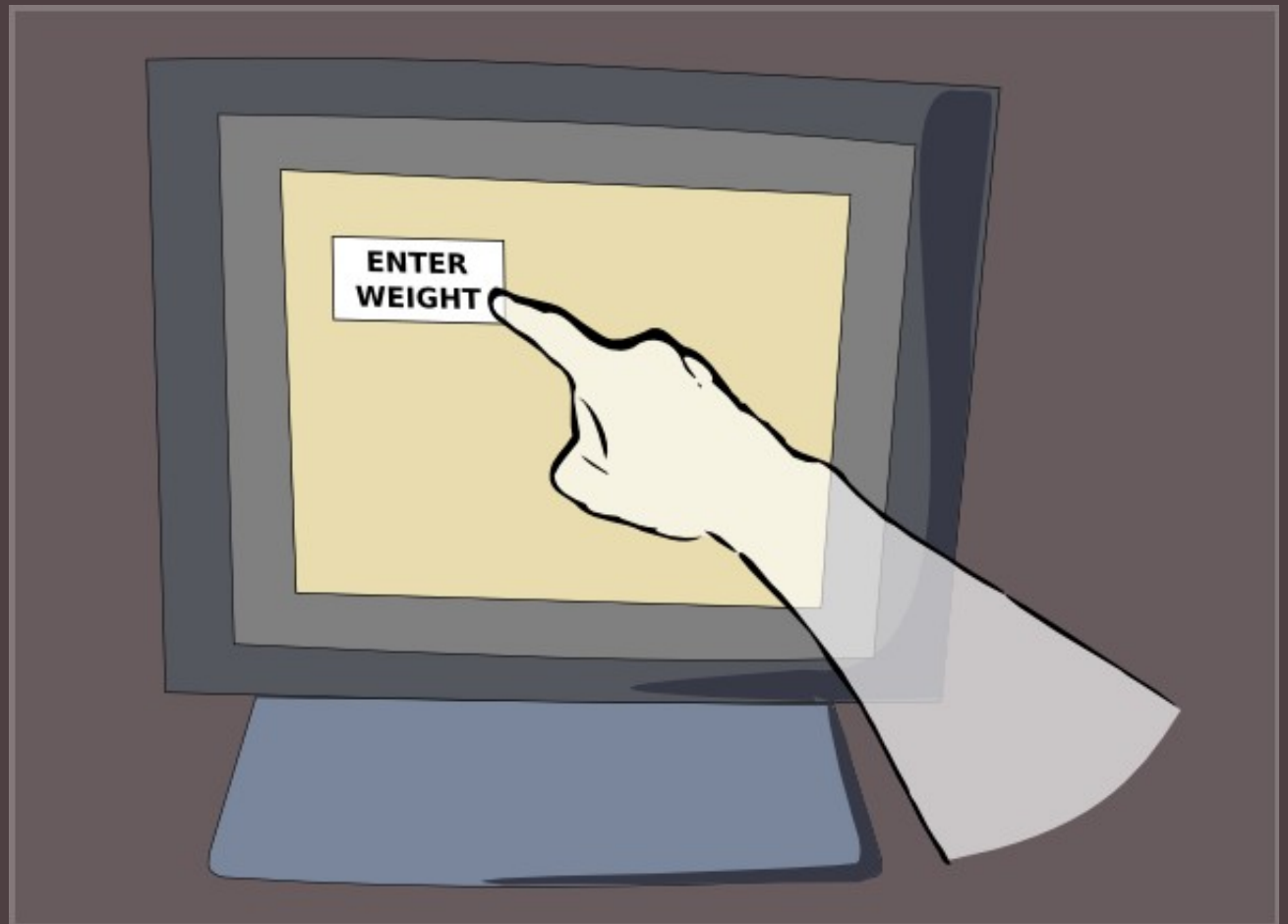
Health Passport



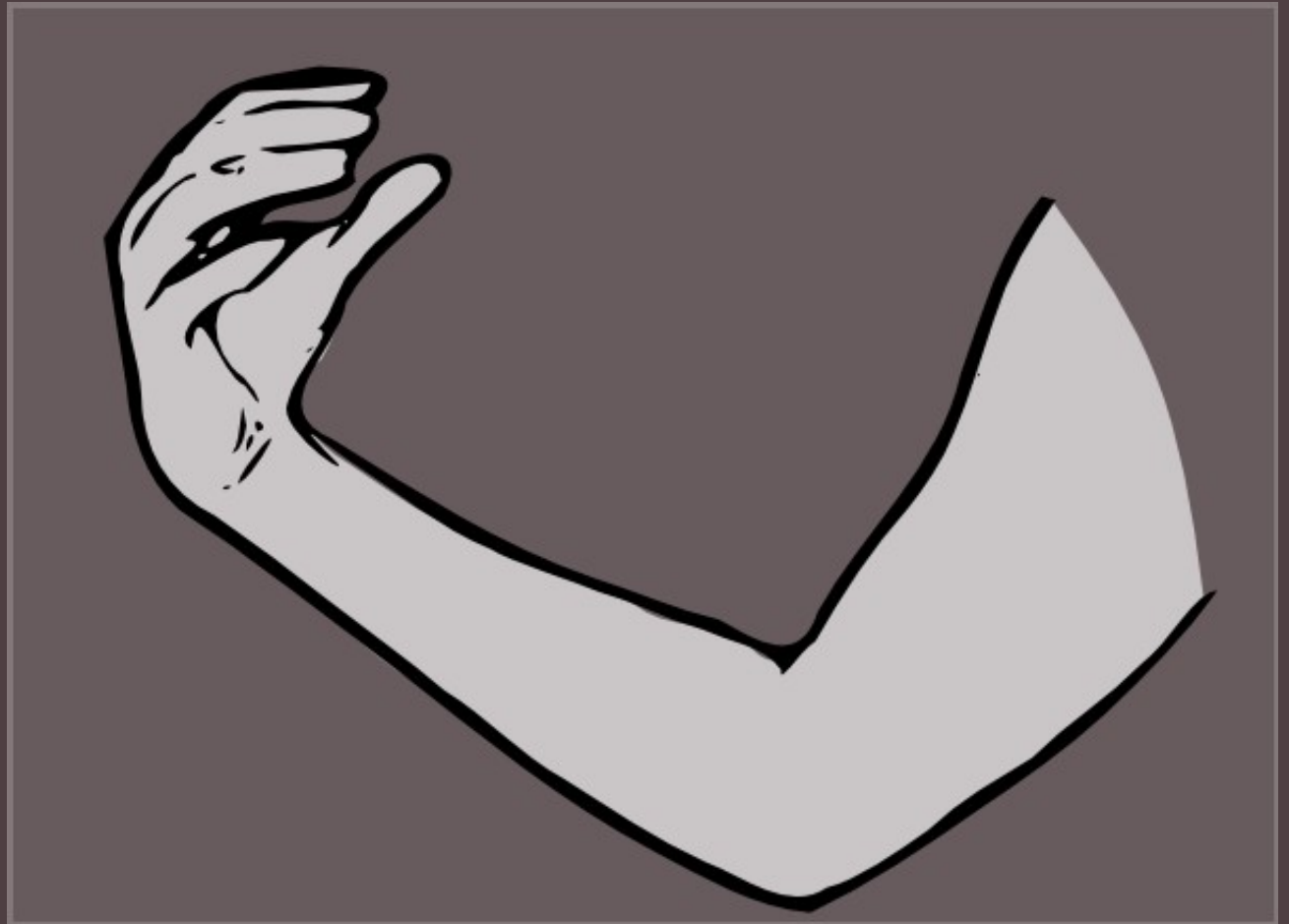
Passport Scanned



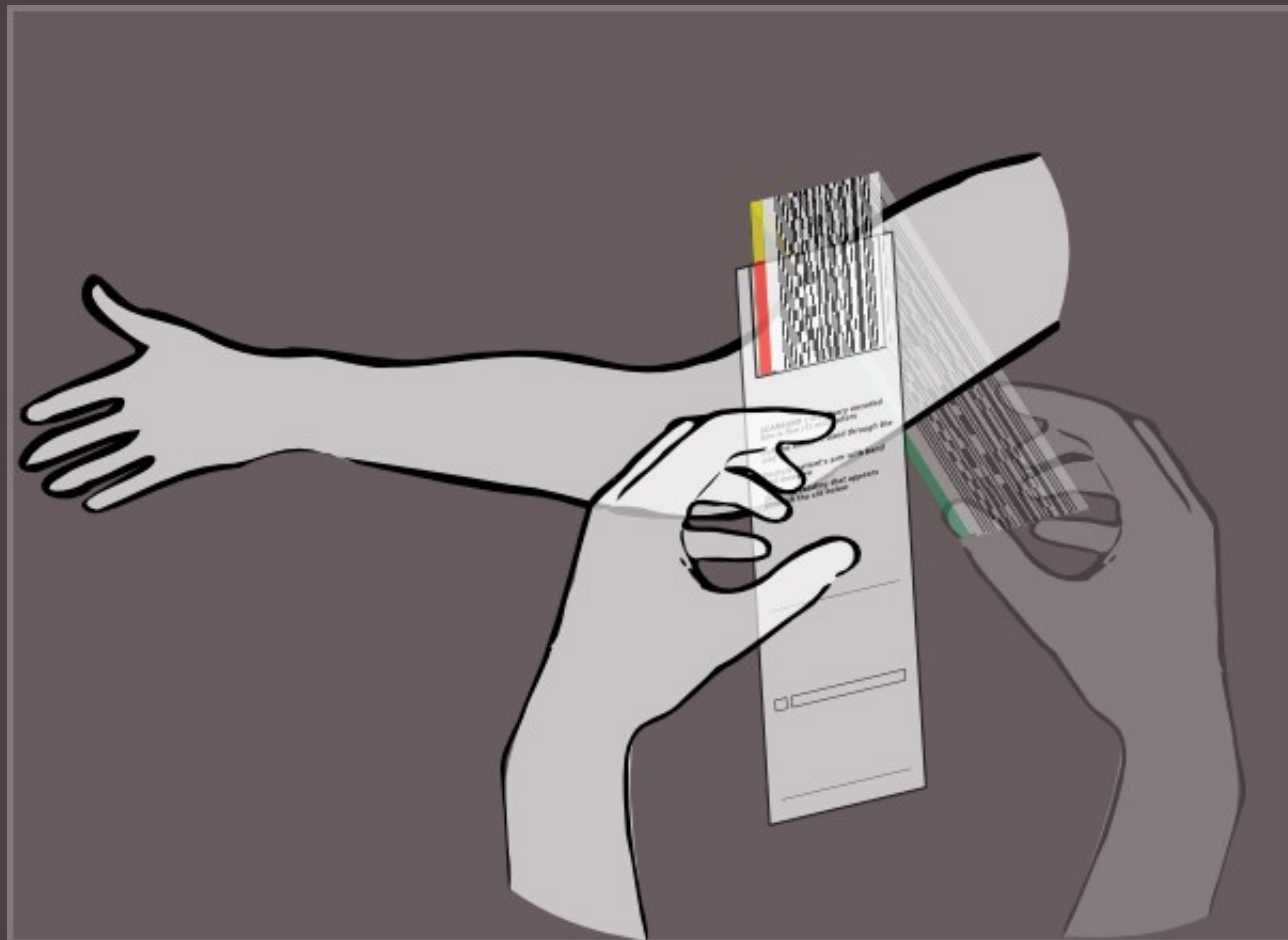
Begin Entry



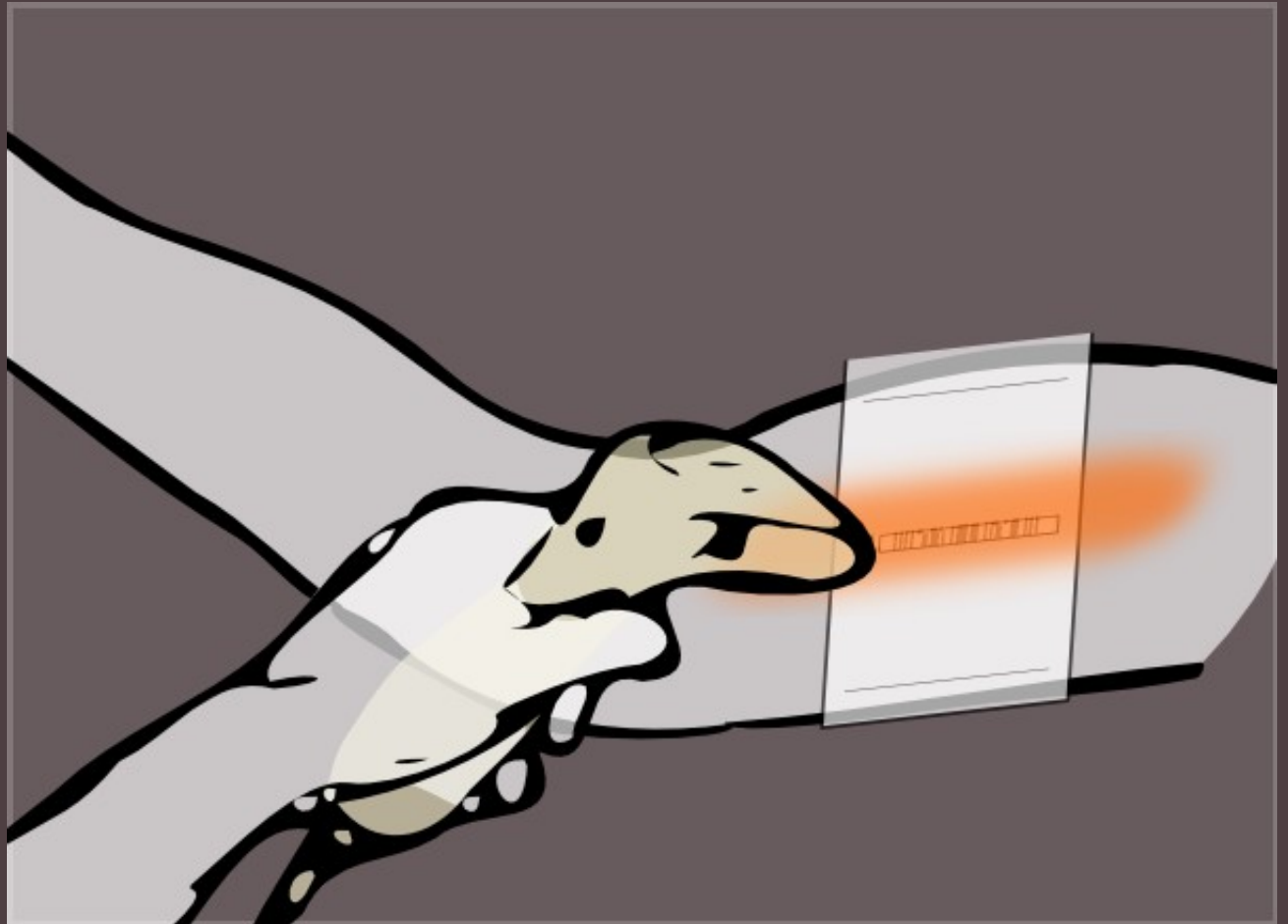
Patient Presents Arm



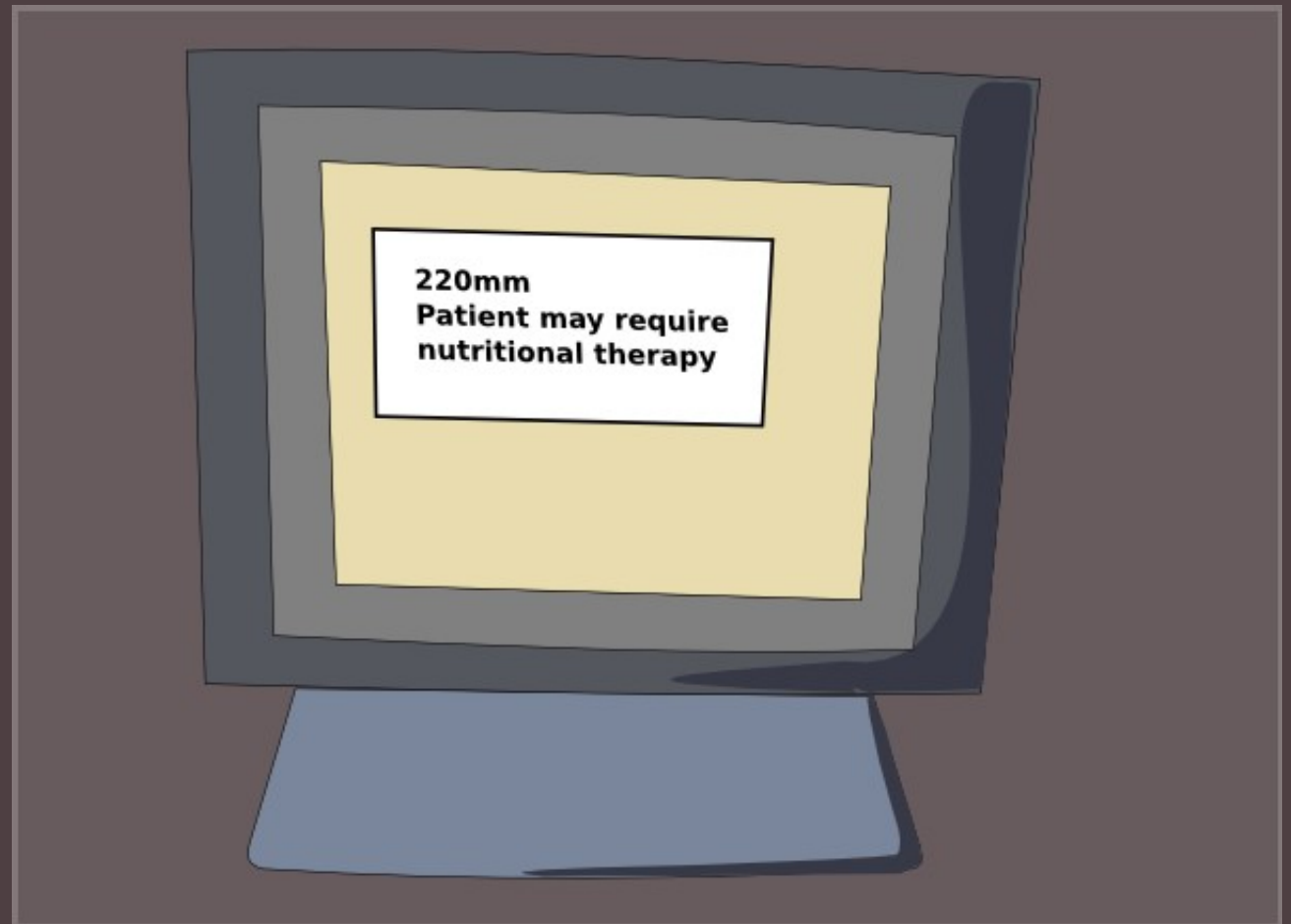
ScanBand Fitted



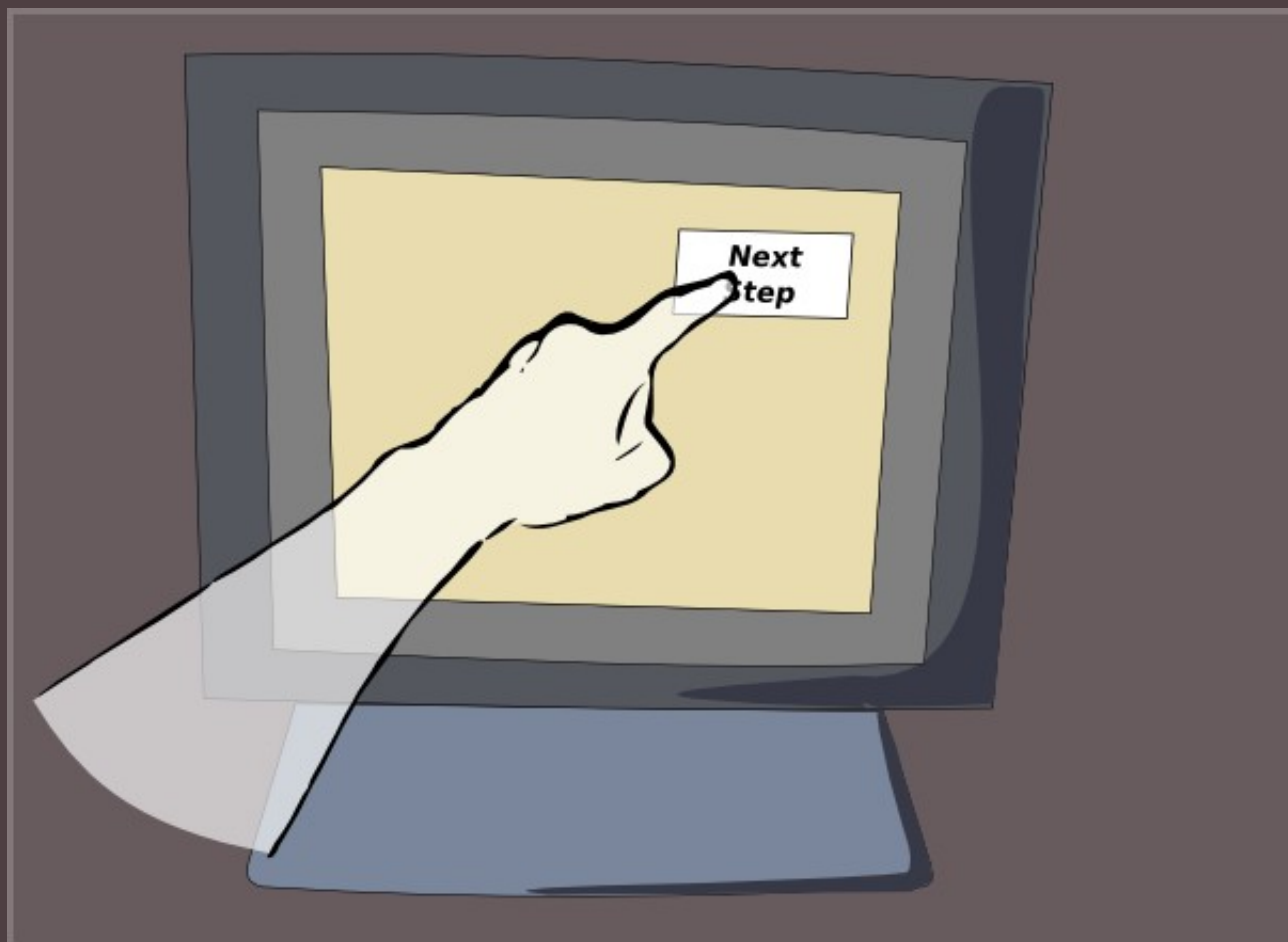
Bar Code Scanned



Measurement Recorded



Operator Continues



Iterations



Diagram illustrating the use of the SCANBAND v 0.1 device for measuring a patient's arm. The device consists of a vertical strip with a series of encoded lines. The instructions are as follows:

SCANBAND v 0.1 Every encoded line is one (1) millimeter

Pull the encoded band through the slot


Encircle patient's arm with band and measure

Scan the reading that appears through the slit below

Below the instructions, there are three horizontal lines for recording the measurement:

Iterations






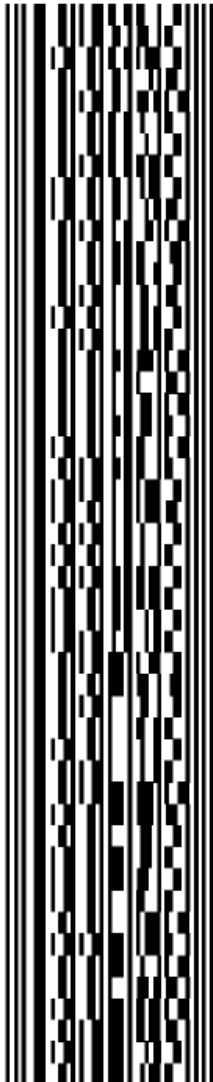



SCANBAND v 0.2 Every encoded line is five (5) millimeters

Pull the encoded band through the slot

Encircle patient's arm with band and measure

Scan the reading that appears through the slit below

☐ 





Iterations

100
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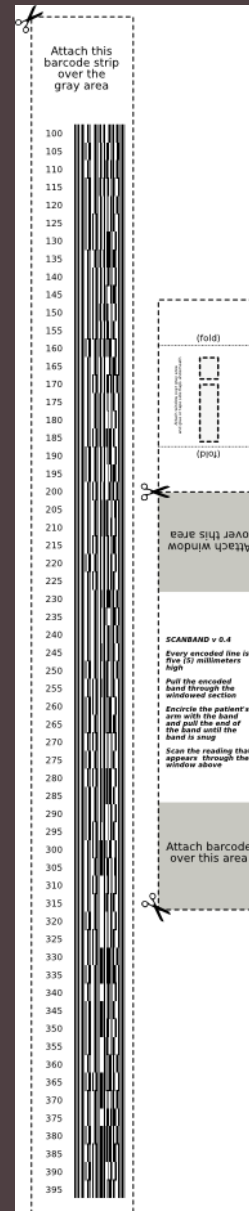
Attach Window
Over This Area

SCANBAND v.0.3 Every encoded line is 100 millimeters
Pull the encoded band through the slot
Encircle patient's arm with band and measure
Scan the reading that appears through the slot below

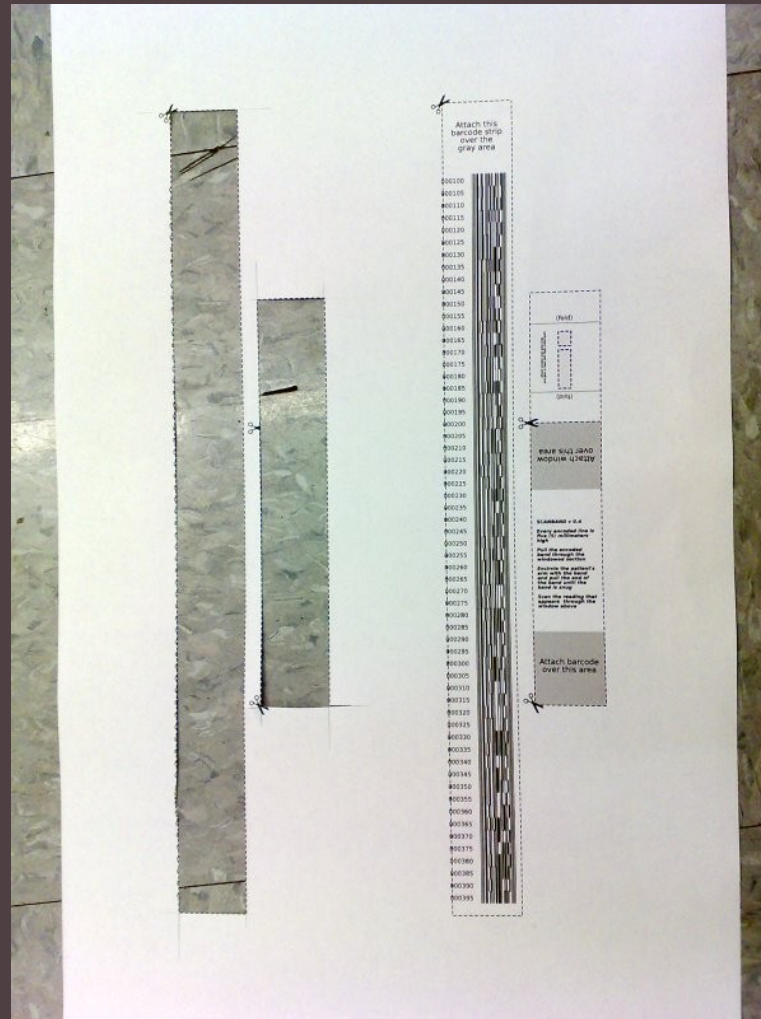
Attach Barcode
Over This Area



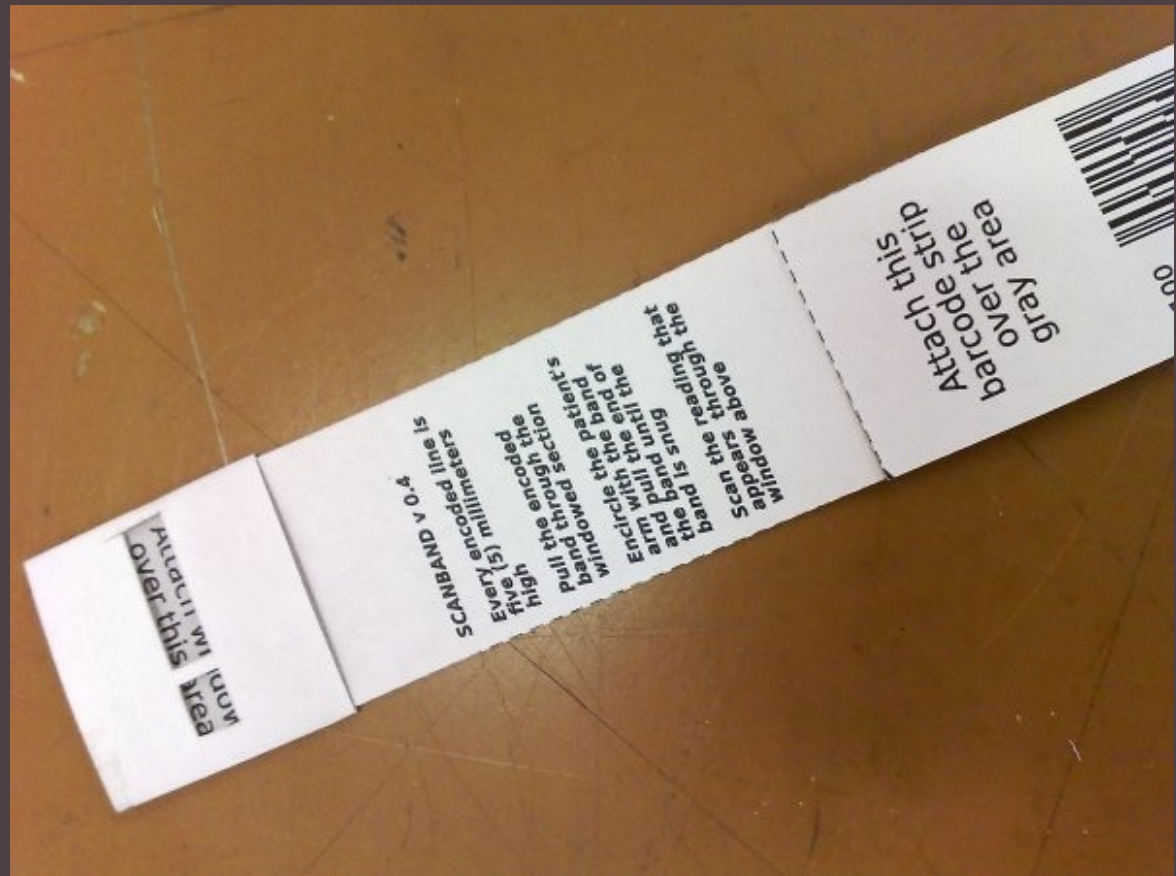
Iterations



Iterations



Iterations



Iterations



Iterations



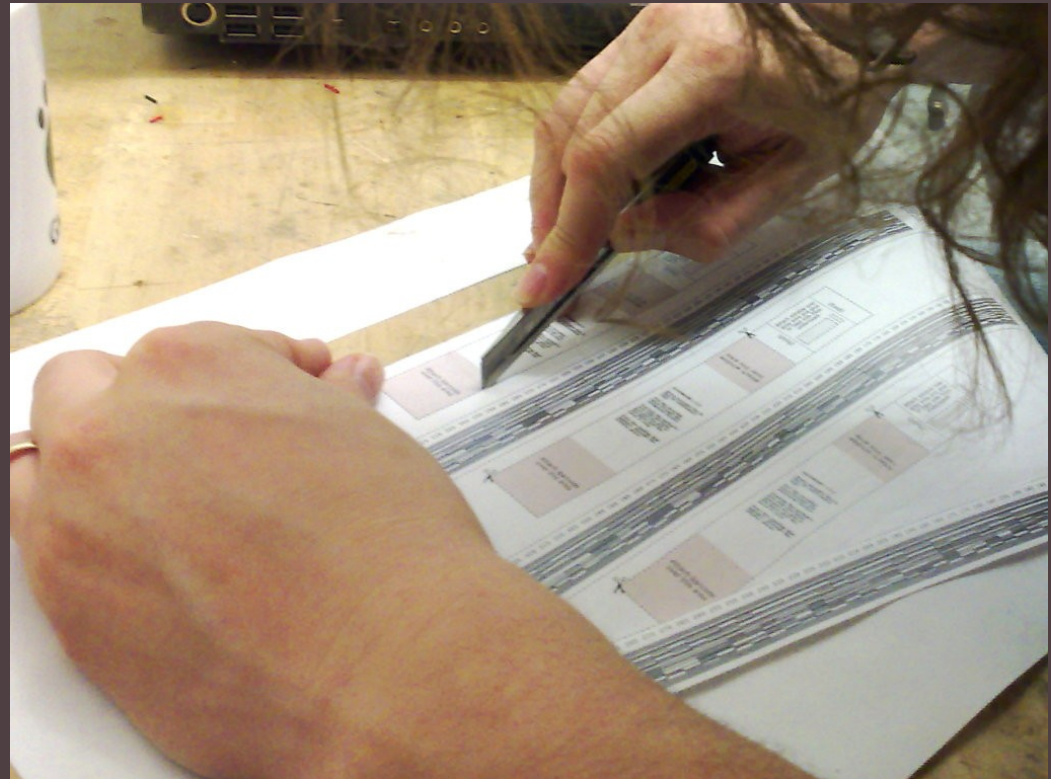
Iterations



Iterations



Iterations



Iterations



Emerging Design Questions

- How can the system better collect and transfer data without paper or unnecessary transcriptions?
- How well do people work with the physical forms I am creating?
- Is this device reducing error?



User Testing

- Likert Scale
- Item Total Correlation



User Testing

Potential Survey Questions for ScanBand Prototypes

Please return this form to Mike Edwards (faculty mail slot #35).

Below are a set of statements that will be included on future surveys about my project. Please evaluate these statements on a scale of 1 to 5, with 1 being a statement that is strongly unfavorable to the concept and 5 being a statement that is strongly favorable to the concept. You **do not** need to agree or disagree with the statements, or even know much about the project. You only need to decide whether the statements use language that is favorable or unfavorable.

1 = strongly unfavorable, 2 = unfavorable, 3 = neutral, 4 = favorable, 5 = favorable

The ScanBand fits poorly on a patient's arm.	1	2	3	4	5
The ScanBand is easy to read.	1	2	3	4	5
The ScanBand is difficult to manufacture	1	2	3	4	5
The ScanBand is pleasing to look at	1	2	3	4	5
The ScanBand is difficult to use	1	2	3	4	5
The ScanBand is inexpensive	1	2	3	4	5
The ScanBand is intuitive	1	2	3	4	5
The ScanBand is clumsy	1	2	3	4	5
The ScanBand is time-consuming to use	1	2	3	4	5
The ScanBand is frustrating to use	1	2	3	4	5
The ScanBand is confusing to read	1	2	3	4	5
The ScanBand is reliable	1	2	3	4	5
The <u>ScanBand's</u> use is clear	1	2	3	4	5
The ScanBand fits in well with the exam-room environment	1	2	3	4	5
The ScanBand is a welcome addition to the tools I use	1	2	3	4	5
The ScanBand causes more problems than it solves	1	2	3	4	5

User Testing

Item-Total Correlation 1	Item-Total Correlation 2	STDEV	MEAN			1	2	3	4	5	6
0.82	0.83	0.76	1.71	The ScanBand fits poorly on a patient's arm	1	2	1	2	2	1	1
0.65	0.79	1.46	1.86	I dislike the ScanBand	51	5	1	1	2	1	1
0.81	0.78	0.69	1.86	I do not think the ScanBand is accurate	48	2	1	2	2	1	2
0.78	0.9	1.53	2	Patients hate the ScanBand	78	5	1	1	2	1	1
0.86	0.97	1.35	2.14	The ScanBand causes more problems than it solves	16	4	1	2	2	1	1
0.86	0.88	1.46	2.14	The ScanBand should not be used in a hospital setting	41	3	1	2	2	1	1
0.84	0.92	1.35	2.14	I would not recommend the ScanBand to my peers	61	4	1	1	2	2	1
0.87	0.97	1.25	2.29	I am afraid my patients will be hurt by the ScanBand	69	4	1	2	2	1	2
0.81	0.96	1.6	2.29	I found the ScanBand unreliable	57	5	1	2	2	1	1
0.8	0.95	1.25	2.29	I do not feel that the ScanBand is effective	53	4	1	2	2	2	1
0.81	0.96	1.6	2.29	The ScanBand is not reliable	17	5	1	2	2	1	1
0.87	0.97	1.25	2.29	Patients do not want me to use the ScanBand	75	4	1	2	2	1	2
0.86	0.87	1.38	2.29	Patients appear uncomfortable with the ScanBand	71	3	1	2	2	1	2
0.83	0.91	0.95	2.29	The ScanBand is difficult to manufacture	3	3	1	2	2	2	2
0.81	0.96	1.6	2.29	I would never use the ScanBand	68	5	1	2	2	1	1
0.71	0.68	1.25	2.29	The ScanBand is time-consuming to use	9	2	1	2	2	2	2
0.73	0.93	0.95	2.29	The ScanBand is not intuitive	22	4	1	2	2	2	2
0.62	0.84	1.4	2.43	Patients reject the ScanBand	92	5	1	3	2	1	2
0.65	0.77	1.4	2.43	The ScanBand is ugly	21	5	1	1	2	2	3
0.83	0.97	1.13	2.43	I had trouble reading the ScanBand	56	4	1	2	2	2	2
0.76	0.92	1.27	2.43	The ScanBand is confusing to read	11	4	1	3	2	1	2
0.72	0.92	1.62	2.43	The ScanBand is difficult to use	5	5	1	3	2	1	1
0.84	0.94	1.4	2.57	The ScanBand is frustrating to use	10	4	1	2	2	2	2
0.84	0.89	1.51	2.57	I am not comfortable using the ScanBand on patients	54	4	1	2	2	1	3
0.68	0.87	1.13	2.57	I did not understand how to use the ScanBand	50	4	1	2	2	3	2
0.73	0.9	1.51	2.57	The ScanBand slows me down	29	4	1	3	2	2	1
0.67	0.86	1.11	2.71	The ScanBand seems out of place with other tools I use	19	4	1	3	2	2	3
0.85	0.76	1.6	2.71	The ScanBand fails to work accurately	31	4	1	2	5	2	1
0.89	0.84	1.63	3	The ScanBand did not meet my expectations	33	5	1	2	5	2	2
0.96	0.88	1.7	3.29	The ScanBand is too expensive	39	5	1	2	5	2	3
0.91	0.81	1.89	3.29	The ScanBand makes patients uncomfortable	36	5	1	2	5	1	4
0.62	0.61	1.38	3.29	Patients are apprehensive about the ScanBand	73	4	1	3	5	4	2
0.68	0.61	0.82	4	The ScanBand met my expectations	43	5	3	3	5	4	4
		1.34				135	35	69	84	54	61
		0.69				4.09	1.06	2.09	2.55	1.64	1.85
		1.89									

over 80 candidate questions broken down into
30 consistent possible survey questions

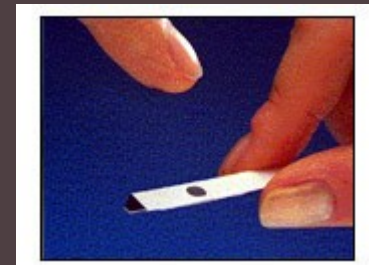
User Testing

- Determine health-worker satisfaction with prototypes
- Use feedback to generate new iterations



Future Work

- Materials
- Linear Measurements



Schedule 2007

- November:
 - Finalize circumference design and begin initial testing in Malawi
 - Begin linear design
- December:
 - Finalize linear design and begin initial testing in Malawi



Schedule 2008

- January: Travel to Malawi?
- February: Systems Integration
- March: Roll out to KCH, patient testing
- April: Revisions based on test results, devices finalized for patient use



Conclusion

