SILICON LABS

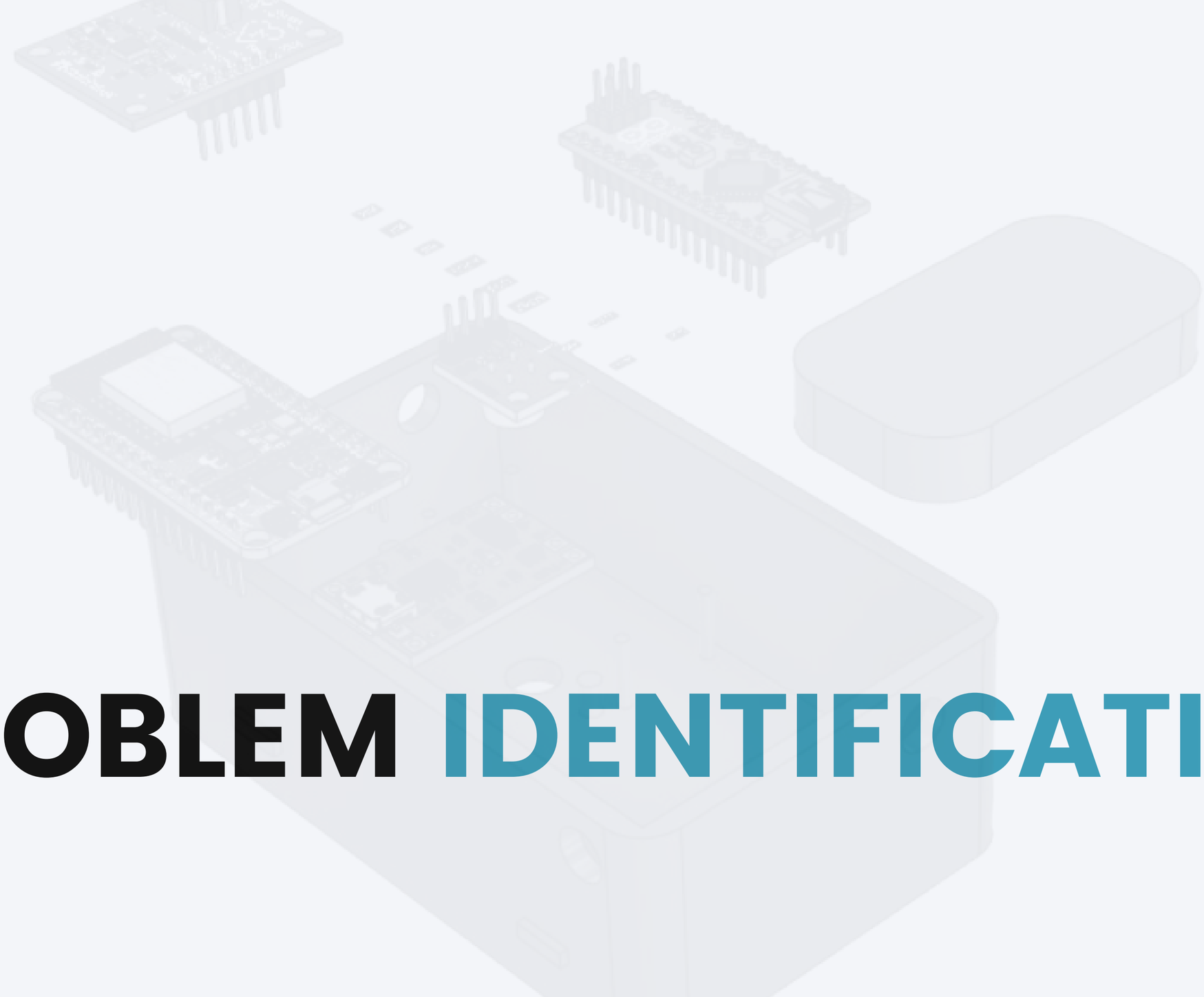
SOCIAL ENTREPRENEURSHIP CHALLENGE

INTER IIT TECHMEET 10.0

BRAHMA

Biometric Rapid Automatic Health Monitoring Assistant

TEAM 10

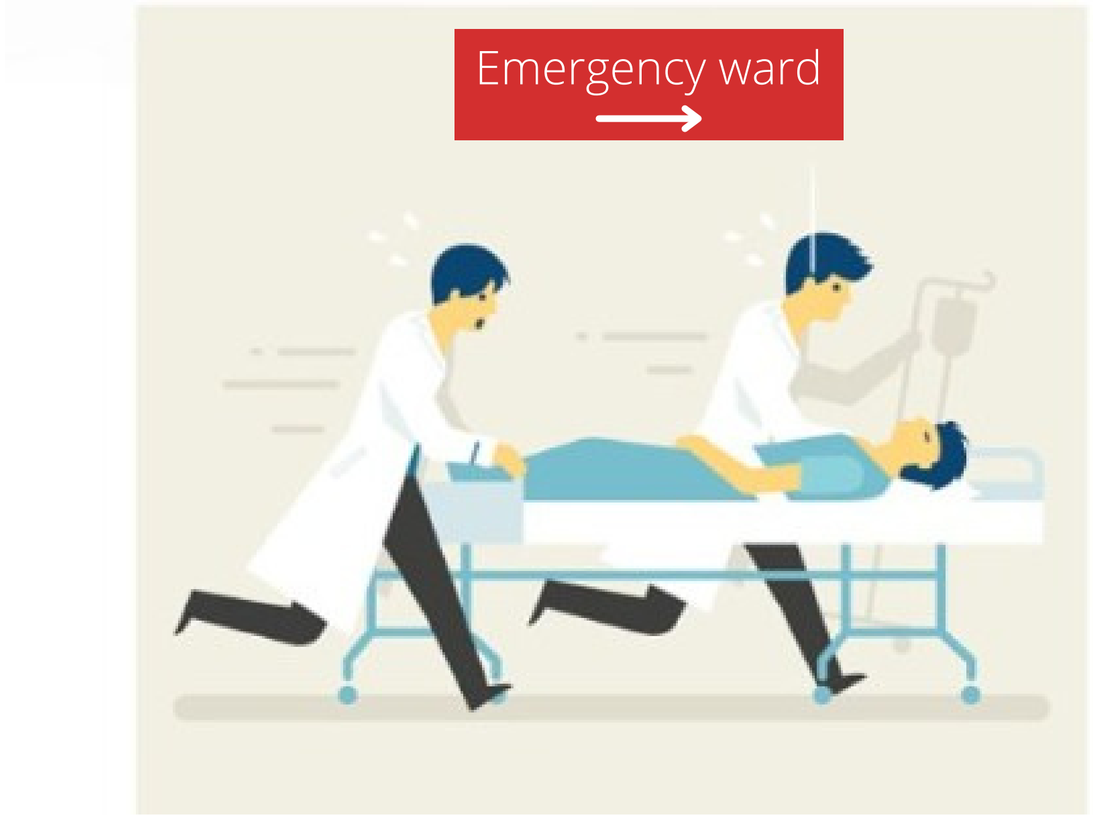


PROBLEM IDENTIFICATION

The patient was admitted to the hospital but left unattended due to the shortage of nurses.

Due to lack of a proper monitoring system, deterioration in patient's health goes unnoticed

The patient gets attention after his condition goes out of control.



Had there been a better monitoring system and enough number of nurses, a life could have been saved

This story is not just a hypothetical story,
but the reality of Indian healthcare system

Technology News / Science

SIX IN TEN PREVENTABLE DEATHS ARE CAUSED BY POOR HEALTHCARE SYSTEMS: STUDY

...itions cost the global economy some $6 trillion in 2015 alone.

Poor healthcare kills 16 lakh in India every year, finds study

LATEST VI

AGENCE FRANCE-PRESSE SEP 06, 2018

Hospitals told to shed staff as NHS funding crisis deepens

Nurses most at risk despite

Mid Staffordshire care scandal in 2013

...are being told to shed staff to ...the NHS from an acute funding crisis, leaving nurses and other frontline

...London is expected to record a deficit of about £46.2m. To save £1m, a trust would have to lose 25 nurses, according to the King's Fund thinktank.

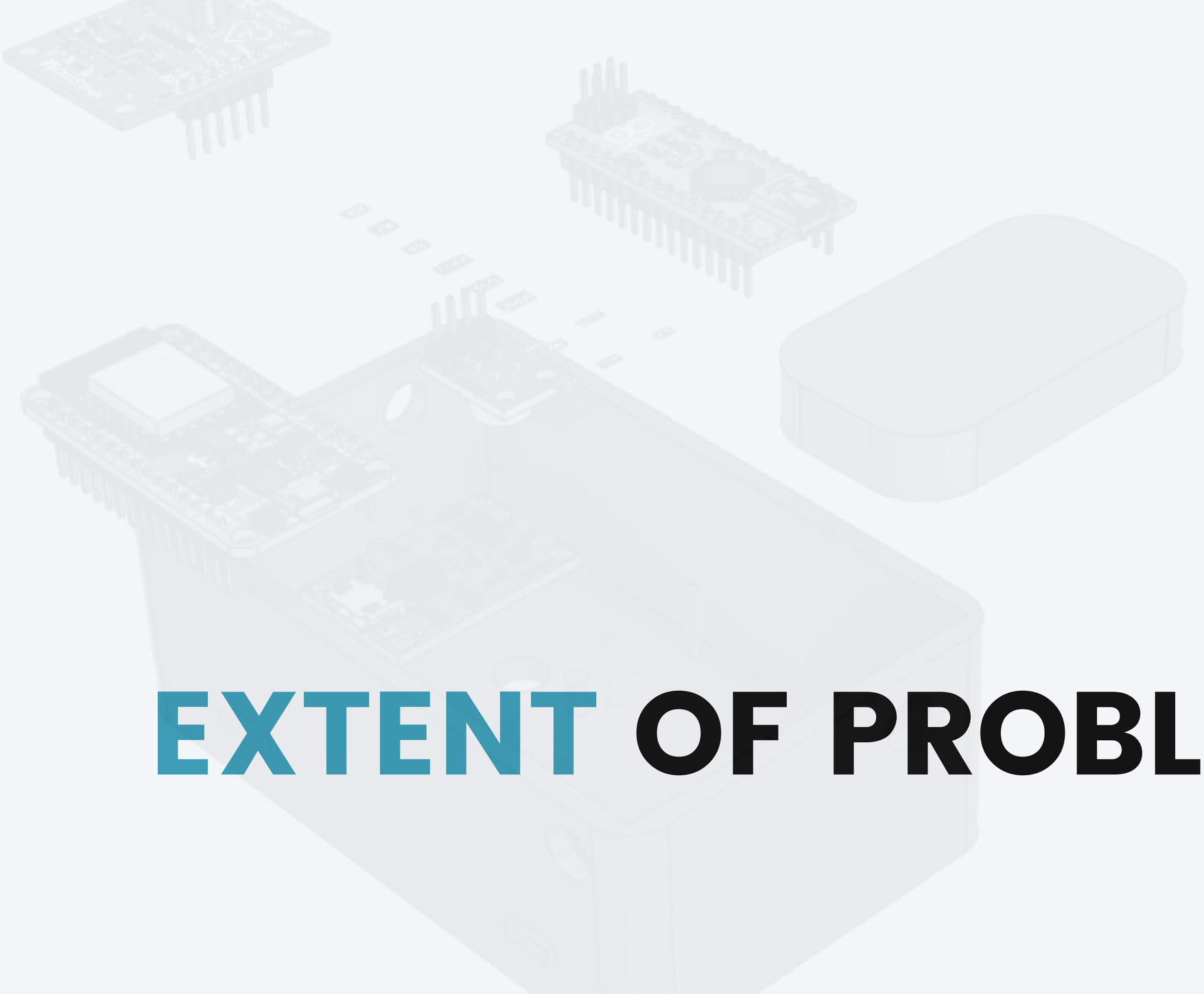
The decision to ...

£60m

The annual deficit Addenbrooke's hospital in Cambridge is heading for, while ...

...almost all the foundation trust ...tals regulated by Monitor are deem... be "financially challenged" and 2... overspent by so much that they are ...ing government bailouts to help pa... bills. The cost of expensive agenc... set to be £4bn this year, is the sing...

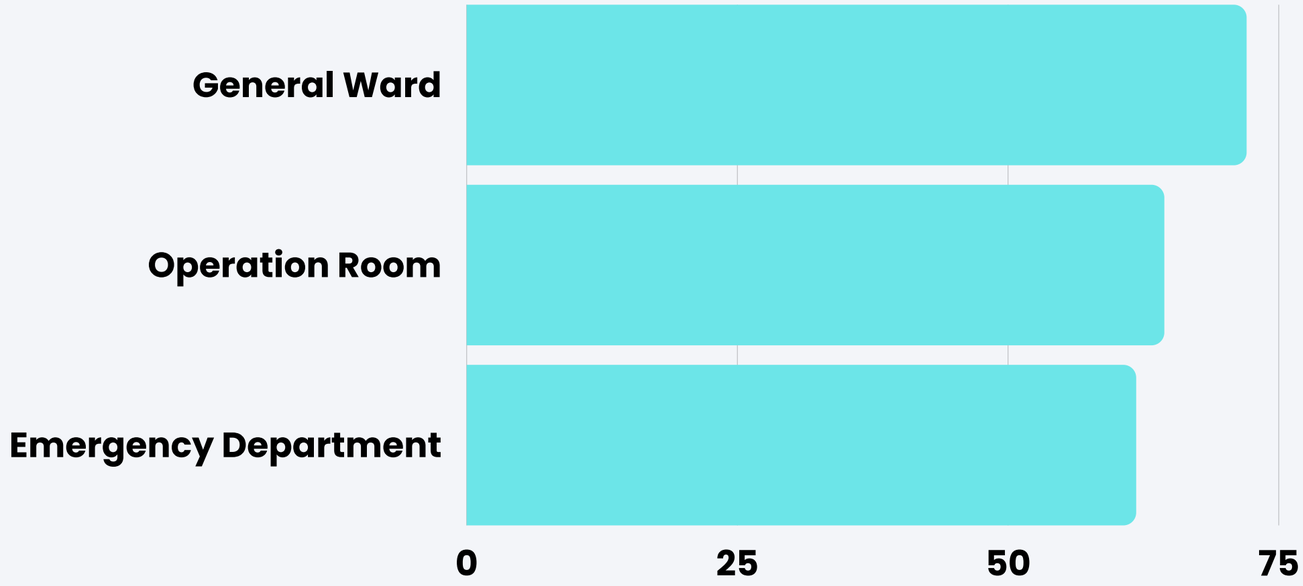
Poor care quality leads to nearly twice as many deaths as due to non-utilisation of healthcare services (838,000 persons)



EXTENT OF PROBLEM

NEED OF A CONTINOUS MONITORING SYSTEM

- General wards are the **most vulnerable** ones.
- Compared to other sections, general wards are **more prone to higher death** rates.
- This is due to the **lack of a continuous monitoring** system.

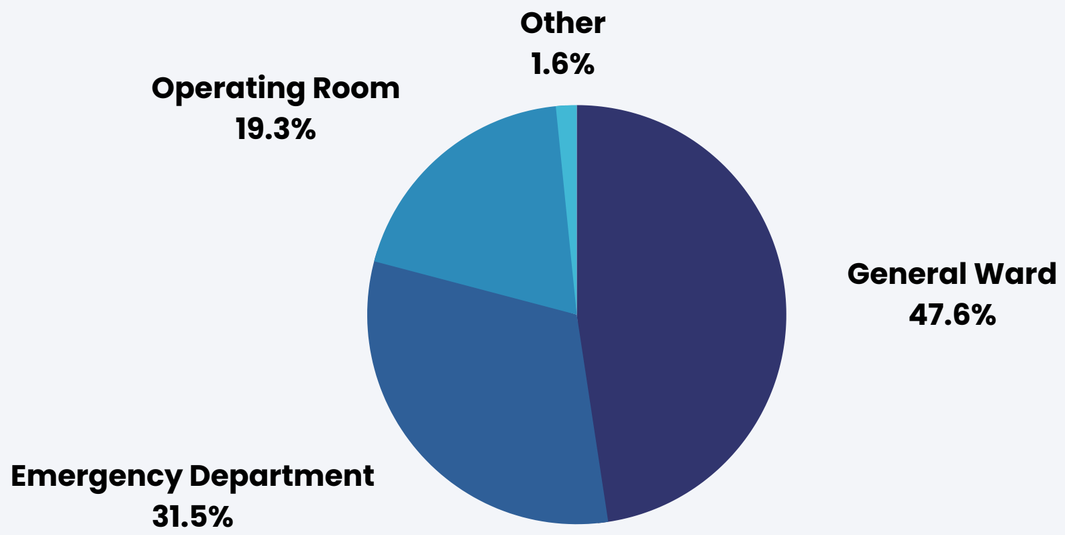


Percentage of people having life-threatening antecedent factor 8hrs before admitting to ICU [1]

[1]. Chey T Daffurn K Jacques T Norman SL Bishop GF Simmons G Hillman KM, Bristow PJ. Duration of life-threatening antecedents prior to intensive care admission. Intensive Care Med, pages 1629–34, 2002.

FATALITIES STATISTICS IN DIFFERENT HOSPITAL WARDS

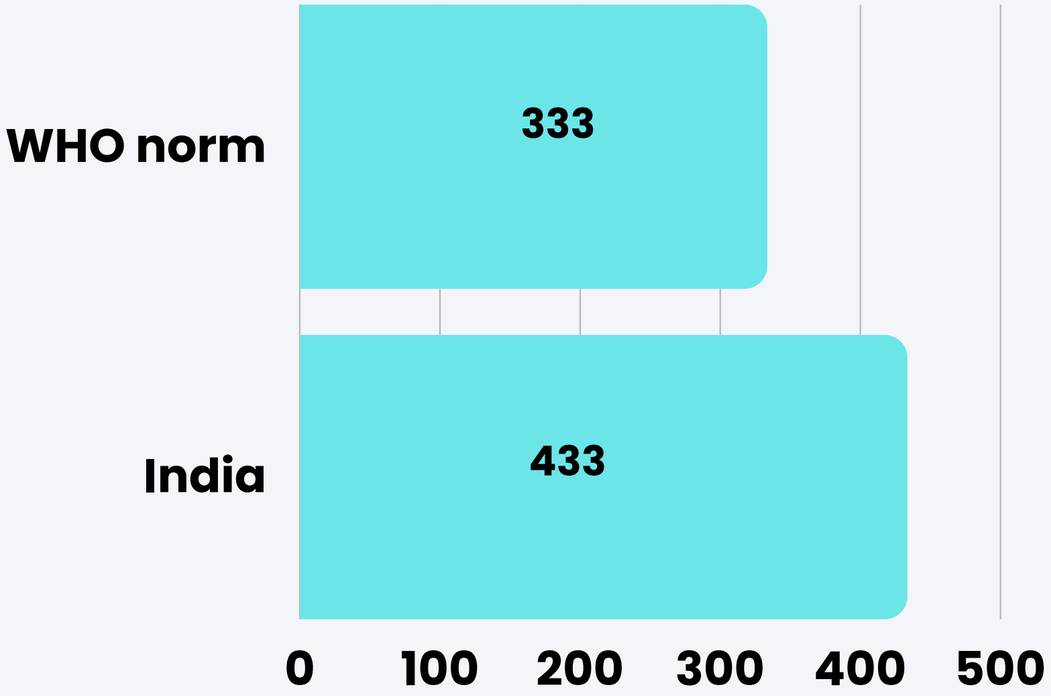
- Non-continuous monitoring causes patients lead to a **life-threatening** condition.
- This leads to a condition where people reach **ICUs** in **critical** conditions.



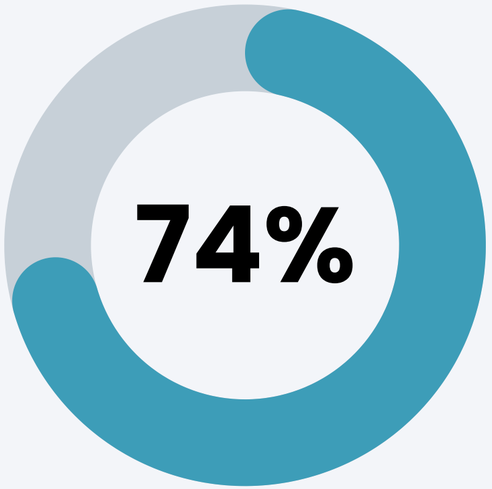
Percentage of Death in different wards [1]

[1]. Chey T Daffurn K Jacques T Norman SL Bishop GF Simmons G Hillman KM, Bristow PJ. Duration of life-threatening antecedents prior to intensive care admission. Intensive Care Med, pages 1629–34, 2002.

WHY IS THE CURRENT MONITORING SYSTEM INEFFICIENT?



Population to nurses ratio[3]



Percentage of nurses who well-received the idea of continuous patient monitoring system [2]

[2]. APRN CNS; Pierson Laura BSN RN CMSRN; Roloff Devin MBA; Mosman Elton MBA; Gross Tera DNP RN; Marsh Scott MBA MSN RN; Willis Valerie MSN RN; Gabrielson Donald MBA HTM Stellpflug, Courtney MSN. Continuous physiological monitoring improves patient outcomes, ajn, american journal of nursing: April 2021 - volume 121 - issue 4 - p 40-46 doi: 10.1097/01.naj.0000742504.44428.c9
[3]. R. Hughes. Patient safety and quality an evidence-based handbook for Nurses, Agency for Healthcare Research and Quality. 2008

TESTIMONIALS

"By continuous monitoring of pulse, blood pressure and oxygen saturation, assessment of the vitals of the patient become easy. Sudden haemodynamic abnormalities of the patient can be found out and one can interact immediately to check the abnormalities with prompt measures. This minimises any unwanted complications of the patient. "

-Dr. P. Nagaraju, MS(AY)
(SASA Ayurvedic Medical College)

"Due to lack of continuous monitoring, we may not predict the complications in a patient particularly if he is under shock in which the patient's condition may become worsen leading from moderate to severe shock. So, always there should be continuous monitoring of the patient not only in ICU but also in General wards to early detection of any complications to interact immediately to save the patient. "

-Dr. Sushil Goenka, MD
(Govt. Hospital, Raiganj)

What do we need from a solution?

- Real time Monitoring
- Workload Reducing
- Cost Effective
- Portable

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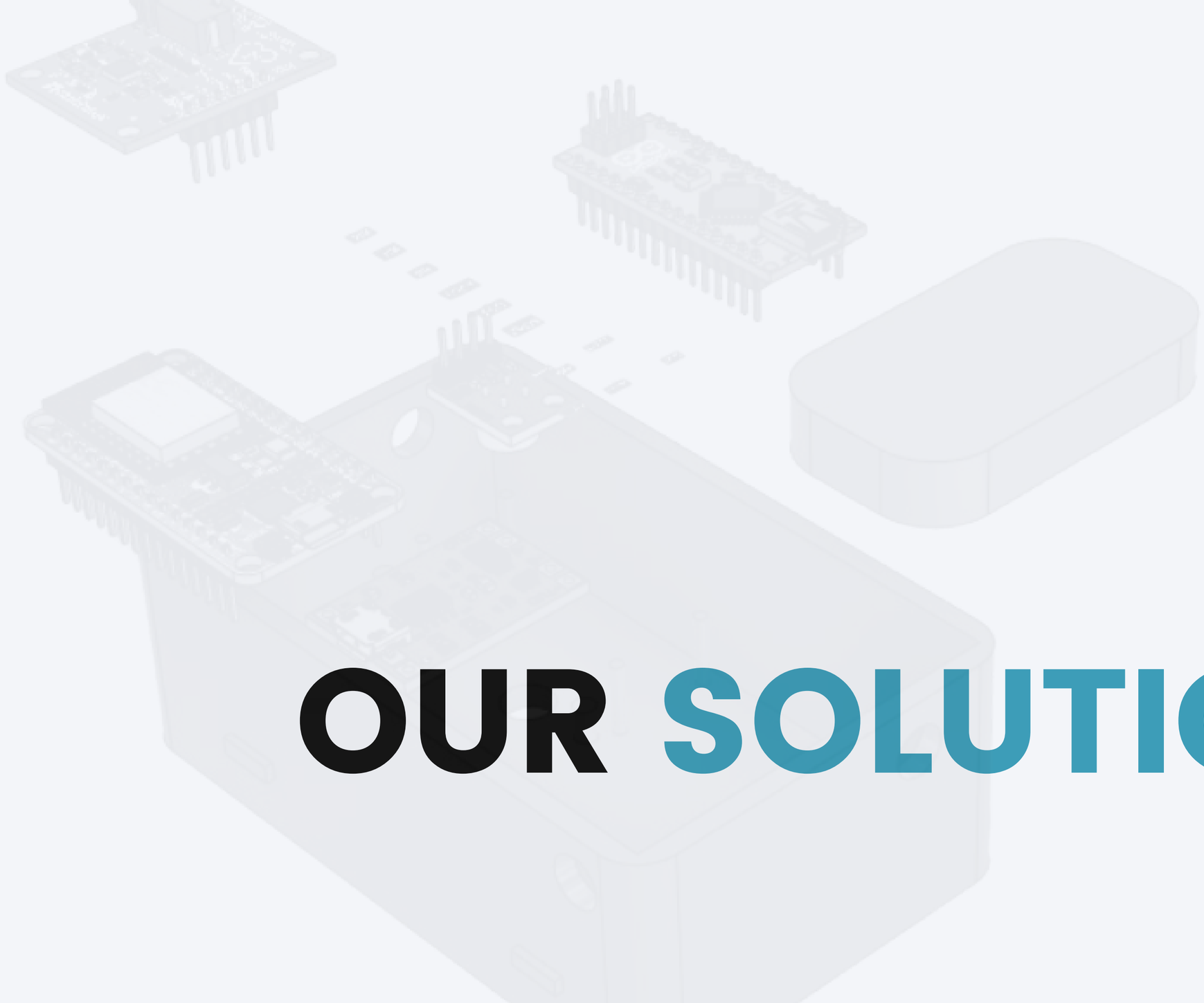


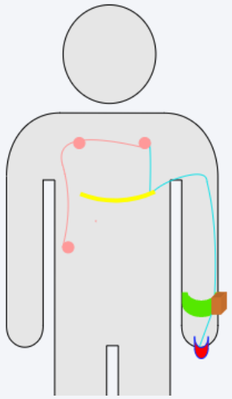
OUR SOLUTION

BRAHMA

Biometric Rapid Automatic Health Monitoring Assistant

BRAHMA continuously **reads** the vitals of patients which can be **monitored** by the medical staff in **real-time**. In case a patient's health deteriorates, **automated alerts** are sent to the doctors.

In case of normal condition of patient

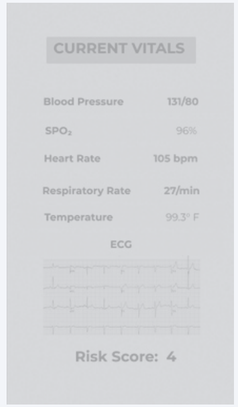


Patient

Data of vitals sent to server

Server

Readings sent to app

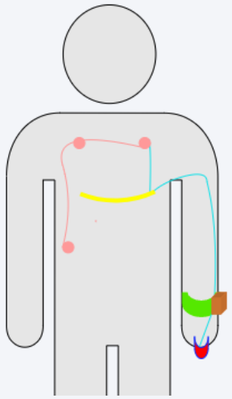


Mobile App

Data a click away

Doctor

In case of normal condition of patient



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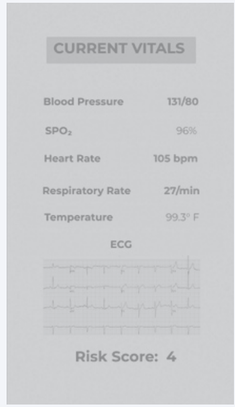

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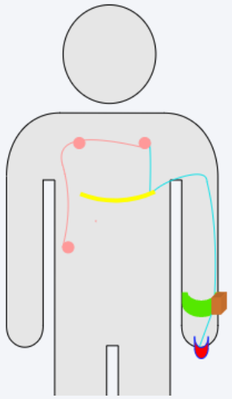

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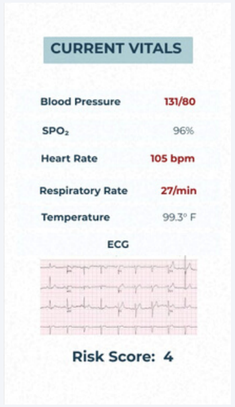

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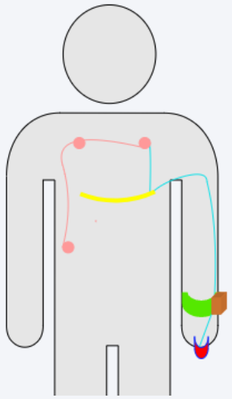

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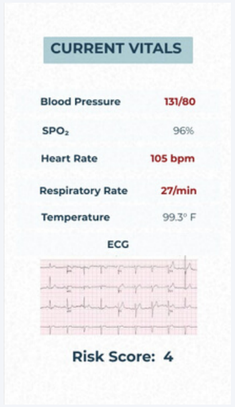
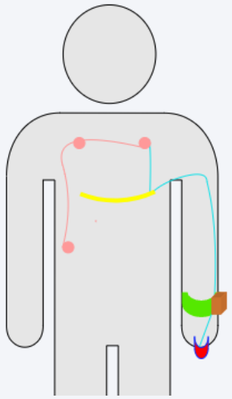


Mobile App

Data a click away

Doctor

In case the condition of the patient deteriorates



Patient

Data of vitals
sent to server

Server

Readings sent
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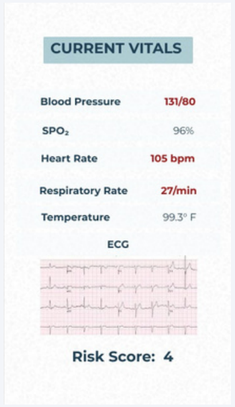
Generate
alerts



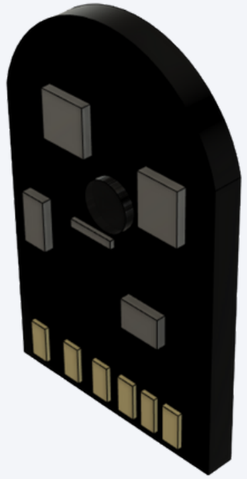
Mobile App

Data a click away

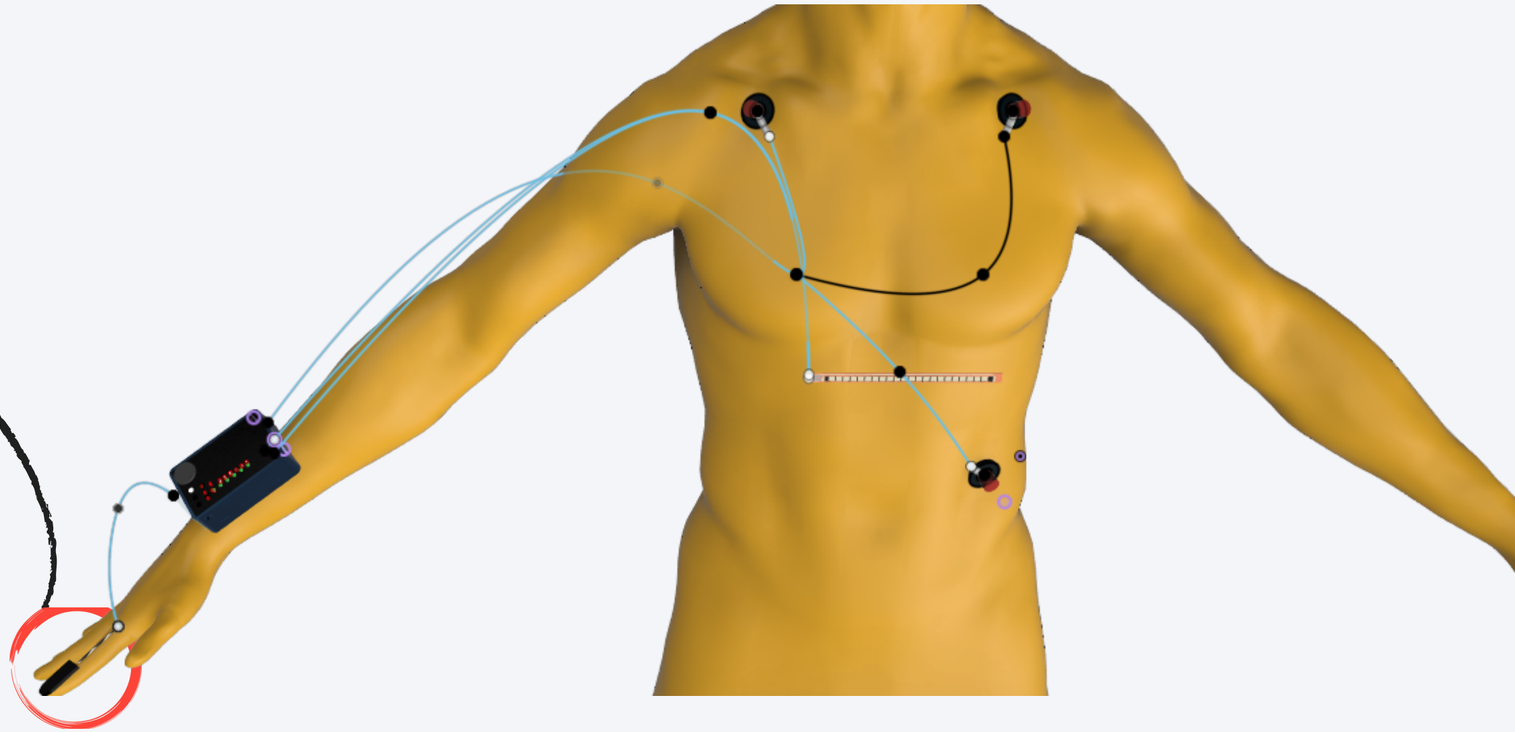
Doctor

HARDWARE

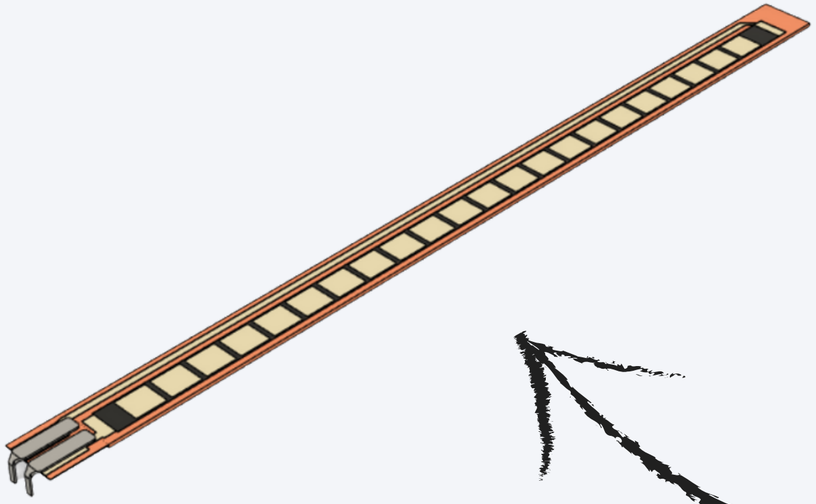
SPO_2, BP, PULSE



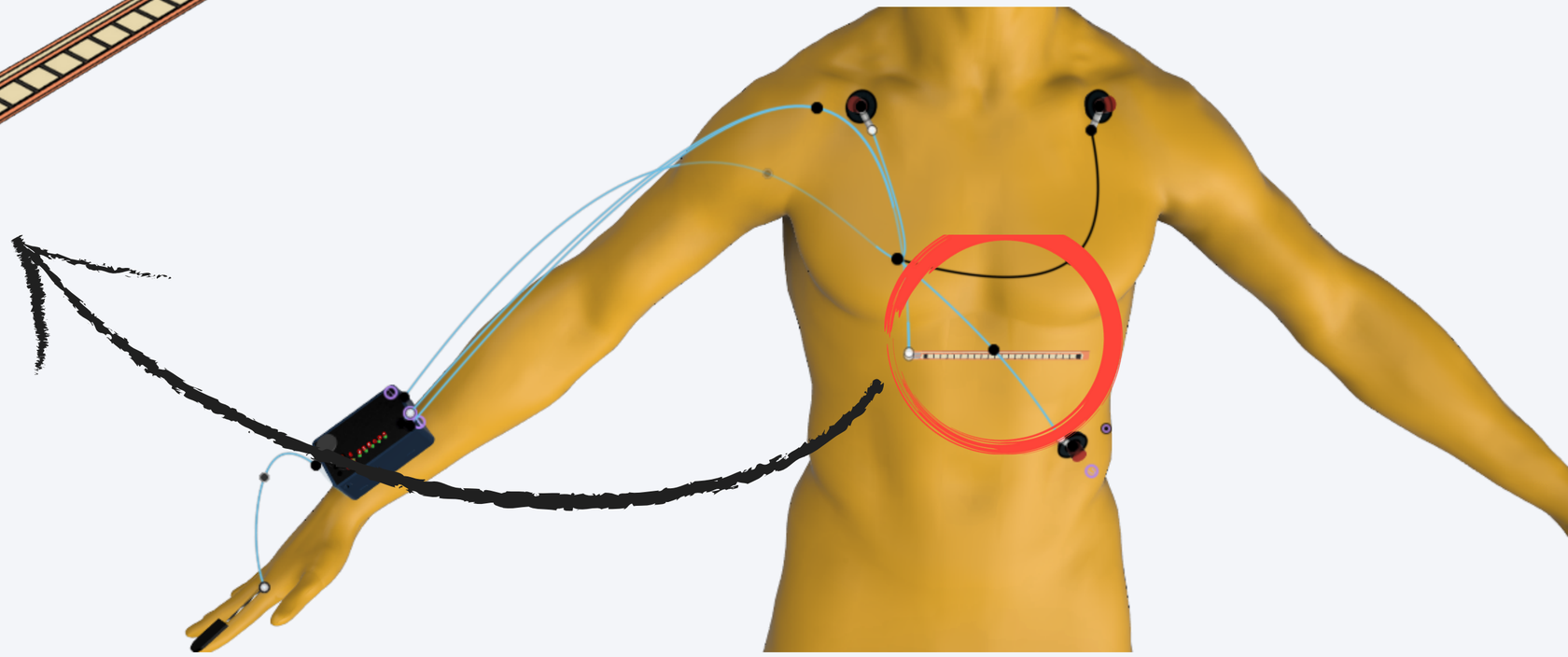
MAX32664D and MAX30102
Sensors on the finger



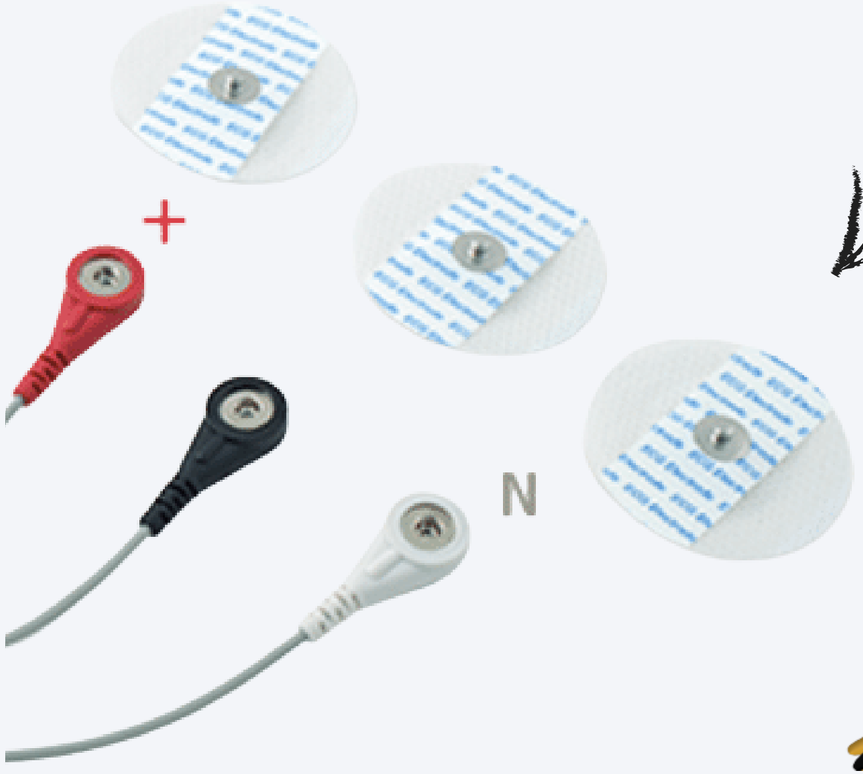
RESPIRATORY RATE

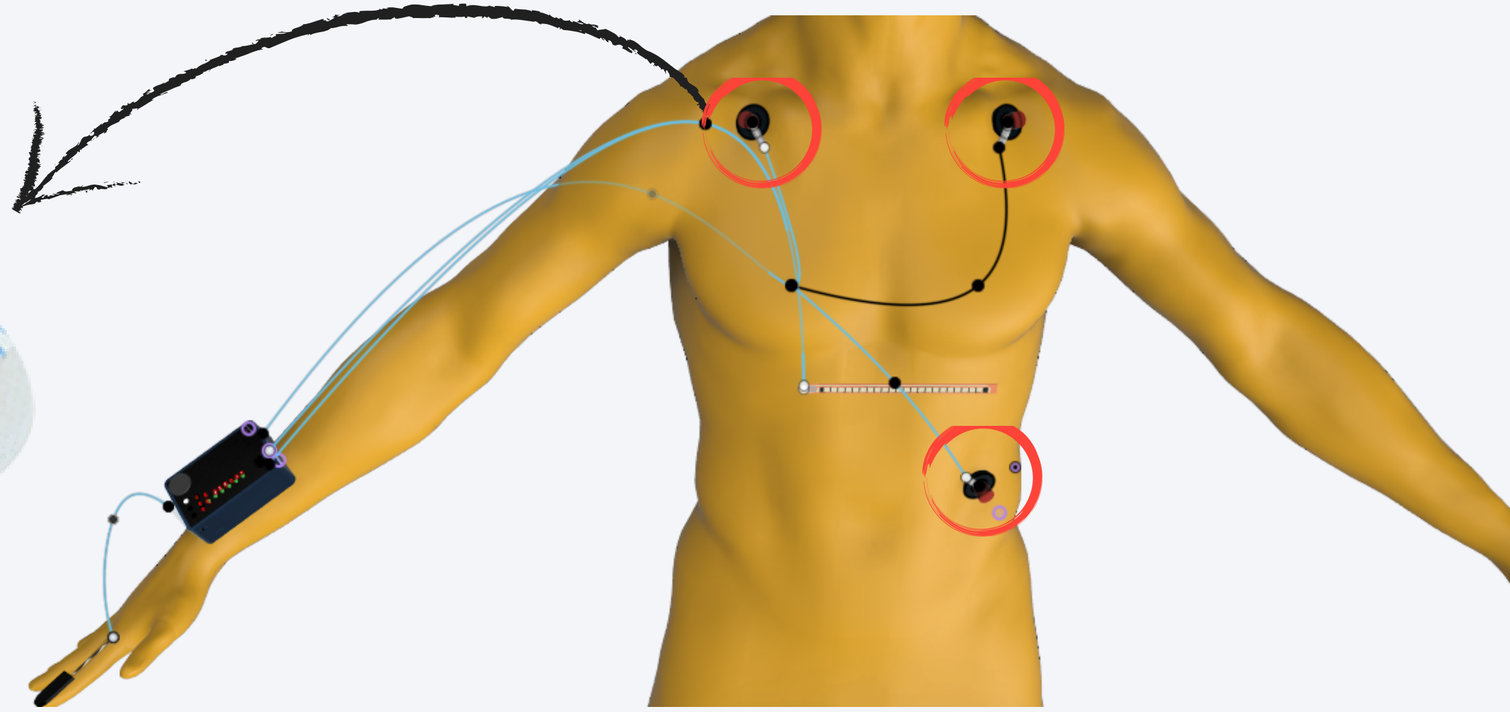


Flex Sensor
on the chest area



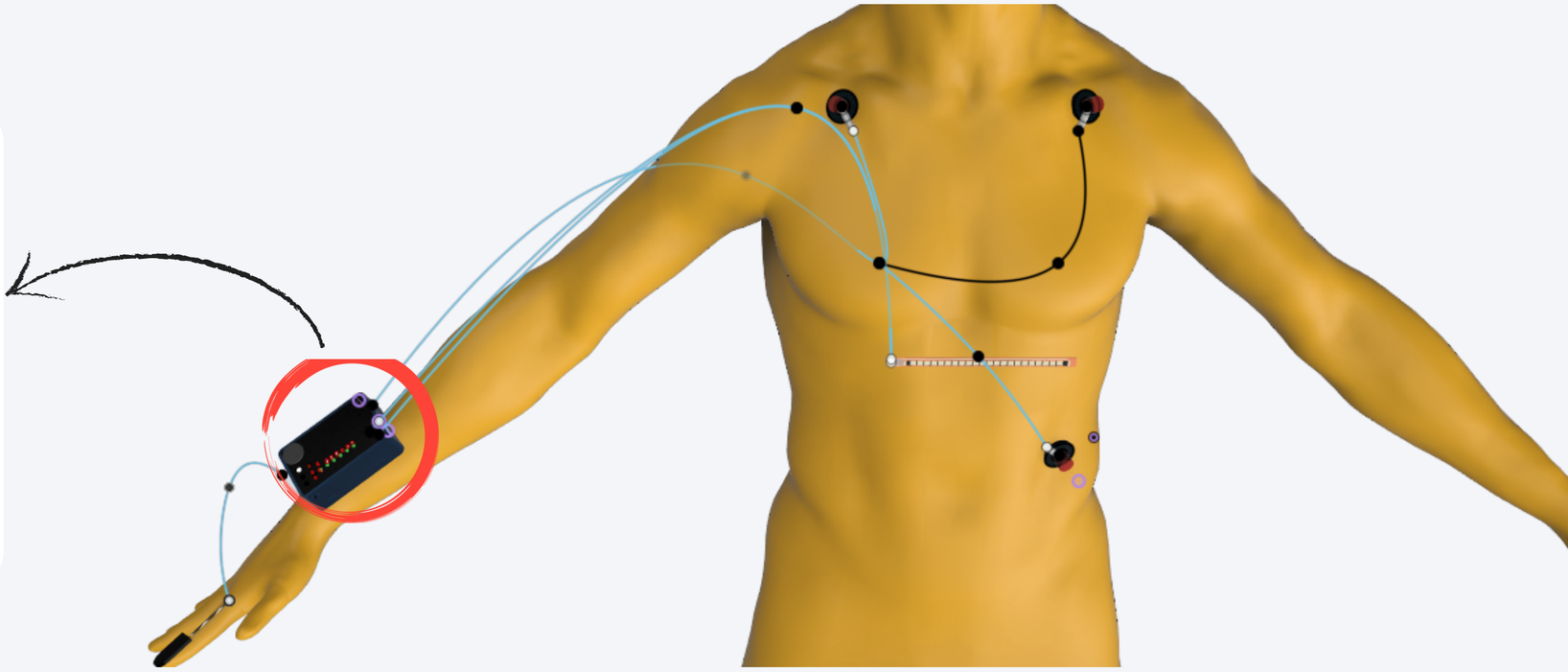
ELECTROCARDIOGRAM





ECG Electrodes
Two adjacent Clavicle bone and one adjacent lower left abdomen

WRIST CASE



Link to the video -https://drive.google.com/file/d/1KiChZso93ZZ4fAAYvzvlSeaepoBzS6E5/view?usp=sharing

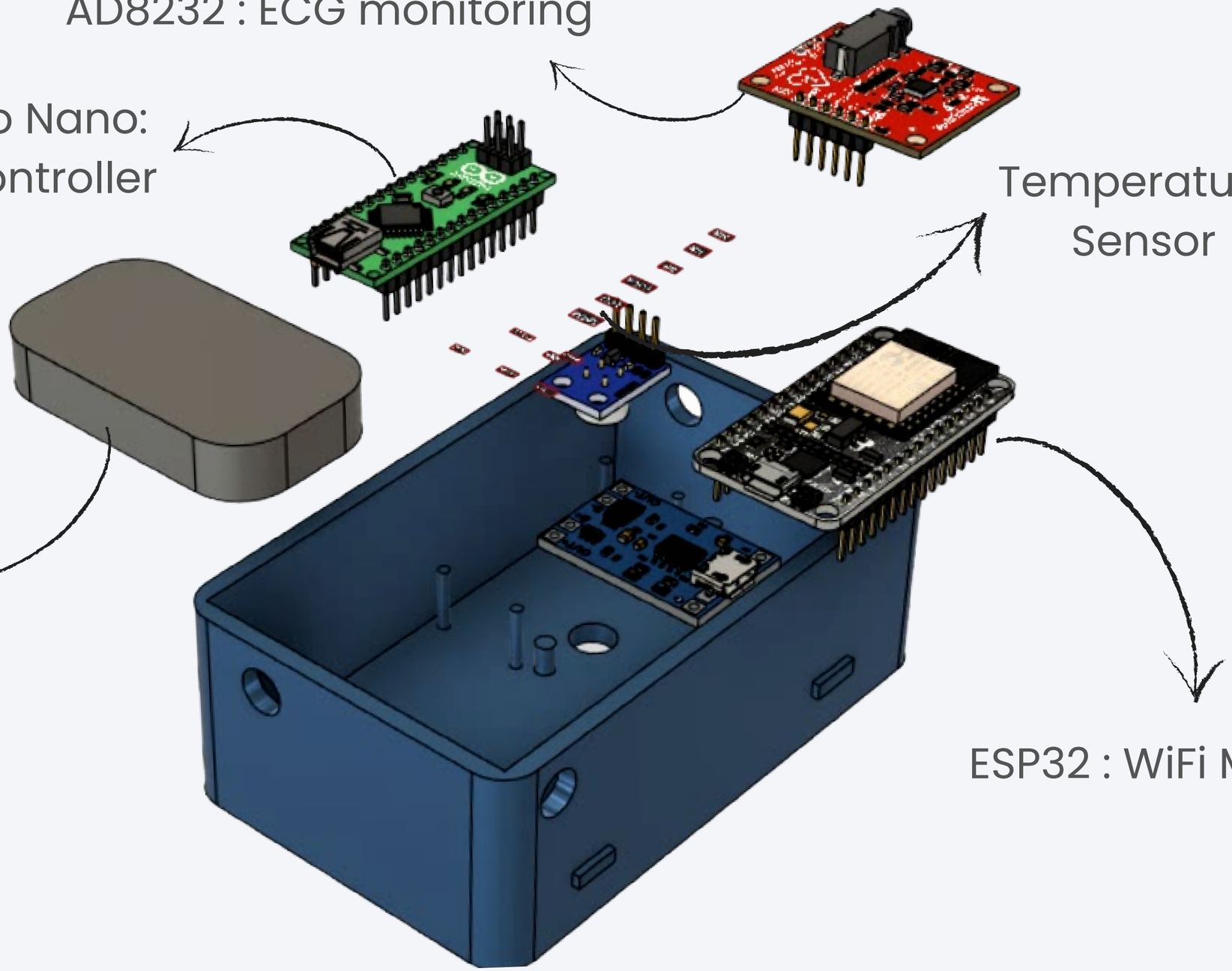
AD8232 : ECG monitoring

Arduino Nano:
Microcontroller

Temperature
Sensor

LiPo Battery

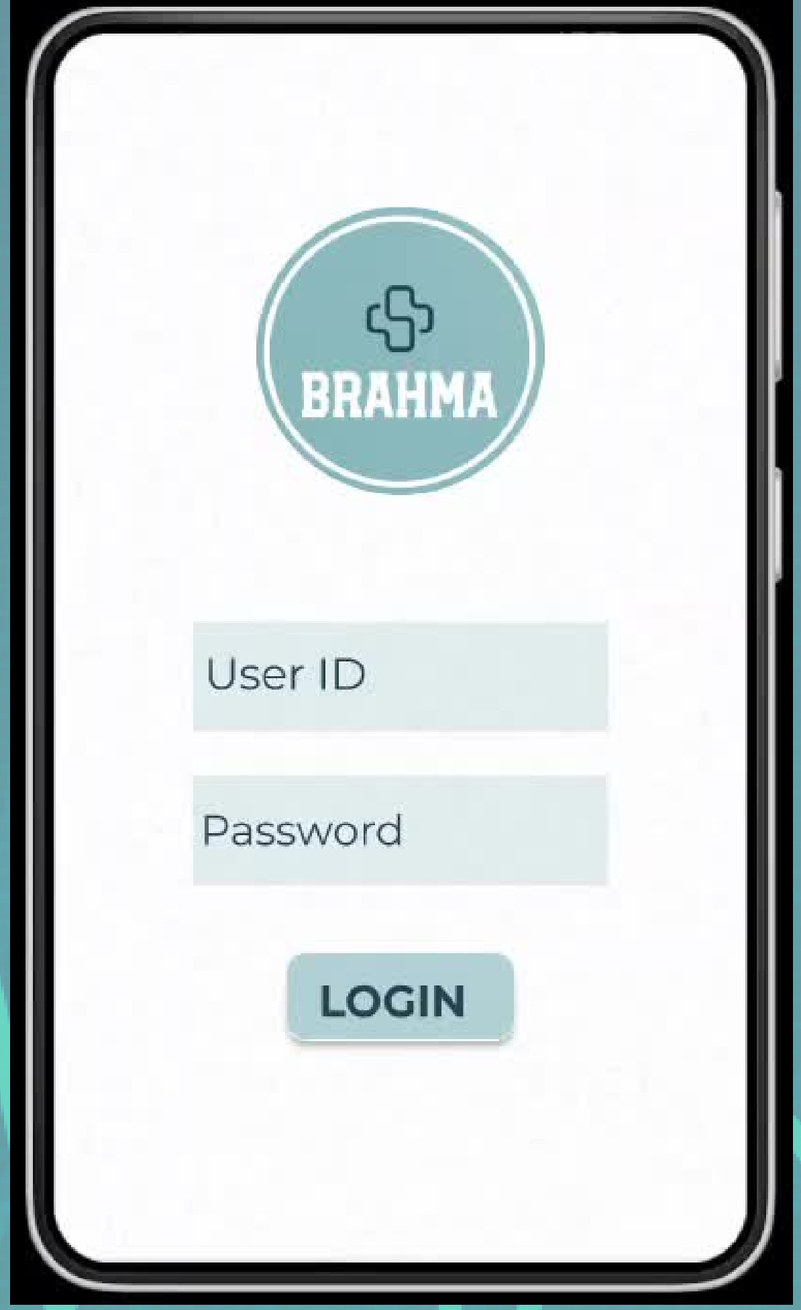
ESP32 : WiFi Module



LIVE DEMONSTRATION

1. https://drive.google.com/file/d/11-wHksJ1C3C4qqiXTp3Rfv0iftKFbunk/view?usp=sharing
2. https://drive.google.com/file/d/1PZrXYMM1bVS4M2wBv7k9rqqvvKyOvO4e/view?usp=sharing
3. https://drive.google.com/file/d/1984eArwAdwkMm7MXP8XMQmNBrn4rr-z3/view?usp=sharing
4. https://drive.google.com/file/d/13hkzqZZYrtB44WNpP8-JJd3dlg3UNYez/view?usp=sharing

SOFTWARE



Link to the video of software UI-https://drive.google.com/file/d/1vbCkXblIx-0XPsRHJ8OsEGIsTTMVeHaC/view?usp=sharing

RISK SCORE CALCULATION

Using the data sent by the sensors, a **risk score** is calculated to quantitatively estimate the health condition of a patient. This can be viewed by the medical staff on the app. If the score is high, then the doctor is alerted.

RISK SCORES	3	2	1	0	1	2	3
SpO2	<91	92-93	94-95	>96			
BP	<70	71-80	81-100	101-199		>200	
HR		<40	41-50	51-100	101-110	111-129	>130
RR		<9		9-14	15-20	21-29	>30
Temp		<35		35-35.4		>38.5	

TOTAL SCORE	STATUS
0-3	Normal
4	At Risk
>4	Alert

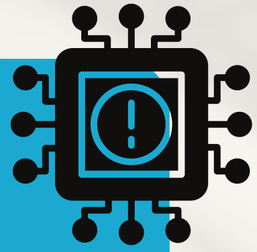
FEATURES

FAILPROOFS

EARLY WARNING

DATA PRIVACY AND SECURITY

FAILPROOFS



Sensor Malfunction

Machine Learning can be used to detect and flag data abnormalities due to sensor malfunction. Alerts will also be shown on the device and the mobile application.

Battery Warning

A LiPo battery acts as backup in case of a power cut. In extreme cases, the battery might drain out, then a warning will be generated, which will be sent to the mobile application.

Network Issues

On loss of internet connectivity, the data will be stored on the local database on the device and will be uploaded to the remote database as soon as the internet is restored.

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EARLY WARNING

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Patient Vitals

Patient Vitals data are collected from the sensors

Database

Data of patient's vitals in the past are being stored

Risk Score

The probable risk score after a certain time will be calculated using DEWS architecture

Patient's Condition

A comment is made on the patient's condition after a certain time

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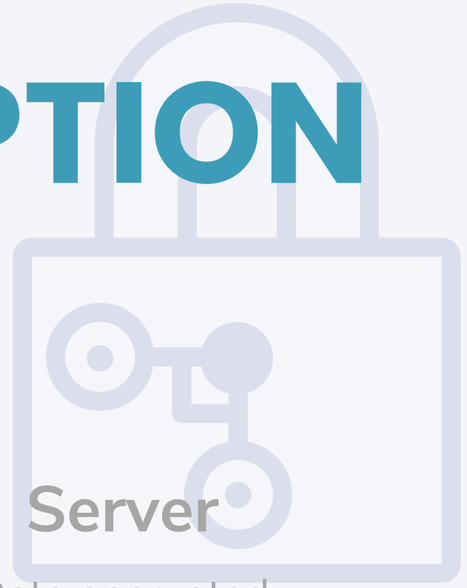
DATA PRIVACY & SECURITY

END TO END ENCRYPTION



Patient Vitals

Patient Health Data encrypted with server's key

Server

Encrypted data uploaded to server

Storage

Data Signature stored in blockchain

Blockchain

Data integrity and security assured using blockchain

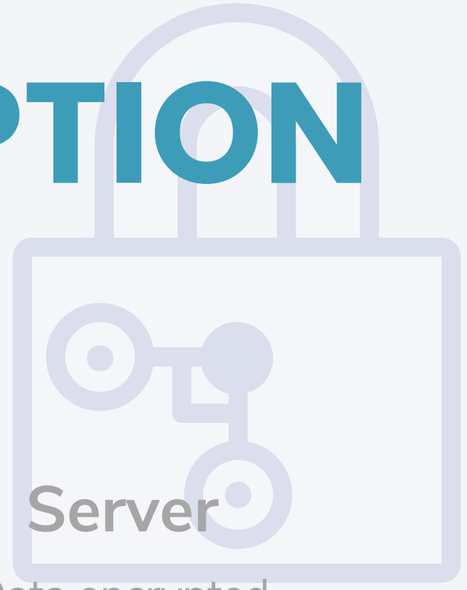
Server

Data encrypted with Client's Key

Doctor / Relative

Patient Health Data decrypted and accessed securely

END TO END ENCRYPTION



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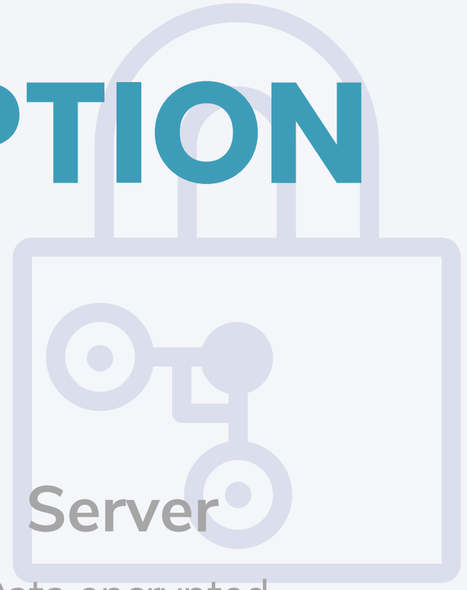

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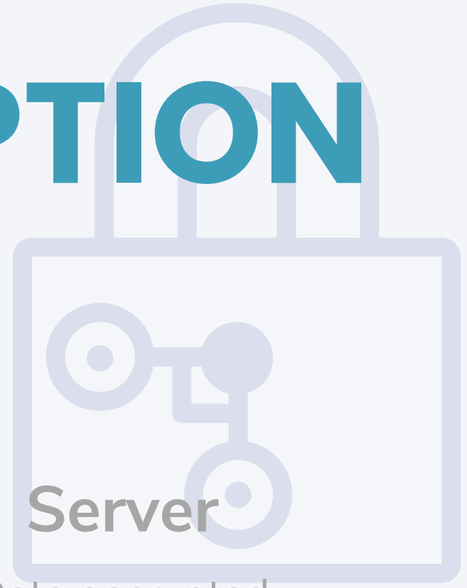

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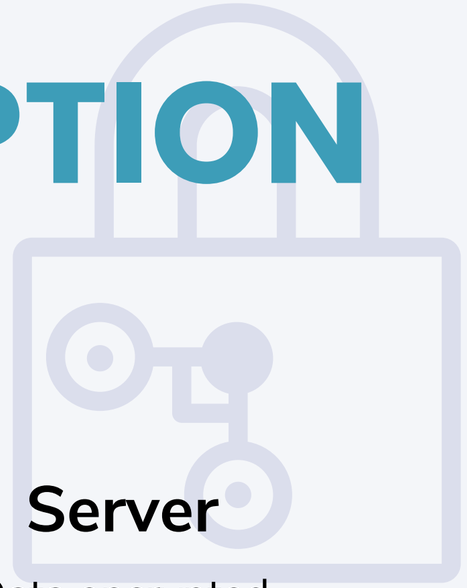

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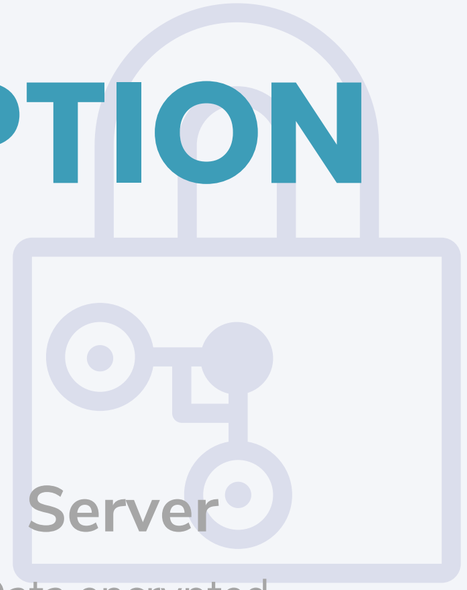

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Why choose **BRAHMA ?**

A major objective of a hospital is to provide good quality health-care system to its patients along with earning profit.

Patients and their families will also prefer hospitals which advertise continuous monitoring, and so this will also increase the profit of hospitals.

The utilities provided will help monitor vitals & predict deterioration of patient’s condition & provide details to doctors on a easy-to-use user friendly app.

Liabilities and deaths in Hospitals due to human negligence and improper monitoring will be greatly reduced.

BUSINESS PLAN

BUSINESS PLAN

We'll offer our product to the customers on a **Fee-for-service** basis

Our Customers : **Hospitals, Clinics**

Key Partnerships : **Multi-specialty Hospital chains, Government ABHA plan**

COST ANALYSIS

₹2875
Prototype Cost

₹2000
Estimated Manufacturing Cost

₹2.58
Cloud Service Subscription
(per device per month)

PART	PRICE (in rupees)
MAX32664D+ IC	₹ 310
MAX30102	₹ 100
ECG Module - AD8232	₹ 549
ECG Electrodes	₹ 30
Temperature sensor - SI7051	₹ 533
Flex Sensor	₹ 200
Buzzer	₹ 69
ESP32 WiFi Module	₹ 100
Arduino Nano	₹ 385
2-cell Li-Po Battery	₹ 99
Manufacturing Cost	₹ 500
TOTAL	₹2875

REVENUE MODEL

₹2000

One Time Setup Fee

Subsciption Fees (per device)

Daily	Monthly	Annual
₹5	₹90	₹900

₹50

Patient registration fee

STAKEHOLDERS

01

Hospitals

Liabilities and death due to human negligence and improper monitoring will be reduced.

02

Nursing Staffs

No longer require to check on all patient frequently

03

Patients & their Families

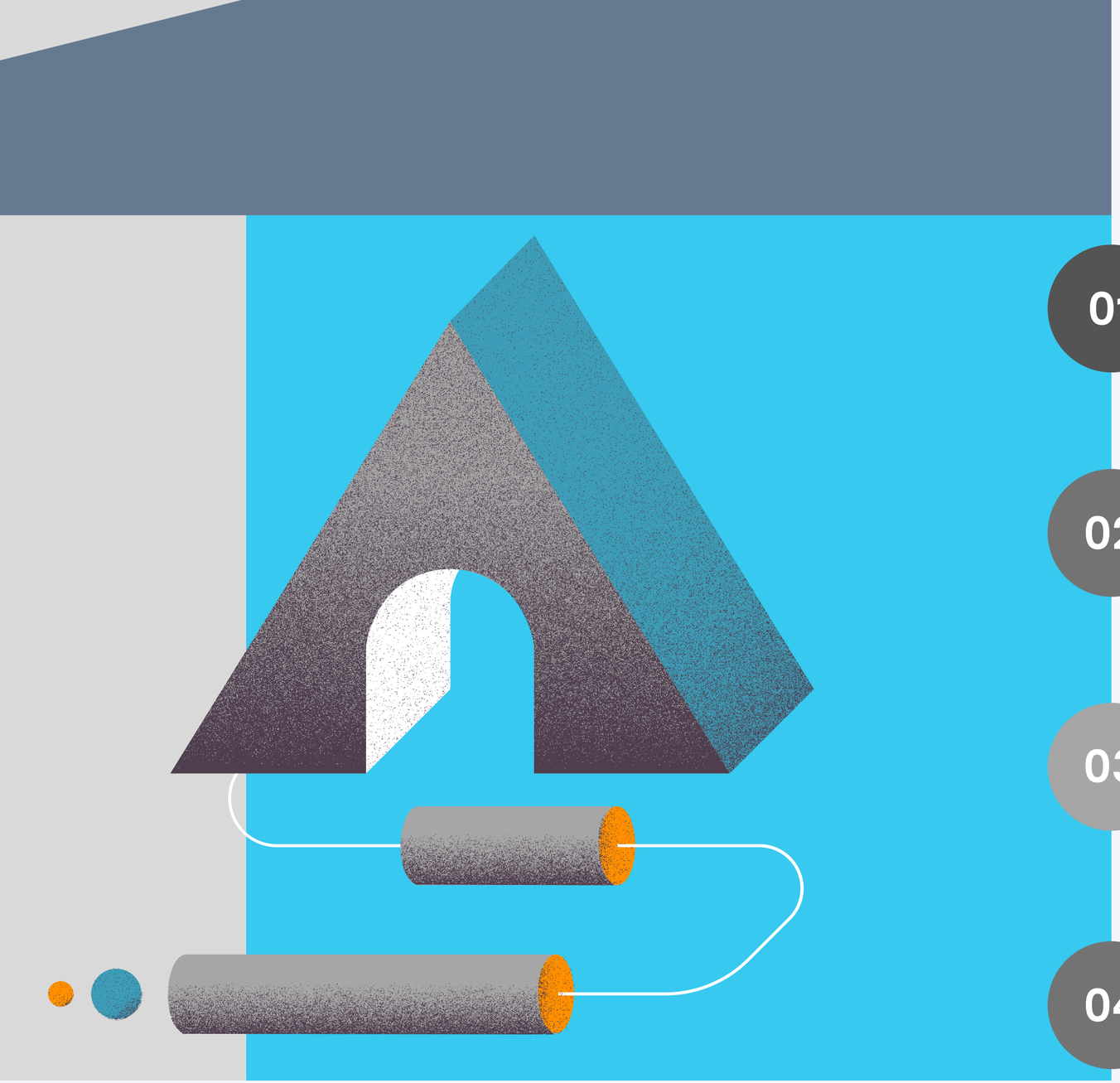
Patients's health will be monitored and discussed with their families on regular basis

04

Remote Patients

Patient's at home can rest assured that their vitals are being monitored continuously

Marketing Strategy



01

Health camps

Conduct health camps targeting doctors and medical professional to increase awareness

02

Healthcare Innovation Expos

Showcase **BRAHMA** in healthcare innovation symposium and expos to increase reach and scalability

03

Hospital Visits

Demonstrate effectiveness in constant patient's care and reducing staff workload to encourage investment.

04

Advertisement via Partner Hospitals

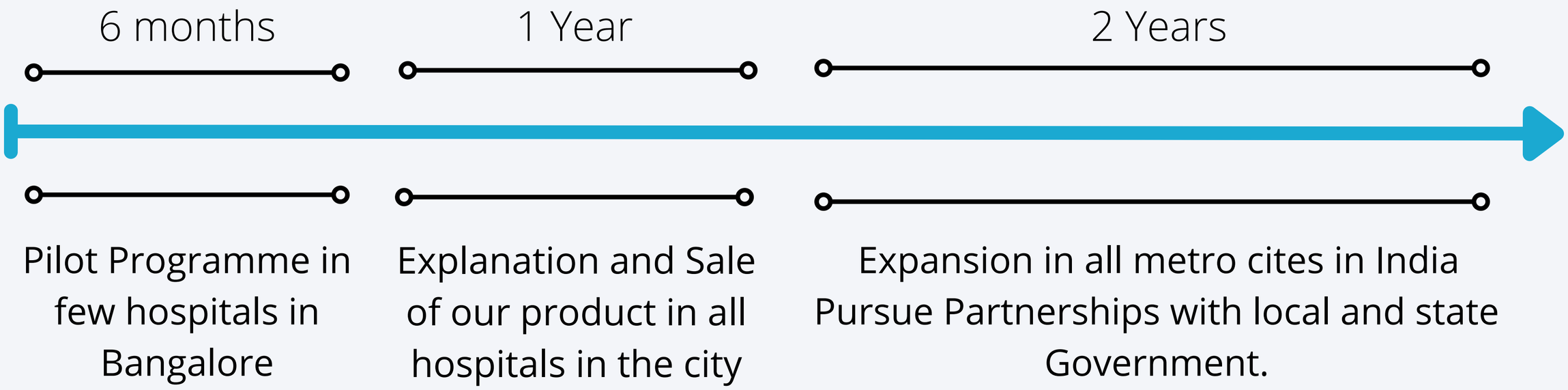
Advertisements via Hospitals availing our services as they can now advertise continuous monitoring of the patients

VENTURE JOURNEY

Key Targets

- Reach Profitability by end of First Year
- Recover Initial Investment by the end of the second year and achieve a positive balance sheet.
- Expand reach in all Metro Cities.
- Set Deals in place with Local Governments for use of our product in Government Hospitals.

BUSINESS TIMELINE



FINANCIAL TARGETS

Year 1

Sales Target :

- Number of Units sold: 5,000
- Revenue: (₹2,000 + 6*₹90) × 5,000 = ₹127 lacs

Costs :

- Manufacturing Costs: ₹2000 × 5,000units = ₹100 lacs
- Marketing and Sales Costs: ₹` 10 lacs
- Technical Support Costs: ₹` 15 lacs

Investments:

- Research and Development Costs: ₹ `70 lacs

FINANCIAL TARGETS

Year 2

Sales Target :

- Number of Units sold: 50,000
- Revenue: (₹2,000 + ₹900) × 50,000 = ₹14.5 Cr

Costs :

- Manufacturing Costs: ₹2000 × 50,000units = ₹10 Cr
- Marketing and Sales Costs: ₹` 1 Cr
- Technical Support Costs: ₹` 1 Cr

USER JOURNEY

Targeted Customer Segments

Our targeted customer segments consist of :

- Multispeciality hospital chains
- Health centres

Delivery Channels

Our primary delivery channel comprises the sales agents who will reach out to the hospitals and the clinics.

User acquisition & retention

We will ensure the customer base retentivity by providing various perks along with the subscription, like complimentary training of nurses .

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Success Metrics

1

Number of subscriptions and products sold

Get an idea about the influence and the spread of the products.

2

Ratio of subscription renewals to total products sold

Direct measure of customer retention and patient trust in our product.

3

Ratio of products sold to total number of beds occupied in general ward of each hospital

Higher the ratio, higher the hospital dependency on our product ,which is a measure of hospital trust.

SOCIAL IMPACT

Improved working condition for medical staff

BRAHMA will reduce the workload of nurses and related hospital staff allowing them to work more efficiently and provide better care.

Sense of safety among the patient's family

The health of patients will be constantly monitored and will also be shared with their family members. It prevents any delay in sensing the sudden deterioration of patient's health

Patients at home are as safe as those in hospital

Patients who are admitted at home can be assured that their vitals are constantly monitored. It will also help in spreading medical aid to remote places.

Saving lives in rural areas

In rural areas in India, where there are only 16613 PHCs there is huge need of devices like BRAHMA, which can continuously monitor patient's vitals and can save their lives by sending warning message to doctors in hospitals.

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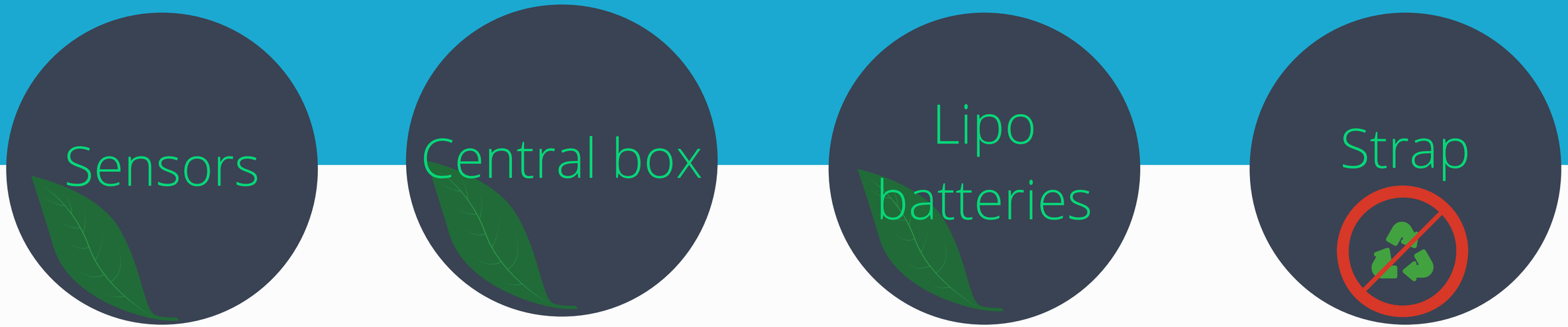
Environmental Considerations



The materials used for making all these parts are primarily eco-friendly and positively impact the environment. Most of them are non-hazardous and can be easily recycled. Few components like wrist-wrap and finger wraps can be reused in new devices.

POTENTIAL COMPETITORS

UNIQUENESS

BRAHMA

Biometric Rapid Automatic Health Monitoring Assistant

UNIQUENESS

BRAHMA

Biometric Rapid Automatic Health Monitoring Assistant

UNIQUENESS

BRAHMA

Biometric Rapid Automatic Health Monitoring Assistant

Early vital analysis

Improved Ease of Use

Early Warning Systems tuned for specific diseases

Addition of other monitoring devices for specific cases like continuous glucose monitoring, maternity care monitoring etc.

FUTURE PROSPECTS

THANK YOU