Invention Journey

EMUiNVENT


"Creativity is thinking up new things. Innovation is doing new things."
THEODORE LEVITT

Record of Invention (ROI) Log The Invention Journey

Invention or Innovation. What's the difference?

The invention involves engineering and developing a new solution, product or process. When you improve upon an existing solution, product or process to solve a problem (for example make it more convenient to increase its uses) it becomes an innovation. An invention is an entirely new solution to a problem, a radically different breakthrough which achieves a completely unique function. An innovation is an improvement over the existing solution.

Why do inventors record their invention process?

All inventions have a purpose and use. An invention is complete when a successful prototype is ready and the inventor is confident that s/he can make exact copies of it. However, a prototype results from many steps. Inventors record every detail of these steps for many reasons, for example, to be able to replicate the prototype with accuracy; to prove that they went through those steps and so they are the legal inventor of the prototype and to record all learnings that happen in the process. This log is the recorder of your invention. Record each step you did, why you did what you did, how you did it, in whose presence you did it. Tomorrow if this invention becomes BIG, you will be able to use this log to prove you are the inventor. Invention log is also part of the patenting process.

How to Use this Record of Invention (ROI)?

The sections of this ROI follow the process of invention. As you move further in the process, keep recording everything, what, why, how, and also who and where, when applicable. One way to figure you are doing everything right is by making sure that you are following the sections
in the given sequence and completing a section before moving to the next one. Each team/ project needs to complete one invention log.

Statement of Originality

We certify that to the best of our knowledge, the ideas and the work described in this log have resulted from the work of the team signing off here.

Inventor Name(s)	School Name & Grade
Abdur Rahman Abdul Hafeez	Adamjee Govt. Science College, Grade 12
Muhammad Ahmed Abrar Hussain	Govt. Delhi College, Grade 12
Usman Rasheed Siddiqui	Adamjee Govt. Science College, Grade 12

Signature(s) - typed	Date
A.Rahman	13-11-2023
M.Ahmed	13-11-2023
Usman.R	13-11-2023

ALL ABOUT ME!

What is your name?

Abdur Rahman, M. Ahmed, Usman

How old are you?

17

Where are you from?

Karachi, Pakistan

What are you excited about?

Cricket, Innovation, Calligraphy

What do you like to do during your free time?

Play Cricket, Explore Inventions,Practice Calligraphy,

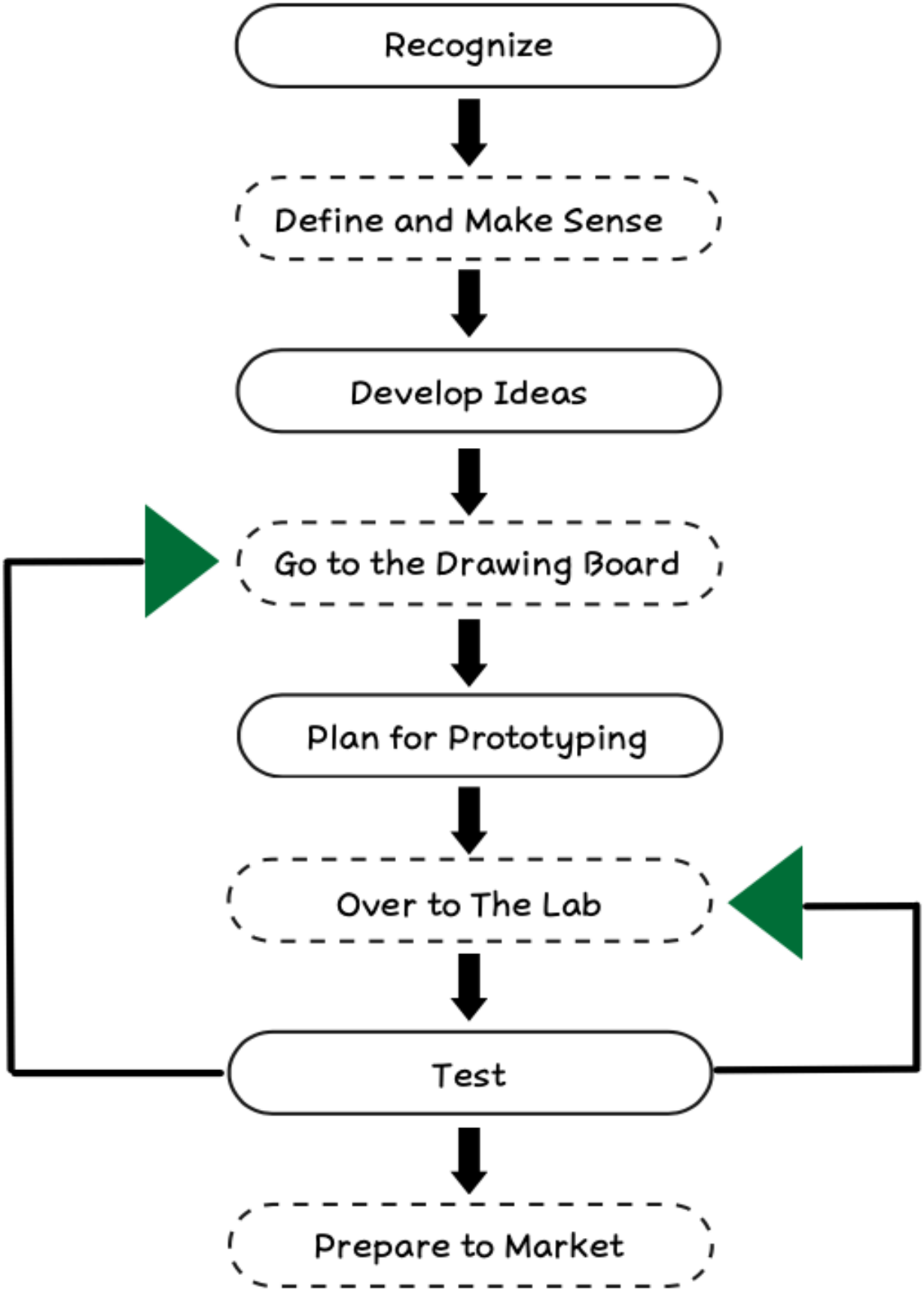
What is your favorite book?

The 7 Habits of Highly Effective Teenagers, Sean Covey.

What are your favorite foods?

Haleem, Biryani

INVENTION FLOW CHART




OF THE ELEMENTS
WE DARED TO DESIGN
Shimmer

STEP 1 - IDENTIFY THE PROBLEM

Identify a few problems that you or your friends/family relate with!

1. Expensive ventilators at hospital
2. Figuring out one's inner potential (skill development)
3. Fake news on internet
4. Frequent electricity breakdown
5. Over screen time
6. Depression

STEP 2- DEFINE AND MAKE SENSE OF THE PROBLEM

2.1 Talk to others and understand all aspects of the problems! Now, pick one problem you want to move forward with and take the next step!

Problem #1:

Person Name	Age	Comments
Rabia Malik	45	The solution of this problem will save the lives.
Osama Sheikh	21	Saving the life is an act of Kindness.
Tauqeer Malik	37	This is an optimized solution for difficulty

		in breathing.
Mudassar Sheikh	57	You can make a nice circuit using AMBU bag.

Problem #2:

Person Name	Age	Comments
Rabia Malik	45	It will let you explore much.
Osama Sheikh	21	People are afraid of experiencing.
Tauqeer Malik	37	It will really help students for selecting their career.
Mudassar Sheikh	57	I knew myself at this age.

Problem #3:

Person Name	Age	Comments
Rabia Malik	45	Don't follow much pages on internet.
Osama Sheikh	21	It causes me needless curiosity.
Tauqeer Malik	37	I don't believe except in official news.
Mudassar Sheikh	57	We must authenticate the source before believing.

Problem #4:

Person Name	Age	Comments
Rabia Malik	45	Electricity breakdown causes backward life.
Osama Sheikh	21	It creates thoughts against the government authorities.
Tauqeer Malik	37	We can not study or use smart devices.
Mudassar Sheikh	57	One's life get paused because of this.

Other notes:

Over screen time does not only affect the eyes but also the neck and back bone and causes depression.
Depression may result in serious loss.

2.2 Define and describe the problem in great detail so it captures all aspects and conveys the same extent and nature of the problem when someone else reads it. How did you come up with the problem?

People nowadays especially the poor ones, face big troubles when one of their family member get admitted to a hospital. They can't bare the heavy expenses there. When this comes to Oxygen supply to the patient, these people are helpless which results in the death of their loved ones. Moreover, hospitals which run on donation many times face lack of ventilators for Oxygen supply due to their heavy costs.

We came up with this problem when during Covid-19 many people died due to breathing problem. Furthermore, I've perceived a lot of deaths due to unavailability of ventilator or due to their extremely high rent rates.

2.3 Very specifically, list what you want your solution to achieve? (Example: My problem is that I can't keep dry when I wash dishes. Now the solution I would like to achieve is to stay dry while I wash dishes.)

We want our prepared ventilator

1. To be in the reach of all people.
2. To be fully functional as the present ventilator but at a feasible cost.
3. To become easily available in all types of hospital.
4. To be able to be used on minor as well as severe patients.

STEP 3- DEVELOP IDEAS AND DRAFT ALTERNATE SOLUTIONS

3.1 Research and record the most important factors in solving this problem.

- Power source: This provides the energy needed to operate the ventilator.
- Controls: These allow the user to set the ventilator's settings, such as the rate of ventilation, the volume of air delivered with each breath, and the pressure of the air.
- Monitors: These track the patient's breathing and other vital signs such as heart beat and body temperature.
- Safety features: These protect the patient from harm, such as high pressure or low oxygen levels.
- Patient circuit: This is the tubing that connects the ventilator to the patient's airway.
- Humidifier: The humidifier adds moisture to the air delivered by the ventilator. This helps to prevent the airways from drying out.
- Mask: The mask is worn over the nose and mouth to deliver the pressurized air.

What are some different ways you can solve this problem?

Some of the preventions that we can apply in our life in order to not to get in such a situation are:

1. **Quit smoking:** This can be a major factor of breathing difficulty. Quitting smoking can reduce the danger of various lung and other types of cancers as well as oxygen deficiency.
2. **Regular Exercise:** This can be major way to solve breathing problems as exercising keeps the body fit and healthy and helps to lead a fit and strong life
3. **Getting enough sleep:** The phrase "*Early to bed, early to rise, makes you healthy, wealthy and wise"* should be practiced in words and actions in order to prevent a number of diseases.
4. **Healthy diet:** Taking a balanced and healthy diet can be one of the best decisions.
5. **Vaccination:** Getting oneself properly vaccinated may reduce the danger of exposure to different diseases and increase immunity.
6. **Consultation to a doctor:** People suffering breathing difficulty should take medical advice through a qualified doctor regularly in order to be on track and to maintain a healthy lifestyle.

3.2 Research different sources to find any similar solutions already out there!

The OpenVent ventilator is an impressive way to overcome this problem but it lacks alarm system, humidification, and nebulization. It may also not provide adequate ventilation for patients with severe lung conditions e.g. ARDS, COPD and asthma.

OpenVent-Bristol | 'low-tech' COVID-19 ventilator (openventbristol.co.uk)

CPAP is actually used to treat patients suffering from sleep apnea. It is also used to treat ventilator patients and was common during the Covid-19. But it lacks providing a controlled ventilation to the patient, and may also not be suitable for patients suffering from claustrophobia.

Turning sleep apnea machines into ventilators - Berkeley Engineering

The OpenVent is working to design an open source ventilator. Its designs are available online for free.

https://engineering.berkeley.edu/news/2020/04/turning-sleep-apnea-machines-into-ventilators/

A standard CPAP machine provides one constant pressure and cannot move air in and out, thus it cannot ventilate. A ventilator provides air at variable pressures to move air in and out of the lungs according to the settings and patient's needs.

https://www.healthline.com/health/what-is-a-cpap-machine#bottom-line

The cost of sensors used in it is very high whereas we're trying to make a low cost ventilator

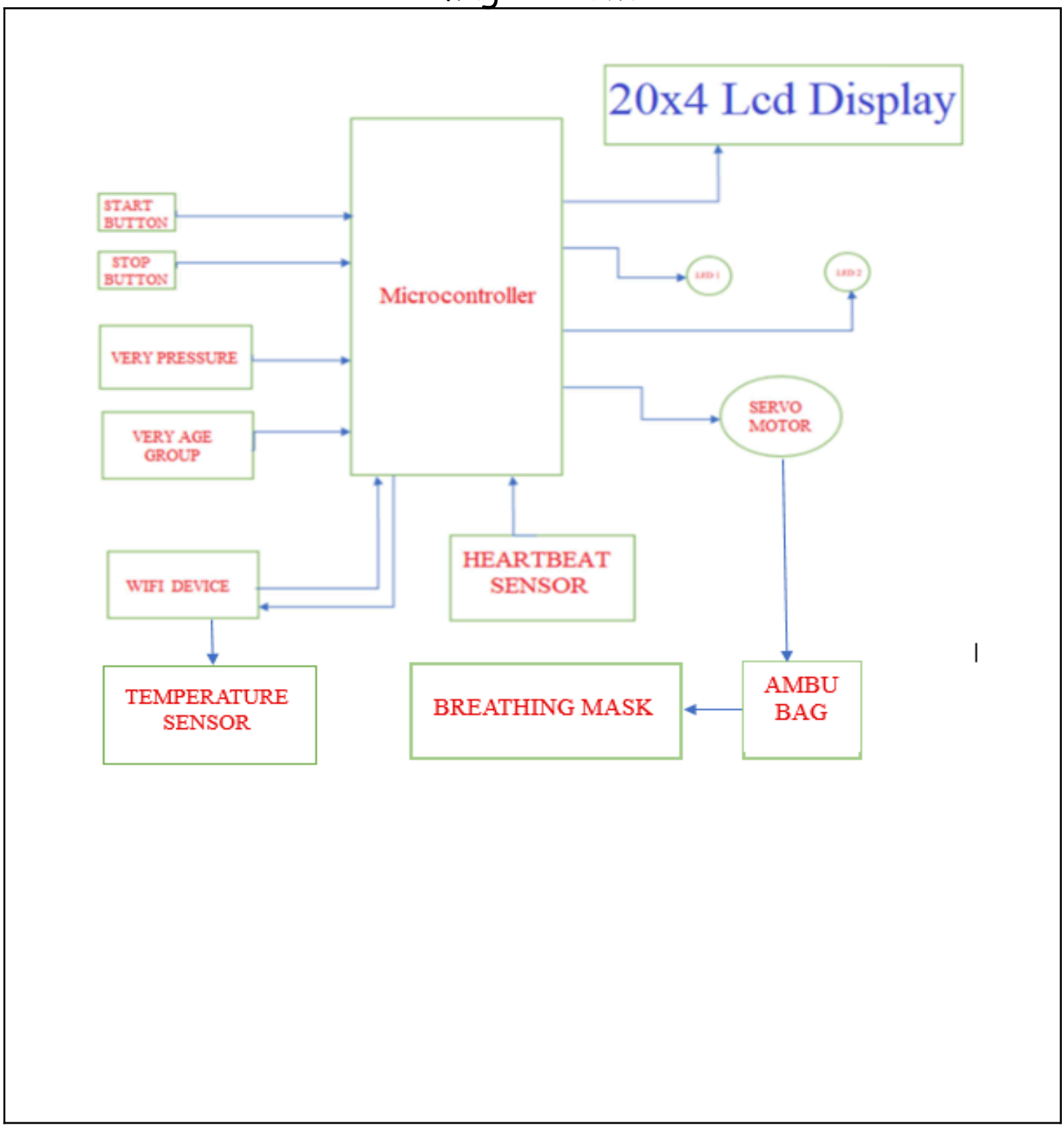
https://www.ajmc.com/view/researchers-modify-sleep-apnea-machines-to-ease-ventilator-shortage

3.2.1 How are they different from what you are trying to do?

What we are trying to achieve is that we have to provide a fully functional ventilator meeting all the needs of patients. The above mentioned solutions do meet some requirements but as a whole they do not provide a proper solution to the problem. We are looking to design a ventilator which has a full pressure and volume control, proper alarm system and meets the requirements of every type of ventilator patient whether he is a severe one or going through a mild problem.

STEP 4- OVER TO THE DRAWING BOARD

4.1 In as much detail as possible, draw a blueprint/model of how your solution will (a) look; (b) what pa rts/components/elements it will involve; and (c) how it will work. If possible, show or list all its functions! Insert an image below!



Mentor/Teacher Solution Sign-Off

I,Dahika Abdul Hafeez, am aware of the guidelines for the invention process and approve the solution each of my students/team wants to pursue. This solution and the process of developing it is within the guidelines and meets safety requirements. I will guide them through this process.

Teacher's Signature - typed	Date
Dahika	13-11-2023

4.2 Talk to experts and potential users of your solution about the obstacles/ problems you are likely to face in making a real model of your design. Note those problems and how you identified them. Note what the experts and users said, their experience in this area, and why you chose to talk to them. Along with the observations of others, also note what problems you think you will face in making a model. Note the credentials of the experts here.

Issue 1

User/Expert Name:	Dr. Khurram
Credentials of the experts:	Professor at NED University
Problem user/expert identified:	Heart Beat rate and temperature can not be sown on LCD screen.
Problem you think you will face:	Arduino NANO may not be sufficient enough to for running the program.

Issue 2

User/Expert Name:	Mr. Tauqeer
Credentials of the experts:	Masters in Electronics
Problem user/expert identified:	All components of a circuit can not be connected to a 9 volt battery.
Problem you think you will face:	9 volt battery will not be enough to operate the circuit.

Issue 3

User/Expert Name:	Miss Hoorain
Credentials of the experts:	Biomedical Engineering
Problem user/expert identified:	We cant make a project without an AMBU bag or an air providing component.
Problem you think you will face:	High cost will be needed in order to make ventilator on own.

4.3 How will you overcome these issues? As you record how you will overcome these issues, if the changes are minor, revise the existing model iteration. If you make major changes to your model, add more iterations to your first model (Model i1….Model i2).

We did not neet to change the iteration as the changes were minor,
We have used ESP8266 a WiFi module to connect Temperature sensor and heart beat sensor and the results can be shown on the mobile screen.
We have provided 9 volt to Arduino NANO and ESP8266, used 5 volt from Arduino NANO to power LCD screen, potentiometers, LED lights, servo motor and switch buttons. Also we have used 3.3 volt from ESP8266 to power the temperature sensor and heart beat sensor.

4.4 There is a great emphasis needed on making green solutions. This means whatever solution you arrive at, try to make it as sustainable as possible. Note here how your design can be more sustainable. If it uses less of the natural resources, or does not damage the environment, it is a sustainable solution. (Materials or substances that occur in nature and can be used for economic gain, such as minerals, forests, water, and fertile land).

To make it sustainable we have used less power as we used only a single battery of 9 volt and provided other 5 volt and 3.3 volt of power from Arduino NANO and ESP8266 respectively.

STEP 5- PLAN FOR PROTOTYPING

5.1 Talk to experts (engineers, scientists, entrepreneurs) to: (a) figure out the best materials, parts and components to use; (b) and where to find them. Record the materials, parts and components you will use and where you will get them from.

Arduino NANO, ESP8266 WiFi module, 16*4 LCD screen, Servo motor, Temperature Sensor, Heart beat sensor, LED lights, Potentiometers, switch buttons, bread board and Jumper wires were found from an electronic components shop.
AMBU bag, Reservoir bag and Ventilation mask for patient were found at surgical shops and pharmacy.
Servo motor arm, nails and nut bolds were found at hardware tools shop.

5.2 Read research articles and other published information to: (a) better understand the parts and materials you plan to use; (b) the skills needed to make the model into a real invention; (c) explore if you need any additional skills to make your invention. Note your findings here.

-Arduino Nano is an open-source breadboard-friendly microcontroller. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.
-NodeMCU is an open source development board and firmware based on the widely used ESP8266 -12E WiFi module. It allows you to program the ESP8266 WiFi module with Arduino IDE.
-Heart beat sensors are designed to give digital output heart beat when a finger is placed on it.
-The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air.

-An AMBU bag, also known as a manual resuscitator or bag valve mask (BVM), is a device used to provide respiratory support to patients in emergency and non-emergency situations. It consists of a self-inflating bag, a mask or mouthpiece, and a valve to control the flow of air.
-MG995 servo is a powerful servo motor that is capable of spinning and controlling things that a small hobby servo motor could never accomplish doing. It comes with a bunch of accessories so you could connect it easily with the outer world.
16*4 LCD Display can display 4 lines with 16 characters in each line.

Connecting all these components together to make a circuit needs basic electrical and electronics knowledge for making the circuitry. Also, Arduino NANO needs additional skill of programming in C language which is used in Arduino IDE for controlling the circuit.

5.3 Connect with experts who can help you make the prototype. Note the credentials of the experts here.

-Professor at NED University, Ph.D. in Digital Signal Processing.
-Electronics Component provider, Masters in Electronic Engineering.
-A friend from Biomedical Engineering.

STEP 6 - OVER TO THE LABORATORY

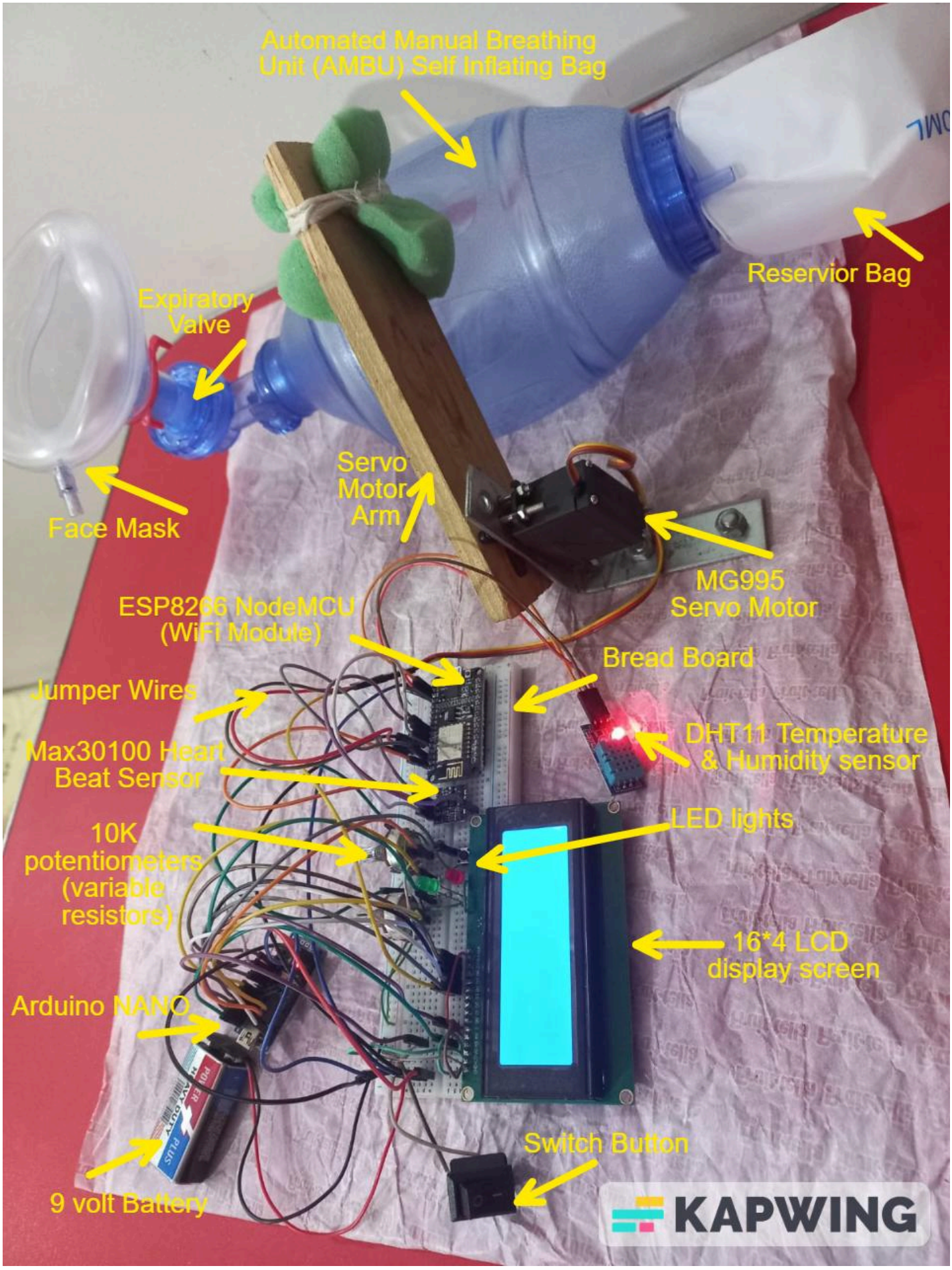
6.1 Arrange the materials, tools and machinery you'll use to build your prototype. Do not hesitate to ask for help from others where you need it.

Prototype 1 - Build: Note any and all observations you have while building. Attach pictures of the process as

you build.

Notes:

While making the circuit we have to be careful regarding the connections of wires and the battery.
We must provide positive and negative both voltages to each component on the bread board and included in the circuit.


Automated Manual Breathing Unit (AMBU) Self Inflating Bag
Reservior Bag
Expiratory Valve
Face Mask
Servo Motor Arm
MG995 Servo Motor
ESP8266 NodeMCU (WiFi Module)
Bread Board
Jumper Wires
DHT11 Temperature & Humidity sensor
Max30100 Heart Beat Sensor
LED lights
10K potentiometers (variable resistors)
16*4 LCD display screen
Arduino NANO
Switch Button
9 volt Battery
KAPWING

STEP 7 - TEST YOUR PROTOTYPE

7.1 Describe how you will test your prototype

We will supply 9 volt from a battery after the circuit connection is complete an the program is uploaded in Arduino NANO.
We will place a paper over the breathing mask to check the speed and flow of air in AMBU bag. Also we will test multiple times by changing the volume and pressure and selecting different age group.

Now, **test your prototype**

7.2 Identify and record all positive and negative observations you have **each time you test** your prototype.

POSITIVE:

All the components were powered up.
LCD screen started displaying.
Pressure and volume were varied using potentiometers.
Servo arm started pressing the AMBU bag and air flowed at desired level.

NEGATIVE:

The program was not successfully uploading in Arduino NANO.
Some LED lights were burnt on providing 9 volts without a resistor.
Servo motor was not rotating at the desired angle.

At this point, consider if you need to go **back to the drawing board** (Step 4) or **over to the lab** (Step 6) for some revisions to the prototype. Keep creating new versions of ModelI1, ProtoI as needed so you can record all the iterations you did. Keep making changes to your prototype and try new iterations until your invention works as planned.

STEP 8- PREPARE TO MARKET

Once the prototype of the product is ready, there are four decisions you need to make to see how you can effectively market this product. These are **price, branding, value, and where and how you will sell the product**.

Decide on a catchy name for the product that will appeal to most people and also convey the purpose of the product. Think about words and word combinations that describe your product and the solution it provides. Then use them to decide on a name.

8.1 What possible words, word combinations and names can you think of?

Controlled Ventilator,
Portable Ventilator,
Pressure & Volume Controlled Ventilator,
Low cost ventilator,
Your life saver at each & every place.

ECO VENTURE FLOW PRO

"EVERY LIFE SAVED IS A BEACON OF HOPE."

AffordaFlow PressureSync
EcoFlow PrecisionVent
BudgetGuard VolumePro
ThriftFlow ControlCare
EcoVenture FlowPro
EcoPulse FlowGuard
BudgetPump VolumeSync
ValueFlow PressureCare
FrugalPulse VentPro
WiseVent VolumeGuardian
EconoPress PrecisionFlow

8.2 Now think of the value your product offers. List the functions and benefits it offers to the user. How is it better and/ or different than the products already available in the market?

The value our product offers is that it is of very low cost as compared to the ventilators in hospitals.
It's functional benefit is that it provides controlled pressure and volume. Also the flow of air is according to the age group of the patient.
It's different from the products available as it is easily portable and can be taken at each place.

8.3 Determine the price at which you will sell it. What will it cost you to build the product? What will it cost you to sell it? Will people be willing to pay for it?

It has costed us around $50 to build ECO VENTURE FLOW PRO portable ventilator.
It costs us around $20 us to sell it (excluding the cost of product).
This sums upto $70 to sell a single product.
We are going to charge $200 for this ventilator and we think that people will be willing to buy it since it is better than CPAP, it provides controlled flow over volume and pressure, also it is portable.

8.4 Finally, decide where customers will be able to buy it.

Customers will be able to buy it online,at surgical components providers, medical stores and pharmacies. Also, customers can find it at medical stores near emergencies department of the hospitals.

8.5 Describe your typical customer. What is their :

Age:	60
Gender:	Male
Education Level:	Graduate
Household size:	6
Marital Status:	Married
Other Notes:	A typical customer can be patient of Asthma or finds difficulty in breathing or he can be a smoker.

"The best way to predict the future is to invent it!"

Survey For Students

Your opinion matters! So please take your time and tell us about your experience with EMUiNVENT.

Three activities I enjoyed were:

Exploring innovative ideas.
Learning to make circuits.
Productive meetups with teammates.

B. Two people I want to thank (teachers, mentors, teammates):

My mentor and my teammates.

C. One thing I found difficult or I would change:

To learn skills that are beyond my education level and to identify and get the components for making the product.

D. In the future I would like to…

Explore more innovative ideas and I will try converting my problem into a smart product solving it.

Notes:

- I would like to express my gratitude to the organizers of EMUiNVENT-2024 and all those who helped & guided us.