

NEWYORK FACEMASK

GROUP MEMBERS

ABDALLAH ALOTAIBI, WEBSITE DEVELOPER

JEHAD ALQUBAISI, *CLIENT CONTACT*

ADI ALQURASHI, *DOCUMENT MANGER*

ABDULLAH ALSHAMMARI, *PROJECT MANGER*

SULTAN ALZHRANI, *BUDGET LIAISON*



PROJECT DESCRIPTION

- Design a Face Mask with following features
 - **COMFORTABLY BREATHABLE:** Assisted by an electronic ventilation system
 - **SOCIALLY ACCEPTABLE:** Allow user to assist in verbal and non-verbal communication
- The project is sponsored by Northern Arizona University (NAU)
- The Client is Dr.Trevas

CUSTOMER REQUIREMENTS

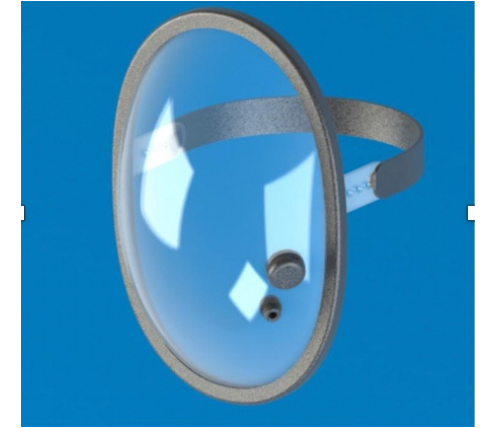
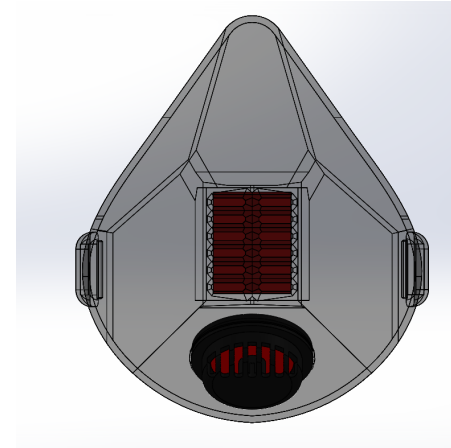
Customer Requirements	Met By Design
Allow unrestricted exhalation and inhalation	Presence of filter makes unrestricted exhalation and inhalation
Allow unrestricted speech and non-verbal communication	Presence of speaker system allow speech and transparent material allow unrestricted non-verbal communication
Allow easy eating and drinking while wearing mask	Not yet present in the design
Allow uninterrupted operability in an 8-hour working day	Presence of battery makes uninterrupted operation for 8 hours
Speaker present to make the voice loud	Speaker is present
Easy to wear	Broad size makes it easy to wear
Not act as a carrier of virus	Filter is not a carrier of virus
Reliable	Plastic body makes it reliable
Durable	Polynomial material to make it durable

ENGINEERING REQUIREMENTS

Engineering Requirements	Operational Values	Met by Design
Length	< 8 inches	The design length is around 6 inches
Battery Time	> 8 hours	Lithium battery gives more than 8 hours
Expiration Rate	6 liter/min	Fan provide more than 6 liter/min flow
Tidal Volume	0.5 liter	Volume is less than 0.5 liter
Transparent Material	< 2 %	Transparency of polycarbonate is less than 2
Weight	< 50 g	Lightweight plastic make the overall weight less than 50 g
Battery Capacity	6.6 W	Battery rating is 2800 mAh
Filter Size	< 12 x 12 inches	HEPA Filter is 11.65 x 11.65 inches
Particulate Size	2.5	Filter is less than 2.8 hence safe to use

DESIGN DESCRIPTION

- Different ideas have generated to select the final design
 - Cloth Mask
 - Plastic Mask with Polynomial Surfaces
 - Plastic Mask with Curved Surface
- Decision Matrix used to select the final design
- Final Design selected
 - Plastic Mask with Polynomial Surface
- Currently, final design of the mask has selected
- CAD model has developed



DESIGN DESCRIPTION

- Selected design is a kind of broad mask
- Covers nose and face
- N-95 Air Filter present at front for inhalation and Exhalation
- Suction Fan and Ventilation System will be fitted on the front Rectangular Inhalation Port
- Speaker present for sound
- Chip and battery install inside the mask for operation



MANUFACTURING

- Some components ordered and received shown

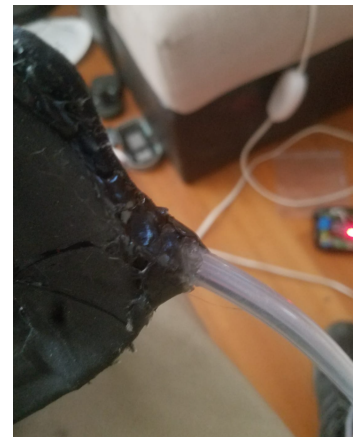


MANUFACTURING

- Few tests have performed to select the best components like for fan.
- The selected fan out of multiple fans contains minimum amount of noise to affect the microphone
- Testing of components like speakers, microphone, pressure sensor has done with the Arduino
- For the implementation of facemask, silicon, epoxy and other related materials have ordered
- But after some trials for making the facemask, team decided to use a prefabricated facemask

MANUFACTURING

- We decided to use a prefabricated mask that fit very nicely over our design
- A hole drilled in the mask
- Silicone tubing bring out of these hole
- A small silicon tube has inserted within the main silicon tube
- Silicone tube contains containing pressure sensor connector
- Pressure sensor has attached in the speaker
- Silicone tube contain wires to connect, provide power to Arduino, Fan, and Microphone
- All the wires have glued within the tube properly



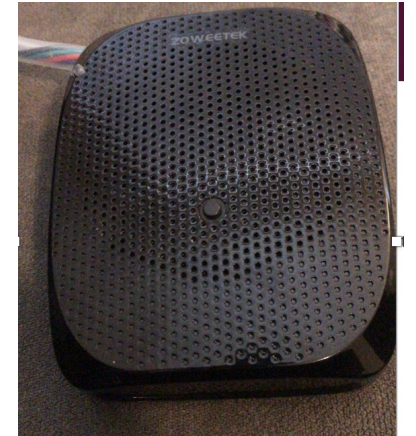
MANUFACTURING

- Silicon tubes have cut and glued in a way that tubes will not get block
- We drew a line around the center portion as well as the two exhaust and input filters
- The border has sewed from where it has cut and folded with glue
- To make the mask adjustable in size, added different size straps
- Several different sizes straps have made
- Each size has a different color button to keep the sets easy to tell from one another
- Another thing to make the mask fit individuals better and seal up any potential are gaps is to include adhesive back foam pieces that are cut two shapes that should already be effective but can also be cut down as needed



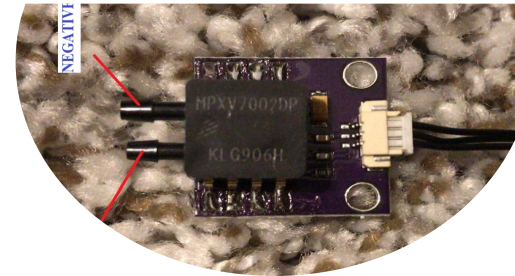
MANUFACTURING

- A power button has been added to turn ON/OFF the device.
- A hole drilled in the back of the device strategically to reset the Arduino for the LED lights
- The button can push by something similar to Sim removal tool
- Filter Template has shown
- The filters have cut down
- Placed inside the filter caps



Arduino Code contains three main parts:

- Pressure sensor



- FAN



- LED's



FINAL DESIGN

- Final Mask has Completed



VIDEO



TESTING PROCEDURES

- Length
 - It can test by using the feet scale. The test can perform in any conditions inside the room. Feet scale is available in all the labs and it can easily perform the test.
- Battery Time
 - To test the battery time, full charged the battery and then keep the mask running with full load and note down the time using the mobile phone. This task can perform inside the room without any other equipment.
- Expiration Rate
 - This can test by using the anemometer available in the chemistry lab to test the air flow measurement. The device has to take in the chemistry lab to perform this test

TESTING PROCEDURES

- Tidal Volume
 - To test this engineering requirement, use Spirometer. This device is available in the civil lab.
- Transparent Material
 - To test it, need clarity meter also called transparency meter. This device is available in the mechanical lab. For performing this test, the material for making the device has to take in the mechanical lab for performing the test
- Weight
 - To test this ER, need a scale machine which is easily available in most of the labs, including chemistry lab and mechanical lab. Hence this test can perform in the lab to measure the weight of device.

BUDGET

Product	Purpose	Material	Unit Cost	Cost
Epoxy Resin	For adhesiveness	Glue material	\$34.99	\$34.99
Plasti Dip Black	For shaping	Aluminum Foil	\$21.95	\$21.95
Acetone	Remover	Acid	\$8.79	\$8.79
Airfit Cushion	Filter	Plastic	\$14.01	\$14.01
Resin Casting	Sealing	Fabric	\$14.99	\$14.99
Disc Pad	Sealing	Paper	\$9.99	\$9.99
Adhesive Foam	Sticking	Foam	\$13.85	\$13.85
Clay	Facemask Design	Clay	\$18.99	\$18.99
Black Cotton	Sealing	Fabric	\$16.99	\$16.99
Sponge Foam	Edges	Foam	\$16.80	\$16.80
Direct	Cliping	Plastic	\$9.99	\$9.99

BUDGET

Product	Purpose	Material	Unit Cost	Cost
Neoprene	Rolling	Fabric Foam	\$11.00	\$11.00
Facemask	Model Mask	Plastic	\$15.89	\$15.89
Amplifier	Voice Loudness	Plastic Silicone	\$35.99	\$35.99
Snap Button	Stich	Metal	\$11.99	\$11.99
Face Shield	Model Mask	Plastic	\$23.39	\$23.39
Mannequin Head	Model Head	Plastic	\$22.99	\$22.99
USB Fan	Air Pressure	Plastic	\$7.90	\$7.90
Cooling Fans	Air Pressure	Plastic Silicone	\$14.00	\$14.00
Transparent Mask	Model Mask	Plastic	\$15.99	\$15.99
Quilting Fabric	Covers	Fabric	\$12.00	\$12.00
Filter	Filtration	Plastic	\$34.99	\$34.99

BUDGET

Product	Purpose	Material	Unit Cost	Cost
Air Filter	Filtration	Plastic	\$12.99	\$12.99
Life casting Alginate	Plaster for model	Plastic Cement	\$39.36	\$39.36
Blower Fan	Air pressure	Plastic	\$9.99	\$9.99
Raspberry Pi	Controller	Silicon	\$9.49	\$9.49
Sheet Rolls	Sheet	Fabric	\$14.80	\$14.80
Pads	Padding	Fabric	\$16.13	\$16.13
Silicon Sealant	Sealant	Chemical	\$16.50	\$16.50
Ribbon Band	Padding	Fabric	\$6.99	\$6.99
Total				\$585

FUTURE TASK

- Complete Testing will be done
- Modify the design if needed after complete testing

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ANY QUESTIONS

