LAG

PROJECT BREIF:

The concept for the project is inspired by sandgrouse birds that adapted to arid zones. Adults fly to water to drink it; young are provided with water by the male parent in his soaked belly feathers which are specially adapted structurally for absorbing and holding water. Mechanical transformation of sandgrouse barbules, when wetted in physio-chemical terms are appropriate for macromolecular system.

The aim of this project is to take advantage of the high rate of humidity in Masdar city. The project utilizes the intricate structural characteristic of natural bamboo fibres along with nano coating technology that converts humidity into water. The material coils when it is in a dry state, once there is an increase in in the humidity levels, the twisted coils begin to uncoil, storing water in the fabric. The bamboo fabric is held by two weight responsive sensors that twists ands wrings the water out of the fabric. A glass funnel like structure is under every module, which concentrates the water into an area and passes it down an opening under which people can walk. On the ground there are openings that lead to the storing of the water in underground tanks that can later be used for other purposes.

ENVIRONMENTAL IMPACT SUMMARY:

The most important quality of bamboo is its environmental-friendly characteristic. Bamboo is cheap, renewable and readily available in areas where it is cultivated and can be grown in a few years. Transportation of bamboo is also cheaper than other materials thus less environmental impact. Bamboo can be a very sustainable crop; a fast growing grass, as it requires no fertiliser and self-regenerates from its own roots, so it doesn’t need to be replanted unlike cotton cultivation, which requires large amounts of water, pesticides and labour. The bamboo fabric is manufactured in a mechanical process that crushes the plant and then an enzyme-breaking additive is added to convert the fibre into a mushy mass which is then mechanically combed out and spun into a yarn. This results in an eco-friendly process.

Once humidity is converted to water, water passes down the opening and onto the ground like rain- this will create a cooling breeze effect on the plot of land.

Extracting water from humidity is beneficial as it contributes marginally to the decreasing of humidity levels as high rates of humidity can contribute to the growth of mold, dust mites, and fungus, making it particularly dangerous for people with asthma and allergies. Moreover, warm environment is a breeding ground for bacteria and fungi, which creates a "toxic mist" that you later breathe in, thus this project decreases the humidity very slightly but will overtime create an impact that will be notable.

WATER TANK:

Water collected from humidity is stored in Al Bassam Fiberglass Underground Tanks that withstands soil corrosion conditions and provides protection against penetration of any materials into the body of the tank to avoid the growth of bacteria, fungi& algae.

\*Add this with cad file diagram\* 🡪 3 modules are attached to 1 tank

See Cad file

FABRIC & TECHNOLOGY:

Natural bamboo fibres are highly water absorbent, able to take up to three times its weight in water and when coated with nano technology, the process of humidity to water is enhanced. The bamboo fabric used is 420 gsm (grams per square metre).

Nano coating technology is based on naturally occurring moisture-gathering mechanisms developed by researchers at Harvard University.

The reversible switching between absorbing- superhydrophilic/ releasing- superhydrophobic states results from structural changes of a magnetic weight responsive sensor.

CALCULATIONS:

Water capacity of bamboo fabric ≈ { (Area of fabric \* gsm) \* 3 } / 1000

A single module consists of fabric unit (A), (B), (C) and (D).

Calculations of a fabric unit (A) in a module:

Bamboo fabric 420 gsm is used.

Length: 5m

Width: 0.241m

Area = L \* W

= 5 \* 0.241 = 1.205m2

Weight = Area of fabric \* gsm

= 1.205 \* 420 = 506.1g

Water capacity = (Weight \* 3)/ 1000 (1000 used to convert grams to litres)

= (506.1\* 3)/ 1000 = 1.5183 L

∴ 1.5183 L is the maximum water capacity threshold the bamboo fibre can hold which is variable and dependant on the humidity percentage and time of the year.

Total calculations of a single module:

**Water capacity of fabric unit (A)** \* 6 fabric units

= 1.5183\* 6 = **9.110 L**

**Water capacity of fabric unit (B)** = { (Area of fabric \* gsm) \* 3 } / 1000

Length: 10.137m

Width: 0.194m

Area = L\*W = 10.137\*0.194 = 1.967m2

Weight = Area of fabric \* gsm = 1.967\* 420 = 825.963g

Water capacity = (Weight \* 3)/ 1000 = (825.963\*3)/1000 = 2.478 L

Water capacity of fabric unit (B)\* 5 fabric units = 2.478\* 5 = **12.39 L**

**Water capacity of fabric unit (C)** = { (Area of fabric \* gsm) \* 3 } / 1000

Length: 13.752m

Width: 0.466m

Area = L\*W = 13.752\* 0.466 = 6.408m2

Weight = Area of fabric \* gsm = 6.408\* 420 = 2691.541g

Water capacity = (Weight \* 3)/ 1000 = (2691.541\*3)/1000 = 8.075 L

Water capacity of fabric unit (C)\* 4 fabric units = 8.075\* 4 = **32.3 L**

**Water capacity of fabric unit (D)** = { (Area of fabric \* gsm) \* 3 } / 1000

Length: 7.962m

Width: 0.241m

Area = L\*W = 7.962\* 0.241 = 1.919m2

Weight = Area of fabric \* gsm = 1.919\* 420 = 805.914g

Water capacity = (Weight \* 3)/ 1000 = (805.914\*3)/1000 = 2.418 L

Water capacity of fabric unit (D)\* 5 fabric units = 2.418\* 5 = **12.09 L**

∴ Total water capacity of a module = Fabric unit (A) + Fabric unit (B) + Fabric unit (C) +Fabric unit (D)

= 9.110 + 12.39 + 32.3 + 12.09 = **65.89 L**

HUMIDITY AVERAGE CHART FOR ABU DHABI: (include April 2018 to April 2019)

<https://www.worldweatheronline.com/abu-dhabi-weather-averages/abu-dhabi/ae.aspx>

WEIGHT RESPONSIVE SENSOR:

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Every kilogramme of the sponge-like fabric can absorb around 3.4 litres of water from the air.

In textile form bamboo retains many of the properties it has a plant. Bamboo is highly water absorbent, able to take up to three times its weight in water. In bamboo fabric, this translates to an excellent wicking ability that will pull moisture away from the skin so that it can evaporate. This makes it great for both hot and cool climates, bamboo clothing offers built-in temperature control. It traps warm air in its cross-sectional fibers to keep you warm in the winter, while its breathable nature and wicking properties keep moisture at bay for greater comfort in hot times.

<https://www.simplififabric.com/pages/bamboo>

Nano coating technology:

A new Nano-coating that can pull water out of the air might allow us to harvest water where there seems to be none. The coating is based on naturally occurring moisture-gathering mechanisms. Researchers at Harvard University have [modelled their new material](http://www.nature.com/nature/journal/vaop/ncurrent/full/nature16956.html#figures)

<http://www.albassam.ae/en/products/view/water-tanks150210060417.html>

<https://www.worldweatheronline.com/abu-dhabi-weather-averages/abu-dhabi/ae.aspx>