

AQUAIR

Acquire water from the air

Water is a need that people cannot live without. Aquair "Acquire Water from the Air" uses Honduras as its focal point, focusing on specific areas that have the resources to collect clean drinking water during the dry season.

In Honduras, the humidity is constantly very high throughout the whole year and prone to fog conditions, so we want to use these natural water resources to our benefit. AQUAIR is an active fog collector, after the fog passes through the centrifugal system, the water is expelled and clean water is collected.



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Social Design
Fog Harvester

Graduation project 2017

Basic Need

Motivation

There are many people in the world that try very hard on a daily basis to collect the resources around their environment to fulfill their "basic needs", which we seldom notice. Our group member, Marco comes from Honduras, which is a country that suffers similar situation. Thus, Honduras became our starting point, hoping that as well as helping change the people's way of living, we can also make good use of the local resources or technology to minimize cost and suit the local people's lifestyle. Expecting that this project can later expand to different places with the same situation.



What is BoP ?

Across the globe, billions of people do not even have their Food, Water, House, Sanitation, Education, Healthcare, which remain the majority of global population.

Principle of BoP design

Awareness

- Make sure people understand how to use
- Many people at BoP live in media-dark zone, or belong to minority language groups

Afforability

- They may invest more than usual on new solution and make a trade-off with another investment.

Acceptability

- It is necessary to understand other factors such as culture and beliefs

Availability

- To build a loyal customer and producer base at the BoP, there must be an uninterrupted supply, such as local resource



„Honduras become the starting point, to raise our awareness of basic need“

User Journey

of daily water collection

Home



Water Source

Home



Rain Collector

Water is contaminated
Not appropriate for drinking



Start at Midnight

Mom and kids walk 3-4
kilometers daily to a nearby
water source at midnight



Water Puddle

Formed after raining,
soft mud around the edge is
dangerous for people to step on



Physical Injury

Children carry heavy buckets
walking for long distance every
day, while the bumpy terrain
makes them more exhausting



Water Storage

Contaminated easily



Scattered Container

Water containers
are scattered, which is lack
of systematic collection



Water Service

Some areas get water



River

Formed after raining,
Dangerous for people to step on
the edge due to the soft mud



Well and Tap

Wells and taps provide water for
nearby communities



Bad Allocation

Run of water easily since there
are many types of households,
and they are not well allocated

Listen to Local

The real response from Honduras people



Woman 5 gallon
Teenager 3 gallon
Child 1 gallon



Water consumption
/ house / day
50 gallon



Emma 17 years old

“I often get up at one in the morning to help my mom Juana to get some water. If there are many people at the waterhole, then I will fetch only one or two gallons”



Andrea 12 years old

“Andrea, 12, is another girl who comes every day with her three siblings to take water from the 7 metre deep well. enough to drink.”



Elena 21 years old

“Elena, 21, said that it takes up to half an hour to fill a 5-gallon bucket. Women, men, boys and girls take turns starting at midnight in order to get enough water.

Our Goal

Define main goals for problem-solving



Increase
Water
Amount



Get from
Near
Location



Reduce
Physical
Injury



Release
Manpower

Weather as Inspiration

Inspect into local condition to find opportunity

Half year drought

The problem : during drought season, people acquire water from river or the storage one from rain season, which is in bad condition for health. Also they need to travel distances to attain water source



Foggy constantly

The opportunity : the communities that World Vision Org is working with locate in mountain areas, where the altitude are above 1000m, and humidity is constantly high, which provide a good condition for fog forming



📍 Santa Ana, Francisco Morazan	📍 Ojojona, Francisco Morazan	📍 San Marcos De Colon, Choluteca
Max: 21.2 ° C	Max: 20.8 ° C	Max: 22.6 ° C
Min: 16.8 ° C	Min: 16.6 ° C	Min: 20.0 ° C
Humidity: 70%	Humidity: 70%	Humidity: 66%
Precipitation: 1237mm	Precipitation: 1262mm	Precipitation: 1337mm
Altitude: 1389 m	Altitude: 1631 m	Altitude: 944 m

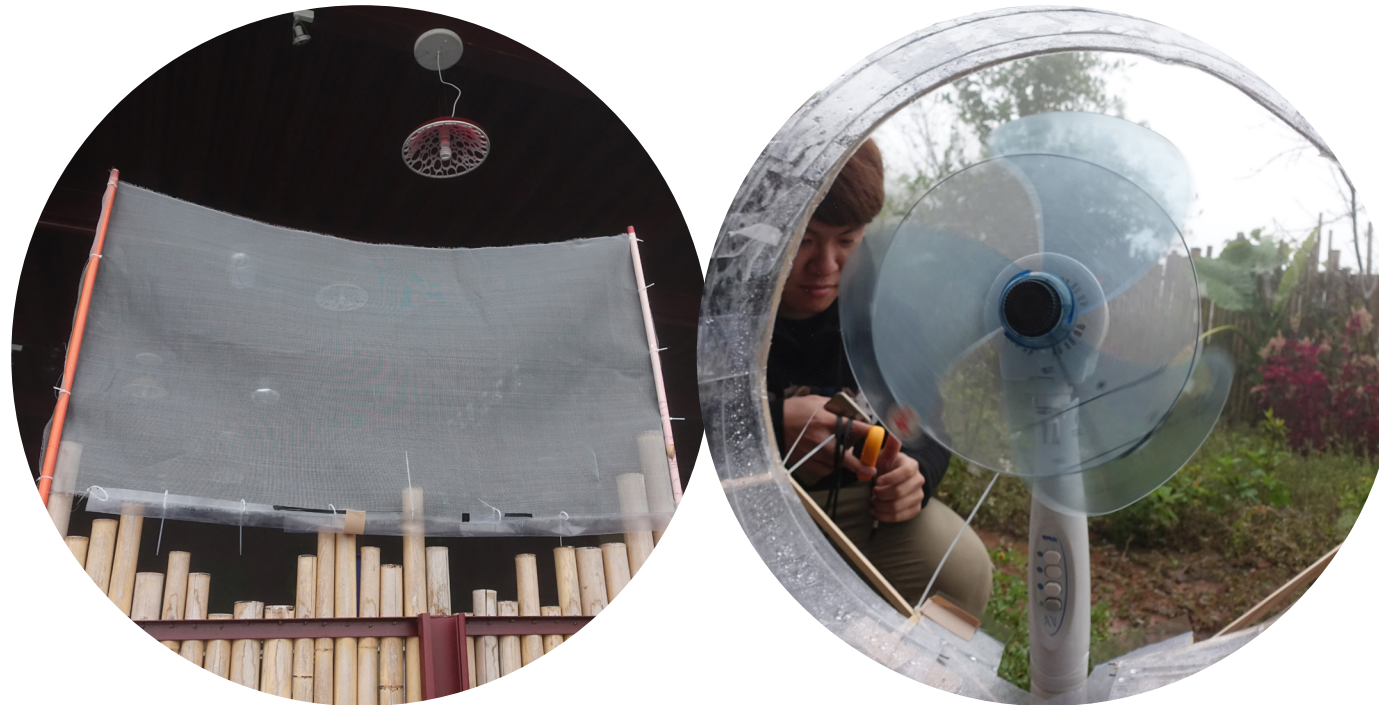
Fog Testing

Bring our prototype to Ali-Mountain

In order to test our idea "collecting fog", we've tried many ways to simulate fog, such as vapor from bathroom, liquid nitrogen, fog producing machine. However, we cannot make sure whether those particles are as tiny as real fog. So, we hopped on the car, and drive to mountain area. Lucily, there was abundant fog during the day, and we successfully proved the the idea!

Ali-Mountain
Chiayi , Taiwan

Goal : Compare & Quantify

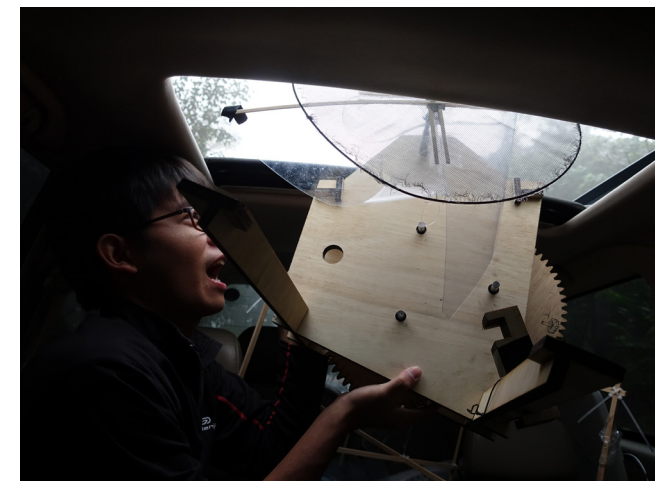


NET passive-attach

This is the simulation of now-existing fog-harvesting net. We tried to compare the difference between ours. After two hours, it turned out 0 ml.

FAN active-absorb

This is our first prototype, with very simple installation, we just want to prove if this idea works. In two hours, it turned out collected 200 ml.



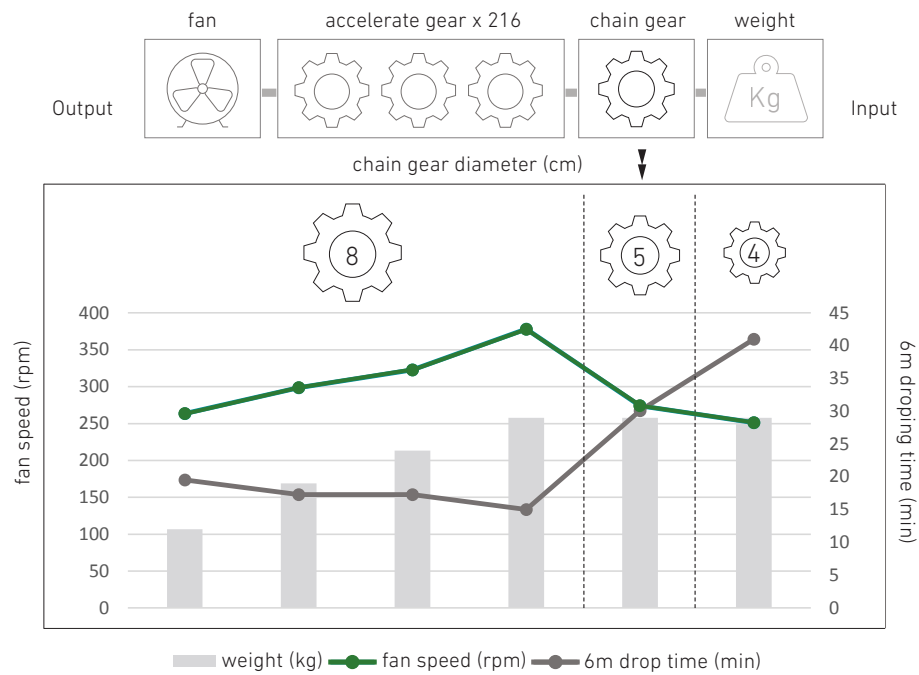
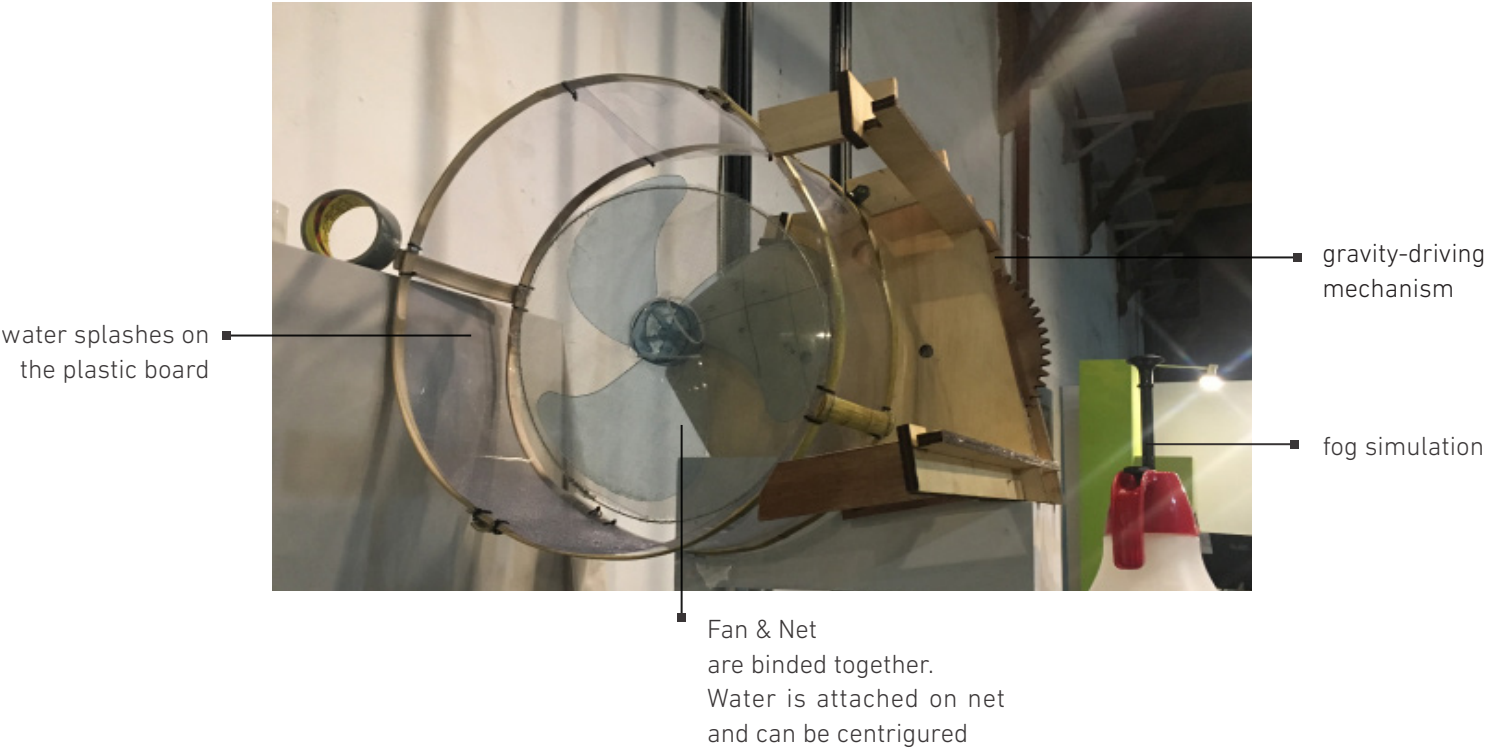
Gravity as Engine

Bring our prototype to Ali-Mountain

After we confirm the idea of fan-absorbing fog, the next step is trying to find out appropriate engine. Since the target area is lack of resource, the electricity source is totally impossible. Thus, we consider the pure machnical system as a rotating power. Instead of human power, such as riding the bike to generate power, we think of ancient technique : "clock".By weigh and different gears, clock can rotate its appropriate speed.



Prototype

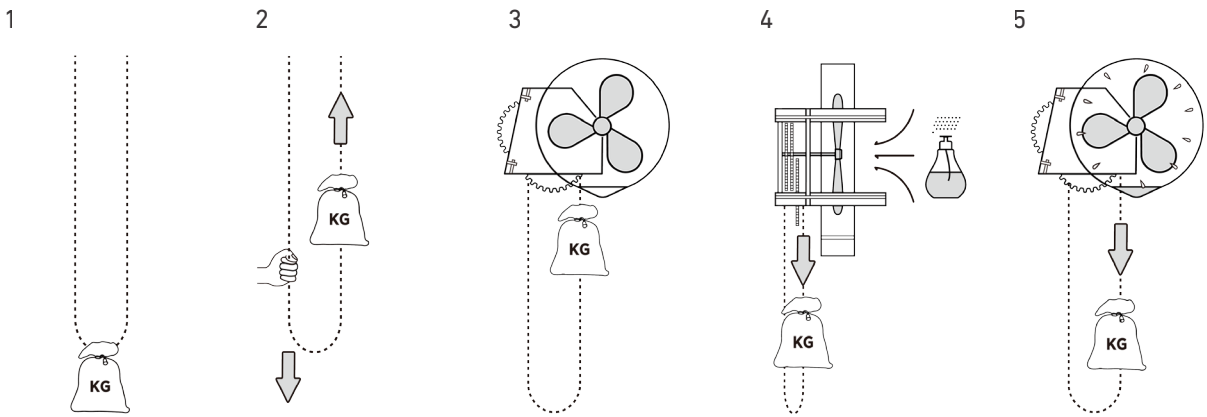


Gear Testing

Testing different diameters of gears to optimize between "fan speed" and "drop time".

Result showed that the 5cm diameter gear worked best :

WEIGHT 29 kg
FAN SPEED 274 rpm
DROP SPEED 30 min / 6m



AQUAIR

A portable fog harvesting device

AQUAIR collects water in a waterproof mesh fabric which is stretched across a pre-fabricated bamboo structure, in order to maximize airflow. What's unique about AQUAIR is the fan and small centrifuge using gravity in the form of a 30-kilogram weight attached to the framework. It lures water vapor down a tube into an awaiting bucket. The entire structure can be broken down put back together by hand, locally sourced rocks and bamboo can be added to the design for the weight and flexible elements.



draw fog in



centrifugal water



gravity as engine



rain collection



Feature

A portable fog harvesting device

Waterproof Fabric

easy to transport

Bellmouth Form

higher air flow

Tensil Structure

traingle support
minimize skeletons



Fan & Net

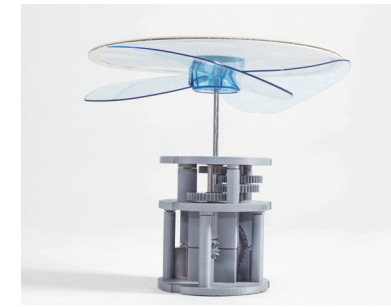
are stucked together
to centrifugal fog that
condensed on net

Gearbox

higher gear ratio

Storage basin

water-diversion roof



Bamboo

local material

Tube

transport water
down to bucket

Bucket

water collector
& primary filter

Weight Bag

30 kg
drop speed : 6m / 30min



How to Use

Simple steps to capture fog through Aquair

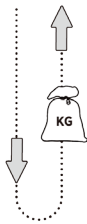


1



Collect 30kg

2



Pull bag
to the top

3



Iniciate fan
draw fog in

4



Water comes
out from fog

5



Water is
collected

Local Material

AQUIR is designed to be easy to build and assemble, so the local people can easily access the parts or create their own versions of AQUAIR. We tried to reduce the import components as many as we can. Only the very crucial parts that need durability and cannot be accessed easily by local resources should be imported.



Import

1	4
2	5
3	6 7

Local

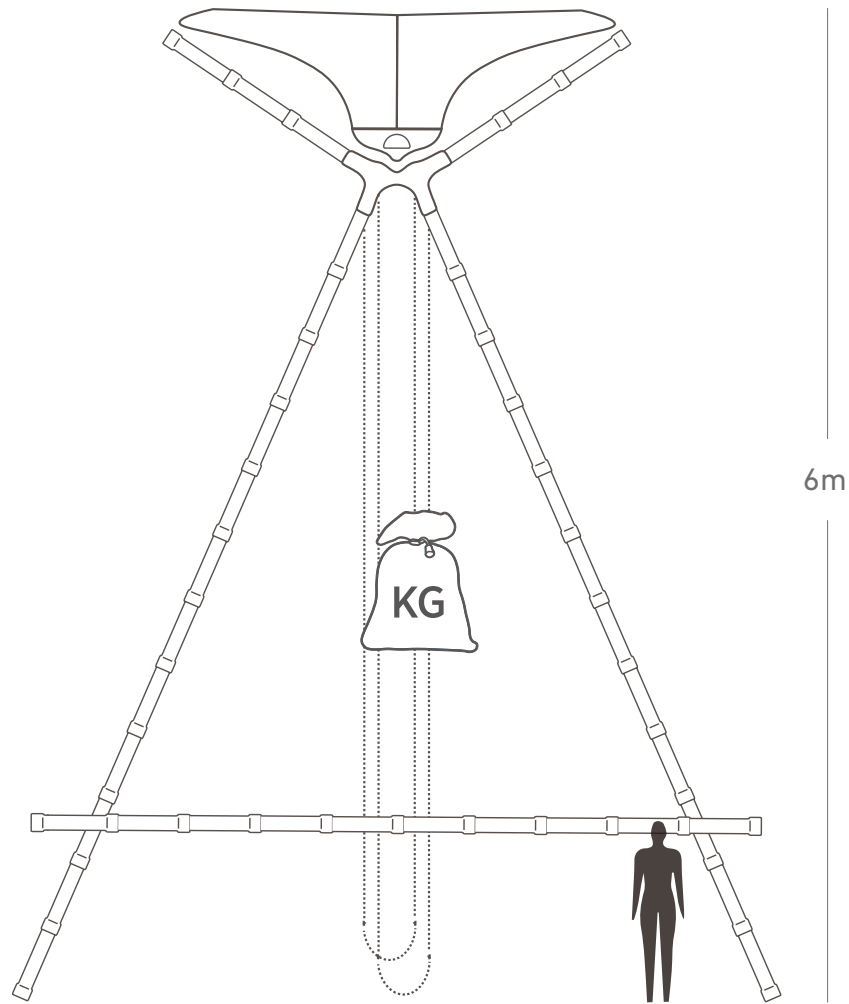
1	4
2	
3	

- 1 Storage basin
- 2 Fixing ring
- 3 Hood
- 4 Holder
- 5 Fan-Net
- 6 Gear mechanism
- 7 Gear chain

- 1 Container
- 2 Weight bag (as package)
- 3 Pipe
- 4 Bamboo structure

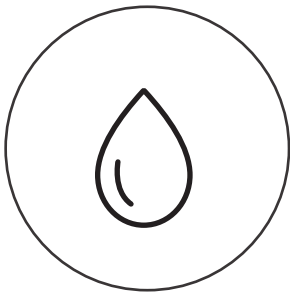
Scale

Currently, we optimize the operating time to 30 min, and the height should be 6m, which means people need to pull the weight every 30 min. As the rotating power is generated by weight, so the higher it is for weight to drop fall down, the longer the operating span. However, build such a huge installation around the habitat is not so appropriate to local living condition, so we try to find a better combination.



Next Step

To inspect our design, the 4A principle of BoP design can always be our instructor. We now just made a first step. To make it really happen, we need to raise our technique to improve the efficiency. To make it more accessible to local, we need to cooperate with local manufacturer. To pass the skill and promote to local, we need to cooperate with local organization.



Raise water efficiency



More local material



Cooperate to transfer technique



Pic 1 AQUAIR Team and friends from South America
Pic 2 & 3 Assembling

Behind AQUAIR



A woman in a white t-shirt and a patterned sarong stands in a lush green forest, operating a water collection system. The system consists of a large red canopy supported by bamboo poles, which funnels water into a central collection point. A hose leads from this point down to a blue bucket on the ground. The woman is holding the hose, and a brown bag is also attached to the system. The background is filled with tall trees and dense foliage.

AQUAIR

ACQUIRE WATER FROM THE AIR