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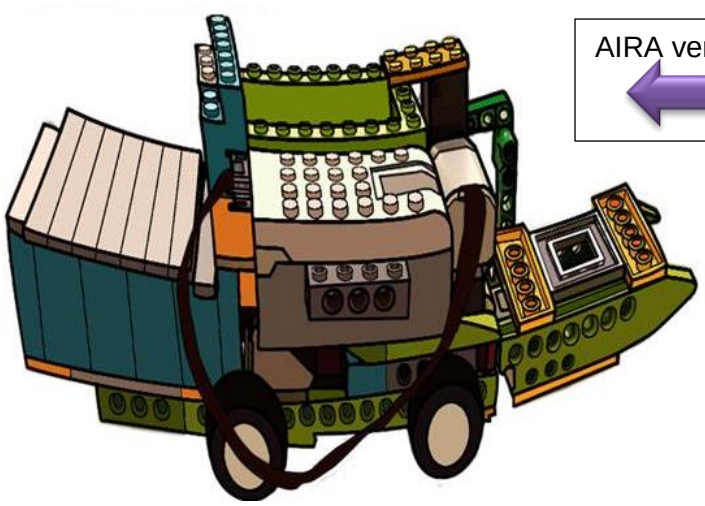
**Bonifacio Global City Taguig**
**Metro Manila**




# AQUA-INTELLIGENT RESCUE ANDROID (AIRA)

**Prepared by**

Almond Rose Obedoza

Denise Gabrielle Guillermo

Elyssa Monique Nepomuceno

# CHAPTER ONE

# INTRODUCTION

Natural disasters like floods happen almost everyday in different parts of the world. The countries hit by the most disasters between 1995 and 2015 are US, China, India and Indonesia. The Philippines was among the top 10 countries where the most people were affected, because up to 130 billion people were hurt.

Polluted water is not only very dirty; it is deadly. One million eight hundred thousand people die every year of diseases like cholera. Several others get really sick because of water-related illnesses. Sick children miss school when affected by floods.

People cannot survive long without clean drinking water. Water is the most important source of nourishment.

Hence, the Aqua-Intelligent Rescue Android (AIRA) was formed to ensure that people never have to worry about getting clean water after typhoons and floods have occurred.

## STATEMENT OF THE PROBLEM

We have typhoons and floods in the Philippines as much as 26 times a year. During floods, water resources such as ponds and rivers get contaminated. It is difficult to get clean water as it takes time for volunteers to bring water and other supplies to flood victims after a storm. Sometimes, it could even take days before rescue teams arrive.

People suffer from dehydration without water, and after floods, it takes months to repair damaged water lines. Floodwater may also go through water lines that aren't secure, making them contaminated. For just hydration, the National Capital Region (NCR) needs 6 Olympic pools of water.

As the threat of typhoons, hurricanes and floods continue to ravage countries all over the world, the question is – what can be done to aid the rescue team in reaching the victims; and, more importantly, how can people have access to clean drinking water in order to survive?

## PURPOSE

The Aqua-Intelligent Rescue Android (AIRA) can collect and purify flood water, thereby lessening the amount of flood while providing much needed nourishment to victims after a storm. It is charged by gathering solar energy on sunny days. When it

runs out of energy, there will be a solar-powered power bank ready to charge AIRA while it runs. When it rains and the water reaches a certain level, it starts to move, gathering water into the Ultrafiltration Hollow Composite Membrane with fibers made of polymer resin (when the floodwater goes through this it leaves the polluted things in it behind), and distributing clean water to marked locations in a village.

Since water lines take months to be repaired, AIRA can also purify water from natural resources and people can drink this.

**SIGNIFICANCE OF THE STUDY**

AIRA saves lives through 5 key actions:

(1) AIRA is able to supply people with enough water until their rescuers arrive. People can't survive for 3 days without clean drinking water.

(2) AIRA helps flood waters recede faster, which allows the rescue teams to reach the victims more swiftly.

(3) Soaking buildings or homes in flood for a long time can be dangerous. Water can not only cause structural damage, it can also provide a place for mold to live and grow. AIRA can prevent such damage by getting rid of flood water and turning it into something useful.

(4) When floodwater contaminates water lines and they get damaged by typhoons, it takes months to repair them. AIRA can purify water from natural resources like ponds and rivers during these months. That way, people can have potable water even if it can’t go through the water lines.

(5) Some people can get caught in the floodwater when it floods. These people can climb onto AIRA and ride it to their homes when it goes to them. Not only can this prevent people from getting diseases in the floodwater, but this can help those drowning in the flood.

# CHAPTER 2

# RELATED LITERATURE

## Thailand SOS

A Thai government agency developed SOS, a mobile unit that can purify flood water after a storm. It is brought about in a boat by volunteers. It uses silver nanoparticles to clean the water. It can convert 200L of water in one run.

## AIRA's Filter

Originally, we wanted to use silver nanoparticles to kill bacteria in floodwater because of its cheap price, but we learned from the Department of Science and Technology (DOST) that the filtration process will take too long if we use this. Aside from this, there are many things other than bacteria that can be found in floodwater. Instead of silver nanoparticles alone, we'll use a filter that the DOST is currently producing, the Ultrafiltration Hollow Fiber Composite Membrane. It has fibers made of polymer resin with small holes for the floodwater to pass through. The bacteria, heavy metals, salt, and other things in floodwater that make it dangerous to drink are left behind when the floodwater flows down the holes. We can coat this filter with silver nanoparticles. This will make the water being purified much cleaner.

Amphibious Vehicles

Our robot's base will be an amphibious vehicle. Amphibious vehicles can move through water without getting damaged and are big enough to collect and store a lot of water. One amphibious vehicle, TOAD, can float above water. This will help our robot move around in floods. TOAD also costs only ₱800,000, which is more affordable than normal ₱6,000,000 amphibious vehicles. Another amphibious vehicle we can base the robot on is SWAN. The DOST is currently developing it. It is made of abaca, which can push debris away.

# CHAPTER 3

# METHODOLOGY

## PROCEDURE AND TIME FRAME

We learned in our Social Studies subject in school about the devastating effects of floods in our country and wondered if there was a way to convert flood water into clean drinking water. We realized it was possible after researching on the SOS unit in Thailand. We took it a step further by turning it into a solar-powered, automated robot that would run on its own and help people in the aftermath of a typhoon. Further research showed that the robot would be useful in other parts of the world as well.

We started building a prototype, with three main parts: the scooper, filter and storage. We initially planned to include a sensor, but ran into problems when we realized that we needed at least 2 motors – one for the scooper and another for the wheels. Both motors are connected to a single hub. We have another hub in place for the sensor, but had to deactivate it after discovering (and confirming from Lego Customer Support) that the use of 2 hubs may result in unstable connections.

We interviewed the president of the Batangas State University, and he said not to use a scooper, but to use a pump instead. Now our robot has a motorized pump to

collect floodwater, a filter to purify it, and a manual pump for flood victims to pump out the water.

We created a video so people would have a quick and easy view of what AIRA does and why it is important. We also prepared a field to better demonstrate how the robot would work in the real world. We then prepared ourselves to present AIRA at the First Lego League Aqua Challenge 2018. After that, we interviewed people like engineers and rescuers. Here are some important things we learned from the interviews:

**Interview Information**

Traffic

During floods, traffic could prevent AIRA from collecting floodwater and going from house to house to distribute clean water. Many cars left during the flood would block the roads, especially in cities, which are very flood prone but also have lots of people and traffic. We learned about this problem in 2 of our interviews. To solve this, droid technology may be used to alert people that AIRA is on its way, or it can even deliver water to people while our robot pumps up floodwater during the traffic. Aside from this, if the flood goes above the cars, our robot's base will be TOAD, which can float above the water, and SWAN, which is made of abaca and pushes debris away.

## The Amphibious Vehicles TOAD and SWAN

TOAD is one amphibious vehicle that we'll base our robot on. It was created by the president of Batangas State University, who we interviewed. This stainless steel amphibious vehicle has wheels to move on land and floats above water. TOAD costs only ₱800,000. It is gasoline powered, but since that is not a clean source of energy, we will make it solar powered instead.

SWAN is being produced by the DOST, who we interviewed. Not only does it float like TOAD, but it is made of abaca and is designed to push debris away.

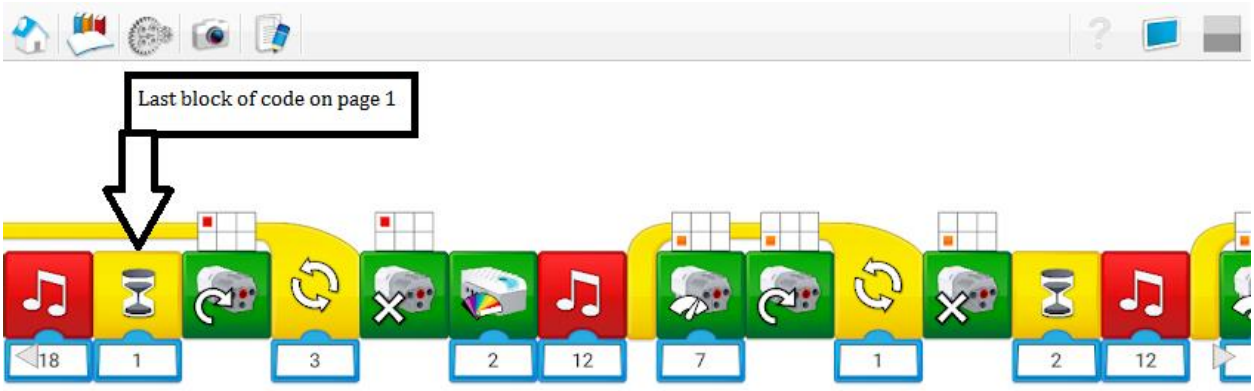
## The Ultrafiltration Hollow Fiber Composite Membrane

This is a filter that we learned about when interviewing the DOST. It has long fibers made of polymer resin, with small holes for the floodwater to pass through. Since the floodwater just flows down the fibers, the filtration process takes a short time, which enables AIRA to get to the thirsty flood victims in a shorter amount of time. We will also coat it with silver nanoparticles to help kill bacteria in the floodwater, making it cleaner than if we use the fibers by themselves.

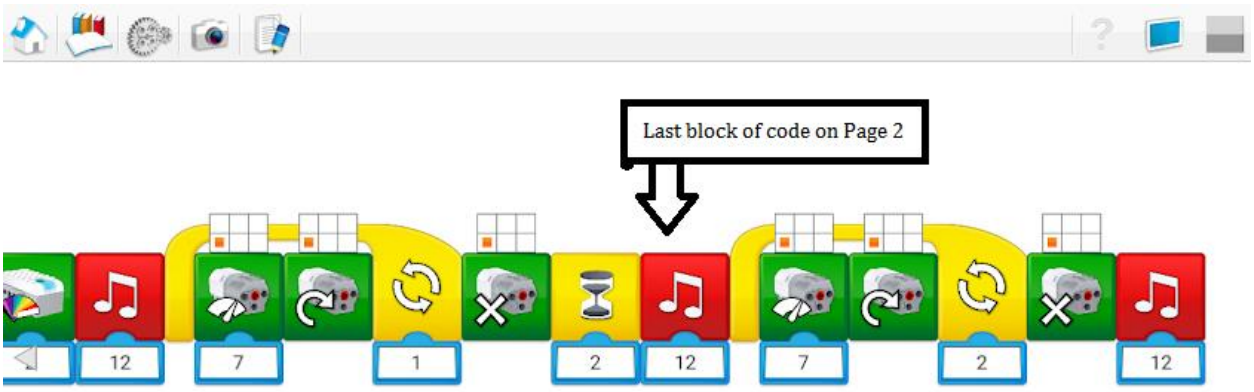
**ANALYSIS PLAN**

These are the pictures of our robot's program on Lego Wedo 2.0.


AIRA's Program Page 1




AIRA's Program Page 2




AIRA's Program Page 3

**SCOPE AND LIMITATIONS**

Some limitations were observed as part of the rules stated that we could only use what was available in our Lego sets and WeDo kits for our prototype:

1. The motors and hubs cannot be submerged in water, and we cannot use anything but Lego brick, so we could not demonstrate actual pumping and filtering of water. We instead demonstrated pumping the water bricks that came with the Aqua Adventure kit.

2. We could not include actual solar panels in the prototype as these are not available in the kits.
3. As mentioned previously, Lego recommends using only one hub to ensure a stable connection. Thus, we could only use two motors. We had to remove the sensor.
4. Our team is composed of 9-year-olds. We still do not have the knowledge to fully explain how the prototype would be constructed in the real world and its actual cost. We could only do research to prove that it is possible and affordable.

# CHAPTER 4

# RESULTS

The prototype ran successfully, demonstrating how the robot could pump flood water into the filter and distribute it to different houses in the village.

# CHAPTER 5

## CONCLUSION AND RECOMMENDATIONS

We have proven that AIRA does not only have the potential to save lives, it also helps save the environment by cleaning up water resources. Our robot is useful now, because there are so many disaster-prone areas all around the globe. We hope that someday, our prototype could be used as a basis for an actual robot that could prevent the loss of life by ensuring that everyone has their share of clean water. More than that, though, we also hope that AIRA will also serve to be a symbol of clean energy, sharing, and the value of human life, so that everyone would do their part to prevent flooding, help others, and most importantly, save the Earth – our home.

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