

Hwa Chong Institution

Project Work

Category 3 Invention Log Book

Title of Project: Mozzie Dry-out
Group Name: Group 3-05
Group Members: 1) Tan Kian Wu 2) Tan Jian Yu 3) Yeo Chi Tze Jared 4) NIL

Overview

This document is to provide a written report on our progress in IVP.

Objectives

1. To show our project work ideation process and how we overcame obstacles
2. To show our project work experiment project and research we have done
3. To show the construction of our prototype and to give an in-depth explanation of our final design

1. Problem Finding

1 A A list of problems we identified

1.The cleaner was having difficulty collecting rubbish in the tall bins when the rubbish is way at the bottom

We noticed very tall rubbish bins in Hwa Chong Institution and various other places and wondered if cleaners would have a tough time collecting rubbish at the bottom of the tall bin.

2. Plastic pollution in the sea and how animals and the environment suffer from it.

3.Losing keys to lockers

This is a common problem especially in places with the need to use locker facilities such as places involving water activities. Keys may be lost while we are engaging in water activities, sometimes never to be found again. This has happened to one of our parents.

4.Dengue

We noticed many neighbourhoods having a Red Dengue Alert banner being displayed.

5.Drink Driving

We read a news article about someone being arrested for drunk driving.

6.Road Cycling

On the way to school we spotted some adult men and women cycling on the roads.With so many cars around the cyclists, it would be very dangerous for both the cyclist and the driver.

1 B A small list of considerations our group had when choosing a problem from the above list to solve

1.How widespread is the problem?

- How many people are affected by these problems

If this problem affects a small number of people, it won't be a good problem to solve.

2. Are there existing solutions?

- What are these existing solutions and how effective are they?

If the existing solutions are not very effective, maybe we can improve on them.

If there is already a perfect solution, then there is no need to solve the problem.

3.Can we outdo existing solutions?

Are we able to improve existing/find better solutions? If not, then it will be difficult for us to make further improvements.

1C Selecting the Problem

Using the Problems that we had listed above we created the problem evaluation grid.

Problem Evaluation Grid

Considerations for Selection	Problems		
	Sea Pollution	Dengue	Drink Driving
How widespread	3	2	1
Existing solutions	1	2	3
Disadvantages of existing products	1	2	3
Factors affecting effectiveness of product	2	<u>3</u>	1
Total score	7	<u>9</u>	8

2. Define the Problem

2 A The Scale of the problem.

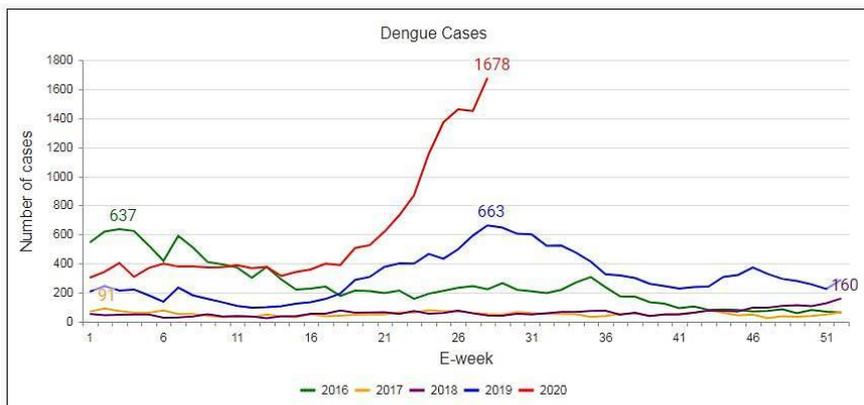
Dengue is a common problem in Singapore. In 2020 alone, Singapore had more than 35,000 dengue cases. Every year, an estimated 390 million dengue fever infections occur around the world. Of these, around 500,000 cases develop into severe dengue, or dengue haemorrhagic fever, a more severe form of the disease.

After some extensive research, we found some existing solutions to the dengue problem including wearing long sleeves and pants, mozzie wipeout fumigation, spraying insect repellent, mosquito coil and using a mosquito patch.

However, there are some downsides to these solutions:

- First, wearing long sleeves and pants is not very convenient in Singapore due to the humid and hot weather.
- Secondly, we found out that many people find that the 5-step mozzie wipeout too tedious and troublesome based on the results from our survey.
- Thirdly, spraying insect repellent is not precise enough to use on the face, close to your eyes and on sensitive skin.
- Next, many people find the smell produced by mosquito coils too smelly.
- Lastly, mosquito patches are not able to protect the whole body.

Hence we decided to develop the Mozzie Dry Out device.



Graph of dengue cases in Singapore in 2020 per week

2 B Existing Competitors

- **Smart leak detector** Patent No: US20190281371A1- A smart leak detector can identify leaks and send alerts to your phone even when you are far away from home.



- **The hurricane sock** Patent No:CN202184137UCN202184137U - The hurricane sock is a water absorbent sock for your garage, basement, windows and doors. Controls liquids and helps prevent

permanent water damage.



3. Our Invention

3 A Describe your proposed invention.

<https://drive.google.com/file/d/1AJJuuit6minEelrPqScRNO8Qmt-WPucx/view?usp=sharing>

A device that uses a rechargeable battery and is easily portable that can help detect potential mosquito breeding sites in construction sites. Most smart leak detectors work indoors and not in an external environment. They are also mainly used in targeting the plumbing business and not the construction industry.

The main benefit is that less manpower is needed to clear stagnant water. Previously, people would have to do daily inspections to ensure no stagnant water accumulates. This device allows workers to have more time for other tasks as the system will only trigger when there is water present.

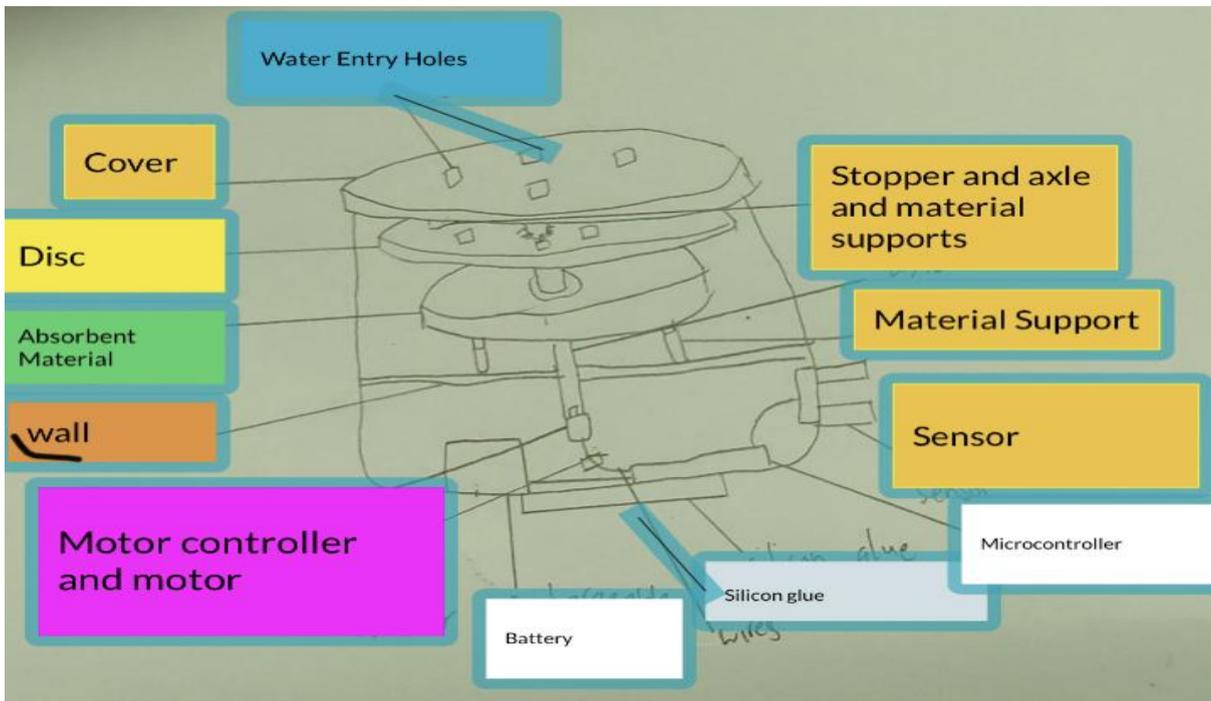
Potential Features:

1. Ability to Control via whatsapp
2. Monthly user alerts
3. Battery alerts
4. Instant report

Properties of product:

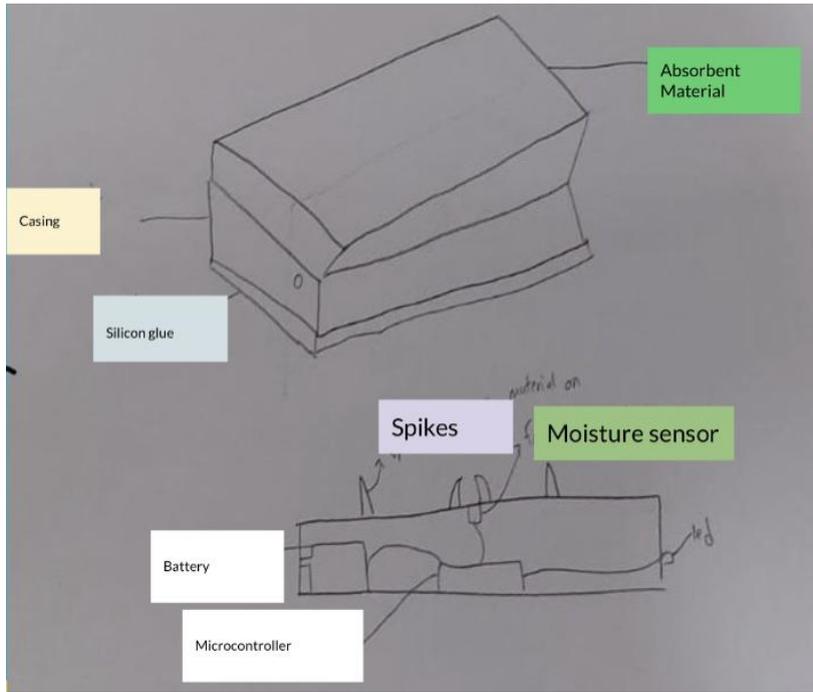
- Low cost and affordable

Design version 3 with parts



This design is heavily inspired by V1 and V2. How this design is supposed to work is that the device would detect water and the disc would rotate such that the holes in the disc would match up with the holes in the cover and let water in to be absorbed. However this design was eventually scrapped due to the fact that the design is overcomplicated and unreliable.

Design Version 4 and onwards after complete redesign



In this version we removed many of the parts that we had deemed unnecessary or overcomplicated. Such items include the motor and the disc which we felt were now unnecessary. We further developed on the design in V5 and V6 by making adjustments based on some more research. In V5 we mainly just did the sketch in virtual prototyping software and in V6 we flipped the device upside down after our mentor had pointed out that our design might have some false positives and is more unreliable than we thought.

3 B Our Goals for the Invention

- **Streamline the 5 step mozzie wipeout process**
- **Reduce the likelihood of someone forgetting to clear stagnant water**
- **Hopefully, reduce the number of dengue cases worldwide.**
- **Make our device as easy to use as possible**

3 C In what ways would your proposed invention be different and/or better than existing solutions?

	Smart Leak Detector	Hurricane Sock	Our Product
Waterproof exterior	3	1	2
Durability	1	3	2
Absorbency of material	1	2	3
Ability to transmit information	3	1	2
Total	8	7	9

3D Key Issues that we may encounter during construction

Making sure the product works as intended without much quality lapses

- Ensuring the product is not over engineered
- Minimising defects and making our product as environmentally friendly as possible
- Slowing down the process of absorption
- Working on the code.
- Testing product in the field

3 E What are the major milestones (project timeline) in our invention process

When Coming up with the Problem: We had some struggles to find the best problem to solve.

First idea: Our first idea was a mosquito repellent dispenser that could be mounted at the door. When a person entered or exited the house, the sensor would be triggered and the mosquito repellent would be sprayed on the person.

Discussion: We decided to meet with our mentor and discussed the opportunities of the product and how it would work

Not feasible: Our first product was almost useless, as it was too expensive, and a cheaper more convenient similar product already existed. There was also some safety concerns about the product as aerosols could be damaging to the body.

Resilience: Despite this, we did not give up and continued working on our project. Eventually, we managed to find a suitable product design. The new design had some problems too, but we did not give up then.

Our Big Idea: A device that detects water and sends a signal to the user's phone if the water level is high enough for breeding of mosquitoes. We should counteract the problem at its source. The only way to ensure that our product would be the most effective is to tackle dengue at its source, which is to prevent breeding of mosquitoes in stagnant water.

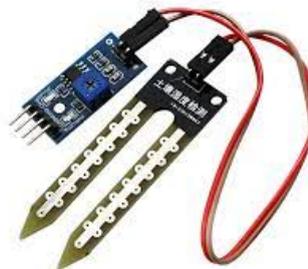
4. Construction Process

4 A Material Selection

We used the Arduino uno to control all the functions of the prototype (including the detection, and output). We intended to use a regular plastic box in order for the casing. This is because plastic is waterproof and we believe that is the simplest solution for the casing. We are using FC-28 soil moisture sensor as our target market is the construction industry and it is a soil moisture sensor. We are using a 9v battery casing with a 9v rechargeable battery. which is similar to the one provided in the arduino starter kit. Additional materials like hot glue may be added to improve the waterproofness.



Arduino Uno



FC-28 Hygrometer

4 B Factors that Can Affect device performance

Considerations for the construction of the prototype included

- the range of the moisture sensor,

- the battery life,
 - the moisture threshold.
- Considerations for the placement of the product includes

- the volume of moisture in an area
- the amount of mosquitoes in an area
- how large is the area.

Main considerations included

- How to alert the user of stagnant water
- How to allow the moisture sensor to detect water the most effectively
- The overall parts which needed to be purchased.

4 C Coding and construction

- We planned to use the FC-28 moisture sensor to detect moisture at the construction site.
- It was wired up in analogue mode to the microcontroller Arduino Uno.
- We then used Arduino IDE to code the project.
- For the message sending part, it was far more complicated.
- We first tried using SMS however we soon realised that since Singapore phased out 2G systems, our project would not work.
- Next we tried WhatsApp and Arduino.
- Although it did work, the device had to be connected to the computer at all times to function.
- This is because the python code needed for the project to work could not be uploaded to the Arduino.
- As a result, we decided to use Node Red which we intend to use by sending an email to the user instead of a WhatsApp message.
- The email will be sent on a daily basis.
- After we had done that, we used glue to attach the circuit board to the plastic box before covering it up.



```

project_code_2 | Arduino 1.8.15
File Edit Sketch Tools Help

project_code_2
int sensor_pin = A0;

int output_value ;

void setup() {

  Serial.begin(9600);

  delay(2000);

}

void loop() {

  output_value = analogRead(sensor_pin);

  output_value = map(output_value,550,0,0,100);

  if(output_value >= 20){

    Serial.println(output_value);

  }

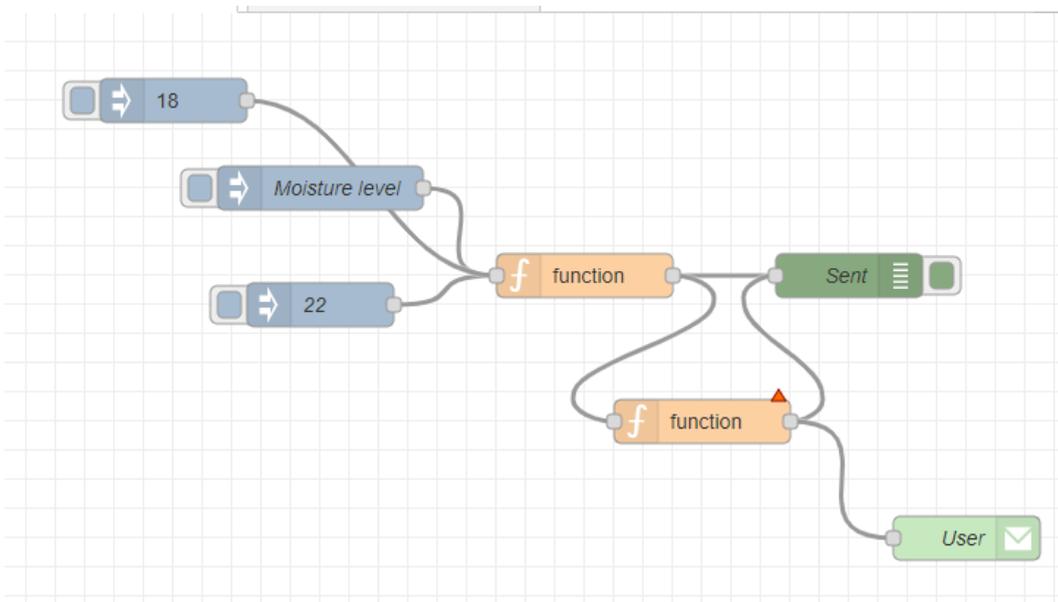
  delay(1000);

}

```

Arduino Code that We Used

This code allows us to check the information that is being inputted by the FC-28 Moisture sensor and send it to the Whatsapp Sandbox.



Code from Node Red

This allows us to send information via email since the Whatsapp method does not fully work.

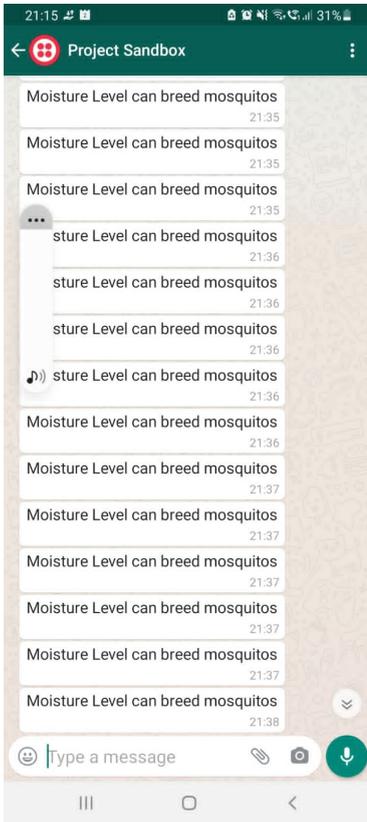
```

from twilio.rest import Client
import serial
import time
ser = serial.Serial('COM8',9600)

account_sid = 'AC40bc604b4f03823a35c5cdb074f18362'
auth_token = 'ff7edd1f83c39f3c7830f6917e51547b'
client = Client(account_sid, auth_token)
while True:
    while ser.inWaiting():
        moisture = ser.readline().decode()
        sms="Alert, Moisture level is "+str(moisture)+". "
        message = client.messages.create(
            from_='whatsapp:+14155238886',
            body=sms,
            to='whatsapp:+6596558678'
        )
        time.sleep(5)
print(message.sid)

```

This is the python code used when coding the project.



Our first trials that we came up with resulted in the spamming of the phone as we did not add in the readings as well.



Our first version of prototype. This is a version where no parts were physically connected to the plastic casing as that would make it easier for modification.



Rechargeable battery powering the device.

<https://drive.google.com/file/d/1RSHkpnrAKGiKW15z8-VOefK6knNvT0rE/view?usp=sharing>

Google Link for short video on the device

5. Modification and Evaluation

5 A Criteria and Results of tests

Test Iteration:1	Tick			Remarks (suggest possible modification(s) for improvement)
	Pass	Fail	Potential Failure	
Test Date: 13/7/2021				
Waterproofness	✓			Plastic box prevented all and any water from entering the casing. No changes needed
Sending the Information 1	✓		The Connection is very sensitive and can easily be lost	The information was sent via whatsapp perfectly. Information was accurate as well. The one problem is that notifications were coming in too fast and were seen as spam. Possible improvements is the use of a daily email system that makes use of Node red instead.
Sending the information 2	✓			The signal was sent successfully

6. Reflection

6A our personal reflection on our project work journey

Kian Wu: I have learnt how to collaborate with my teammates on a long term basis, build up my leadership skills in organising meetings and planning stages of the project while balancing life and Schoolwork. This project has also opened my eyes to how much I have left to learn when it comes to coding.

Jian Yu: I have learnt a lot throughout the project work journey, and have found it as a fun and exciting experience. I learnt skills such as design thinking, using a comparison chart, crafting scripts, making slides, social skills, as well as to have resilience. The expert mentors have guided us and helped us whenever we needed. Through communication and working together, we got to finish our project successfully.

Jared: I have learnt how to research about products effectively, how to think creatively and innovatively, how to decide on a problem to solve efficiently

Our reflection as a group: From this project work experience we had learnt how to think innovatively and what it means to come up with something on our own. From this we had also learnt how to persevere in the face of adversity as we had to come up with brand new ideas over 5 times and we also had to ensure that our product was useful and unique. We also learnt that no idea is perfect and to every single good idea there is always a major drawback.

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