

# Hwa Chong Institution

## Project Work

### Category 3 Inventions Log Book

Title of Project:
Magical Potato
Group Name:
Magical Potato
Group Members:
1)Zhao Hao Xuan (1P131) [Leader]
2)Tan Jia He (1i419)
3)Matthias Yong Cheng Hoi (1A230)
4)Xu Le (1P228)

# 1. Problem Finding

(The beginning...)

Identify a problem you would like to solve. You may want brainstorm for problems using different approaches eg thematic, survey or general brainstorming etc.

**1 A Document a list of problems you have identified. Your documentation should show clearly how your group came up with the problems.**

#1- Youths not being aware of the severe impacts of climate change: My 11-year-old brother was watching a documentary about the negative effects of climate change and I asked him “Don’t you know this already?” And he said no.

#2- Heavy rain/fog impairs the visibility of drivers which might lead to road accidents: Hao Xuan, our group leader, was walking home one day when he noticed that the light rain led him to continuously wiping the water off with his sleeve. We realised that this was similar to more pressing real-life issues (stated above).

**1 B You should have selected a problem based on some considerations. Identify and justify these considerations.**

We chose to work on finding a way to improve the drivers’ vision when driving in heavy rain, because when we did some light research, at least 4 sources (listed in the References) stated that nearly “1.35 million people die in car accidents” worldwide yearly. Another source showed that accidents occurring in low visibility due to heavy rain and fog involved “injuries of higher severity”. Thus, we decided to work on the problem of reduced visibility of drivers in heavy rain/fog.

**1 C List some problems your group would like to solve. List also the considerations for selection of problem in the evaluation grid below. Score the considerations, against the problems, with points 1 (least significant) to 4 (most significant). Sum up the total points for each problem. Identify that problem you would like to solve.**

Problem Evaluation Grid

Considerations for Selection (out of 5)	Problems		
	Ignorance of Youths about Climate Change	Decreased Visibility of Drivers in Heavy Rain/Fog	
Severity	5	3	
Solvability	2	4	
Capability of impacting problem (of solution)	1	4	
Existing solutions which are impactful (lower=more solutions)	3	5	

Total Score	10	16	
-------------	----	----	--

## 2. Define the Problem

(This is one...)

Now that the problem has been identified, it is important to gather information on the extent of the problem and/or evaluate the usefulness of existing solutions based on *some criteria*. You may need to conduct surveys and research on existing solutions.

### 2 A Extent of problem (Research and discuss the problem and write down the problem statement)

On average, there are "38,700 vehicle crashes" occurring each year "due to low visibility in bad weather". Furthermore, out of the "16,300 people" who are injured in such crashes, "600 are killed". Singapore had an "average vehicle crash rate of 7,900 from 2014-2019".

### 2 B Compare and contrast the existing or similar solutions.

- Scrub the headlights with sandpaper (takes a lot of time, drivers may be in a rush to attend to urgent matters -> impractical)
- Clean the windshields to remove dirt that might dribble down during heavy rain. (does not help with heavy rain)
- Install auto-sensing windshield wipers (does not work in a storm, because infrared sensors used to detect rain cannot reflect light in dark weather -> ineffective in the most critical moments)
- Spray rain repellent on the windcreens. (though quite similar to Magical Potato, it needs to be applied very frequently and does not last for very long ("approximately 10 min of driving"))

## 3. Your BIG IDEA<sup>#</sup>

(Developing the idea....)

Write down your proposed invention and why you want to do it. State also how you think your proposed invention is better.

### 3 A Describe your proposed invention.

Our invention is an **amylose sheet** which, when applied to a car's windshield or (side) windows, will make it temporarily **impervious** to rain/fog. Amylose, a component present in starch, is responsible for its impervious property.

### 3 B Explain the purpose of your proposed invention and the potential benefits to users.

Those who find that heavy rain/fog severely impacts their driving, especially those who are visually challenged, can apply our amylose sheet onto their car's windshield/side windows to have greatly improved visibility during their drive. This could potentially decrease the average rate of vehicle

crashes occurring due to bad visibility because those who use our invention would be able to avoid any oncoming traffic.

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

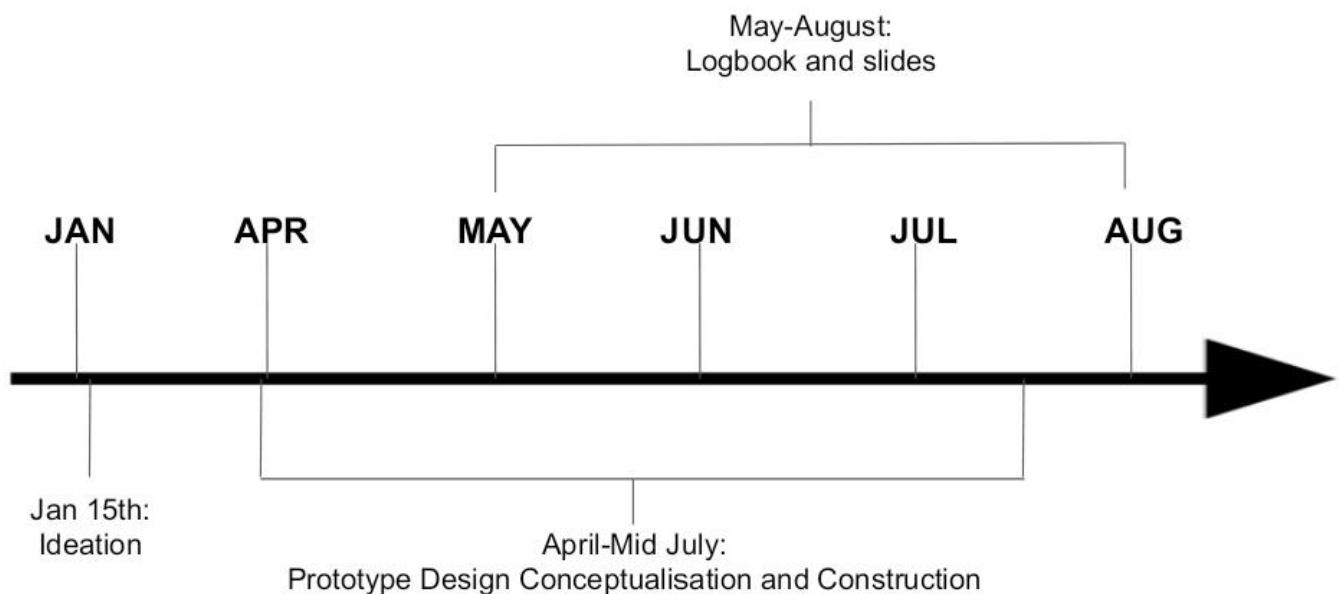
Our proposed invention

- is environmentally friendly
- is inexpensive
- is effective
- provides convenience

**3 D What are some problems you expect in the course of your proposed invention?**

- If the starch undergoes starch gelatinization, the starch will become a gel which we cannot paint on the cling wrap, let alone centrifuge
- Very heavy rain may be able to wash the amylose sheet off
- The amylose sheet may not work if the starch expires
- Insects may be attracted to the amylose sheet

**3 E What and when are the major milestones (project timeline) in your invention?**



***#must be able to be constructed based on current / emerging technologies, must not violate the laws of Science or go against the laws of nature.***

**4. Construction or Modelling Process\***

(This first... then that...)

You are now onto the fabrication of your prototype/ product. You need to select material and understand how to put them together so that your prototype/ product construction of the prototype is not possible, then you have to create an animation / as a proof of concept that it can be applied in a bigger scale.

**4 A Explain how and why the materials were chosen for the prototype/ product of your invention**

Materials chosen:

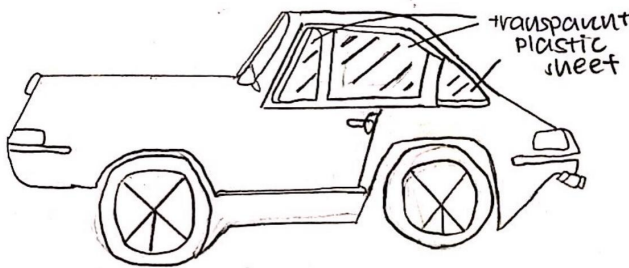
- Potato (carrier substance of starch)
- Starch (carrier substance of amylose)
- Amylose (To be applied on the cling wrap)
- Centrifuge (To separate the amylose from amylopectin)
- Cling Wrap (To be spread on the windshield)

Amylose, together with amylopectin, are the two major constituents of potato starch. We decided to use amylose instead of starch because only amylose is relevant to the function of Magical Potato. Hence, we plan to use a centrifuge to separate amylose from the unwanted amylopectin. Furthermore, since amylose is a natural adhesive, it will easily stick onto the cling wrap. The friction between the cling wrap and the vehicles' windscreens would also guarantee that the cling wrap would not fly off even during very heavy rain.

**4 B Explore these considerations that may guide the construction of your prototype/ product.**

We can centrifuge the starch to obtain relatively pure amylose, which would stick onto the cling wrap, which in turn would remain on the vehicles' windscreens due to the large amount of friction between the cling wrap and the vehicles' windscreens.

**4 C Propose how the prototype/ product will be constructed or developed. You may use drawings and photographs.**



1. Extract starch from potato.
2. Heat the starch in a hot water bath to 65 degrees Celsius. (ratio of starch to water is roughly 9:5)
3. Immediately centrifuge the starch at 6000 R.P.M. to separate amylose from the unwanted amylopectin.
4. Refrigerate the amylose or mould might grow on it.
5. Apply it onto cling wrap.

## 5. Modification and Evaluation

Upon the completion of your prototype/ product, you would need to see if it is working the way you want it to work. Check if your product has met the identified purpose and the user's need; and implement necessary modifications and improvements. This process may take several rounds.

## References

**6 A Cite the references you have used for your project work. Your source of reference should come from different types (e.g. books, magazines, websites, journal articles, interviews, photographs, product brochures, reviews etc.)**

Google. (n.d.). *Redirect notice*. Google.

<https://www.google.com.sg/amp/s/www.myimprov.com/fighting-foggy-windows-car/amp/>.

*Low visibility*. Low Visibility - FHWA Road Weather Management. (n.d.).

[https://ops.fhwa.dot.gov/weather/weather\\_events/low\\_visibility.htm](https://ops.fhwa.dot.gov/weather/weather_events/low_visibility.htm).

Google. (n.d.). *How to Keep Car Windows Fog Free Using a Potato*. Google.

<https://www.google.com.sg/amp/s/www.wikihow.com/Keep-Car-Windows-Fog-Free-Using-a-Potato%3famp=1>.

Miyerov, S., & wikiHow. (2021, August 10). *How to Increase Driving Visibility in Rain*. wikiHow.

<https://www.wikihow.com/Increase-Driving-Visibility-in-Rain>.

*How do weather events impact roads?* How Do Weather Events Impact Roads? - FHWA Road Weather Management. (n.d.). [https://ops.fhwa.dot.gov/weather/q1\\_roadimpact.htm](https://ops.fhwa.dot.gov/weather/q1_roadimpact.htm).