Hwa Chong Institution

Project Work

Category 3 Inventions Log Book

Title of Project: <u>Trash Can Management</u>	
Group Name: Dark Blue	

Group Members:
 	
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1. Problem Finding

(The beginning…)

Identify a problem you would like to solve. You may want to brainstorm for problems using different approaches e.g. 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.

A common thread across the problems identified are problems faced in a school environment that will affect a conducive learning environment.

- The teacher takes a very long time to pick students to answer questions
    - Some students do not want to answer questions
    - Too much time taken to find students to answer questions. This occurs in class very often
    - Those students who raise their hands are more likely to be chosen to answer the questions
    - Sometimes the teacher may choose some students more often than others

- Some people in school have no people to play ping pong with
    - Some students are very lonely and have no one to play with and still want to practice ping pong.
    - Some students are too shy to approach the other students to play
    - Salisbury journal, NYT and various other newspapers have done studies stating that having no friends is bad for health

- Rubbish bin overflows sometimes
    - Unhygienic
    - Cleaners do not really know when it overflows. When the cleaners do not know, they will go at regular intervals and waste their time and energy if the bin is not full.
    - On iEMB, the Teachers are always pointing that out and at the end of the week, students say that they see the rubbish bins overflowing.

    - Students do not throw food containers or other types of rubbish into designated bins

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

- Impacts monetarily
- Feasibility of existing solutions

- Impact if a suitable solution is applied

1 C **List some problems your group would like to solve. List also the considerations for the selection of problems 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

*add more columns and rows where necessary

Considerations for Selection (Larger number = Bigger Problem)	Problems		
	Teacher taking a long time to pick students to answer questions	Students having no one to play ping-pong with	Rubbish bin overflowing
Impacts monetarily	1 Wastes money because Teachers can use online rng machines	3 No external profits, high cost for the acquirement of materials	2 Save costs spent on hiring cleaners and plastic bags
Feasibility of existing solutions	3 Can be overcome with the usage of online websites, although that will take slightly more time	1 Difficult to make successfully, given the competition on the market. Better to get other students to make friends with them etc.	2 No available effective solutions. The canteen bins overflow very often.
Impact if a suitable solution is applied	2 Less time wasted on choosing students to answer questions etc.	3 No big impacts other than letting students be able to play ping-pong alone.	1 Save money from wasted plastic bags and can manage cleaners better, while ensuring the cleanliness of rubbish bins
Total Score	6	9	5
Considerations (Lowest best, highest worst)	2	3	1

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 the problem (Research and discuss the problem and write down the problem statement)

Rubbish bins overflow occasionally. After lunch or recess, the bins overflow, and at the end of the week, there is a lot of rubbish in the brown bins around the school. There was also food packaging stacked on top of the bins, at the bin near the collection area on 5/3 in the morning during SPACE. It looks unhygienic and uncomfortable because you do not get to use the bins and also there is rubbish strewn around. On iEMB, the Teachers are always pointing that out and at the end of the week, students say that they see the rubbish bins overflowing. In the canteens, the rubbish bin is full most of the time. Cleaners go and empty the bins at designated timings and they might be wasting their effort.

The proposed system will help to measure when the bins are full, and this system will send the information to the cleaners to alert them when the bins are full. This helps cleaners save much more time and will also help clean the bins more efficiently.

2 B   Compare and contrast the existing or similar solutions.

- Getting students to throw their food waste into black trash bags and dispose of them at a designated point.
- Bigger bins
- More cleaners
- A system to help measure when the bins are full, feeding this information into a main control system so that the cleaners can be managed better
- Cleaners go and empty bins at designated times

The criteria a chosen such as to ensure that said solutions can be cheap, applicable and will be able to be used successfully, such as to ensure that the school will be able to use the solution without much problems

Solutions	Feasibility	Cost	Potential Problems
Getting students to throw their food waste into black trash bags and dispose of them at a designated point.	Works quite well currently, but does not help for the trash bins in the canteen	Money wasted on buying plastic bags. Sometimes there are only one or two people who are throwing food packages into the plastic bags.	Some classes are located far away from the collection points. Accidents may occur. Students may also forget,

			or feel it is too bothersome.
Bigger bins	Bigger bins may be useful such that they can hold more rubbish and will not overflow as easily. However, they cannot be too big or the cleaners are unable to carry them around easily. The bins will still overflow.	All the bins have to be replaced or the school has to buy different kinds of plastic bags to line the bins.	Cleaners have to carry bigger plastic bags which are heavier. They might not be able to carry them.
More cleaners	More cleaners need better management, but the bins can be cleaned more frequently and less overflowing occurs	More money wasted on hiring cleaners. Management needs more attention and more equipment might need to be bought.	Management issues. Might get messy because cleaners are new to the school and might not know where the bins are.
A system to help measure when the bins are full, feeding this information into a main control system so that the cleaners can be managed better	No change except a data feed telling cleaners about when the bins are full, weight of rubbish.	Money will be wasted on buying the resources needed, but that is balanced out by money saved from managing workers. Less time and resources are needed to identify whether more or fewer workers should be hired	Reliability issues, but those can be fixed by using tested-and-proven materials (eg Arduino) and experiments. Also, when students throw rubbish in, it might block the sensor at one moment and the sensor might register the bin as full.
Cleaners go and empty bins at designated times	Sometimes the bins are overflowing or not full, and hence the cleaners may be wasting their	No real impact, but money is wasted on not full plastic bags	Cleaners waste effort when they could go and empty the bins when they are full.

	effort		

3. Your BIG IDEA[#]

(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.

The proposed system is one that can measure the volume of the rubbish in the rubbish bins using an ultrasound sensor and send an email to the cleaners when the bins are full using an Arduino with a transmitter in it. With this system, managing rubbish collection will be improved and overflowing of rubbish can be prevented.

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

It will be able to detect when a bin is full, and also display the weight of the rubbish so that the collection of rubbish in the rubbish bins can be managed better.

After that, it would send an email to the cleaners phones where the cleaners would then proceed to clean the rubbish

The cleaners can then go and empty the rubbish bins when they are full and will not waste their effort emptying it when it is not full

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

There are 2 current methods, one of which is getting the students to use black trash bags. In that case, getting cleaners to clear out the trash bins is ineffective and inefficient because the trash bags in them may not be full and plastic bags are wasted. It also does not help the rubbish bins in the canteen which are always overflowing. Our method is better because it enables cleaners to view all the trash bags which are full and can clear out rubbish bins with more efficiency rather than letting the trash bags sit there, which dirties the floor and there is also a stench for classes close to the collection point. The second method is getting cleaners to routinely go and empty the bins. This is inefficient because sometimes the bin may not be full, but the cleaner has to empty it anyways. Also, the bins might overflow but the cleaners would not know. This will be extremely unconducive for the students. Our current method ensures that cleaners do not waste their effort emptying bins when they are not full, and also ensures that the bins do not overflow, making the school a more conducive learning environment.

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

Machining of the outer covering of the device and the choosing and also delivery and purchase of materials

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

- Project design finalization: *By 27/3/21*
- Choosing/ordering of materials for prototype: *By 30/3/21*
- Acquirement of materials for prototype: *By 10/5/21*
- Putting together prototype: *By 1/6/21*
- Testing of the prototype: *By 27/6/21*
- Improvements: *By 27/7/21*
- Written Reports to end: *By 1/8/21*

#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 can perform its function.

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

Ultrasound sensor	Sense the height of the rubbish in the bin
Arduino	Runs code, does internal calculations, and sends information via wifi
Wires	Connects the parts
Matrix Display	Shows Bin Stats
Cardboard Covering	Aesthetically pleasing
Batteries	Power the machinery
Solar Panels	Recharge Batteries

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

The ultrasound sensor is the most accurate considering infrared sensors are unable to detect transparent items no, the arduino has been proven in other projects, we don't have replacements for wires or matrix displays and the plastic shell. The solar panels are a viable way to recharge the batteries without needing to plug them into a power socket.

4 C   Document the prototype/ product development stages.   You may use drawings, photographs, or videos.

Videos are in Google Drive

If the construction of the prototype is not possible, then you have to create an animation / as proof of the concept that it can be applied on a bigger scale.

4A   **Explain why the construction of a prototype is not possible and the proof of concept is needed in your case.**

4B   **Briefly explain how the video/animation can effectively show how your invention will work and the different considerations.**

Warning:

- *Video / animated simulation only if prototyping is absolutely not possible.*
- *Video / animated simulation must be logical and convincing that the invention works.*
- *Constraints must be clearly included in the logbook or the project will be heavily penalized.*

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.

5 A   **Write down your prototype/ product test criteria and check against it if it works. Identify areas of weakness for modification. Indicate the test iteration and date of the test.**

Test Iteration:	Tick			Remarks
5 June 2021	Pass	Fail	Potential Failure	
Ability to detect rubbish levels			✅	The ultrasound sensor's sound waves sometimes do not bounce back to the ultrasound sensor when the distance between the rubbish and the top of the bin is too near.

Ability to inform cleaners about rubbish levels		✅		Unable to send messages to cleaners informing them that rubbish bins are full.
Battery life of power source			✅	We will plug in the device to a power source. However, not every bin has a plug located near them.

Test Iteration:		Tick		Remarks
17 June 2021	Pass	Fail	Potential Failure	
Ability to detect rubbish levels	✅			The set distance between the rubbish and the top of the bin before an email is sent to the cleaners informing them that the bin is full is large enough. This ensures this error will not happen.
Ability to inform cleaners about rubbish levels	✅			Able to send emails to cleaners informing them that rubbish bins are full.
Battery life of power source			✅	The power source used will be batteries. However, they do not last very long

Test Iteration:		Tick		Remarks
28 June 2021	Pass	Fail	Potential Failure	
Ability to detect rubbish levels	✅			The measurement of the rubbish levels from the top of the bin is accurate.
Ability to inform cleaners about rubbish levels	✅			Able to send emails to cleaners informing them that rubbish bins are full.
Battery life of power source	✅			We have added a small solar panel to the bin so that the batteries can last longer.

*Add more rows for more criteria
** Repeat table for next test iteration

OR if you are creating an animation/video to show how your invention will work, write down the different possibilities/outcomes [success or failure) if a full-scale prototype is to be constructed.

6. References

Read http://www.bibme.org/citation-guide/apa/ on how to cite 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.)**

None