Hwa Chong Institution

Project Work

Category 3 Inventions Log Book

Title of Project: SMART fan
Group Name:
Group Members: 1)Chung Wai Keong 2)Joey Tang 3) 4)

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. Hawker centre cleaners have a very large work load as tables are relatively hard to clean
    a. Food stains
    b. Spilled soup

Possible solutions: smart table (cost???, only able to make a small diagram of actual product.)

2. Disabled people find it hard to move around
    a. Bus?
    b. Stairs
    c. Places without ramps

Possible solutions: Attachable ramp to wheelchair (some wheelchair designs might not be able to fit) Triple wheels: inspired from shopping cart. Will be hard for user, might not be very useful unless there is someone to push the wheelchair. However, this still would not make it easier for the user ON the wheelchair.

3. Fans are left on when it is windy, lights are left on when it is bright.
    a. A lot of electricity wasted
    b. Will have to change bulbs more often

Possible solutions: Smart fan that can turn itself off/smart light that can turn itself off. Can use resistors, or can design own. Many ways to do counter this problem. Wind sensors, force of wind to push switch.

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

The number of people this will affect. This will be the target audience and the larger the target audience, the more useful the product will be.

How big a difference the product is going to make. This can help us tell the importance of solving the problem, and thus by determining how important solving the problem is, we can make a better decision.

How widespread the problem is. We consider this to be a separate condition from target audience as this is about the problem being common, not about many people having this problem. This is important as it helps us to determine how much this problem is affecting our nation.

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

*add more columns and rows where necessary

Considerations for Selection	Problems		
	Fan that turns off by itself	Dining table that is easier to clean (hawker centres)	Device that recycles heat produced by air-conditioning
How big target audience is	3	2	1
How much difference this product can make	2	1	3
How widespread the problem is	3	1	2
Total Score	8	4	6

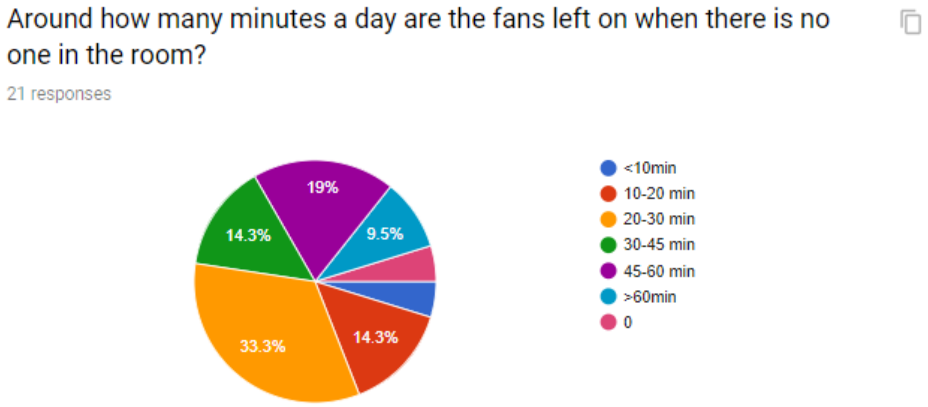
2. Define the Problem

(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)

In most households, there are many people leaving lights and fans on when they are not using it.



This takes up quite a lot of electricity as ceiling lights are not LEDs and most fans use wireless AC motors. There is also a large amount of time that the fans are left on, as seen in the earlier diagram. Some people are also too used to turning on the fans that they do not take note of whether it is windy or not.

More information	LED	CFL	Incandescent
Lifespan in hours	10,000	9,000	1,000
Watts (equivalent 60 watts)	10	14	60
Cost per bulb	$2.50	$2.40	$1.25
Daily cost*	$0.005	$0.007	$0.03
Annual cost*	$1.83	$2.56	$10.95
Cost for 50k hours @ $0.10 kWh	$50	$70	$300
Bulbs needed for 50k hours	5	5.5	50
Total cost for 50k hours with bulb price	$62.50	$83.20	$362.50

As the chart shows, LEDs are much cheaper to run and also more reliable in the long run. This makes it better for the user as they will have to change the bulbs less and thus waste less money and effort (in installation). By not using incandescent or CFL lights however, the LEDs used must be able to give a certain intensity of light as LEDs in nature are dimmer than CFL or incandescent lights.

Problem statement: The excess time lights and fans are left on contribute greatly to the electricity used, cost for the user and how long the product can last.

2 B Compare and contrast the existing or similar solutions.

Haiku fan:

- SENSEme technology → motion sensor used, strong and accurate. This makes it easy for the user to use the product, as this technology is good.
- Very expensive
- Positive reviews, although price brought up sometimes
- Energy efficient

XIaoMi Smart fan:

- Can be brought around the house, easy to carry
- App to connect to the fan, making it accessible
- Can set time for the fan to turn off by itself
- Does not use motion sensor or wind sensor

Some toilet or carpark lights

- Uses LDR
- Industrial purpose
- Not commercialised
- Good, reliable but energy consumi

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.

Our proposed invention is a smart fan which makes use of a small wind sensor and a LDR to control the speed of the fan and the intensity of the light respectively. The wind sensor we would be using is the Rev. C wind sensor.

Benefits

i. It is small, unlike industrial wind sensors
ii. It requires a low voltage to run
iii. It is easily programmable by Arduino

Disadvantages:

1. Cannot be found in Singapore.
2. Not the latest product and might not be the best
3. Users will not be able to adjust the settings of the sensor by themselves, might not fit their needs.

The fan will be a small table fan with a opening at the back of the product where the wind sensor and LDR are located. An LDR is a light dependant resistor, controlling the amount of electricity passing through the circuit based on the light intensity of that area. This is suitable for our project.

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

The purpose is to help users regulate the amount of electricity used by fans and lights. By including the light into the fan and using an LED, less electricity is used. The users will also not need to turn on the light and fan separately, making it more convenient for them. This will undoubtedly reduce the amount od electricity used for lights and fans. Furthermore, by using the Rev. P wind sensor, the user will also not need to set up or prepare anything by themselves, so it is easier for them to use.

Potential benefits:

- Less electricity used
- Do not need to turn on fan and light separately
- Regulate use of electricity
- More convenient

Potential disadvantages:

- People will only rely on this to save electricity
- Rev P sensor may not have a suitable range that suits the user
- LDR can be fried easily because it uses the hot wire method.

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

Both the Haiku Fan and XiaoMi fans use motion technology, which is costlier and energy-consuming than Wind sensing technology. The Haiku fan's motion sensor is also so strong that it will turn on even if a ball rolled into the room or a pet walked into it. This still wastes electricity as the Haiku fan is very strong and will consume a lot of electricity even for a small ball or pet.

The XiaoMi fan's motion technology is not as sophisticated as the Haiku Fan. It can be connected to a mobile app that allows users to check its battery, whether it is turned on and how long it has been turned on for. The user can also set the fan to turn off or on at a specific time each day. However, if the user forgets to set it or check their phone, electricity will still be wasted.

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

Some of the problems:

- Wind sensor might be hard to acquire (have to get from overseas)
- Might not have some electrical components
- Circuit might not work
- Sensor or breadboard or cable might be faulty and we might not know it
- Sensor might not fit the purpose we want it to

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

- When we found out how to use the LDR to make the circuit
    - This was an important part of our project as it made up half of the prototype, and if we couldn't complete it, the prototype would have been incomplete

#***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

Our prototypes

- Fan Blade PLA plastic → cheap, light but hard
- The rest of the fan → cardboard, some wood

What we envision our product to be

- Fan blade → metal, catches wind well
- Rest of fan → wood/plastic, sturdy and not bendable

As PLA plastic is a cheaper solution to making the fan blade than industrial plastic, we chose to use PLA plastic. It is light but can be easily cutter to make shapes, including that of a fan blade. We chose cardboard to make the body of the prototype as it is cheap and will not break easily. However, some constrains are that it may be squashed during transportation or torn because of bad handling. Thus, we thought about using wood. Still, we decided to use cardboard.

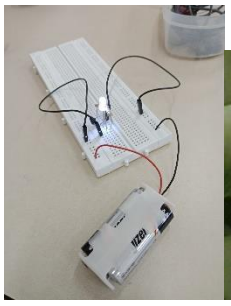
4 B Explore these considerations that may guide the construction of your prototype/ product.

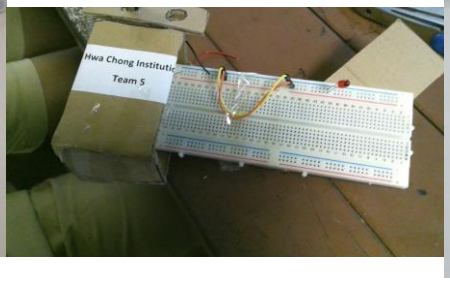
Some considerations:

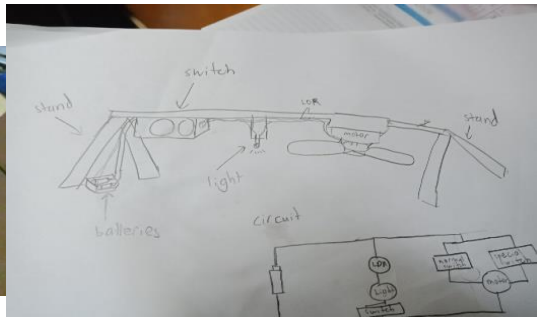
- Time taken to assemble circuit
- Time take for sensor to arrive
- How well the sensor works
- How fast we can learn Arduino/ find a suitable script for the sensor

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

Prototype 1 → Prototype 2







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 test.

Test Iteration:	Tick			Remarks
Test Date: June 10 2018	Pass	Fail	Potential Failure	
If light aspect can work	yes			
If fan aspect can work		yes		
If it is astatically pleasing		yes		

*Add more rows for more criteria

** Repeat table for next test iteration

Test Iteration:	Tick			Remarks
Test Date: August 1 2018	Pass	Fail	Potential Failure	
If light aspect can work	yes			
If fan aspect can work		yes		
If it is astatically pleasing	yes			Relatively, compared to first prototype

Test Iteration:	Tick			Remarks
Test Date: August 1 2018	Pass	Fail	Potential Failure	
If light aspect can work	yes			
If fan aspect can work	yes		yes	
If it is astatically pleasing	yes			Relatively, compared to first prototype

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 (eg books, magazine, websites, journal articles, interview, photographs, product brochure, reviews etc.)

Information:

Wind sensors:

https://moderndevice.com/product/wind-sensor/

https://www.digitalsmarties.net/products/wind-sensor-rev-c

https://moderndevice.com/news/calibrating-rev-p-wind-sensor-new-regression/

Light sensors:

https://www.youtube.com/watch?time_continue=26&v=YqzqE25T5bY

https://www.build-electronic-circuits.com/ldr-circuit-diagram/

https://www.electronics-tutorials.ws/io/io_4.html

https://www.atp-instrumentation.co.uk/blog/how-to-measure-light-levels/

Programming:

https://www.arduino.cc/en/Main/Products

http://forefront.io/a/beginners-guide-to-arduino/

https://www.arduino.cc/en/Guide/HomePage

Existing products:

https://www.haikuhome.com/sg

http://blog.alansoon.com/technology-gadget-software/portable-stylish-fan-occasions-new-xiaomi-zhimi-smart-standing-fan-%E6%99%BA%E7%B1%B3%E7%9B%B4%E6%B5%81%E5%8F%98%E9%A2%91%E8%90%BD%E5%9C%B0%E6%89%87-gadgets-review

Others:

https://home.howstuffworks.com/ceiling-fan.html

https://www.researchgate.net/publication/272295340_Design_an_Automatic_Temperature_Control_System_for_Smart_Electric_Fan_Using_PIC