

Hwa Chong Institution

Project Work

Category 3 Inventions Logbook

Title of Project: ResQ Balloon
Group Name: ResQ Balloon
Group Members: 1) Ron Sim [Leader] 2) Sean Yue 3) Chew Wei Herng 4) Wyatt Lim

1. Problem Finding

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.

Potential Problem #1:

We found out that there was an increase number of drowning incidents. According to the Channel News Asia website, between 2006 and 2010, there were up to 12 cases of children drowning annually. However, the safety consciousness of parents does not seem to have improved. On the contrary, between 2011 and 2015, there were up to 27 cases of children drowning every year—more than double the number of the previous 5 years.

In Singapore, many young children spend their weekends at the pool, many of them at swimming lessons in large groups where supervision may not always be sufficient. Parents, distracted by mobile phones, may not always be tuned into the risks of their children in the water. It is imperative therefore that these children are protected from the risks of drowning even as they need time in the water to learn to be water-safe. Thus, a project to think of possible ways to decrease the number of victims and save more lives might be a worthwhile pursuit.

Potential Problem #2:

In Singapore, there is an increase in the number of people getting diabetes and being overweight. The problem was so serious that in his National Day Rally last year, Prime Minister Lee Hsien Loong emphasized that an average of about 1,200 diabetics undergo amputations every year. This is a very serious matter which shows that Singaporeans are not exercising enough or at all. Inventing a device that helps Singaporeans monitor their blood sugar levels would help them manage their weight and diet better.

Potential Problem #3:

With the advances in technology, more and more people are having mobile phones. This is especially true in Singapore where the mobile phone penetration rate is extremely high. Many people text and walk at the same time, resulting in many pedestrians being injured. Globally, the total rate of pedestrian fatalities compared to overall road deaths is getting worse each year. In 2008 more than 1000 pedestrians were injured seriously enough to seek medical attention at hospitals as a result of texting and walking. Addressing this problem would decrease the number of pedestrian accidents, reducing the burden on our healthcare system.

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

Problem Selected: #1

In doing so, we considered:

-Awareness and present solutions:

While there is no doubt that the diabetes epidemic is urgent and serious, there is a greater marshalling of resources towards this initiative on the national scale. As such, we did not consider problem # 2 as the main problem to solve.

-Impact

In contrast, there appears to be little or no urgency to create safer water environments for young child, or pedestrians who use mobile phones.

In weighing the two groups & their problems, we considered the long term impact. While pedestrians might shortly recover from the injuries, the physical and/ or mental injuries sustained by a child from a near-drowning episode affects his quality of life for decades. The child suffers damage, sometime permanently. Therefore there will also be a greater burden on his family and future caregivers.

-Fatalities

All our problems feature high rates of injuries. However we decided to focus on drowning as 360,000 people die a year due to drowning. In the context of Singapore, where people are only resources, this represents an unnecessary—and absolutely preventable—drain on our economy and development. Inventing a device to decrease death rates from drowning also represents a step in safeguarding Singapore’s future.

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	Problems		
	Drowning	Pedestrian accidents related to mobile phone use	Diabetes/ Obesity In Singapore
IMPACT	4	2	3
AWARENESS & PRESENT SOLUTIONS	4	4	1
FATALITIES	3	2	3
Total Score	11	8	7

2. Define the Problem

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.

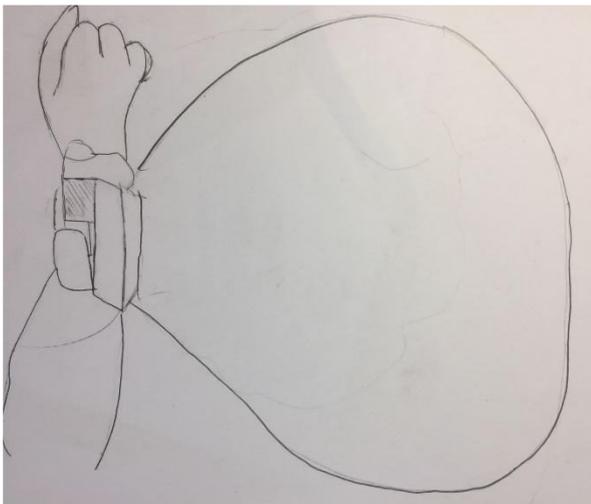
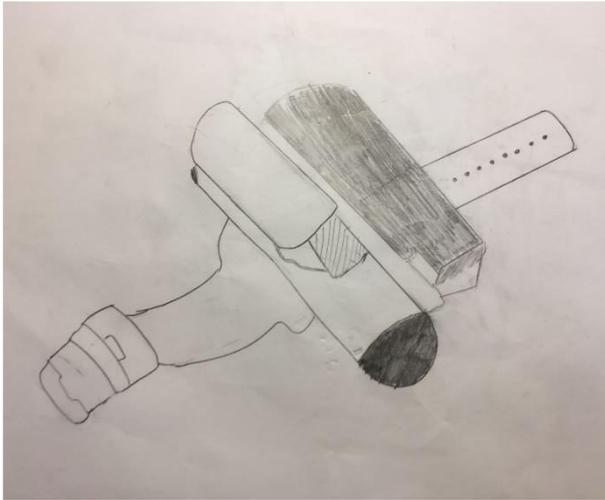
2 A Extent of problem (Research and discuss the problem and write down the problem statement

In Singapore, many young children spend their weekends at the pool, many of them at swimming lessons in large groups where supervision may not always be sufficient. Coaches may not have enough attention for all the students. Parents might assume that the coach will take care of the child. They are also distracted by mobile phones, may not always be tuned into the risks of their children in the water. It is imperative therefore that these children are protected from the risks of drowning even as they need time in the water to learn to be water-safe. Thus, a project to think of possible ways to decrease the number of victims and save more lives might be a worthwhile pursuit.

In 2015, drowning caused about 360 000 deaths thus this showed an urgent need of invention to help everyone prevent from drowning. The physical and/ or mental injuries sustained by a child from a near-drowning episode affects his quality of life for decades. The child suffers damage, sometime permanently. Therefore there will also be a greater burden on his family and future caregivers.

2 B Compare and contrast the existing or similar solutions.

We envision our device to be strapped to the wrist of young children. When the lever is pulled by the user, a carbon dioxide cartridge is pierced to release the gas, inflating a nylon balloon and help the wearer float to the surface of the water.



	Our product	Kingii (http://www.kingii.com/)	ISWIMBAND (http://www.premieraquatics.com/news/view/swimband)
Pros	Light-weight Cheap to produce. Compact.	Light-weight.	Inflates automatically
Cons	-	Cannot alert passers-by. Expensive.	Bluetooth connection issues; does not activate all the time. Dependant on batteries.

3. Your BIG 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.

We envision our device to be strapped to the wrist of young children. When the lever is pulled by the user, a carbon dioxide cartridge is pierced to release the gas, inflating a nylon balloon and help the wearer float to the surface of the water. (See sketches in 2B).

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

Our proposed invention serves to decrease the incidents of death caused by drowning for young children. We do this by increasing water safety, alerting caregivers when children experience difficulties in the water while simultaneously enabling the children to remain afloat.

Our invention is cheap so it will be affordable to most people. It is light-weight, compact and comfortable for young children to wear. So it will not occupy much space and would be convenient for parents to pack for their children.

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

We added an alarm, which rings loudly to alert passers-by, in case a child cannot scream for help. Even if the child is floating on the surface of the water, he cannot swim towards the edge of the pool. Some parts needed in our device can be 3D printed therefore it is lighter, and less bulky. Conventional products may not be suitable for children; ours is especially catered to children.

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

Some problems we may face include how are we are going to manage our time to do the project and how we intend to work together well as a team to make our prototype. We may also face the problem of finding children to test our prototype, as parents may be afraid to let their child take part in an experiment that might seem dangerous.

4. Construction Process

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.

We began by choosing the material for the strap. At first, we considered: slap band, a leather strap, a rubber strap and a Velcro strap.

The relative advantages and disadvantages of each type of strap is tabulated below.

	SLAP BAND	LEATHER STRAP	RUBBER STRAP	VELCRO STRAP
Waterproof	Yes	No	Yes	No
Comfortable	Yes	Yes	Yes	No
Design Consideration	It is very hard to attach items on it	It is very expensive and not waterproof	This is simple and convenient and not too expensive	Easy to wear, however it is not waterproof and is bulky when there's water
Costs	\$8	\$15	\$15	\$8

Given this analysis, we wanted to work with a **rubber strap**. Thereafter we realised that **3D-printing the strap** was even better as it would fit the wrist sizes of children better.

We decided between several different types of buzzers and considered their loudness, whether they were waterproof and the costs.

	KLJ-4020 SMD Magnetic Buzzer	458-1163-ND Buzzer	12V Round Magnetic Buzzer	CPT-2521C-500
Loudness(db)	73	90	80	95

Waterproof	No	No	Yes	Yes
Cost(\$)	4	11	8.30	5.30

Even though the CPT-2521C-500 is louder and cheaper than the 12V Round Magnetic Buzzer, we still preferred to use the latter. This is because the CPT-2521C-500 will cost much more when shipping costs are added in.

We considered between a plastic bag, a normal balloon and a nylon balloon.

	Plastic bag	Normal balloon	Nylon balloon
Pros	Cheap Easy to get	Easy to get Cheap	Durable
Cons	Burst easily Cannot support weight of child	Burst easily Cannot support weight of child	Less readily available

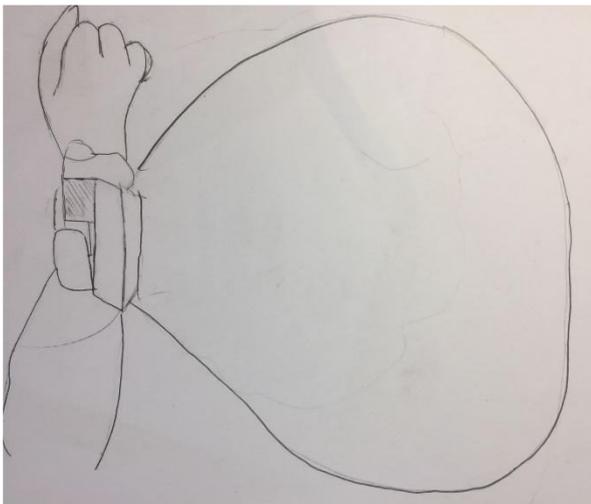
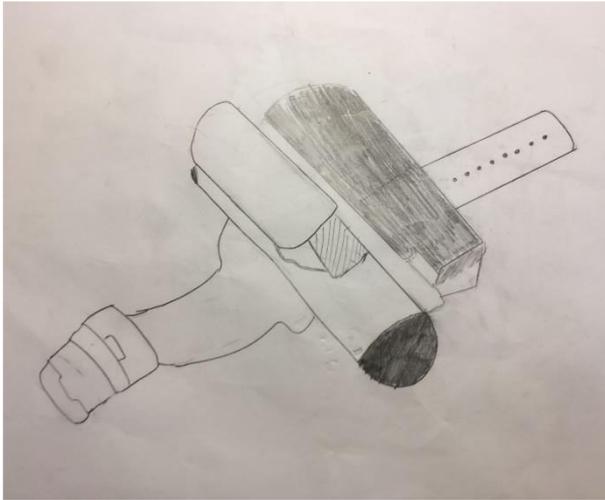
Given this analysis, we decided to use a **nylon balloon**.

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

Our proposed invention serves to decrease the incidents of death caused by drowning for young children. This means we have to keep our product light, to allow it to be worn easier by children. However, this also means that our product only needs to be able to lift the weight of a child, and not an adult.

Our invention is cheap so it will be affordable to most people. This means that we must keep the cost of our items as low as possible, so that it will not be a hassle.

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



Thereafter:



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
	Pass	Fail	Potential Failure	
Test Date:				
Safety	v			The balloon did not pop. The circuit was not exposed to water.
Reliability		v		It fell apart so it would not help the user.
Structural integrity		v		After we tried to use it, it fell apart in the water.

*Add more rows for more criteria

** Repeat table for next test iteration

6. 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.)

Kotwani,M.(2017,March16.) *More children in near-drowning mishaps:KKH Study*. Retrieved from <https://www.channelnewsasia.com/news/singapore/more-children-in-near-drowning-mishaps-kkh-study-8144022>

Haza.R.(2018,July.) *'Negligent parents distracted by mobile phones put children at risk, says police'*. Retrieved from <https://www.thenational.ae/uae/negligent-parents-distracted-by-mobile-phones-put-children-at-risk-of-drowning-say-police-1.745891>

Abu.B.J. (2017, 13 October.) *'National Day Rally; 1 in 9 Singaporeans have diabetes; problem 'very serious', says PM Lee'*. Retrieved from <https://webcache.googleusercontent.com/search?q=cache:iKNFavJYHUsJ:https://www.channelnewsasia.com/news/topics/nd2017/national-day-rally-1-in-9-singaporeans-has-diabetes-problem-very-9140176+&cd=1&hl=en&ct=clnk&gl=sg>

McCorMack.C. (2017, July 18.) *'Distracted Walking a Safety Concern'*. Retrieved from <https://www.safety.com/distracted-walking-a-major-pedestrian-safety-concern/#gref>