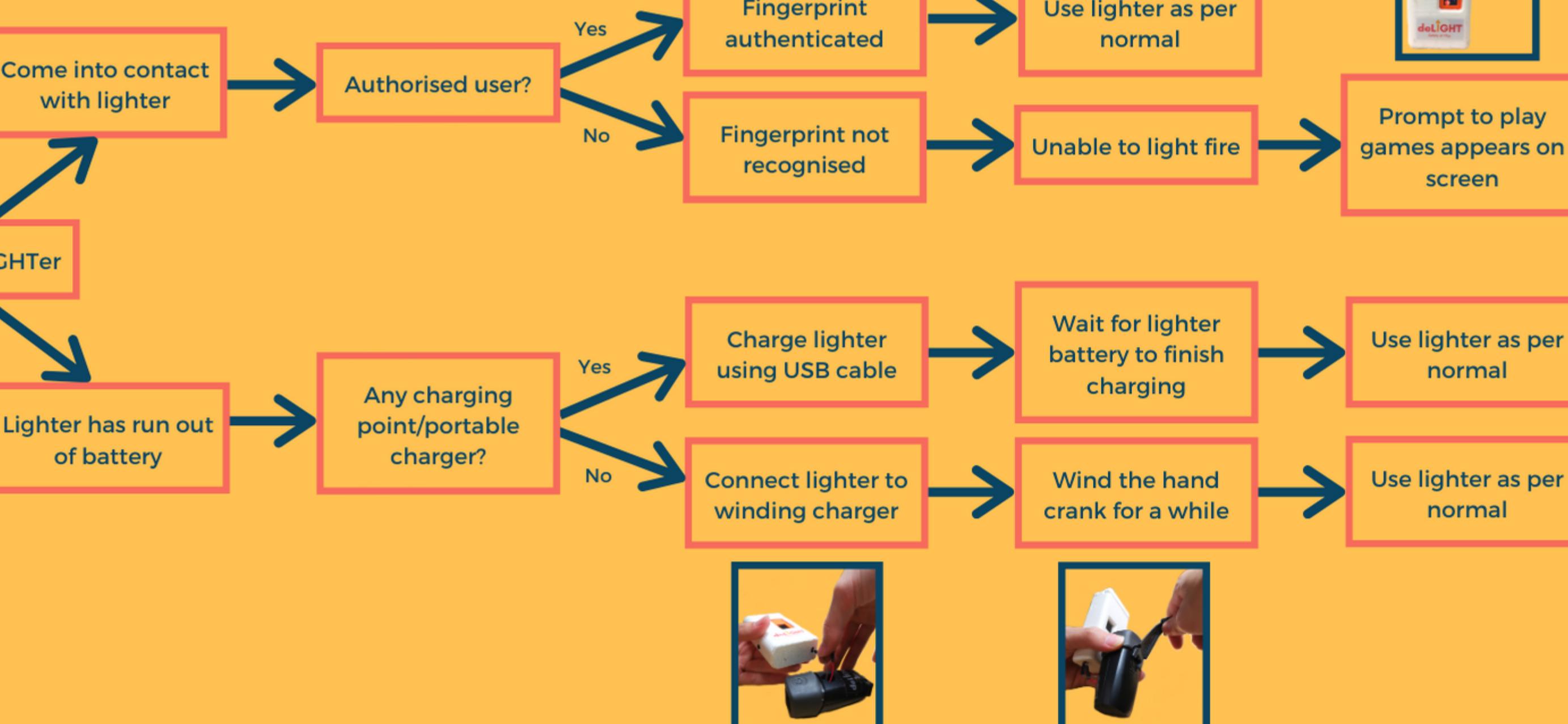


## ACTIVITY DIAGRAM

Problems

Solution



## TESTING PLAN

### Research

Researching about the materials, parts and ways we need to make our products.

WEEK 09



WEEK 10

Production  
Purchasing needed parts and materials. Design products. Basic first version of prototypes.

Iteration  
Parts and materials bought arrived. Second version of prototypes. Gather user feedback.

WEEK 11



WEEK 12



Showcase  
Finishing touches added to our final product.

WEEK 13

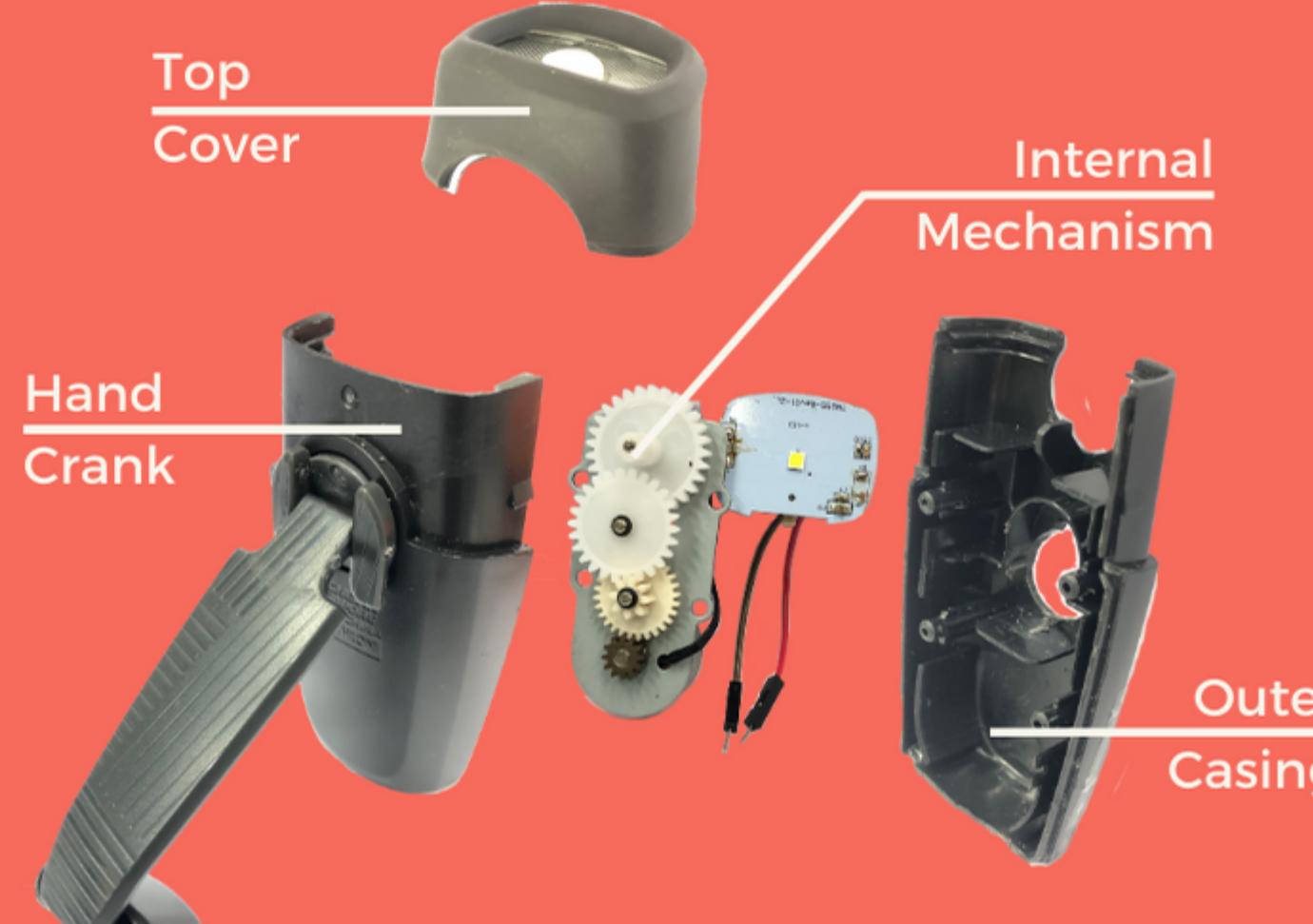


## COMPONENTS

### LIGHTER



### CHARGER



Folding line

Cut along this line

Cut this square

Cut along this line

## WORLD TEXT

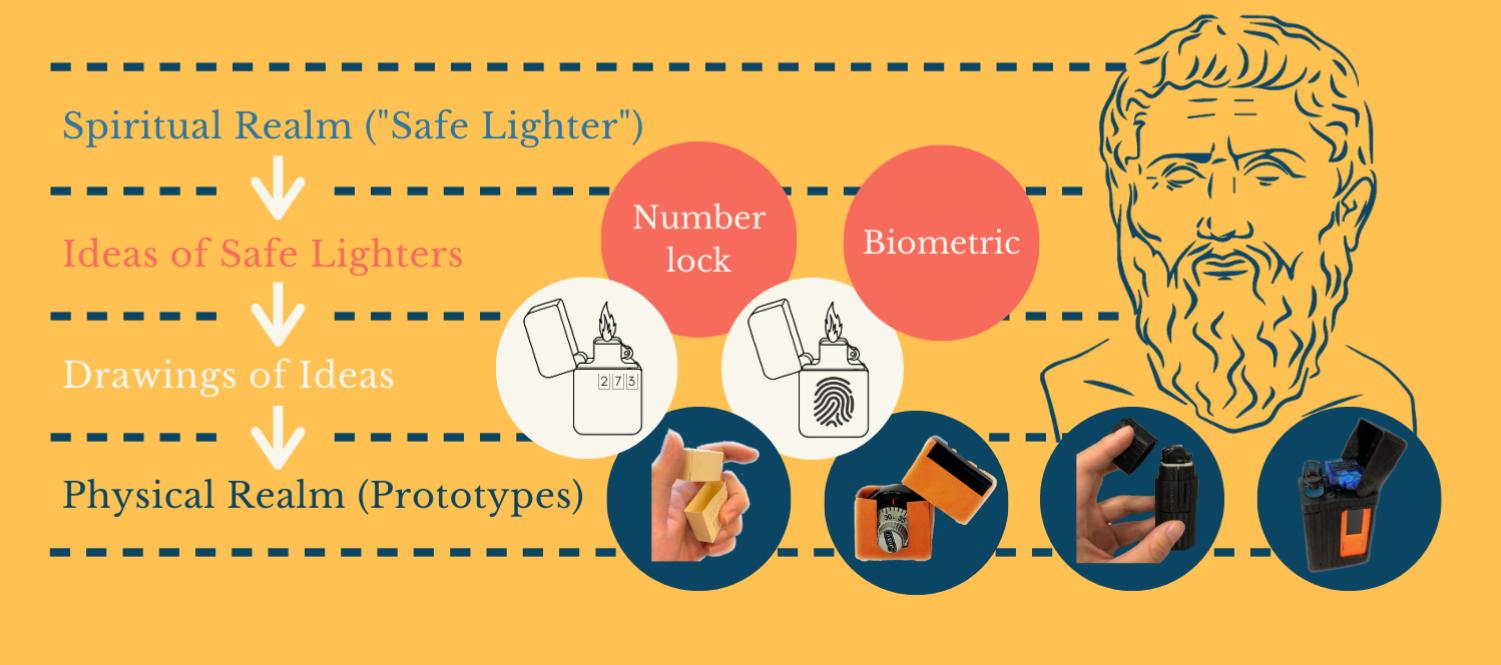
### HASS

#### "LIGHTER" + "SAFE"?

To begin our design process, we had to start with a concept. We began our ideation with an ideal concept of wanting a lighter to be safe. However, we were unable to picture how it was going to look like or what functions it will have, and we were held back by the fact that 'lighter' and 'safe' are two terms that are ostensibly ironical. We analysed the connotations surrounding a lighter and reverse engineered that while bringing in elements of play, developing a lighter that is safe even when children play with it.

#### PLATO'S REALM OF FORMS

This was parallel to Plato's realm of forms. At the beginning stages of the design process, the safe lighter existed only in the spiritual realm. It was a perfect ideal we were setting out to achieve in the physical realm ultimately. At this stage, we were unable to imagine the looks, features, feel of the product. With this ideal in the spiritual realm, we then had to go through the process of ideation, which slowly formed the outlines of our products. Ideas such as a lighter with a biometric unlock, slowly formed the outline of it. Drawings followed and then prototypes which expressed the concept in the physical realm. We then went through iterations of our prototypes to come closer to our ideal product in the spiritual realm. The design process is akin to Plato's realm of forms, and even as we further our work on this product, the question we ask is, how can we best express the concept of a safe lighter.



## PHYSICS

### PHYSICS

Over the course of our design process, we had to constantly lean on physics concepts to test the feasibility of our ideas. This was especially so with the self-powered sustainable lighters, inspired by self-powered torchlights. Based on the Maxwell-Faraday equation,  $\text{emf} = -\frac{d\phi}{dt}$ , a changing magnetic flux is able to generate an EMF that can be used to charge a rechargeable battery. However, these torchlights make use of LEDs which are extremely efficient whereas the energy efficiency of an electric lighter does not come close to that. Nevertheless, we forged ahead.

We had two main ideas, one that utilises a shaking mechanism and another that utilises a winding mechanism to generate current to charge up a battery that would power the electric lighter, both based on the mentioned Maxwell-Faraday equation. With a few estimates of the voltage and current output, we estimated the power output while still keeping the lighter sufficiently small, which proved to be a challenge. With this we ruled out the shaking mechanism and constructed a prototype with the winding mechanism.

Having created our prototype that utilises the winding mechanism, experiments were carried out to find out its power output and hence its feasibility as a charging mechanism. In our experiment, we cranked the winding mechanism at different rates over a period of 10 seconds and measured the average current output, the results are as shown in the graph, which has a  $r^2$ -value of 0.9745. We were able to easily generate a current that peaks at 21.3mA with a voltage of 5V. This gives a power output of 0.106W sufficient to power the electric lighter with about 2 minutes of winding, which requires a power of 10W. This gives users a self-sustaining method to power the lighter, for instance campers who may need that spark in desperate times. However, further work can still be done to further improve the power generated to improve its efficiency.

## THE ONES WHO MADE deLIGHTer POSSIBLE



James RT  
Daddy



Kenneth Chin  
Precise Engineer



Sharmayne Lim  
Designer

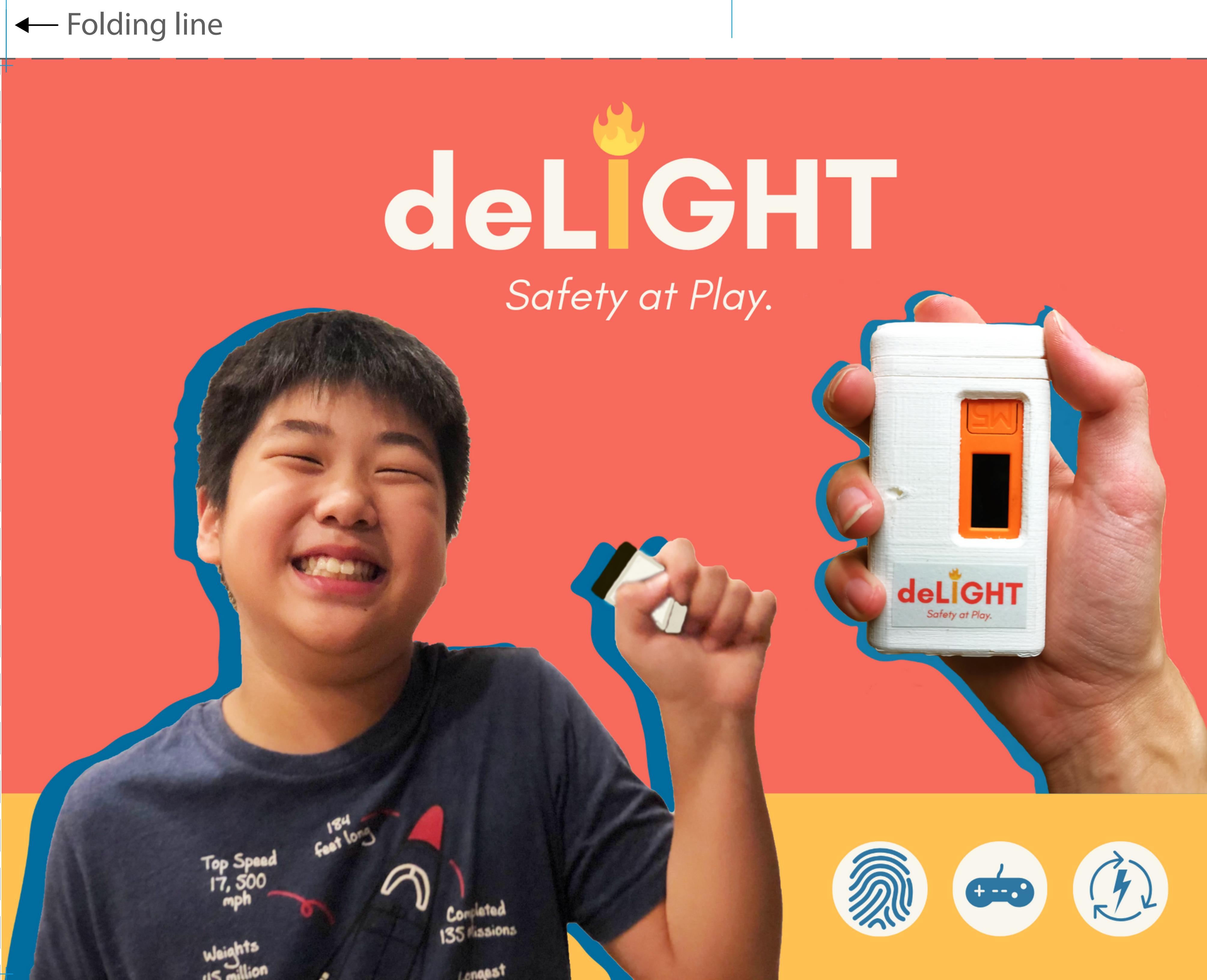
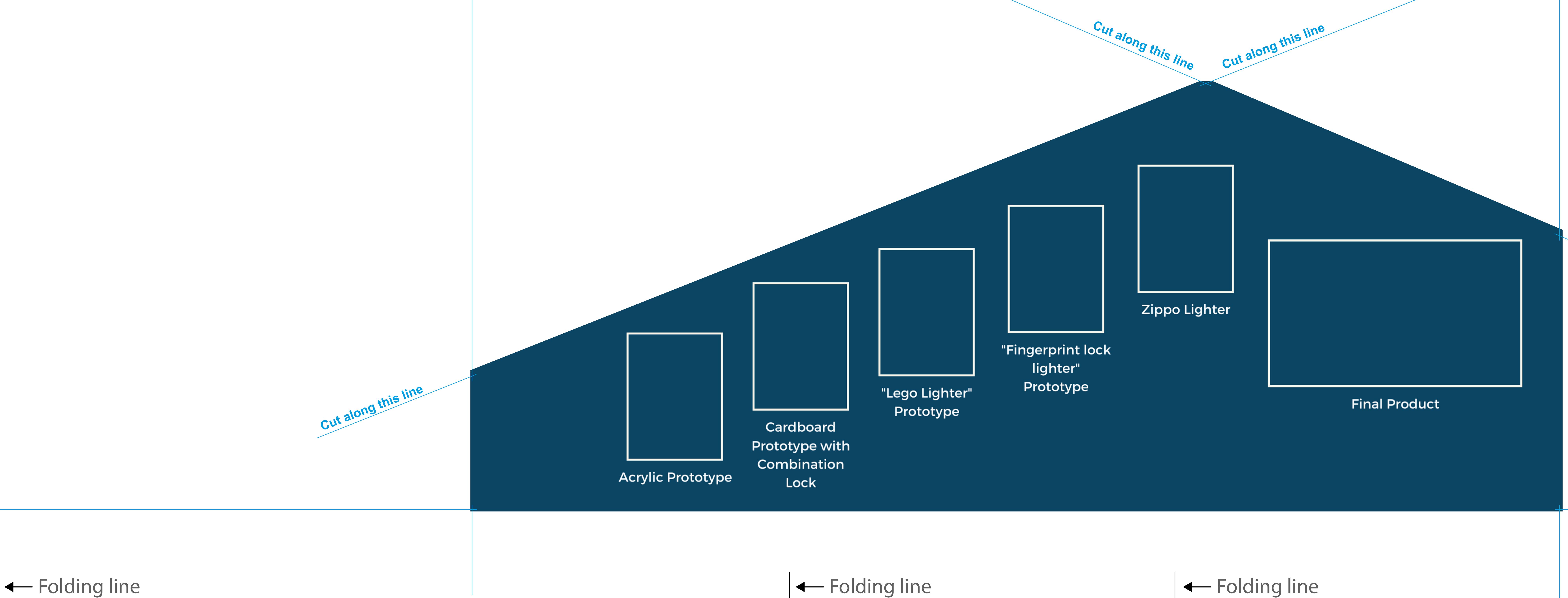


Ragul Balaji  
Grandmaster Wizard



Ivan Mun  
Crash Test Dummy

## THE EVOLUTION OF deLIGHTer



← Folding line

AT PLAY 2.0

deLIGHT

Unsupervised children playing with lighters leads to grave consequences. Additionally, lighters which have run out of fuel are rendered useless in situations whereby lighter refills and charging points are unavailable. Our solution prevents children from activating the lighter when they come into contact with it as it has a fingerprint lock that only registered fingerprints are able to unlock. Also, when our lighter has run out of fuel, there is an option to recharge it by winding it. At the same time, our lighter allows children to have fun by playing video games on it or winding it.

← Folding line

**F07-01**

**INTRODUCTION  
TO  
DESIGN**

**FACULTY**  
Arlindo Silva  
Daniel Joseph Whittaker

**COHORT 07**  
**TEAM 01**

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2019