

### ABSTRACT

As the population continues to increase, cities have become denser and more crowded. Due to inflation, it is becoming difficult to afford a vehicle thus increasing bike users.

Furthermore, having stay-at-home orders had many people exploring outdoor-related activities also resulting in an increase in biking/skateboarding, etc. The 21st century requires innovation in everyday items which is the market we hope to fill.

Communication between drivers and bikers on the roads is one of the bigger problems we are aiming to resolve. The necessity of a regular helmet has always been present however, having a helmet with features that would help communicate with others on the roads improves safety. This will be done with the use of headlights, brake lights, and indicators.



### CONTACT

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### INTRODUCTION

This product is designed to enhance the traditional helmet by increasing the safety of the rider with design modifications to improve communication between bikers and make them more visible to other riders on road.

Our problem revolved around the lack of safety measures present for urban bikers. Some of the many statistics that encouraged us to expand on our initial idea are:

- Approximately 62% of cyclists without helmets end in fatal injuries.
- In 2020, 932 cyclists were killed in vehicle-bike collisions (this number was increased by 8.9% in 2021)

To obtain the best solution for our problem, we brainstormed features that users would benefit from, followed by multiple customer responses to determine what changes need to be made to build our modern helmet.



### METHODS AND MATERIALS

We utilized 3D printing to manufacture our helmet prototype making it both cost-effective and efficient which allows for more customization and design flexibility. Figure 1 and 2 show the CAD design of the helmet.

Below is a list of all other materials required to create our prototype:

- Manual Left/Right indicators
- Light Sensored Headlights
- Motion-Sensored Brake Lights
- Outer Shell (3D Printing)
- Power Bank
- Remote Controller
- IR sensor
- Wireless IR Remote
- Triple Axis Accelerometer
- Push Button Switch
- Light Sensor
- Battery indicator
- EPS foam

Our Bike-Mate design consists of a hard outer shell (PLA), compressible inner foam, and adjustable straps and pads, with durable silicon LED lights for brake lights, indicators and headlights. All materials have been carefully selected for their lightweight properties to ensure user-friendliness and safety.

### RESULTS

The following features were chosen to explore and incorporate into a helmet:

- Powerful Headlights
- Automatic Brake Lights
- Remote Indicators

The headlights are located at the front of the helmet and are switched on via a light sensor. This feature ensures that the rider has sufficient visibility at all times, especially during low-light conditions.

Brake lights are placed at the back of the helmet and are triggered via an accelerometer. This feature provides an extra level of safety for the rider, as it alerts other drivers on the road that the bike is slowing down.

The indicators are placed on both sides of the helmet and are triggered by a remote attached to the bicycle via an IR sensor. This feature allows the rider to indicate their intention to turn without taking their hands off the handlebars.

Our product boasts a battery life exceeding 50 hours, even with all lights and indicators switched on, to give cyclists an absence of worry and reliable performance.

After solidifying our deliverables, the next steps were determining how to execute the features and identifying our target audience.

Receiving feedback from potential customers was crucial to determine the necessary features for the product.

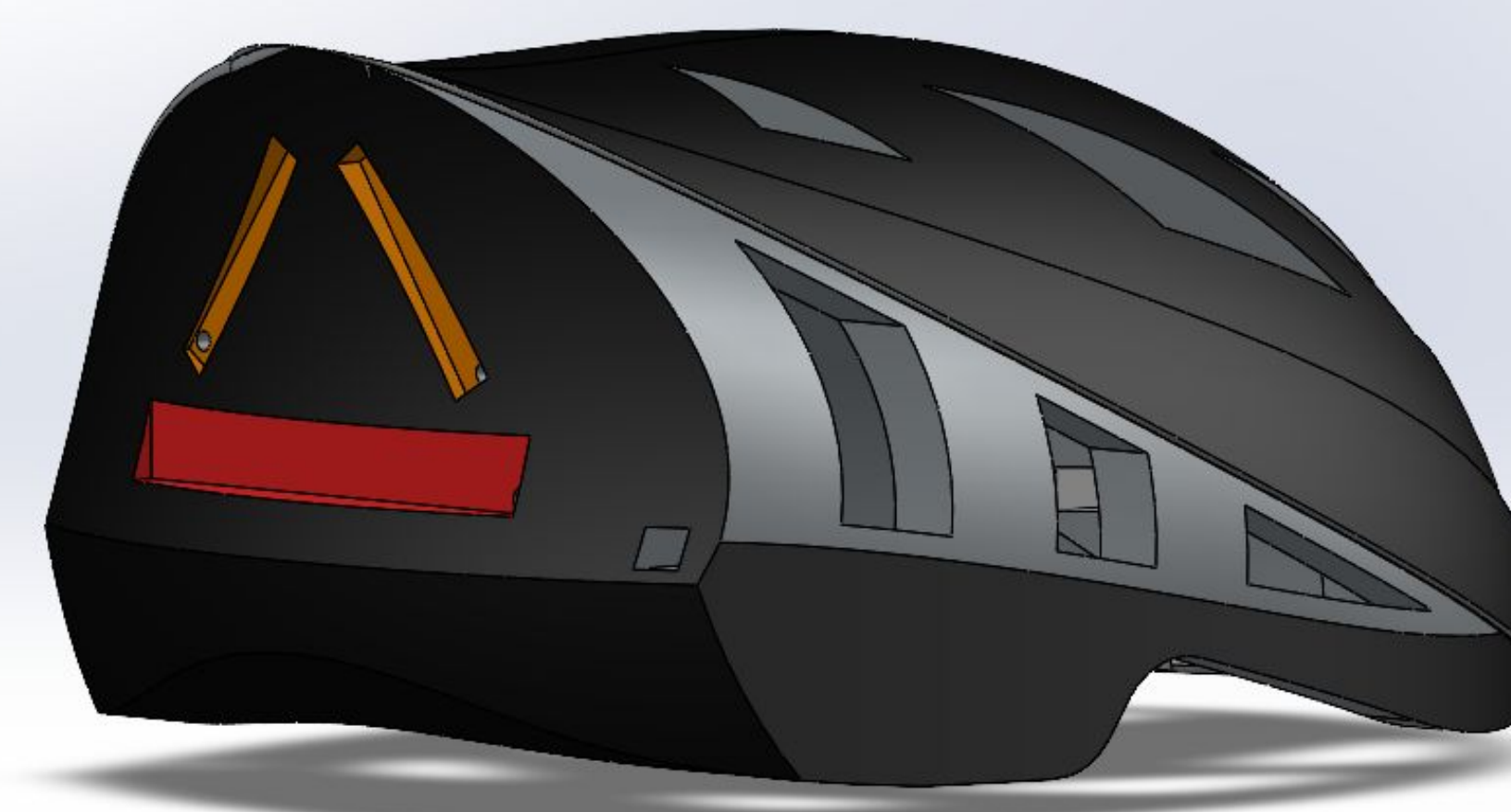


Figure 1. Prototype (Indicator/Tail Light)

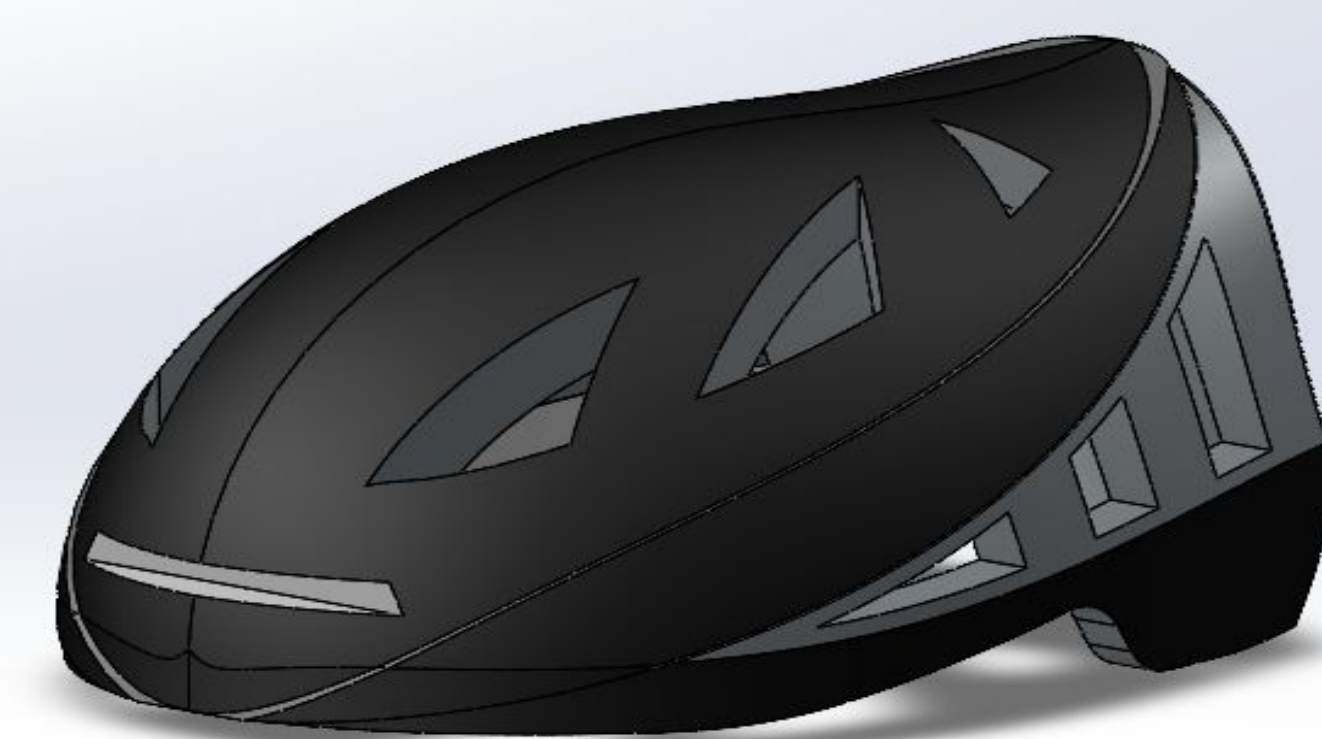


Figure 2: Prototype (Headlight)

### DISCUSSION

Our helmet detects when bikers are braking, allowing them to ride with greater ease and focus on the road ahead. These features provide comfort, and peace of mind for bicycle riders when there are other automobiles on the road.

Customer discovery interviews and surveys showed that our target audience, who use bicycles as their primary mode of transportation, would greatly benefit from our product. The positive feedback indicates that the features our product offers, are valued by our potential customers.

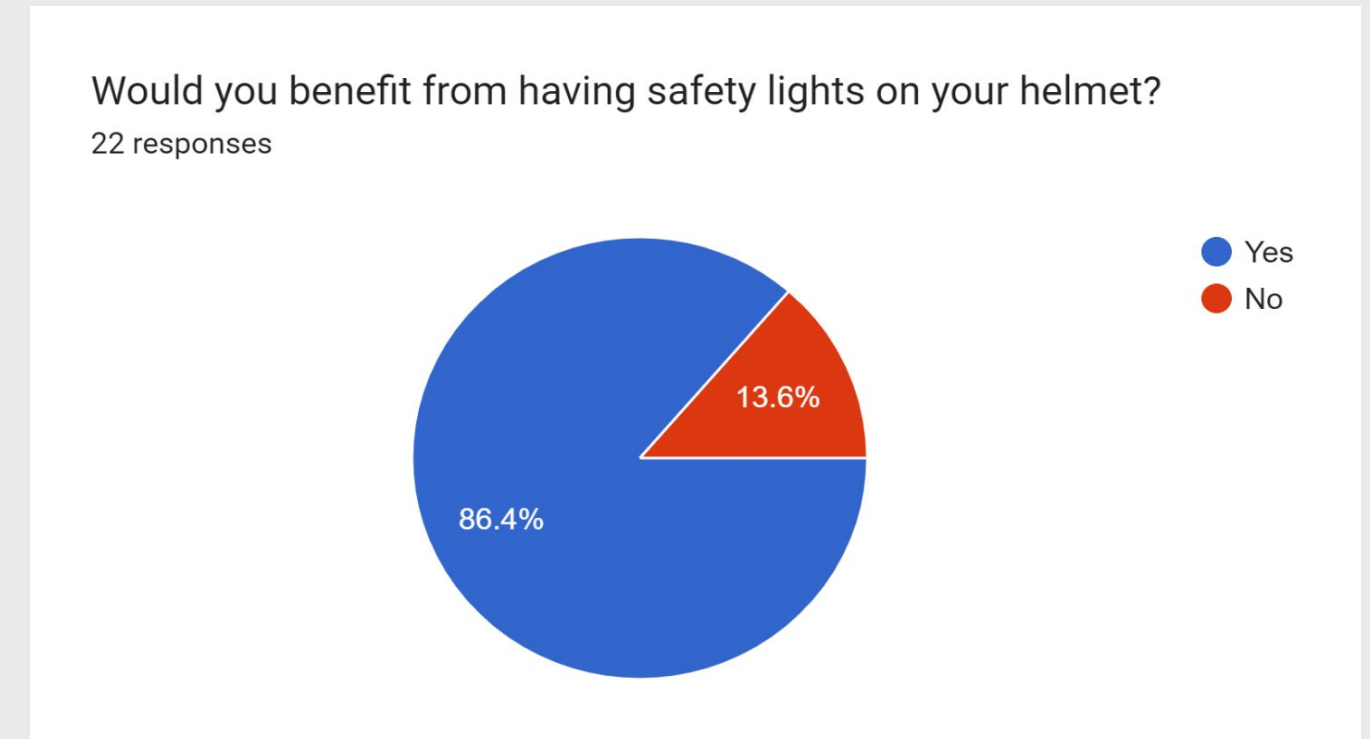


Figure 3: Customer Survey Result

Bike-Mate offers value for cyclists looking for a high-quality safety product at a low price of \$88 unlike our competitors who charge a premium of \$120.

### CHANGES IN DESIGN

- At first we wanted to control the indicator lights using a gyroscope to anticipate lane changes on roads. However, this could be a safety issue since the biker needs to indicate before turning. Our solution was to implement remote controlled indicator lights for ease of communication.
- Our initial design was to implement these features onto the bike. However, the helmet better suited our idea to make our product greatly accessible for any bike.

### CONCLUSIONS

Our product provides users with essential comfort, peace of mind, and feasibility, all at an affordable cost. In urban areas, these features are crucial for safe and stress-free biking, benefiting both bikers and drivers sharing the road.

### REFERENCES

1. Team, R. R. (2020, December 28). Motorcycle Crash and Safety Statistics. Road Racerz. <https://roadracerz.com/motorcycle-accident-statistics/>
2. <https://injuryfacts.nsc.org/home-and-community/safety-topics/bicycle-deaths/>