



THE HANDY HELMET

A COLLAPSIBLE, CLEAN, & CUSTOMIZABLE HELMET FOR THE UNIVERSITY OF MARYLAND



USER REQUIREMENTS

Established from student interviews.

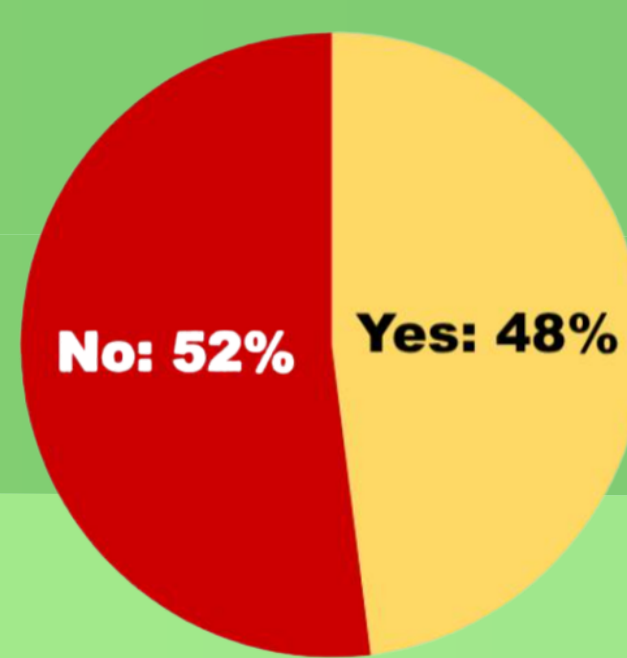


- Easily available. → Convenient
- Easily stored. → Collapsible
- Protect the user. → Durable and Sanitary
- Overcome force of peer pressure. → Customizable

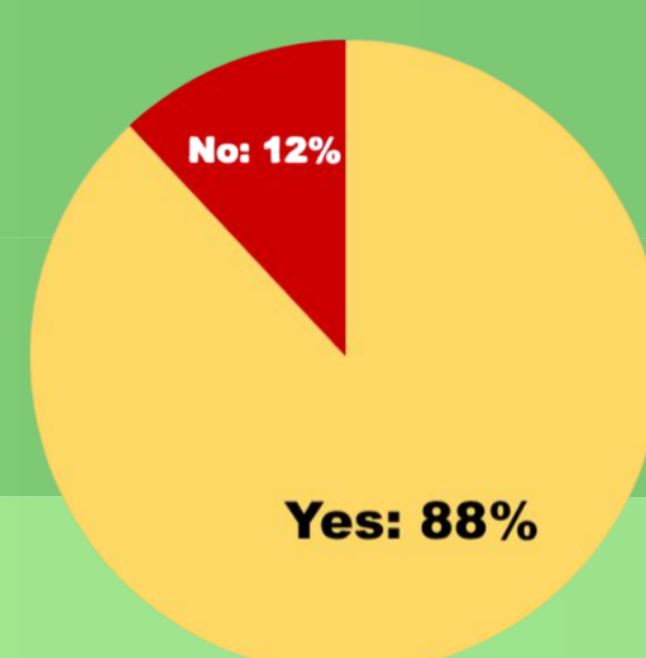
USER DATA

We interviewed 25 UMD students.¹⁴

Do you wear a helmet?



Would you wear a collapsible helmet?



Why don't you currently wear a helmet?

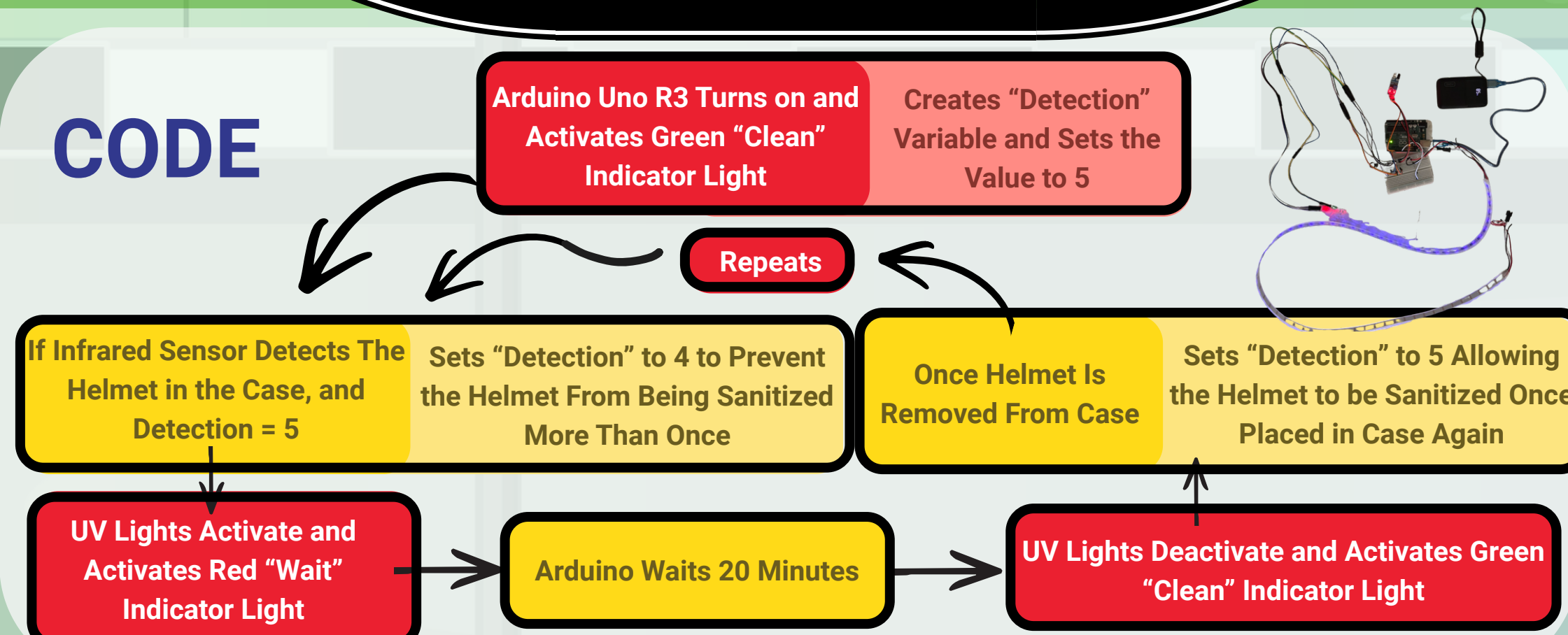
"inconvenient" "too big" "no storage"
"peer pressure" "not cool" "don't have one"

OBJECTIVE

Increase helmet use around UMD campus by creating a helmet that is easily available and that students want to use.

- Provide cost-effective & customizable helmet.
- Develop an easy-to-store helmet.
- Provide a safe, reusable, & clean helmet.

CODE



PROBLEM

STUDENTS AT THE UNIVERSITY OF MARYLAND (UMD) WHO USE E-SCOOTERS AS TRANSPORTATION, OFTEN LACK ACCESS TO OR NEGLECT WEARING PROPER SAFETY GEAR, PUTTING THEIR LIVES AT RISK.

With rising e-scooter riders in the U.S., injuries treated in "emergency departments rose...nearly 300% from 2020 to 2024"¹⁷

PLAN & DESIGN

Researched helmet technology, sketched designs, & developed 3D CAD rendering of helmet & case

BUILD & TEST

3D print & assemble helmet & case. Assemble & code Arduino circuit. Conduct impact tests.

ANALYZE & IMPROVE

Synthesize data. Analyze weak points of the helmet to be improved in future iterations.

EMPATHIZE

Conducted user interviews and learned that helmets are not worn due to bulk, accessibility, & peer pressure.

Design Process

PROTOYPE 1

- PLA filament 3D designed helmet.
- String for connections.
- Speedometer, Arduino UNO R3 connects to powerbank with USB cord. NEO 6M GPS Module connects to satellite. NEO 6M GPS Module calculates rider speed.

ISSUE

Speedometer too big for user's arm & redundant with current scooter and cell phone features to display speed.

PROTOYPE 2

- Removed speedometer and built UV sanitizing helmet case.
- Coded infrared sensor and UV lights to sanitize helmet.

ISSUE

Case too small to fit helmet & lights, helmet failed Virginia Tech testing. Needed more padding and a stronger string replacement.

FINAL PROTOYPE



The UV Sanitizing Helmet case is designed to be placed on the front of a e-scooter. When helmet is inserted, infrared sensor turns on UV lights to sanitize, making it ready for its next user.

The Handy Helmet is collapsible, making it easy to carry and store around UMD. It is made out of durable PETG filament, and can be customized with user's choice of colors, logos, and engravings. Replaceable foam provides necessary energy absorption. String is replaced by more durable chin strap woven through helmet.

TESTING DATA

Prototype 1 tested at the Virginia Tech 5 Star Program.

Helmet broke at Peak Linear Acceleration of 250g. "There's just not enough softer padding to absorb energy,"² Barry Miller, Director of Outreach and Business Development.

Head Survival & Helmet Durability Testing

- Dropped prototypes at increasing heights until failure using a cantaloupe as a surrogate. Final prototype protected cantaloupe for double the fall height.
- Helmet was thrust from 65 degree angle from ground at 3 & 4 feet and cantaloupe survived trials.

Cantaloupe Survival Rate

Drop Height	Cantaloupe Survived		
	Unprotected Cantaloupe	Prototype 1	Final Prototype
1 Foot	✓	✓	✓
2 Feet	✓	✓	✓
3 Feet	✓	✓	✓
4 Feet	✗	✓	✓
5 Feet		✓	✓
5 Feet 4 in.		✗	✓
6 Feet			✓
7 Feet			✗

RESULTS

- A **collapsible** helmet makes it **convenient** for UMD students to store helmet, whether in UV scooter case or backpack.
- 3D printed **customizable** helmets alleviates peer pressure.
- 3D PETG Filament & duel foam provides **durability**.
- UV-sanitation helmet case provides **sanitary** helmet for re-use.

CONCLUSION

Final prototype meets the user's needs by enabling UMD students to easily transport and store a helmet around campus. Attached to scooters, UV sanitation case lifts barriers to helmet access. Helmet customizability alleviates peer pressure across campus, allowing all students to feel confident while staying safe.

FUTURE

- Add future software integration to only allow e-scooter use if helmet is removed from case.
- Invited to speak at College Park Council Hearing & engage with partnership between city and e-scooter company Veo.

CITATIONS

B. Miller. (2026, April 3). Personal Interview.
Twenty-Five University of Maryland Student Interviews. (2026, March 13). Personal Interview.
Zukowski, D. (2025, September 5). *US e-scooter injuries treated in ERs rose 80% last year: report*. Smart Cities Dive. <https://www.smartcitiesdive.com/news/electric-scooter-injuries-increase/759357/>