TEAM 039

Navigation Assisting Helmet for Visually Impaired

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Introduction

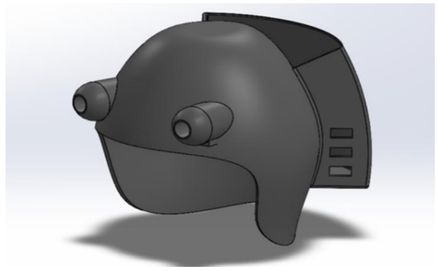
Individuals with visual impairments face navigation challenges, as traditional aids detect only static obstacles, limiting safety and independence. A smart helmet addresses this by providing real-time obstacle detection and alerts, enhancing mobility and confidence.

Constraint	
1	comfortable
2	safe
3	long-lasting
4	accurate
5	consistent

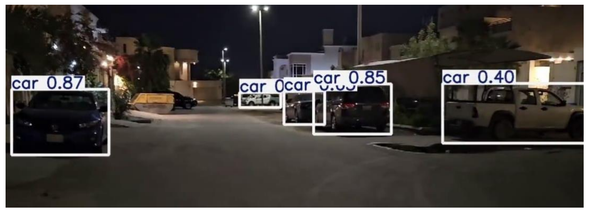
Specifications	
1	weight < 0.6 KG
2	heat<65c internally
3	Power < 27w
4	Battery Life 4-6 hours
5	system response < 0.5s
6	0.8< detection range <1.5M
7	noise<65 dB
8	impact-resistant body < 15N
9	Cost < 6000 SAR

Prototype Design

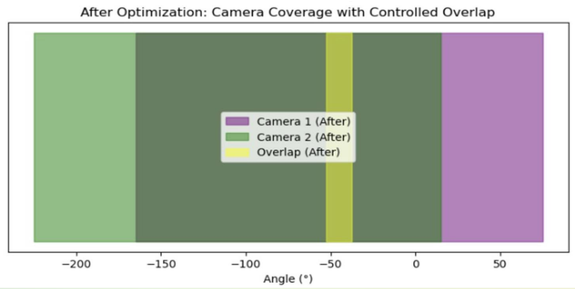
The helmet is made of two materials: a TPU inner lining for comfort and adaptability, and a PETG outer shell for lightweight strength and impact protection.



The helmet is equipped with two cameras running the YOLO model for real-time object detection.

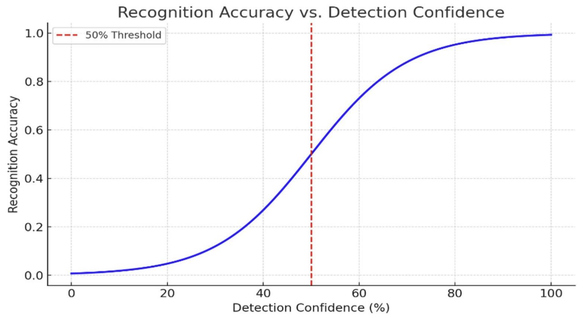


Using Bounded Brent's method, we optimized camera placement and eliminated FOV overlap.

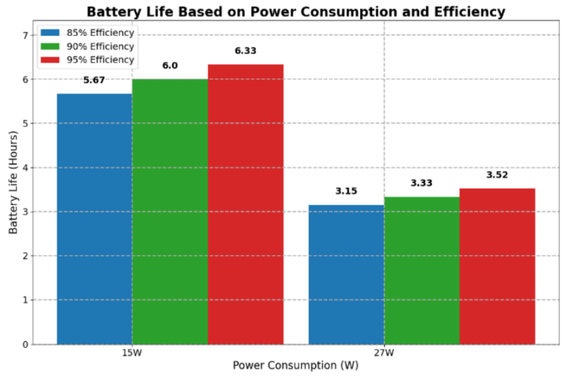


Validation

Employing YOLO, the dual-camera setup delivers < 0.5 s response and a 1.5 m detection range

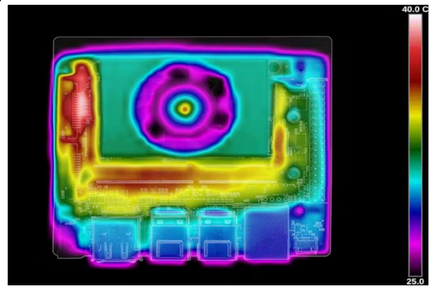


the helmet offers 5–6 h runtime per charge at 15 W average power.

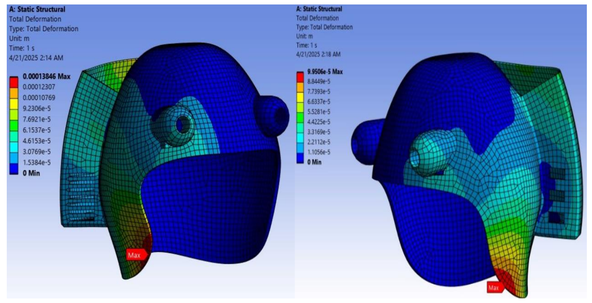


The helmet is powered by an NVIDIA Jetson Nano, complemented by a Raspberry Pi Pico for signal buffering and bridging, ensuring efficient and reliable system performance.

while maintaining an operating temperature below 65°C.



By combining two materials—TPU and PETG—we achieved an impact resistance exceeding 15 newton, while maintaining a total helmet weight under 600 grams.



Conclusions

The smart helmet was successfully developed to assist individuals with visual impairments, achieving all required specifications while maintaining a total cost under 6000 SAR.