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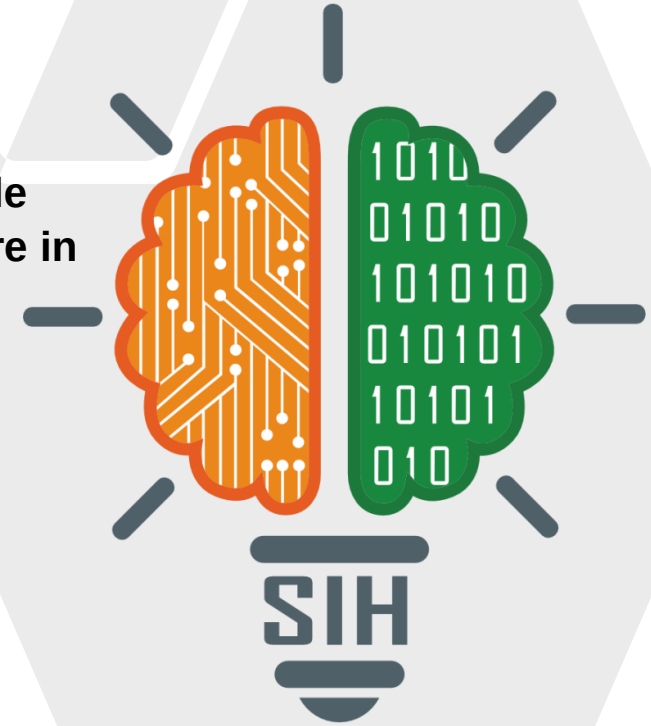
DETECTION OF GLAUCOMA

1. Problem Statement ID – SIH1550
2. Problem Statement Title- Development of portable device (non-contact device) for measurement of eye pressure in glaucoma patients for usage at home.
3. Theme- MedTech/Bio-Tech/HealthTech
4. PS Category- Hardware
5. Team ID-39110
6. Team Name (Registered on portal)- eyeSPY



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NON-CONTACT GLAUCOMA DETECTOR

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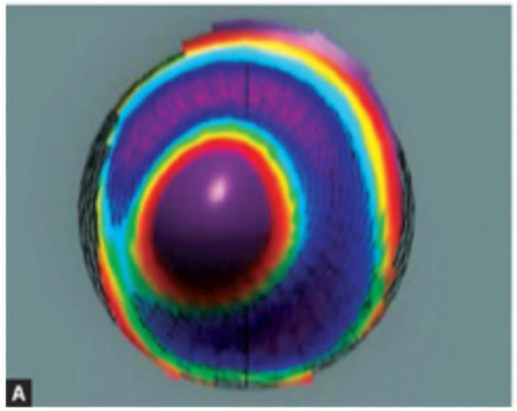
Solution:

- **Portable**, **non-contact** device for glaucoma detection.
- Combines **photoelasticity** and **corneal topography**.
- **Reduces discomfort** and **infection risk** compared to current methods.

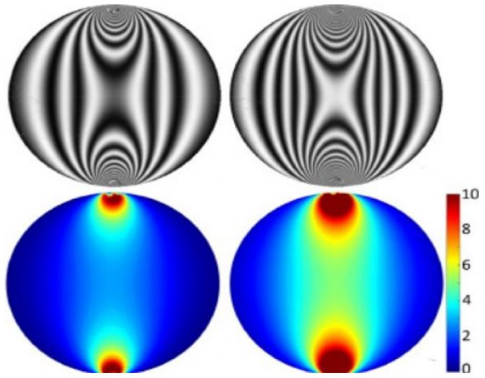
How it Addresses the Problem:

- **Non-contact measurement:** Increases patient comfort.
- **Early detection:** Detects stress patterns in the cornea, indicating early signs of glaucoma.



3-D reconstructions of an Orbscan map

- Different colors indicate varying corneal curvature or thickness.
- corneal topography



Stress pattern on material

- These images represent different intensities of stress.
- Photo-elastic analysis of Stress

Innovation & Uniqueness:

- **Non-contact approach:** More **patient-friendly** than contact-based industry methods.
- **Integrated technology:** Combines photoelasticity and corneal topography for a **detailed** stress map.
- **Novel diagnostics:** Detects pressure variations for **improved** glaucoma accuracy.
- **Compact & portable:** **Lightweight design** enables easy home monitoring.

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TECHNICAL APPROACH

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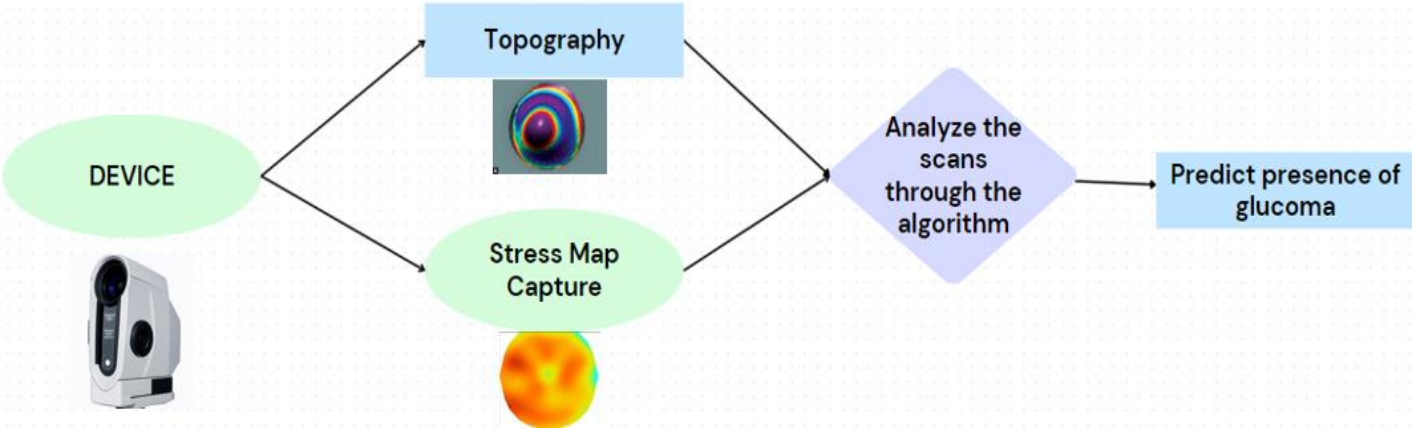
Technologies to be Used

Programming Languages/Frameworks:	
Hardware	Modified Topography Device, Photoelasticity Setup , Camera sensor , Polarizing Filter , Processing Unit (Computer/Tablet)

Flow Chart



Methodology and Process for Implementation

Step 1: Data Collection

- **Capture Fringe Patterns**: Use a **photoelasticity** setup to **capture** the **stress-induced fringe patterns** on the cornea.
- **Topography Capture**: Use **our device** to capture detailed **corneal surface topography** for structural data.

Step 2: Generate Stress Map

- Combine the stress values derived from fringe patterns and corneal topography.
- **Create** a **stress map** to visualize stress distributions across the cornea. Areas of **non-uniform stress** or **clustered pressure differences** indicate potential glaucoma.

Step 3: Relative IOP Detection.

- Detect elevated IOP from the **clustered** differences in stress values. Areas of high stress concentrations may be early indicators of glaucoma.

Step 4: Output and Visualization

- Display the stress map and indicate **regions of high stress** for diagnosis.
- Visualize data in real time, and **suggest possible IOP ranges** based on observed stress anomalies.

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FEASIBILITY AND VIABILITY

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Idea: Integrate **OCT and photoelasticity** for medical imaging.

Feasibility:

•Mature technologies with proven applications.

•Integration is feasible due to miniaturization advancements.

Challenges:

•Accurate calibration for varying eye pressures.

•Device must be portable and affordable.

Strategies:

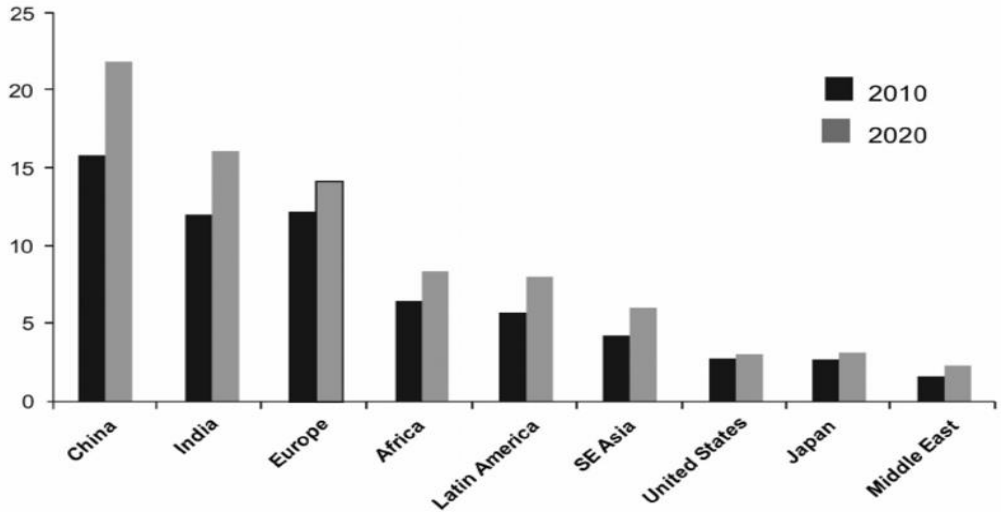
•Develop **adaptive** calibration algorithms.

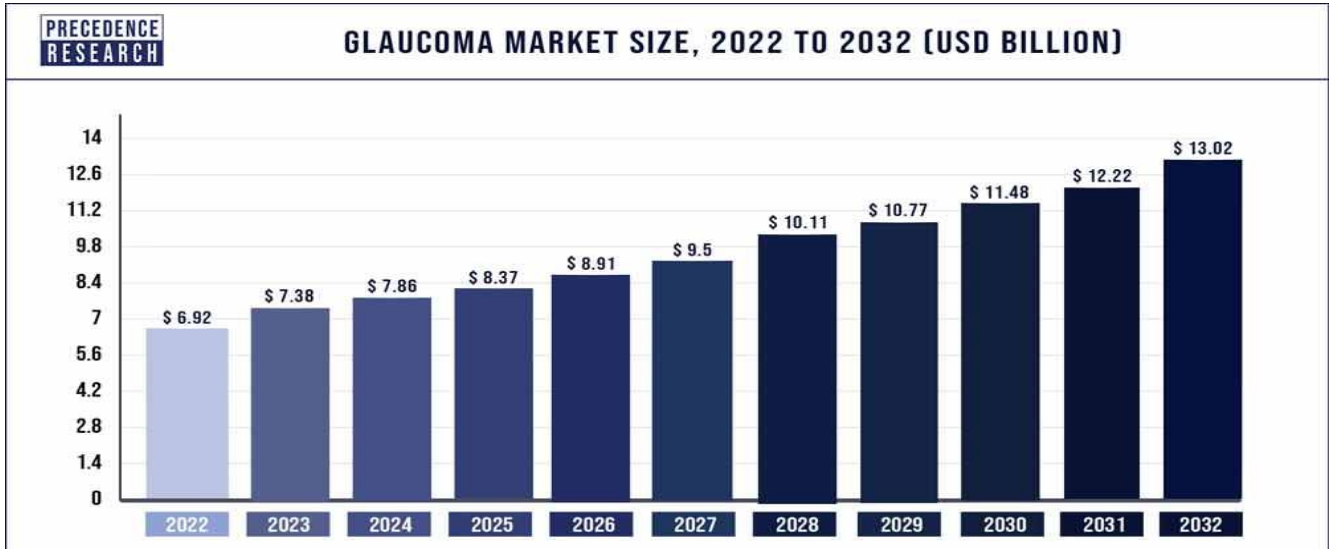
•Utilize advanced miniaturization techniques.

•Source **cost-effective** components.

•Conduct clinical trials for validation.

•Partner with **manufacturers** and **research institutions.**





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IMPACT AND BENEFITS

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Target Audience:

•**Glaucoma Patients:** Offers a **convenient**, **affordable** home monitoring solution, empowering proactive condition management.

•**Clinicians in Remote Settings:** Provides **valuable tools** for healthcare providers in areas **lacking** specialized equipment or trained ophthalmologists.

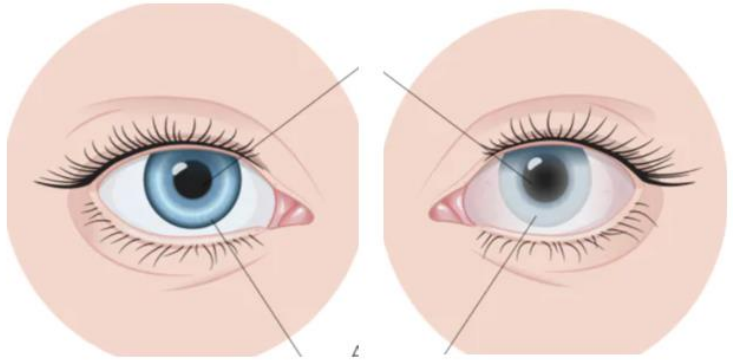
Benefits:

•**Early Detection:** Enables **early glaucoma detection**, preventing **vision loss**.

•**Improved Outcomes:** **Enhances** patient monitoring at home, boosting quality of life.

•**Cost Reduction:** **Low-cost solution** alleviates **financial burdens** on patients and healthcare systems.

Sustainability: **Reduces** clinical waste by **eliminating** disposable Tono-meters.



NORMAL EYE *GLAUCOMA EYE*

Traditional device
Orbscan 3

PROTOTYPE
Portable

RESEARCH AND REFERENCES

References-

- https://pubmed.ncbi.nlm.nih.gov/11349932
- https://pubmed.ncbi.nlm.nih.gov/20948240
- https://www.biorxiv.org/content/10.1101/2024.02.29.582785v1
- Dr Agarwal's' Textbook on Corneal Topography Including Pentacam and Anterior Segment OCT