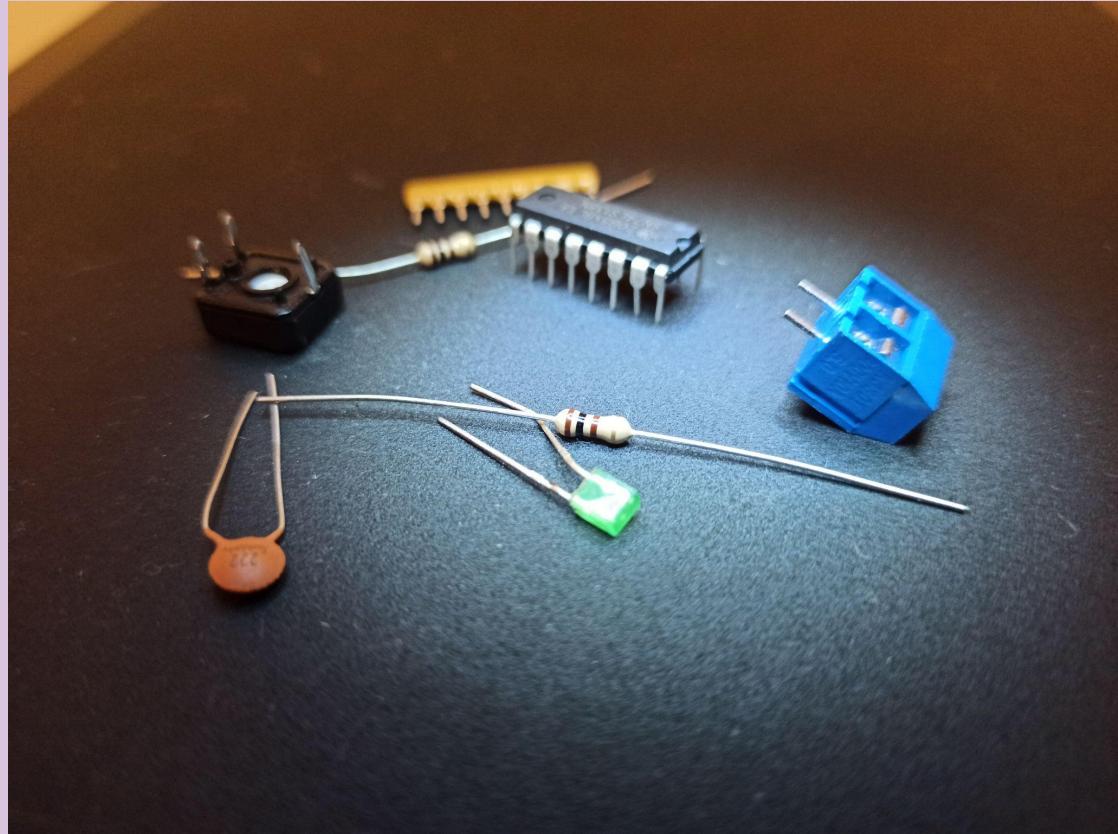


AI based Electronic Component Identifier

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Course ID: TU807

Object detection

- **Important in**
 - **Security**
 - Notifying concerns
 - People
 - Animals
 - Flora
 - **Production**
 - Discarding defects
 - Damage
 - **Analysis**
 - Quality inspection
 - Scratches
 - Spots
 - Classification
 - Resistor
 - Capacitor
 - Total and class count



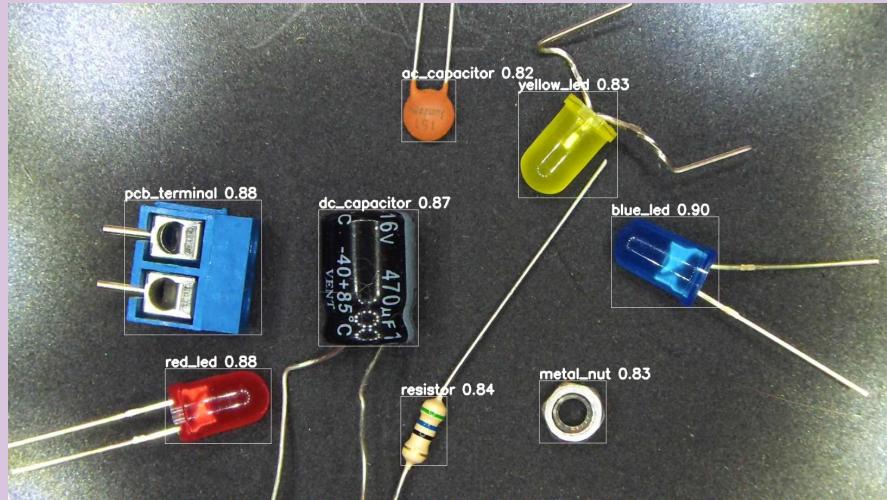
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The problem

- Object detection from images:
 - Natural to intelligent creatures.
 - Designed for object detection through evolution.
 - Second nature.
 - Binary data to computers.
 - Has no concept of object, image, or color.
 - Everything is processed the same.

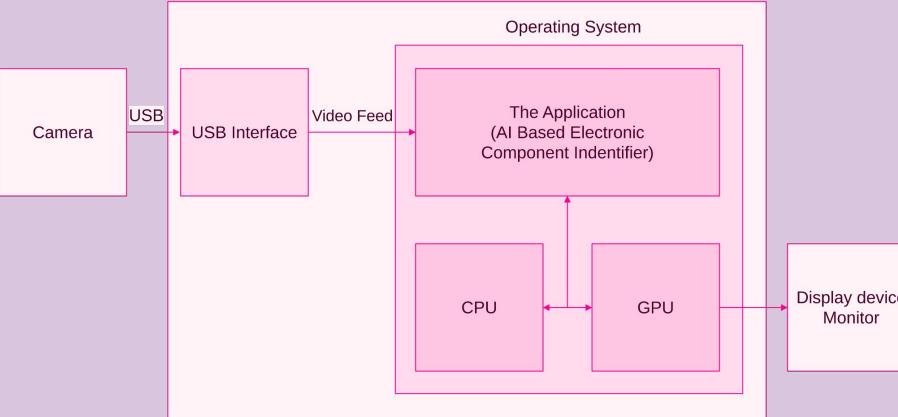
AI based Electronic Component Identification

- GUI display
- Identifies:
 - Position (Bounding Box on a live display).
 - Class name.
 - Resistor
 - Capacitor
 - Confidence (Percentage).
 - Quantity.
 - Potential extra information:
 - Resistors - Color code to Ohms.
 - Capacitors - Number code to farad.
 - IC - Pin count, text on the IC if visible.

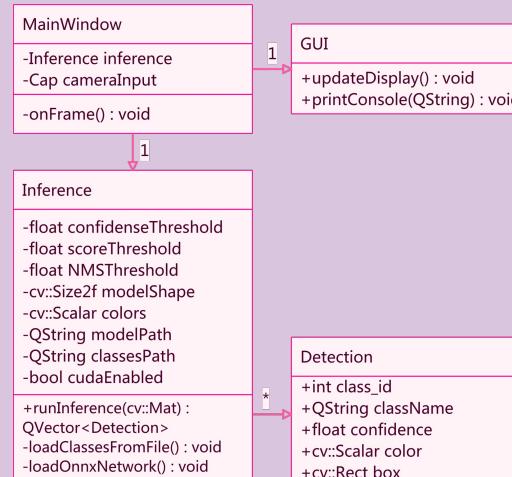


System Block Diagram

Machine running the Application



Class Diagram



Concept Diagrams

- **System Block Diagram**

- Camera is External.
- Communication through USB.
- The application utilises both CPU and GPU

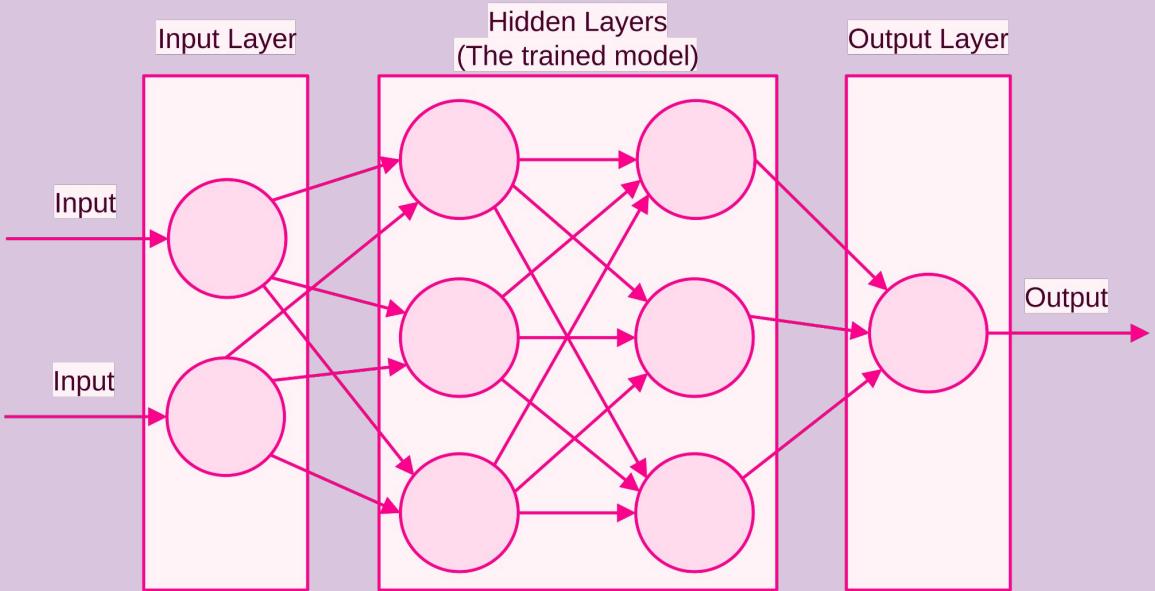
- **Class Diagram**

- MainWindow is the controller.
- Inference is responsible for object detection.
- GUI is the output.

Solution

Inference, Deep Learning

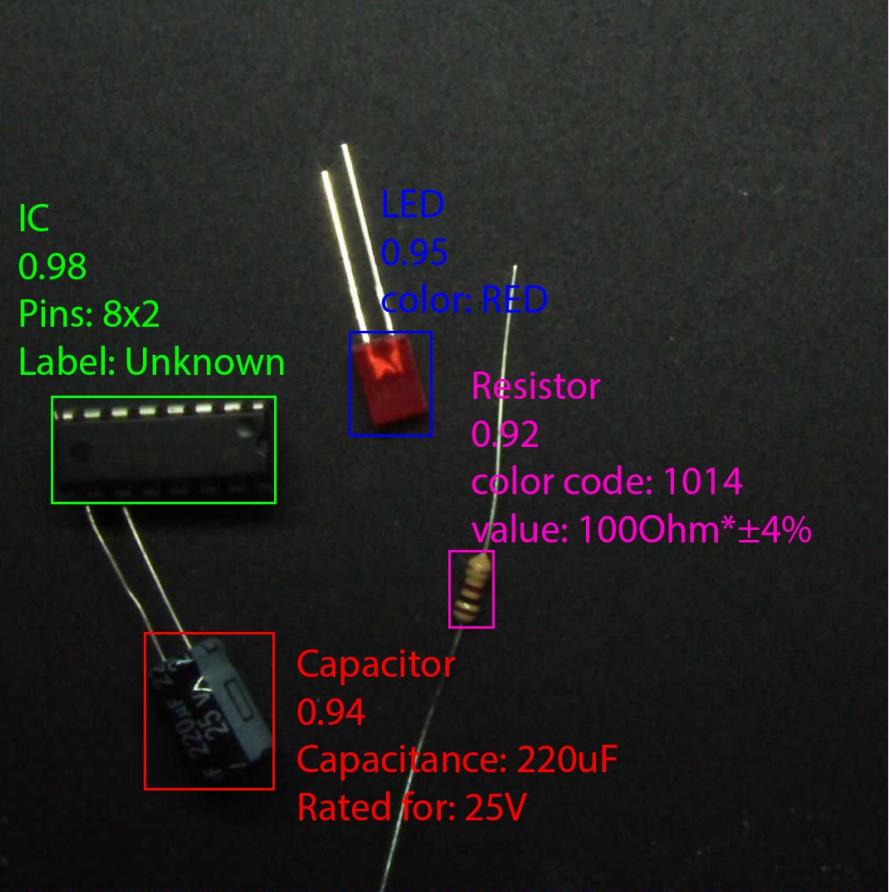
Simple Neural Network Diagram





Model Training

- Trained on over 3000 images
 - Taken on the rig.
 - Manually labeled.
- Each picture should have some variation in conditions.
 - Position
 - Rotation
 - Lighting



Note: For now, this was achieved through image manipulation.

Post-Processing

Additional processing after Inference has identified the objects.

- Identification of (For those that apply)
 - Labels using Text Recognition
 - Color codes
 - IC
 - Pin count
 - Color (LED)

Discussion

- Inference is capable of extracting an Extremely high level of information.
 - Post-processing is expected to be considerably less accurate.

Conclusion

- Data gathering and training of the model will be the most time and computation intensive process.
- While the project is mostly software-focused, the physical aspects are a crucial key to the overall success of the project.

References

- [1] YoloV5 <https://github.com/ultralytics/yolov5>, accessed on 6th of November, 2022
- [2] Ultralytics <https://ultralytics.com/>, accessed on 6th of November, 2022
- [3] COCO dataset <https://cocodataset.org/#home>, accessed on 7th of November, 2022



The end

Any questions?