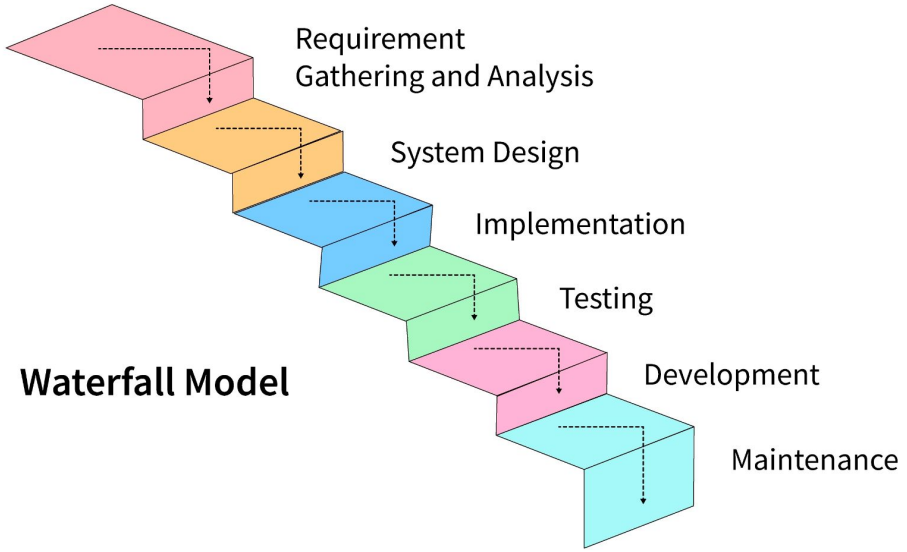
OpenCV, Image Recognition, and the Future of Workplace Safety

Let **Computer Vision** carry you to your 2030 goals

By Kaela and Campbell

Methodology



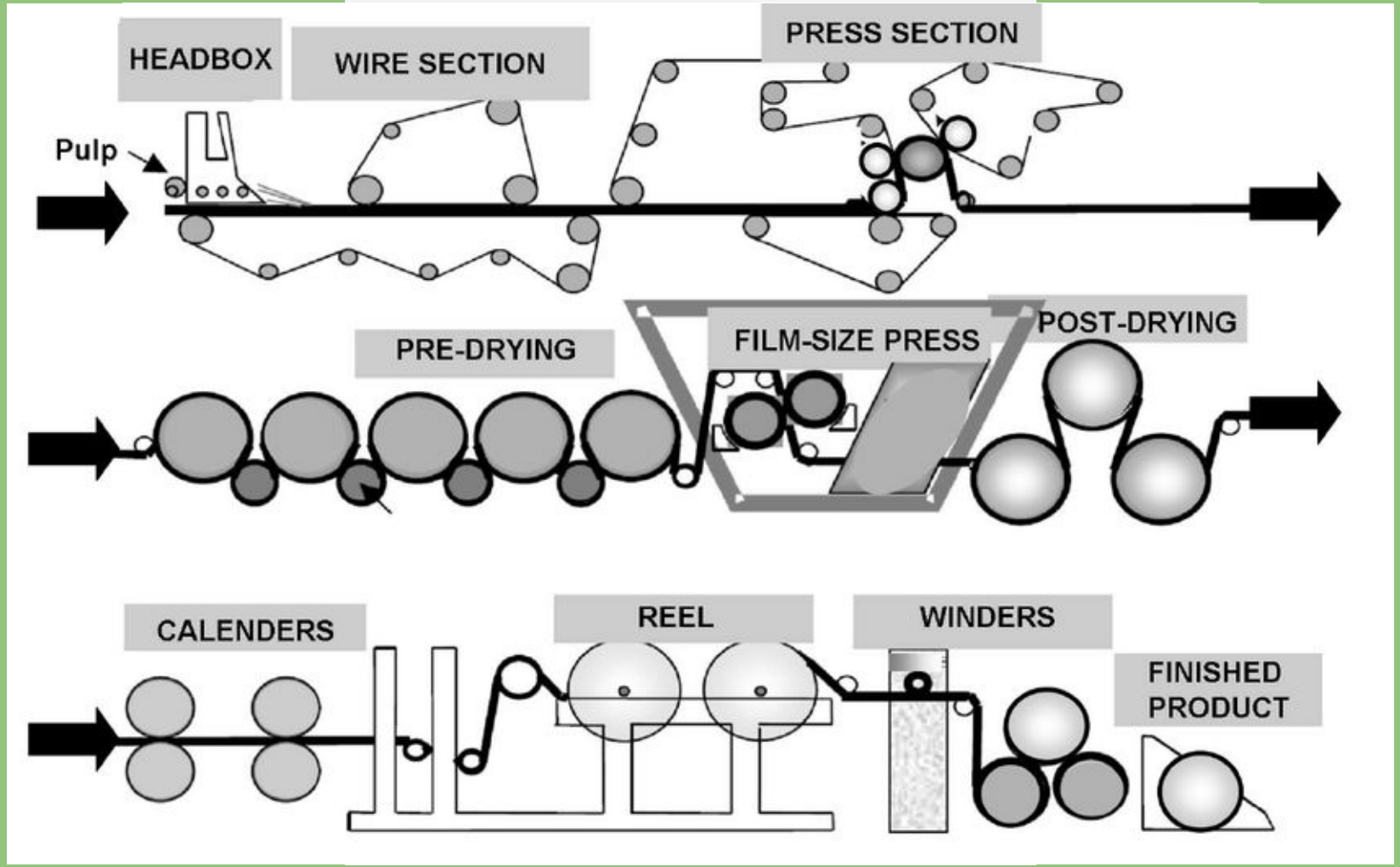
Research

Kaela

- Corrugate making process
- Mechanics of paper machine and corrugator
- Online reports of past instances of unsafe situations leading to injury or death

Campbell

- Computer Vision: face & object recognition/tracking
- Image translation techniques: blob detection, Haar-like features, Histograms of Oriented Gradients, Adaptive thresholding


HEADBOX
WIRE SECTION
PRESS SECTION
Pulp
PRE-DRYING
FILM-SIZE PRESS
POST-DRYING
CALENDERS
REEL
WINDERS
FINISHED PRODUCT

Rotating And Fixed Parts

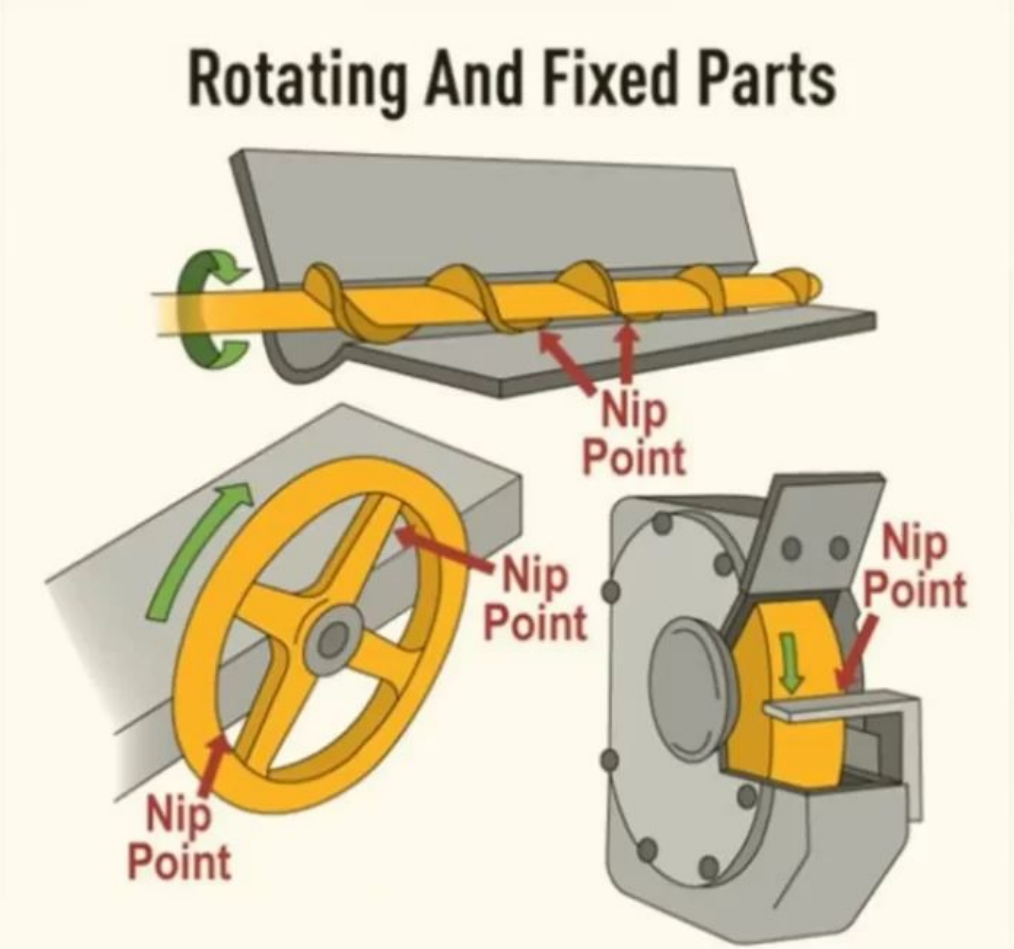
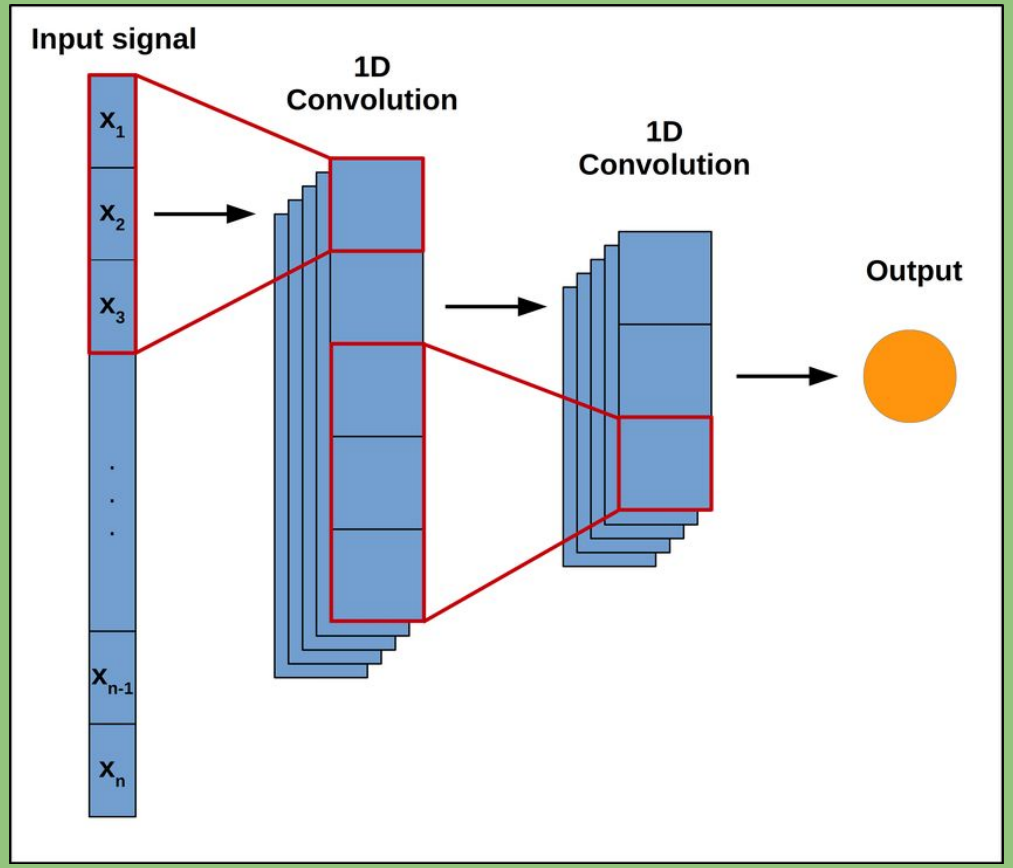


Image recognition process:

1. A data set is gathered
2. The neural network is fed and trained
3. Inferences are converted into actions



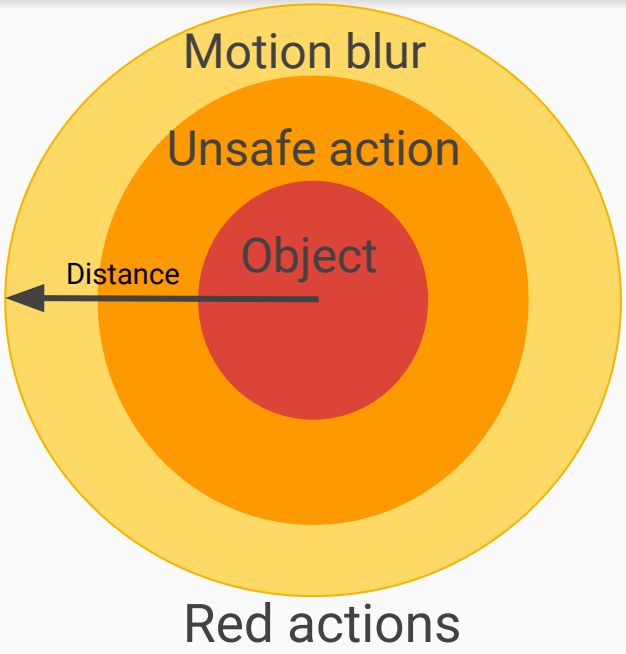
Analysis

With this research in mind, we constructed an abstract solution based on the layering system of neural networks in tandem with the most common contributing factors to workplace injury that can effectively detect and react to risky or abnormal behavior near dangerous machinery.

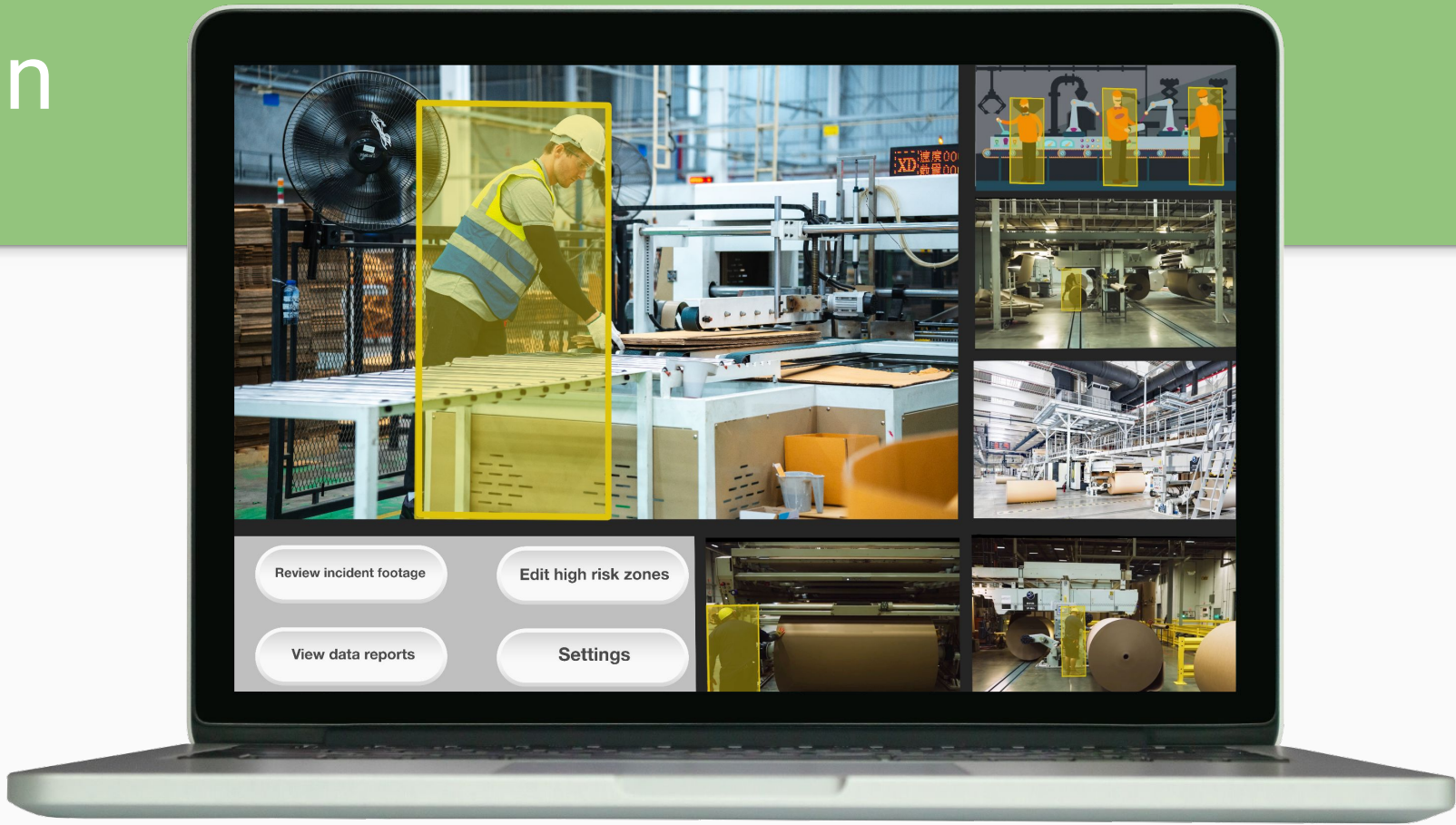
Solution

Using image recognition to identify high risk areas on machinery, unsafe procedures, and motion blur, this software will calculate risk severity of events based on factors like distance, incident frequency, and length of event. Risk severity is either red, yellow, or green.

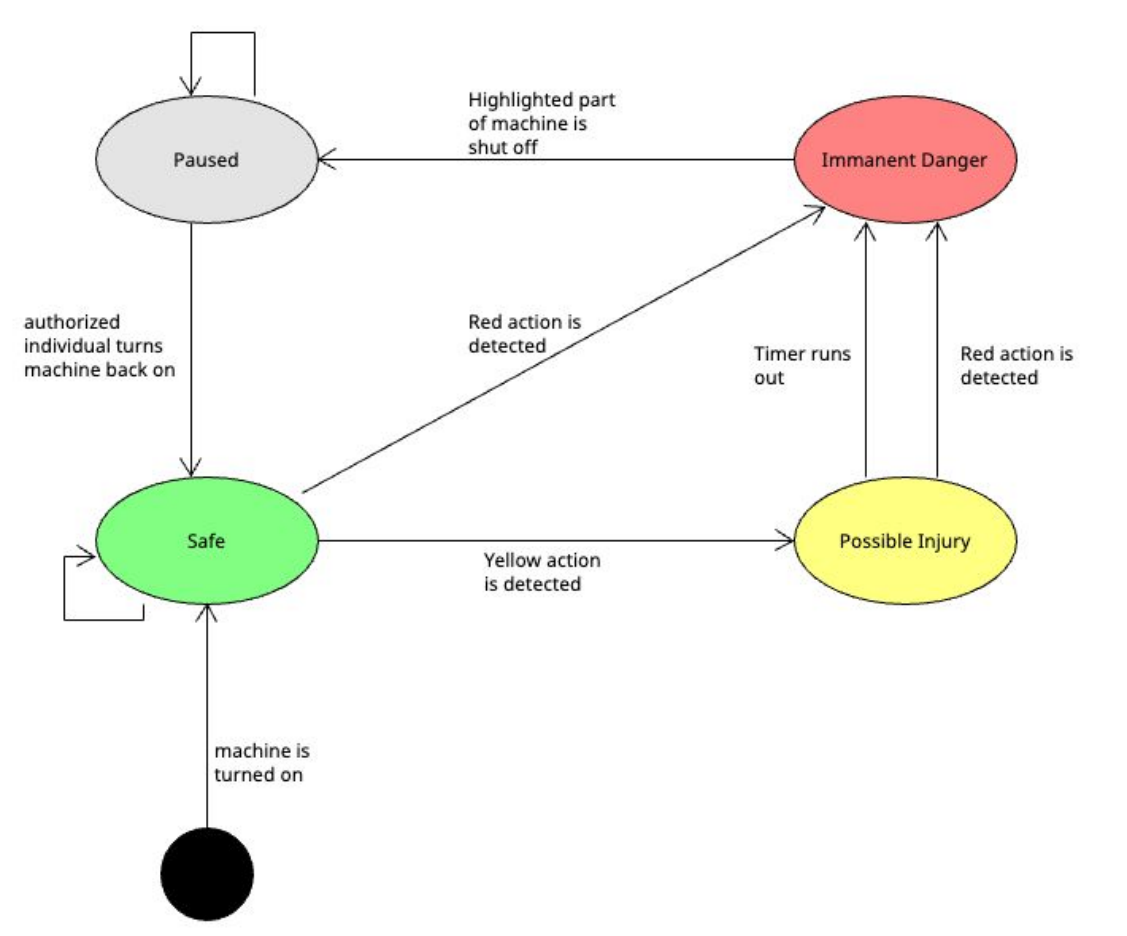
The programs response to each state of risk severity can be decided by individual locations, but flashing lights, tracking frequency and time, and completely shutting off the machine will be reaction options.



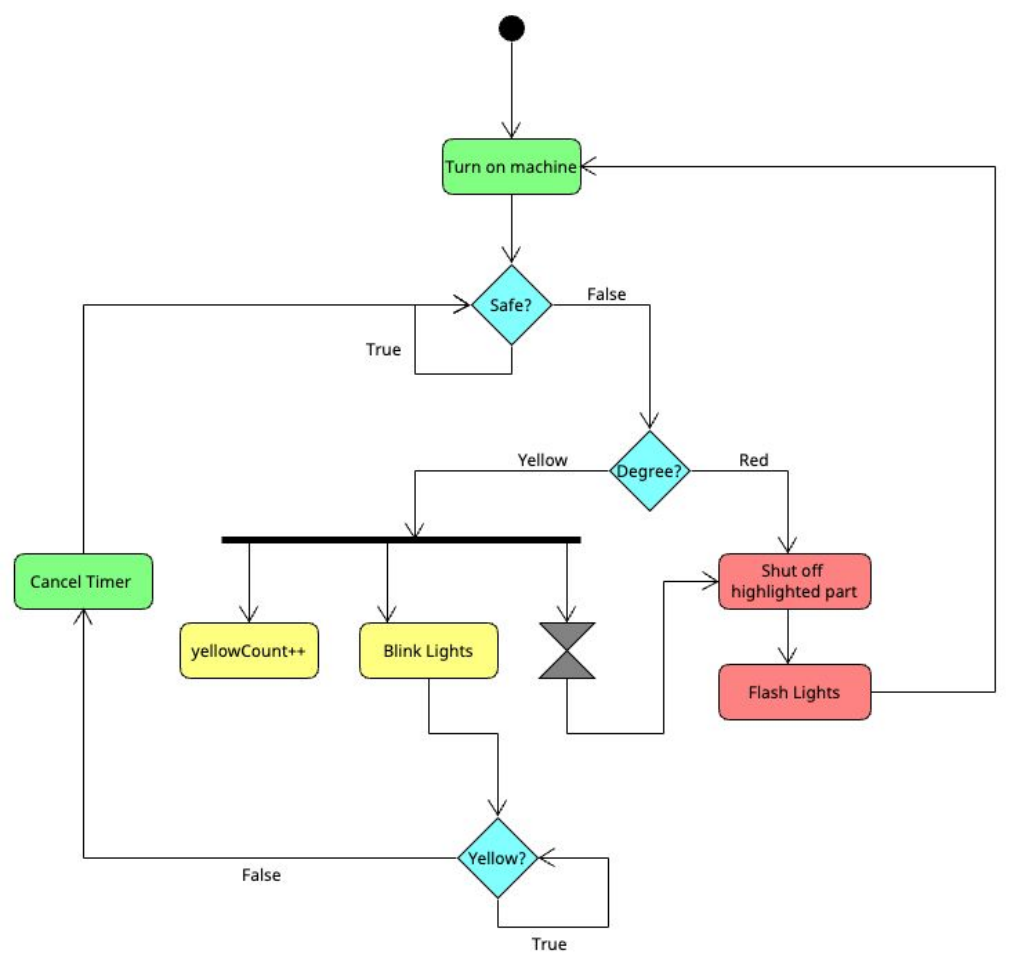
Design


Review incident footage
Edit high risk zones
View data reports
Settings

State Diagram



Activity Diagram



Demo

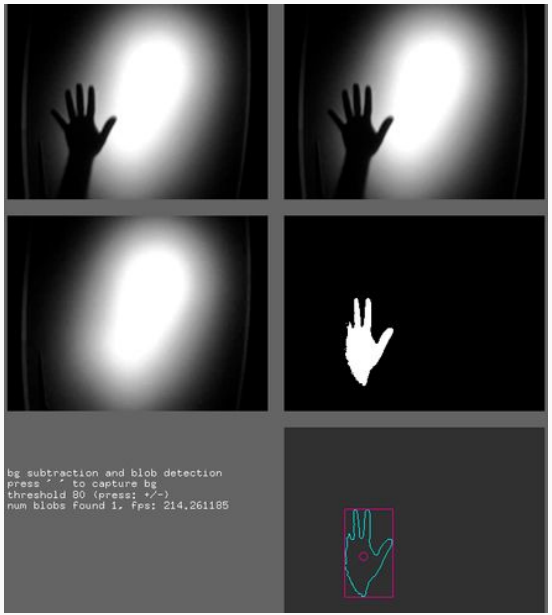
Implementation

Physical Aspects

- Employee training
- Cameras
- Risk state communication
- Emergency Alert Systems

Technical Aspects

- Training input
  - Examples of each risk factor (speed, behavior, etc.)
  - Confirmation of correct output
- Risk Factor calculations



More things to Consider

In order to actually implement this plan, we still need to consider:

- Cost of cameras (installation, maintenance, extra power)
- Cost of machine slowdowns vs full stops
- Optimized method to compound Risk Factor data
- Ethical, yet effective, data set
- Time it takes machine to stop compared to reaction time for high risk situations

Conclusion

Summary:

- Use DNN & CNN framework to categorize safe, potentially dangerous, and imminently dangerous actions
- Uses generalization techniques to allow system to discover new potential hazards and risky behaviors
- Separate image recognition output into multiple factors that are compounded to give a general Risk Factor
  - Some factors are weighted more heavily than others
- “Red” and “Yellow” events are customizable depending on machine throughput, plant conditions, and supervisor preferences

Questions?

Thank you!