FPGA Camera-Controlled Traffic Lights

PREMILA ROWLES AND JESSICA QUAYE

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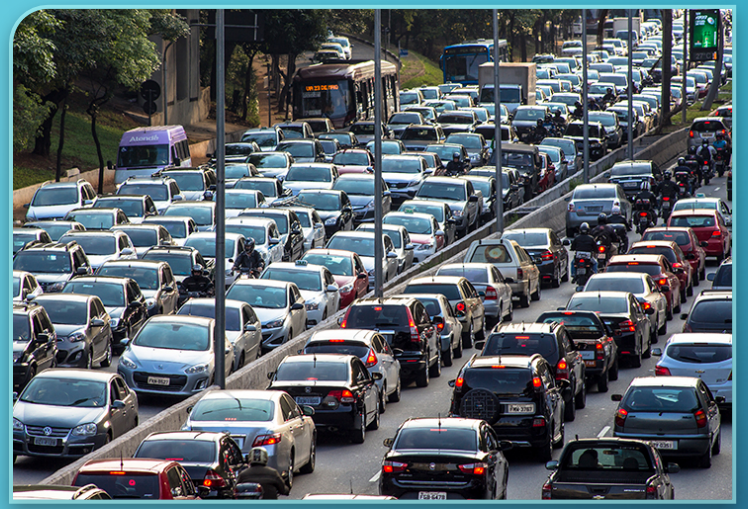
BACKGROUND

- Traffic congestion during rush hour
- Accidents without immediate attention



PROJECT OVERVIEW

- Use camera to monitor traffic
- Process image to understand traffic and other activities
- Control traffic signals using this information, send help signal, detect reckless driving
- Draw visualization (of what is happening on the street) on the VGA monitor

IMAGE PROCESSING

- Conversion from NTSC -> ZBT (YCrCb) -> RGB
- Y : Green
- Cr : chromaRed channel
- Cb : chromaBlue channel

Y

Cr

Cb

IMAGE PROCESSING

- RGB -> HSV -> Erosion & Dilation
- In HSV, hue is most likely to be similar
- Unlike RGB, HSV can separate luma from chroma
- Dilation adds pixels to boundaries
- Erosion removes pixels from boundaries

HSV Color Space

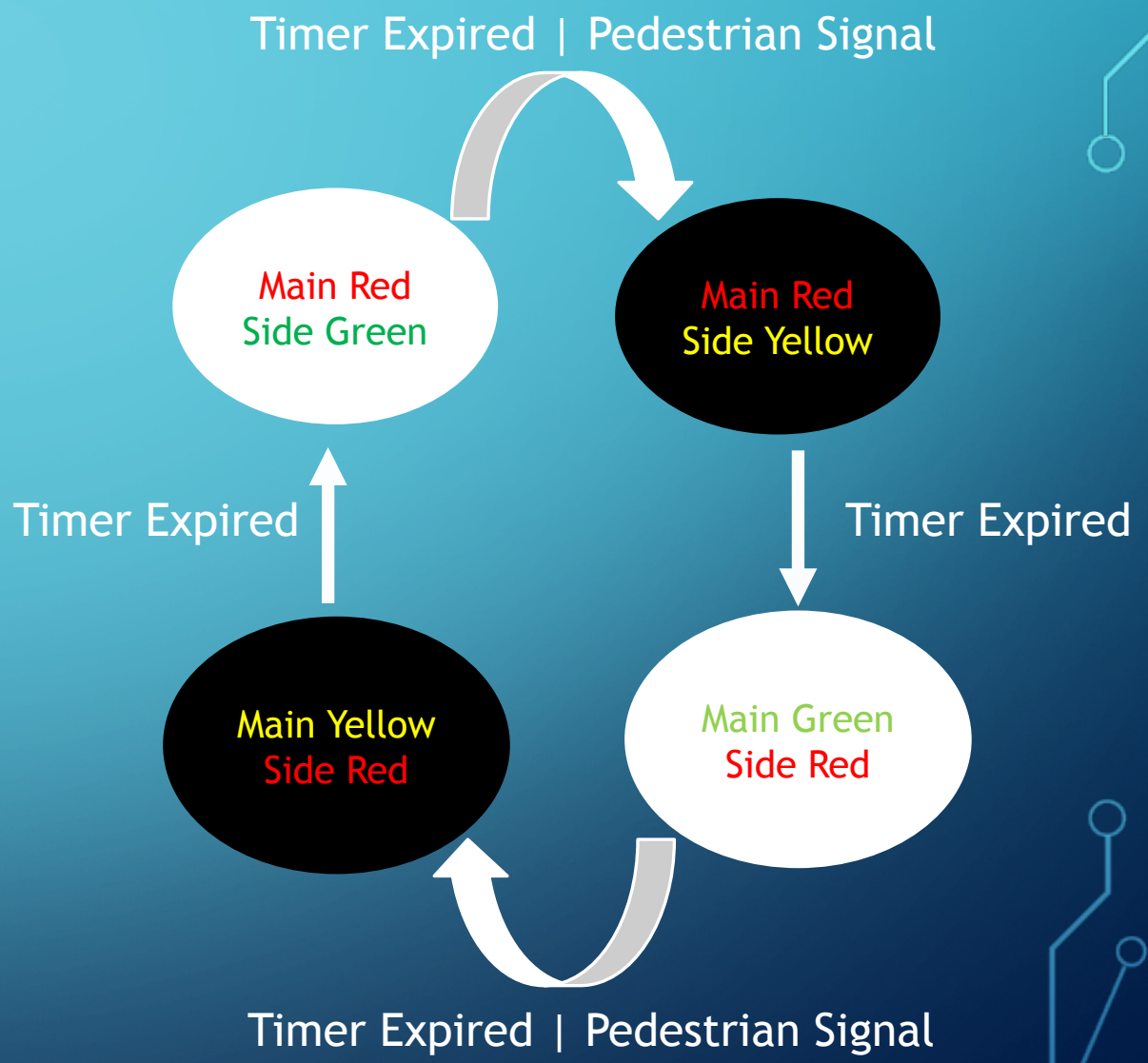
Eroded & Dilated

IMAGE PROCESSING -> FSM AND VISUALIZATION

- Stream of pixels
- Calculating speed and direction of cars
- Detecting Collisions
- Detecting reckless driving

TRAFFIC CONTROL FSM

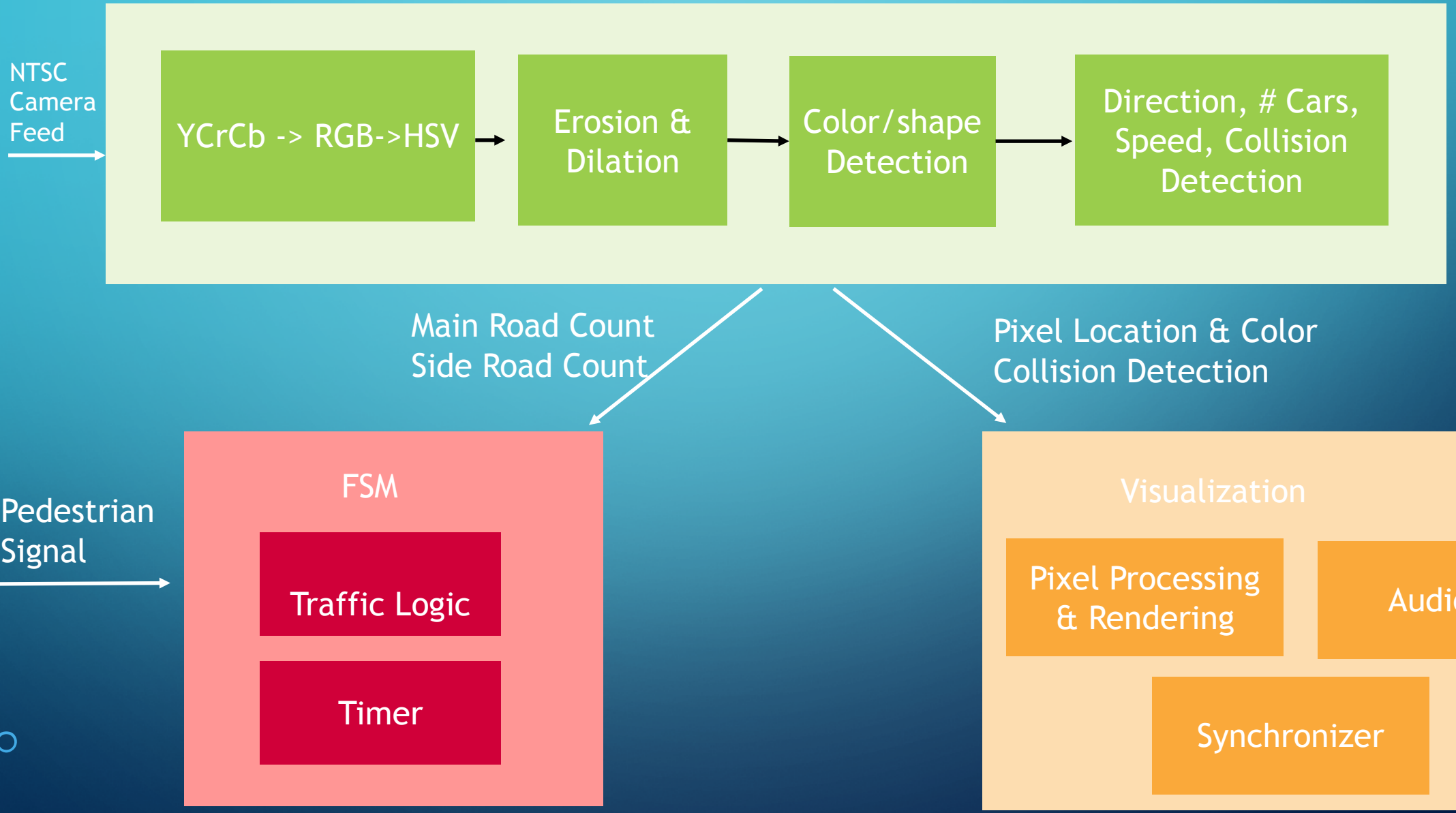
- Input: number of cars in each direction + pedestrian signal
- Output: traffic signals of all traffic lights



VISUALIZATION/ANIMATION ON VGA

- Cars on the road in motion, real time
- Car accidents (collision) & ambulance
- Reckless driving & police

HIGH LEVEL BLOCK DIAGRAM



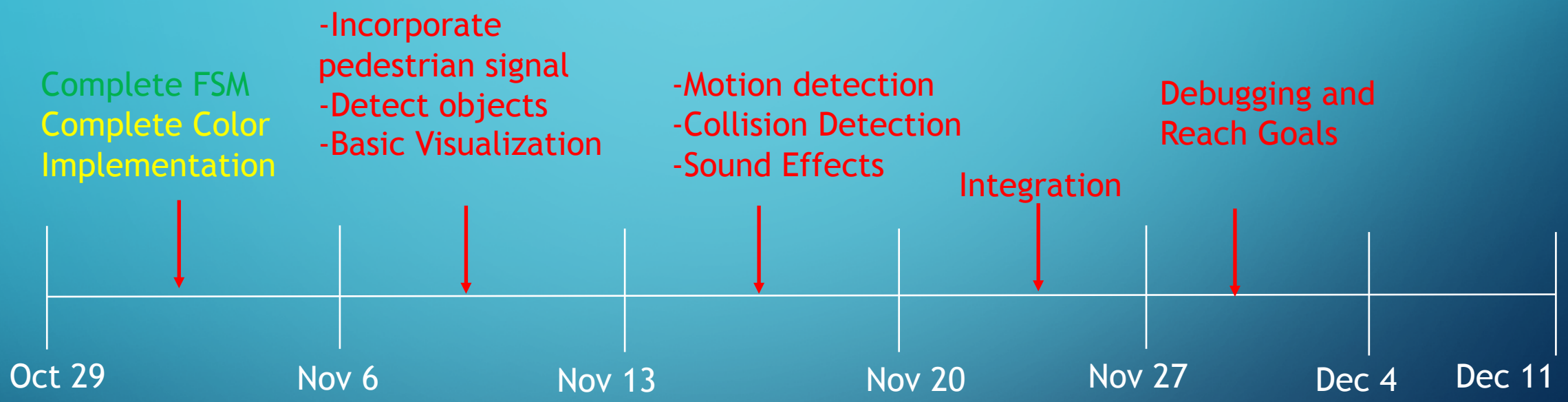
GOALS

Module	Baseline	Expected	Stretch
Image Processing	Given camera input, determine number of cars and corresponding direction on a two-way street.	Detect collisions on the street and send help signal.	Detect reckless driving. If a traffic warden is detected in the middle of a street, turn off traffic lights.
FSM	Control traffic on a two-way street	Add logic to incorporate pedestrian “push-to-walk” signals to the FSM.	Increase number of lanes on roads to incorporate left and right turns,
Visualization + Audio		Imitate the road. When an accident occurs, the display an ambulance approaching the collision point.	Add animations to ambulance during visualization on the screen as well as ambulance siren. Make it possible to playback accidents. Audio screams for “help!”

ANTICIPATED CHALLENGES

- Noise in image processing (bumper-to-bumper cars)
- Reckless driving (detecting speed and tracking motion with precision)

TIMELINE


Complete FSM
Complete Color Implementation
-Incorporate pedestrian signal
-Detect objects
-Basic Visualization
-Motion detection
-Collision Detection
-Sound Effects
Integration
Debugging and Reach Goals
Oct 29
Nov 6
Nov 13
Nov 20
Nov 27
Dec 4
Dec 11

THANKS! QUESTIONS?