

Michigan Technological University: College of Computing:

Undergraduate Research Team presents:

EV Scholars: Autonomous Vehicles Workshop



Who are we?

Ben Bistline
2nd Year Computer
Engineering
Palmyra, PA

John Dagg
1st Year
Mechanical Engineering
Shelby Township, MI

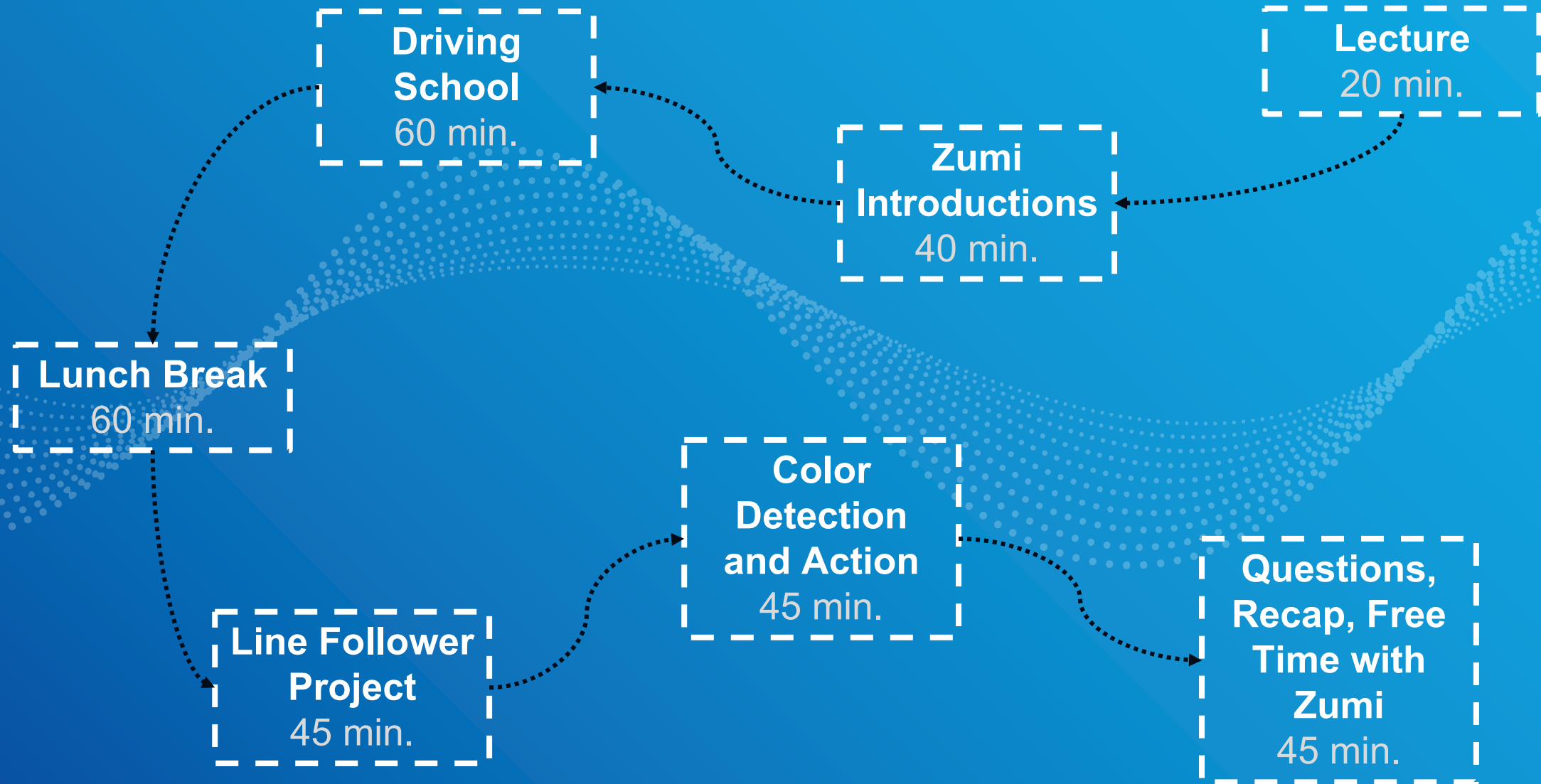
Yash Tiwari
1st Year
Computer Science
Houghton, MI

Michael Kulas
3rd Year
Computer Science
Iron Mountain, MI

Table of Contents

1. Schedule of events
2. Robolink: Zumi
 - A brief overview of what “Zumi” is.
3. Automation
 - Basic and intelligent automation
 - Automation in vehicles and Zumi

Schedule of Events



Robolink: Zumi

What is it?



All About Zumi

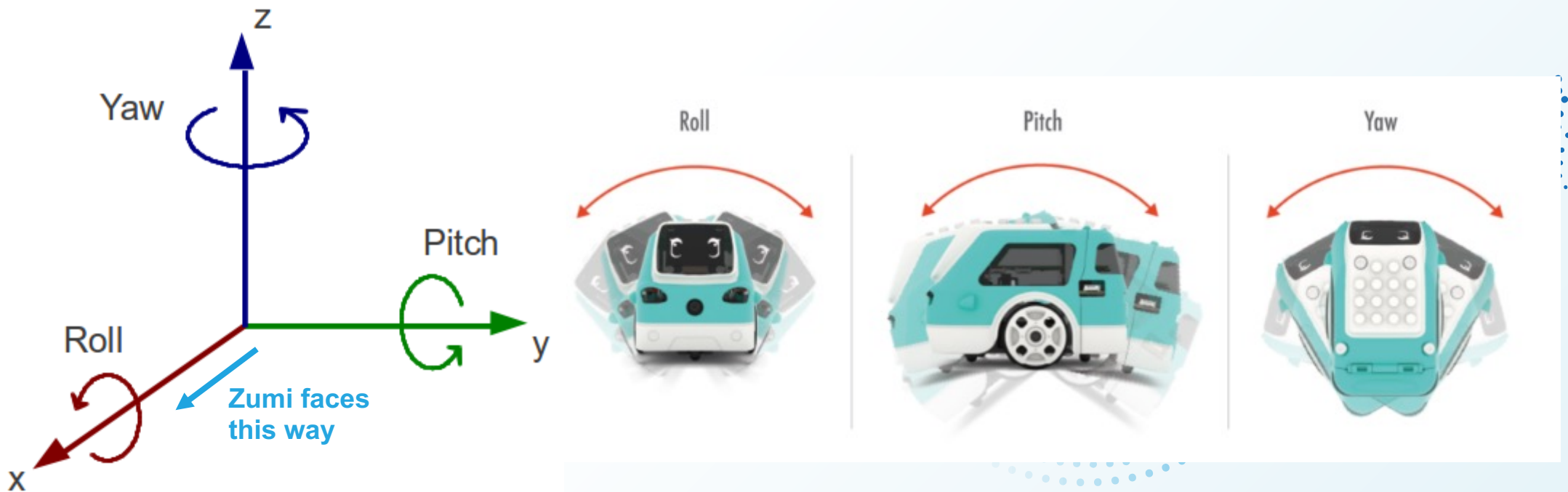
- Tiny, self-driving car focused on teaching K-12 about:
 - Artificial intelligence and computer vision
 - Autonomous vehicles
 - Programming LEDs, sounds, motors
- Libraries are provided for Python and Blockly
- Zumi will be a part of the introduction to Java classes in the Fall of 2023
 - Java libraries have been developed

Zumi Components



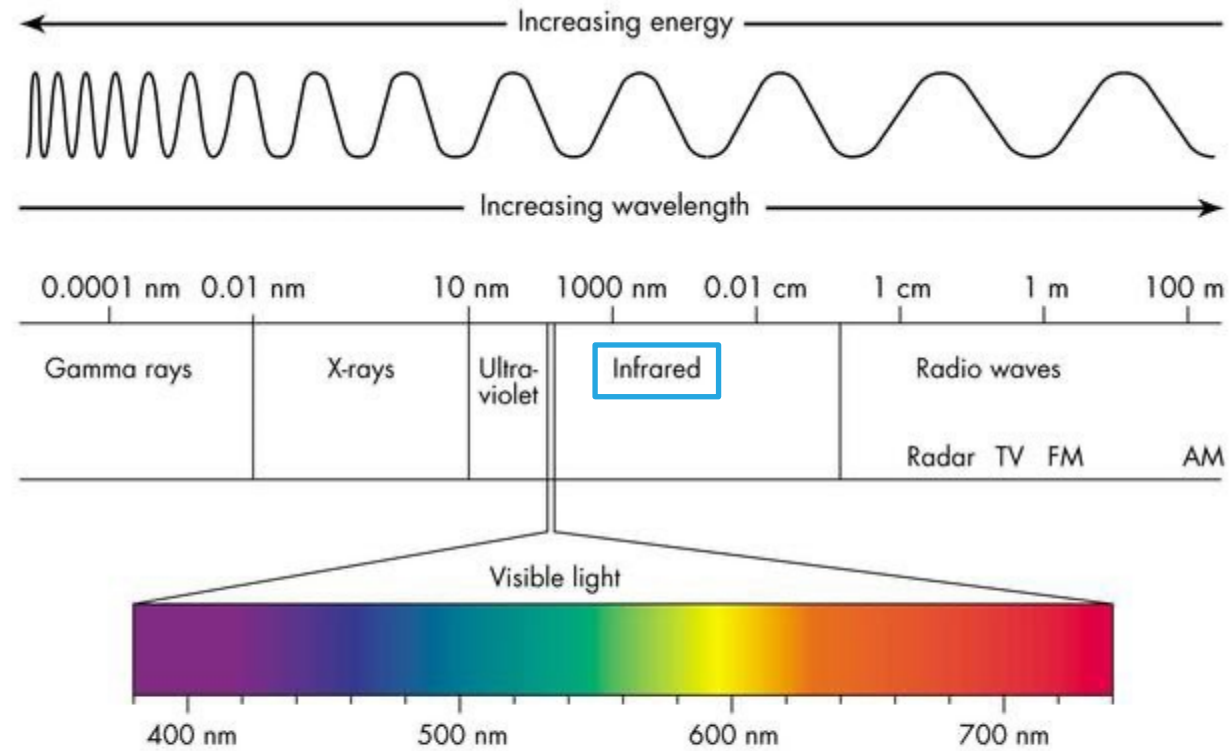
What Do These Components Do?

- Gyroscope / Accelerometer:
 - Reads roll, pitch, and yaw
 - Useful for autonomous driving
 - Accelerometer measures acceleration
 - Not as valuable to us, can be rather inaccurate



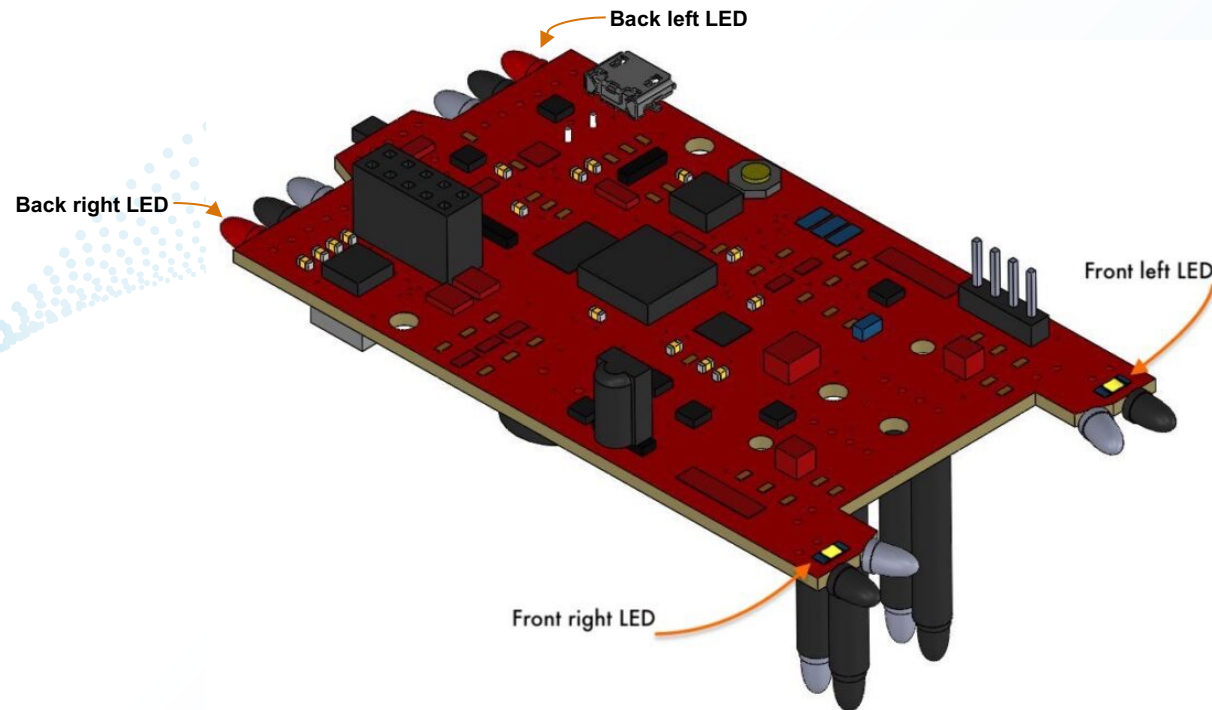
What Do These Components Do?

- IR Sensors:
 - IR is short for “infrared”
 - Zumi has **six** IR sensors (2 front, 2 down, 2 behind)
 - Zumi emits and receives an IR signal and calculates a 0 – 255 value which corresponds to the color of the object that reflected the waveform
 - Can be somewhat inaccurate, but are good enough for measuring thresholds



What Do These Components Do?

- Lights:
 - Zumi has LED headlights and brake lights
 - Headlights → white LEDs at the front
 - Brake lights → red LEDs at the back
 - Simple commands will enable and disable the lights



What Do These Components Do?

- Camera:
 - Zumi's vision abilities use the PiCamera library
 - Zumi has a red light on the bottom left part of the camera that indicates whether or not the camera is in use
 - Zumi has both photo and video features



Automation

Basic vs. Intelligent



What is the difference?

- Basic automation:
 - The system does not use any type of information other than what it has been given to make decisions.
- Intelligent automation:
 - The system uses past experiences, logic, and/or feedback from sensors to make decisions.

Intelligent > Basic

What does this look like in Zumi?

Basic

- Zumi drives preprogrammed paths
- Zumi does not use sensors to monitor its environment
- Zumi cannot tell if something goes wrong

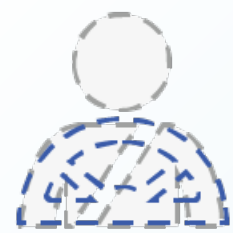
Intelligent

- Zumi drives through its environment on its own
- Zumi uses sensors to observe its surroundings and make decisions
- Zumi can detect a problem and take action to fix it or at least do something about it.

There are different levels of vehicular automation

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation



0

No Automation

Zero autonomy; the driver performs all driving tasks.

1

Driver Assistance

Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.

2

Partial Automation

Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.

3

Conditional Automation

Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.

4

High Automation

The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.

5

Full Automation

The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

What about these?



Tesla Roadster



Chevrolet Silverado LD

These are both
Level 2 autonomous
systems

Level 2

Is the highest level of autonomy available to consumers as of 2022.

What level would
Zumi be?



What does Zumi have in common with these vehicles?

- Both are capable of intelligent automation
- You can enable and disable lights and screens
- You can drive paths using sensors and clues from your environment
- Both need some sort of fuel to operate

What else?

Notice:

- Zumi is a small, educational robot; not an automotive vehicle
 - Therefore, it will **NOT** be perfect
- If Zumi experiences issues or other problems arise, we ask that you bear with us and still try to make the most of the experience

Questions?

The image features a dark blue background with a diagonal gradient. Two decorative elements made of light blue dots are positioned on the right side, forming wave-like patterns that curve across the frame. The word "Questions?" is centered in a white, sans-serif font.