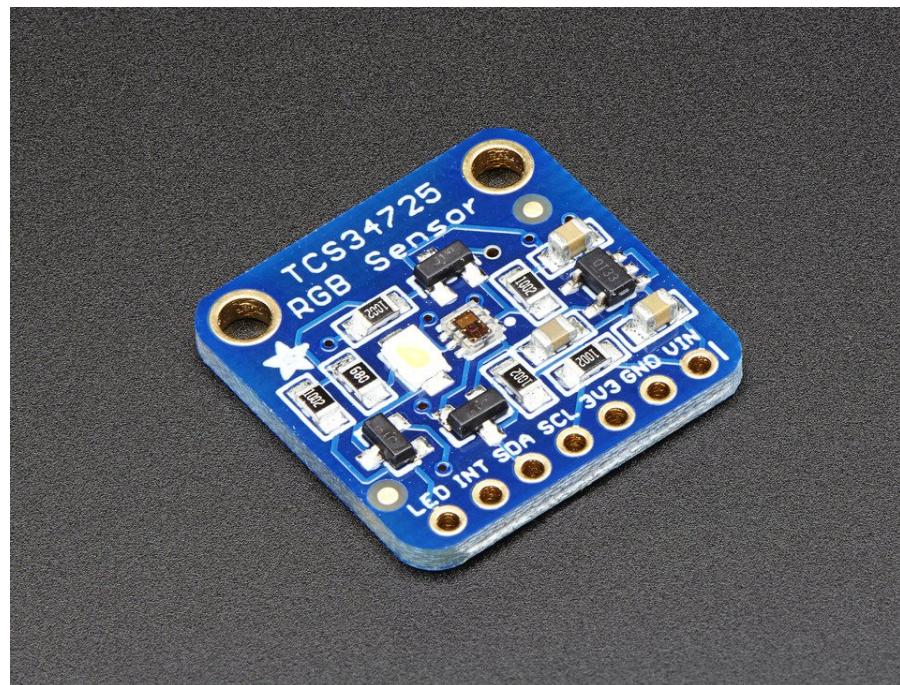


FTC Team #11587

Starry Knights

Tech Learning Series



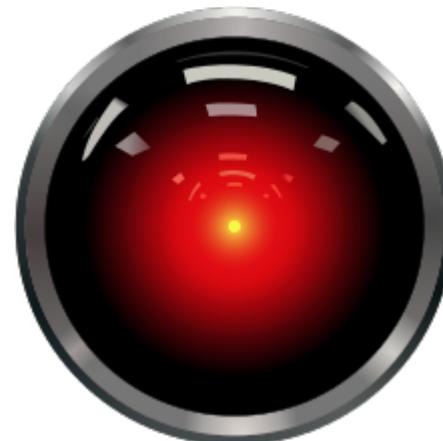
Computer Vision

Introduction

- What Is Computer Vision?
- Computer Vision vs. Human Vision
- The Electromagnetic Spectrum
- Sensor Overview
 - Infrared
 - Visible Light
 - Audio
 - LIDAR
- Summary

What Is Computer Vision?

- Computer vision is a programming discipline which attempts to replicate various elements of human vision
- Requires hardware components to capture data
- Software programming makes data useful
- Vision is a rapidly developing component of robotics



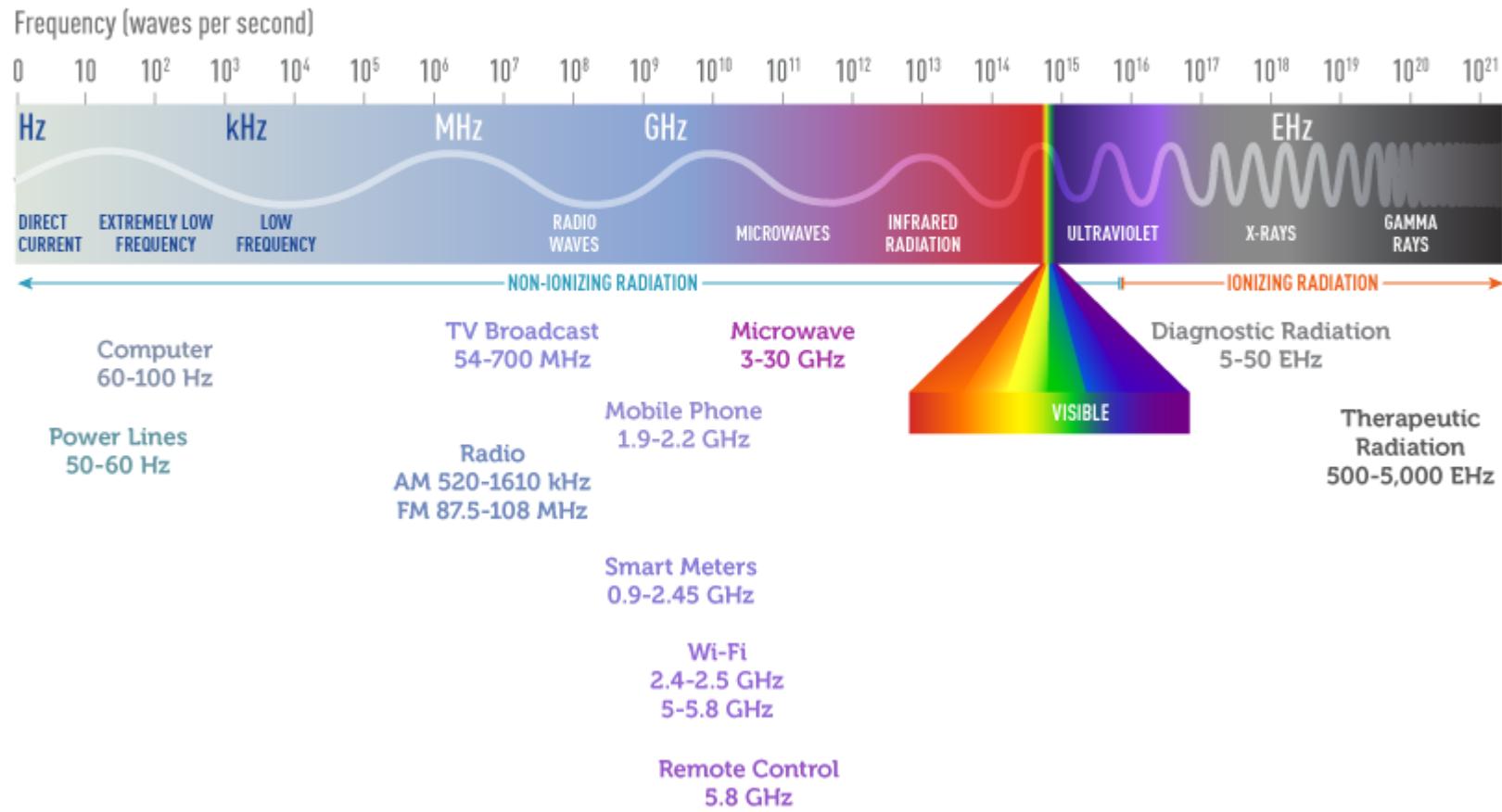
HAL 9000 Camera Eye

Computer Vision vs. Human Vision

- Human Vision Component
 - Color Detection → - RGB Sensor
 - Light Intensity Variance → - Photodetector
 - Object/Pattern Detection → - Software Programming
 - Motion Detection → - Software Programming
 - Distance Estimation → - Ranging Sensors
- Computer Vision Component

Replicating human vision in robotics is a very complex task!

The Electromagnetic Spectrum



- One advantage computer vision has is the ability to utilize a wider range of spectrum than the human eye

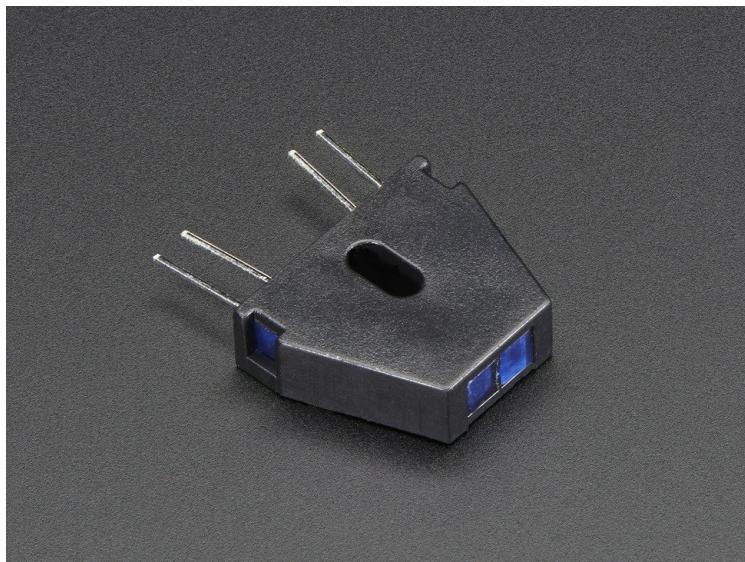
Vision Sensor Overview

- Computer vision sensors are available in a wide variety of spectrum, function, and fidelity
- This overview is not comprehensive – covers the basic types of sensors which could be used for the upcoming FIRST® Tech Challenge season



Vision Sensor Overview

- Infrared Sensors
 - Use IR for tasks like simple ranging & white/black detection



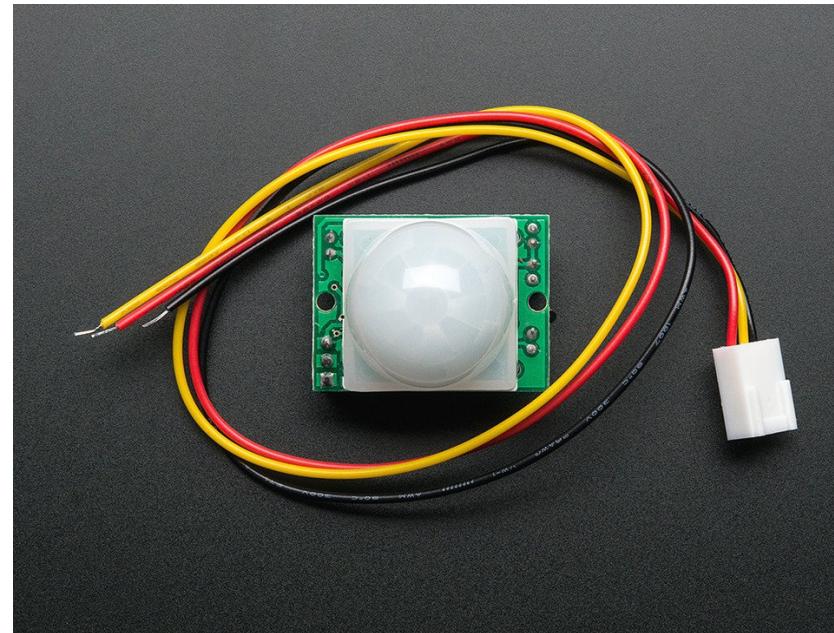
Reflective IR Sensor



IR Ranging Sensor

Vision Sensor Overview

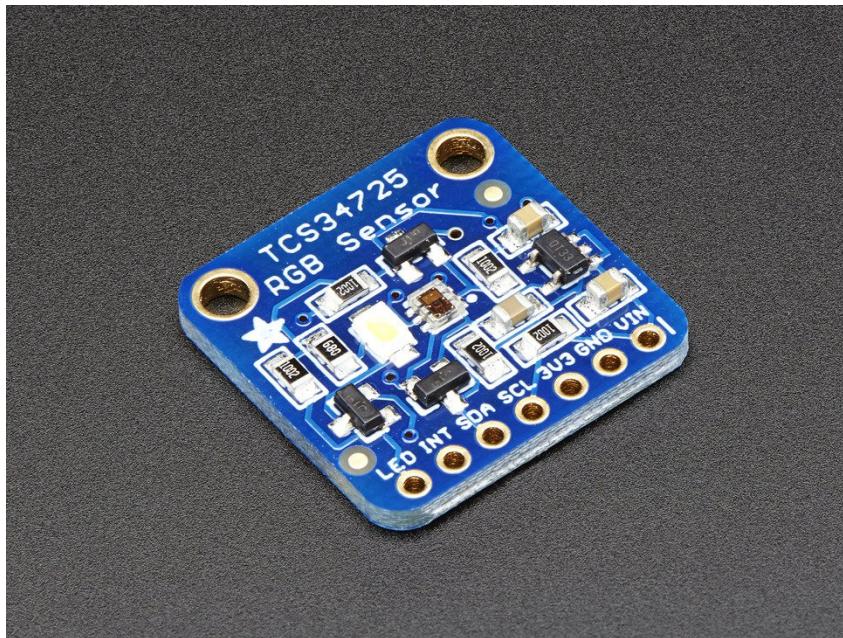
- Infrared Sensors
 - Can be used passively for motion detection



PIR Motion Detector

Vision Sensor Overview

- Visible Light Sensors
 - Widest variety of sensors available for robotics applications



RGB Color Detecting Sensor



Pixy CMUcam5

Vision Sensor Overview

- Visible Light Sensors
 - Image processing include a wide variety of techniques
 - Human vision wins hands-down every time



Vision Processing Using Blob Detection

Vision Sensor Overview

- Audio Sensors
 - Primarily used for ranging due to comparatively low resolution
 - High performance models available but expensive



Ultrasonic Ranging Sensor

Vision Sensor Overview

- LIDAR
 - Light Detection And Ranging



RPLIDAR A2 360° Scanner



Processed LIDAR Image

Summary

- Computer vision is becoming a major developing technology
 - Police License Plate Readers
 - Facial Recognition
 - Autonomous Vehicles
 - Unmanned Aircraft
 - The list is endless...

Computer Vision = Future Job Opportunities!