

The background of the slide is a dark night sky filled with numerous small, glowing orange lanterns. These lanterns are scattered across the frame, some appearing closer and larger, while others are further away and smaller. The lanterns have a warm, yellow-orange glow. On the right side of the slide, there is a semi-transparent dark brown rectangular overlay. Inside this overlay, the title text is written in a large, bold, white sans-serif font. Below the title, the presenter's name is written in a smaller, white sans-serif font. The overall aesthetic is serene and visually appealing, with the floating lanterns creating a sense of depth and movement.

Build a smart garage door opener using computer vision

Present by Wing Chan

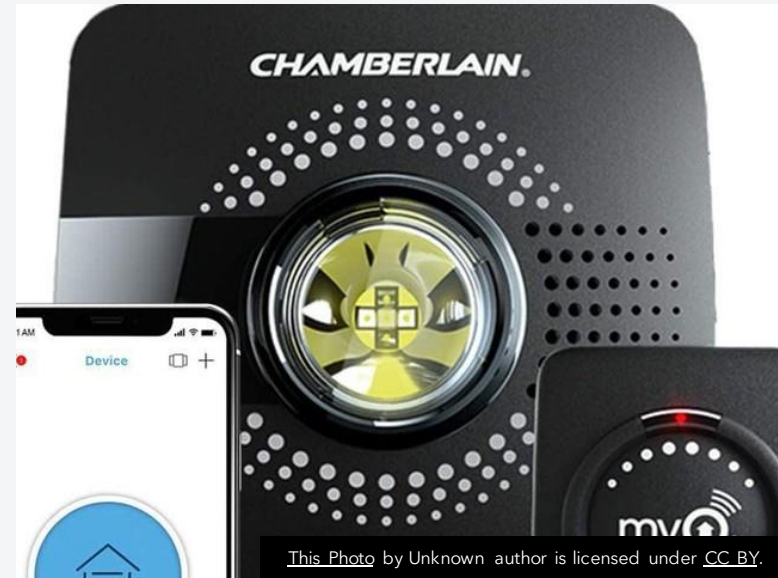
Motivation

- The global home automation market size was USD 45.8 Billion in 2017, is projected to reach USD 114 Billion by the end of 2025, exhibiting a CAGR of 12.1% during the forecast period.
- In the US, almost every household has at least one garage door opener installed which creates a huge opportunity for smart home integration
- The typical price range for a smart home garage opener is between \$200 and \$400. Some aftermarket smart home devices are even cheaper. For example, Chamberlain's myQ Smart Garage Hub is only \$30.



Technical Approach

- Integrate with Chamberlain's myQ Smart Garage Hub and its cloud APIs.
- Added features using computer vision
 - License plate detection
 - Hand gesture recognition
- Raspberry Pi connected with camera

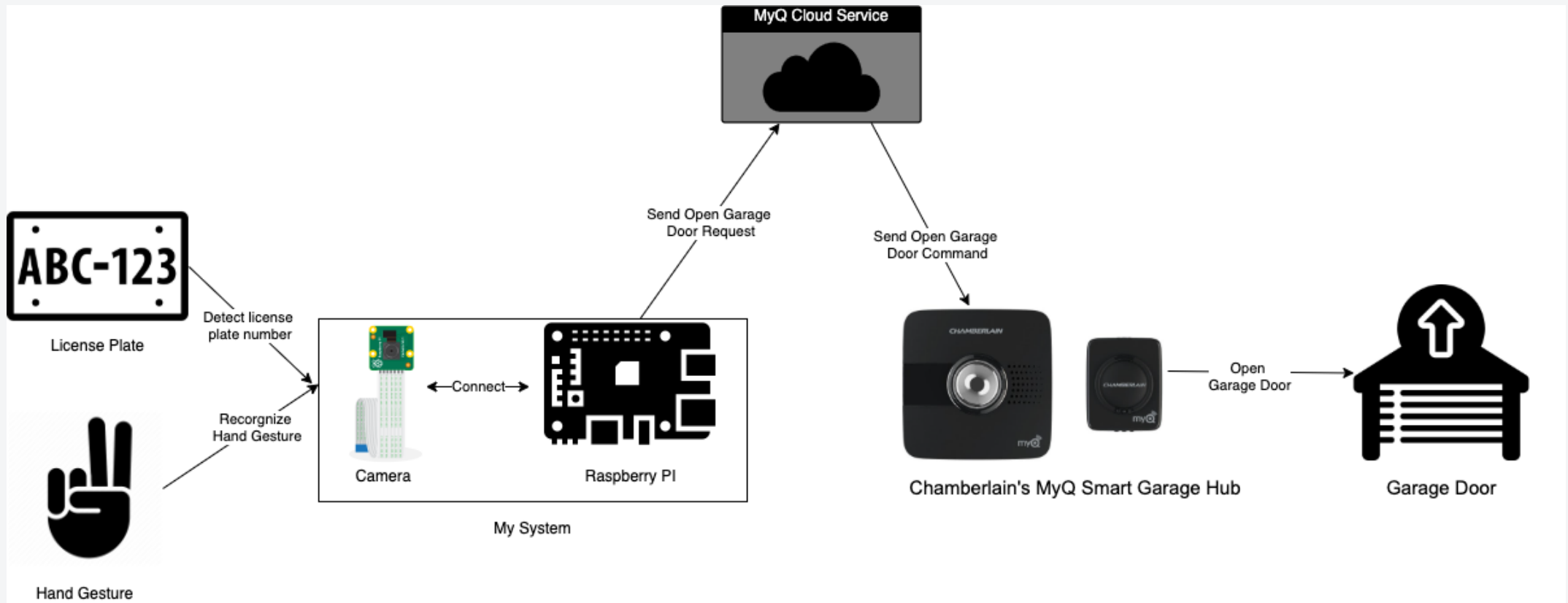


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High-level architecture diagram



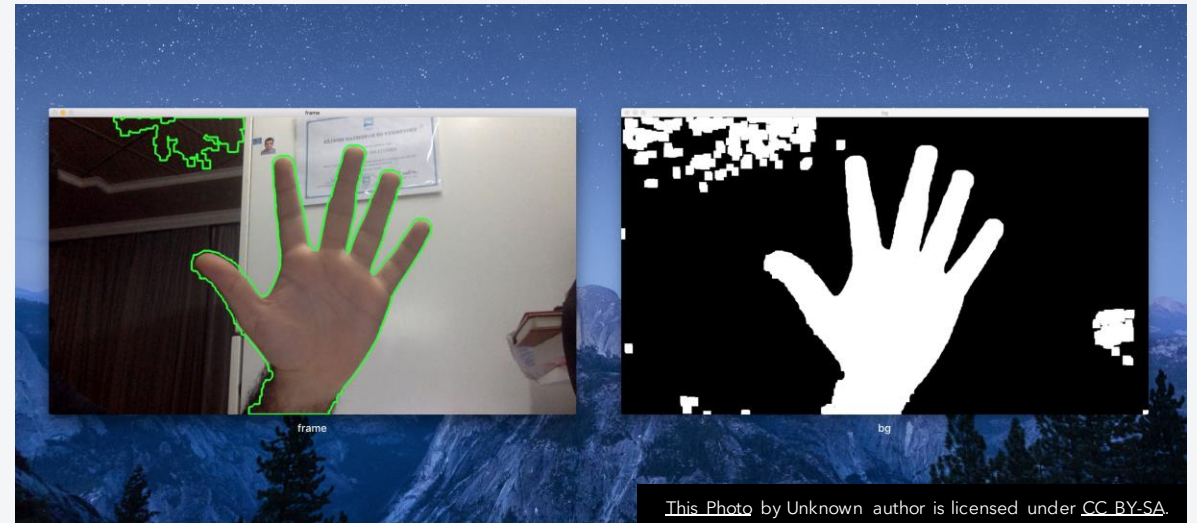
License Plate Detection

- Automatic number-plate recognition (ANPR) - perform optical character recognition (OCR) on images taken by cameras.
- Involve 3 steps:
 1. Plate localization - detect and localize a license plate on the picture
 2. Character segmentation - extract individual characters on the plates
 3. Optical character recognition (OCR) - find the matching letters or numbers from character segmentation



Hand gesture recognition

- One of the most challenging problem for computer vision
- Recognizing hand gestures from real-time video streams and identifying hand region away from its background objects
- Involve 4 steps:
 1. Hand detection
 2. Fingers and palm segmentation
 3. Fingers recognition
 4. Hand gesture recognition



Implementation

- Hardware modules
 - MyQ Smart Garage Hub
 - Raspberry Pi 4
 - Raspberry Pi Camera
- Software packages
 - Pymyq - python library for interacting with the Chamberlain MyQ API <https://github.com/arraylabs/pymyq>
 - License Plate Detector by Apoorva Dave - detects license plate of car and recognizes its characters <https://github.com/apoorva-dave/LicensePlateDetector>
 - Gesture Recognition by Gogul Ilango - recognizing "Hand Gestures" using OpenCV and Python. <https://github.com/Gogul09/gesture-recognition>

Demo

<https://github.com/wingchanatibsa/LearningSessions/tree/master/SmartGarageDoorOpener/demo>

Results & Challenges

- Results
 - Good performance if it is under a strictly controlled environment
 - Many unpredictable situations that could affect the accuracy of CV result
- Challenges
 1. Install python 3.8 on Raspberry Pi OS for using myQ python library
 2. Reflective surface or chrome trim on your car affect the accuracy of license plate detection
 3. Hard to detect hand gesture in outdoor environment

