

# Gate Camera Smart Lock

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## ABSTRACT

With the development of information technology, most people are accustomed to taking mobile phones with them. To make our lives more convenient, how about regarding the phone as a key. As we know, Internet of Things allow devices to communicate with each other and transfer data through internet protocol. Based on this fact, our gate camera smart lock is designed and built. This report contains how to design, implement the gate camera smart lock and evaluations are provided.

## KEYWORDS

Internet of Things, Remote-Control Lock, face recognition, object detection

## 1 INTRODUCTION

To facilitate our life and enhance home security, we designed a gate camera smart lock, which can stream real time videos, be controlled remotely with a phone app, detect the abnormal situations and be unlocked with the house owner's face.

## 2 DESIGN

### 2.1 Hardware Components

#### 2.1.1 Raspberry Pi

Raspberry Pi is a small single-board computer which is portable and easy to use.



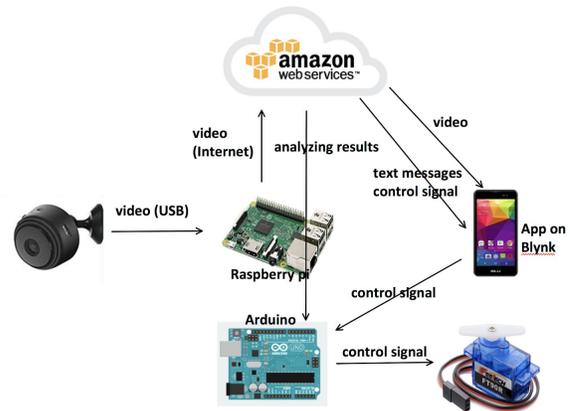
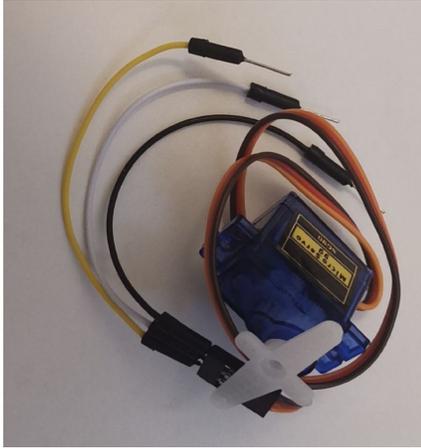
#### 2.1.2 USB Camera

The USB camera can connect to the computer by plugging it into a USB port. Real time video stream is fed to the computer where a software application lets you transfer them to the internet.



#### 2.1.3 toy lock

The toy lock is made by Arduino board and servo kit. Arduino board is able to read inputs and turn it into output. The servo will rotate certain angles after a value has been written into it.



## 2.2 Software Components

### 2.2.1 Motion

Motion is a software which can set up a network to stream videos.

### 2.2.2 Tensorflow

Tensorflow is an open-source platform to develop deep learning algorithms.

### 2.2.3 Twilio

Twilio is a python library with which you can send SMS messages to certain phone numbers.

### 2.2.4 Blynk

Blynk is an IoT platform designed to make development and implementation of smart lot device quick and easy. It can be used to read, store, and visualize sensor data and control hardware remotely.

### 2.2.5 Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software.

## 3 IMPLEMENTATION

### 3.1 Data Flow

### 3.2 Remote lock Control

The lock was controlled by two types of signals. In other words, you can unlock the door based on two methods, using APP button or scanning face.

To implement the remotely control part, blynk is used as an intermediate. A virtual port is set at the Blynk APP, when we push the button, certain value will be written into this port. Then we connect the arduino board to the APP by an authorization code. Once the value is written into the virtual port, the data will be transferred to the arduino board and the value will be written to the real port. This is how remotely control works.

### 3.3 Face recognition

To implement the face recognition, real time videos will be streamed from the USB camera to the remote server and face recognition algorithm running on the server will identify the person. If the result is the owner, a signal will be sent to the arduino and the door will be unlocked. After a few seconds, the door will be automatically unlocked. We used an open source library called face\_recognition to implement the algorithm.

### 3.4 Object detection

To implement the object detection, real time videos will be streamed from USB camera to the remote server and object detection algorithm running on the server will analyze the videos and identify the object. A text message will be sent to the owner's cell phone if the object is recognized as an unknown person. If the camera keep observing unknown person, the owner will keep receiving text messages every 60 seconds. To realize this functionality, we trained YOLO3 model on COCO dataset with tensorflow.

## 4 EVALUATION

We successfully achieved all four functionalities as designed: 1. real time video stream; 2. lock remote control with a phone app; 3. face recognition to unlock the door; 4. object detection and sending messages to the host's cell phone.

Algorithms are well trained and the performance is robust. In future, flexible text contents could be sent to the owner based on his or her needs, because the object detection algorithm could detect 80 kinds of common objects.

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