# Introduction

Security is an important feature when a company is providing a service to their customer. The company needs to make sure that its service can only be used by personnel that are authorized. This is where Z-Recognition comes into play. Z-Recognition is a license plate recognition system that makes sure only authorized personnel have access to a designated area. Z-Recognition does this by taking an image of the approaching vehicle and processing it. If the vehicle is authorized, the vehicle is given access, if it is not appropriate measures will be taken to have the vehicle leave the premises. Our group has decided on a license plate recognition system because of its uses in modern day society. Today, one can still find areas that are monitored by a single employee, or by a ticket-based entry system. These systems could be found inferior because of their reliance on periodic human interaction or supervision. Z-Recognition is designed to run autonomously, and with little hardware and software costs. Because of this it can be implemented almost anywhere, as long as there is an active internet connection. This license plate recognition system also implements a core feature in the future of computer technology, machine learning. With machine learning, an artificial intelligence (AI) can provide systems the ability to learn and improve without explicitly programmed. This means that automated systems become more secure and reliable, without the need of constant supervision. Our final reason for choosing such a project is that it requires both hardware and software to be fully functional. It will require us to work with and learn both software development and hardware incorporation which we, as Computer Engineering and Technology students, would prefer.

# Functional Features

* All functionality will be executed using a local Python script, that will run autonomously
* The Raspberry Pi will take an image using the webcam, and send it to the Azure service
* The Azure service will be used to find all image text information from the image it was sent
* The Raspberry Pi will take the information found by the Azure service, and either
* If a match is found, the servo motor will be activated in a certain fashion
* If no match is found, a sound will be played through the speaker

# Functional Specifications

* The image will be taken and stored using the “camera” module in Python
* Microsoft’s Azure Application Programming Interface (API) will be used to communicate data over Wi-Fi
* The Azure service will process the image for any text found
* Using the API, image data will be retrieved using the “Requests” module, and compared to a local JavaScript Object Notation (JSON) database using the “json” module
* The python script will interface with the servo motor using the “pigpio” module
* If a match is found, the servo motor will be activated for a moment to simulate a gate lift, and then activated once more to simulate a gate lower
* If no match is found, a sound will be played through the speaker using Python’s “playsound” module
* The python script will then sleep for a set time delay, and then execute once more

# Project Plan

* Software
  + Train the Azure service on text recognition from images
  + Create a script that will run, sleep for a set time delay, and execute again
  + Implement the “taking images” aspect of the project
  + Implement the Azure service API calls to send and receive data
  + Create a local JSON database, and implement it in the script
  + Implement servo motor movement
  + Implement speaker audio functionality
* Hardware
  + Connect the webcam though USB
  + Connect the speaker using the 3.5mm jack on the Raspberry Pi
  + Research the GPIO ports on the Raspberry Pi, and figure out which will need to be used
  + Connect the servo motor to the GPIO ports on the Raspberry Pi