AWS Based Building Security System

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ABSTRACT

The quality or state of being secure is Security. Security is a priority for every person. Although security is a broad term, we are considering security in terms of property security for the scope of this paper. Every office and/or commercial business have some security protocol in place to protect his or her assets. These security measures can include security guard, ID cards, Access Codes etc. This is a common practice for protecting places of business. On the other hand, large residential apartments do not have much security measures if any. Most of these residential apartments may have a security guard, but it is difficult for a human being to remember all of the residents face and restrict any unauthorized access to the apartment. In addition, it is not practical to mandate use of ID cards or Access cards for residents of an apartment building. Therefore, this paper proposes an AWS Based system using image recognition, which can assist or take place of the security guard to restrict unauthorized access to the premises.

KEYWORDS

Security, Commercial, Residential, AWS, Image Recognition

1. Hardware Requirements

Hardware requirements for this project consists of Raspberry Pi, Servo Motor and Android Device. The Raspberry Pi is a low cost, credit card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. A capable little device enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. We can deploy large number of Raspberry Pi devices controlled by single server [1]. Servo motors are part of a closed-loop system and are comprised of several parts namely a control circuit, servo motor, shaft, potentiometer, drive gears, amplifier and either an encoder or resolver. A servomotor is a self-contained electrical device that rotate parts of a machine with high efficiency and with great precision. The output shaft of this motor could move to a particular angle, position and velocity that a regular motor does not have [2]. An Android device is a device that runs on the Android operating system. Android is an array of software intended for mobile devices that features an operating system, core applications and middleware. An Android device may be a smartphone, tablet PC, e-book reader or any type of mobile device that requires an OS [3].

2. Software Requirements

Software requirements consists of AWS, Android Application, and Python OpenCV. Amazon web service is an online platform that provides scalable and cost-effective cloud computing solutions. AWS is a broadly adopted cloud platform that offers several on-demand operations like compute power, database storage, content delivery, etc., to help corporates scale and grow [4]. Android App is a software designed to run on an Android device or emulator. The term also refers to an APK file, which stands for Android package. This file is a Zip archive containing app code, resources, and Meta information. Android apps written in Kotlin, Java, and C++ and are run inside Virtual Machine [5]. Python is an interpreted, object-oriented, high-level programming language with dynamic semantics [6]. OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products [7].

3. System Design

The proposed security system consist of three main components, namely, AWS, Android Phone, and Raspberry Pi Based Door. A mechanical door that connects to a servomotor controlled using a raspberry pi device. This way it is possible deploy large number of raspberry pi devices across a large area. In addition, raspberry pi devices are lightweight and compared to regular computer systems, have less processing power. Therefore, a centralized server will be helpful in processing and storing large image data. For the server we use an AWS Cloud based system, which has

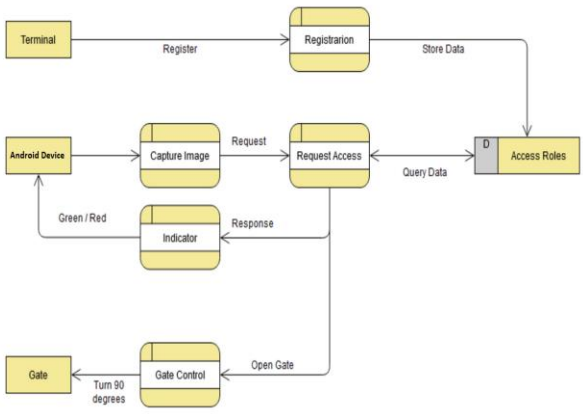
robust computing power and large storage. Android phone used to click picture of person trying to enter the apartment. If the person pass authentication then AWS will directly signal Raspberry PI to open the door for the person.

Fig 1. System Design

4. Implementation

A secure terminal application, independent from the android application, used to register people on the central server. This secure terminal sends person's name, building ID and image to the AWS Server for registration. The secure terminal is also able to remove/revoke access of person from a particular building by sending the person's name and building number to the AWS Server.

An android application deployed at the security door or with the security guard. The android application could only send authentication request to server. Therefore, the application will click a photo of the person trying to gain access to the building and send it to centralized AWS server along with Building ID. Based on the authentication status from the server, the application will flash access granted or access rejected message accordingly to let the security guard know the status and/or enforce any actions. Registration can occur through a secure server only to increase security and robustness of the system.



AWS will host a server that would receive requests. All the communication in the server will take place using http requests. This way the server can easily queue up and handle multiple requests at the same time. The AWS Server will use OpenCV library to learn the images submitted and recognize the people trying to gain access to the buildings. It is possible to submit multiple images of the same person so that the algorithm can recognize the person much faster. The OpenCV library face recognition creates data points on gray-scaled images of the person. Then the data points are compared to the query images to get a match. As these images are stored in form of data points instead of actual image, it is easier to store them on the system, thus large dataset can be easily stored.

The Raspberry PI will act on request of the AWS Server. Only the AWS can directly request Raspberry PI to open the door. Raspberry PI controls the servomotor using 50 Hz signal. Servomotor will rotate 90 degrees to open and wait for 5 sec before closing.

5. Conclusion

AWS Based Security System gives easier option to deploy large-scale raspberry pi systems. Due to various compute and storage, options available on AWS it is easy to scale the system as well as add a more robust CNN based face recognition for more accurate facial recognition. Pairing this system with another form of authentication such as biometrics or access cards make this usable in commercial environment too. This system can also be deployed scenarios where facial authentication is required but not to just open the door but give access to vehicles and payment methods. With some modification, such system can replace paper tickets or passes to access public transport or similar resources.

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