Cloud and Smartphone-based Home Anti-Theft System

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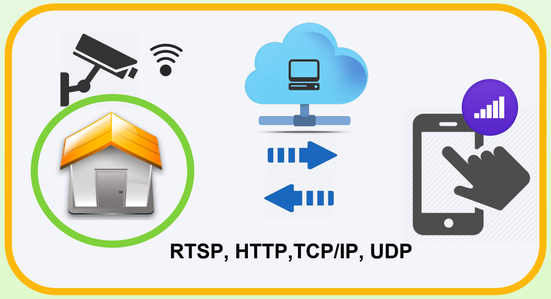
Motivation

In order to protect and guard people or house owner's property, the anti-theft system is proposed, prototyped and implemented to achieve this goal. While people are away from home, the user can watch what's happening at home through a phone app and be alerted automatically when crime is detected at home.

System Architecture

This system prototype is based on the client-server architecture



Smartphone (client):

- Controlling the server on/off.
- Receiving alert and detected scene image
- Watching live video

Home/cloud Server:

- Suspected scene detection
- Scene image grabbing and sending
- Live video server

Cameras:

- capture video in the house.
- Prototyped system uses webcam of a PC
- Future uses wireless camera in house connected to cloud computer

Server Design

The server is a multi-threaded standby system, and it is remotely controlled and can handle the requests from the android client. These threads run in a synchronized manner and perform interrelated tasks without interference with each other.

1.1 System Thread

- Highest level thread to listen to client's system request such as turning on/off system safely

1.2 Motion Detection Thread

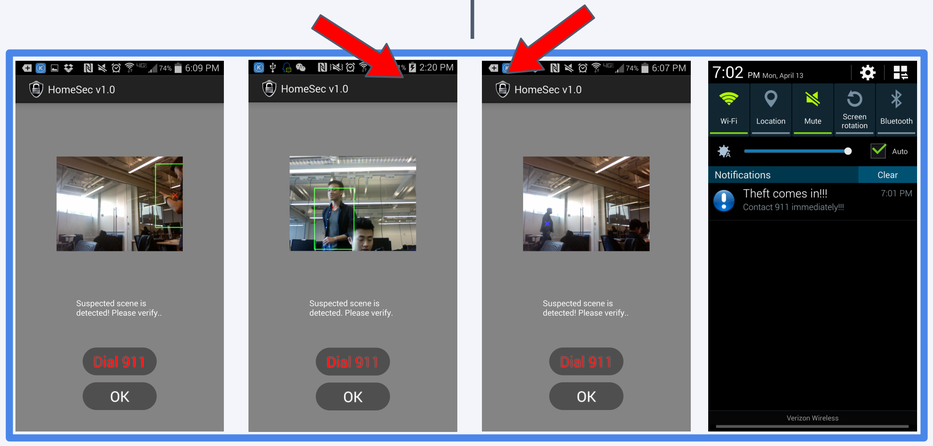
- Compare the picture difference every frame
- Compare every 4 secs for slight moving object
- Thresholding and finding Region of Interest

1.4 Live video server Thread

- Wait for client to start / end video streaming
- Improved RTSP protocol to ensure connection

1.3 Scene image grabbing / sending Thread

- Send notification (alert) through Google Cloud
- New protocol created for sending photo chunks
- Wait for client to clear the warning



Client Design

The smartphone is a remote controller, an alert image receiver and a live video player.

2.1 System Control

- Remotely turn on/off server system safely

Figure 2. System control

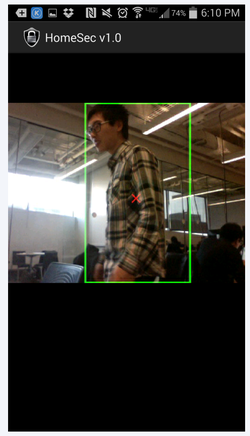


Figure 3. Live Video

2.2 Live video request

- Remotely request server delivering live video

2.3 Notification Listener

- Receive notification from Google Cloud
- Display alert image (new protocol)

Future Work

Prototyped home server is currently a personal PC with a webcam, but will be hosted on public/private cloud (such as AWS) for WAN network access in the future. Cameras will be wireless camera and connected with the server in the cloud, such as the camera below in figure 4 from Alarm.com

Figure 4. Wireless camera connecting to cloud

Reference

[1]http://en.wikipedia.org/wiki/Real-time_Transport_Protocol

[2]http://www.csee.umbc.edu/~pmundur/courses/CMSC691C/lab5-kurose-ross.html

[3]http://en.wikipedia.org/wiki/Real_Time_Streaming_Protocol

[4]http://hmkcode.com/android-google-cloud-messaging-tutorial/

[5] https://www.alarm.com/