The University of Hong Kong

COMP 4801 Final Year Project

Smartphone Driven Pan/ Tilt Security IP Cam Surveillance System

Project Plan

By Cheung Chun Yik
UID: 3035351903
4th October, 2020

Supervised by Dr. Chim T W and David Lee
## Content

1. Background .......................................................... Page 3

2. Project Objectives and Outcomes .................. Page 4 - 5

3. Project Methodology ........................................ Page 6

4. Project Schedule and Milestones .................. Page 6-7

5. Reference ............................................................. Page 8
1. Background

In the 2010s, the rapid development in smartphone technologies led to a shorter product life cycle for smartphones of less than 2 to 3 years on average. With mobile companies launching out new smartphone products at an increasing rate, smartphone users are switching models more frequently as a result. Not only is it a waste of a functioning device, but the issue of electronic waste also arises [1]. Many are exploring solutions to repurpose old functioning smart devices into new usage, which is benefiting the users and environmental sustainability.

In particular, turning old smartphones into IP camera is a direction that many have explored [2]; There exist several Android apps that offers the functionality of security cameras using the main camera of the mobile device. They are branded as home security solutions and generally receive good feedback [3] [4]. The idea utilizes the existing hardware from a typical smartphone, such as the camera, the capacity of the Android system, internet connectivity, and memory storage. Intuitively, users can make use of existing smartphones to set up simple home security solutions by themselves, without purchasing and configuring an extra device.

However, the major downfall of using a smartphone as a surveillance device is physical setups. A typical home security camera offers the camera movement function, where users can pan and tilt the camera during the surveillance. The product has motors and moving parts specifically designed for such movement so that users can get a stable yet adaptive video stream of their home. There are no solutions currently offered by existing apps with this consideration. Most users have to purchase a mobile stand to set the smartphone in place, and there is no direct solution to remotely control the smartphone movement that functions as a typical video surveillance device. This physical limitation makes smartphones less attractive in being a home security camera alternative.

With the recent 3D printing technology becoming more accessible to the public, an affordable phone stand with moving parts can be developed to overcome the physical limitation as mentioned. This project is inspired by MakerLab, Department of Computer Science, HKU; MakeLab has been utilizing 3D printing and embedded system in generating new product prototypes that can be easily implemented as a Do-It-Yourself project. There are existing designs of smartphone stands created by MakeLab with moving parts. The movement control is enabled with the Arduino units. The existing design can be further developed to incorporate into a comprehensive surveillance system — a fully functional home security camera solution, which can be implemented on Android mobile devices.
2. Project Objectives and Outcomes

The aim of the project is to develop a home surveillance product with an Android mobile phone device and a customise phone stands that allow pan and tilt movement during the video surveillance. The deliverables of the project include:

1. The smartphone stand

The MakerLab has existing 3D printing models of smartphone stands, in the form of a small turret. Motors are installed for the movement of the stand, which an Arduino program is provided for the controls. However, to incorporate the existing stands into this project, more customisation is needed to fit the expected functionality.

**Functionality**

1. *The addition of stop switches in the moving part*
   For preventing excessive pan and tile movement of the turret in the case of faulty controls. This also aims to improve the accuracy of motion controls for the Arduino program provided.

2. *A reset button/ reset function of the turret*
   With the stop switches in place, the turret can be set to a default position during each start-up of the device. A reset button can be installed such that the user can set the device to a specific initial position, in the case of malfunctioning.

3. *A more discreet design*
   Addition parts, such as a cover, shall be added to hide the electronic components of the movement parts from users. This helps the device to blend in the setting like a home surveillance system.
2. **An Android mobile app**

The Android mobile app should allow communication of the device used as the security camera placed on the stand (the sending end) for another device (the receiving end). The sending end is likely going to be a functioning old Android device, while the receiving end would be the user’s own current device.

The sending end device will be used for the surveillance camera, as well as direct control of the mobile stands that it is on.

**Functionality for the sending end**

1. *To stream video and audio from the front or rear camera to the internet*
2. *To record the video and audio stream*
3. *To control the turret movement (both pan and tilt motion) via Bluetooth*
4. *Send alert to specific receiving end device in the case of suspicious activity*

The receiving end would allow the user to receive the video stream and monitor activities, as well as to send commands to the sending end device via the internet to control the stands.

**Functionality for the receiving end**

1. *To receive the video and audio stream via the internet*
2. *To send out secure remote controls to move (pan and tilt) the stands remotely*
3. *To receive alerts from specific sending end device*
3. Project Methodologies

With the smartphone stands, SketchUp would be used in making changes to the existing models for the parts of the mobile phone stand. New models for additional parts will be drawn and integrated to the mobile stand that is provided. Prototypes will be print out with Acrylic 3D printers to test how the modification works with the stop switch added.

With the Android mobile app, it would be developed with Android Studio, the official IDE for the creation of Android apps. The app is to be written on Java. Different API would be incorporated in the app for implementing different functionalities; The Auduino program provided for the control of the pan and tilt movement of the phone stand would be integrated. For bluetooth control of the sending end (smartphone on the stand) and the Auduino parts, the built-in Android Bluetooth API would be utilised. For the video streaming compartment, the OpenCV library would be explored and utilised [5].

4. Project Schedule and Milestones

Early September, 2020:
- Gather project requirements and the scope of the project

September to October, 2020:
- Studying SketchUp for drawing 3D models
- Studying Android app programming with Java
- Writing up the project proposal
- Start up the project website
- **October 4th: First Deliverables to be submitted**

Early November, 2020:
- Addition of stop switch on the mobile phone stand
- Relevant modification of the mobile phone stands model for the stop switch
Mid to Late November, 2020:
- Complete first prototype of the modified mobile phone stand
- First iteration of the mobile app:
  - Provide partial functionality on controlling the turret’s movement via sending end
  - Test on the video streaming function

December, 2020:
- Prepare for the interim report
- Second iteration of the mobile app
  - Provide partial functionality on remote control of the turret’s movement via receiving end
  - Video recording function on receiving end

January, 2021:
- Third iteration of the app
  - Sending user alert’s on suspicious active
  - Improving video streaming related issues
- **January 11th -15th: First presentation**
- **January 24th: Second Deliverables to be submitted**
  - Preliminary implementation
  - Detail report

February, 2021:
- Finalise on mobile stand modification
- Forth iteration of the app
  - Complete all functionality for sending end
  - Test on different Android devices as the sending end

March to April, 2021:
- Complete all remaining functionality for the app
- Refining the app’s user interface
- Test on different Android devices for both sending and receiving ends
- Writing up final report
- **April 18th: Third deliverables to be submitted**
  - Finalised test implementation
  - Final report
- **April 19th - 23th: Final presentation**

May, 2021:
- **May 4th: Project Exhibition**
5. Reference


