



UNIVERSITY OF TORONTO  
FACULTY OF APPLIED SCIENCE & ENGINEERING

# The NWTTO App

(Neighbourhood Watch Toronto)

## Final Report

**ECE 1778**

Creative Applications for Mobile Devices  
Professor Jonathan Rose

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Word Count: 2479 (below here)

# 1. Introduction



Neighbourhood Watch is a community-based and community-run program that has been operating in Toronto for over 40 years. It is “neighbours helping neighbours”, by watching out for each other to discourage and prevent crime from occurring. It is also neighbours helping the Toronto Police Services by being their extra “eyes and ears on the street”.

For over 30 years, the Crime Prevention Association of Toronto (“CPAT”) has promoted and encouraged Neighbourhood Watch across Toronto.

Neighbourhood Watch relies on individuals who get involved: Block Captains for residential neighbourhoods and Hall Captains for apartments (“Captains”). Captains self-organize to:

- know their nearby neighbours (“Neighbours”);
- learn crime prevention tips;
- learn what crimes are happening in their neighbourhood; and
- share that information with their Neighbours.

The goal of the NWTO App (for “Neighbourhood Watch Toronto”) is to help Captains do what they do, and allow anyone else interested in crime prevention to learn more about it, and stay informed.

## 2. Functionality

Because Captains are interested in what is happening in the area surrounding their homes, the App uses the User’s address to determine its latitude and longitude. The App then uses that latitude and longitude data to filter information specific to that area from a variety of public, Open Data databases.

The App has two types of Users:

- regular Users (Captains); and
- Administrators.

The App is described below from the perspective of those two User types.

## 2.1. User Registration

Upon opening the App, the User is presented with the landing screen, featuring the NWTO App logo.



### 2.1.1. Access for Unregistered User

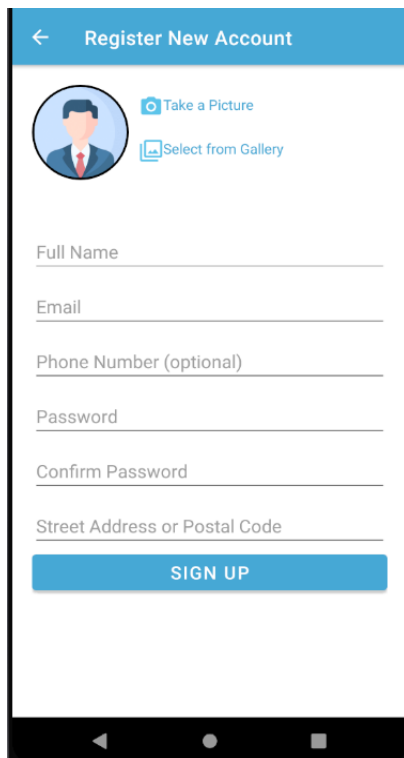
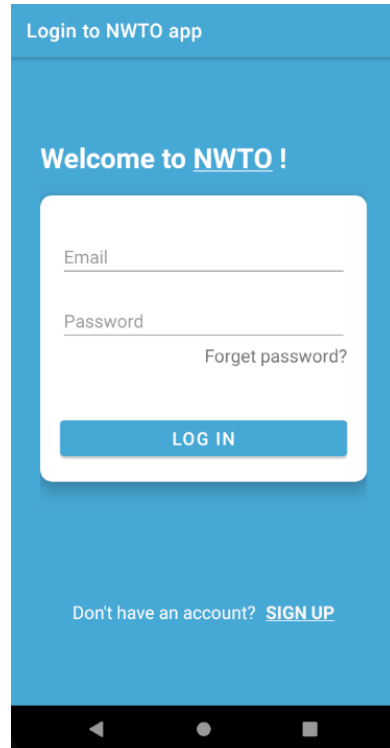
Unregistered Users can access the Log-In screen (described below) and the “About NWTO” screen to learn more about the App before deciding whether to register as a User.

## 2.1.2. Log-In/Registration

The App provides traditional registration and log-in functionality.

Registered Users login with their password.

The “SIGN UP” link allows a new User to register.

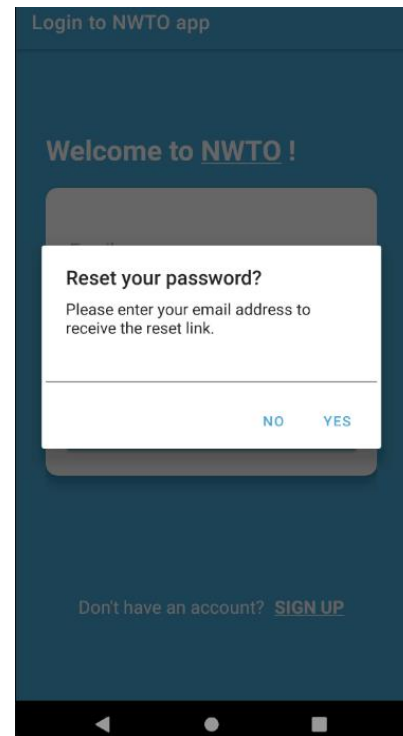


On the “SIGN UP” screen, the User enters basic address and contact information.

Upon entering a partial address, complete addresses are auto-suggested for selection.

After the new User completes registration, the App generates geographic coordinates, postal code, and the City of Toronto “neighbourhood” name for that address, and stores them in the server database.

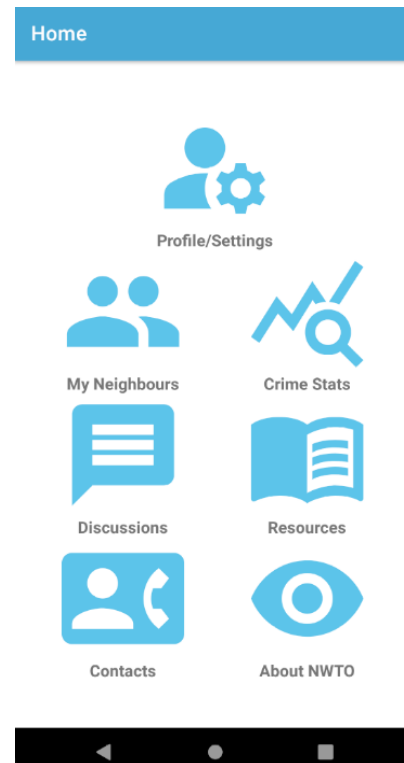
If the User has forgotten the password, a “Forget password?” field allows the User to reset it after answering a password reset email.



### 2.1.3. The Home Screen

After logging in, the Home screen is presented.

The Home screen is the navigation screen for the App.

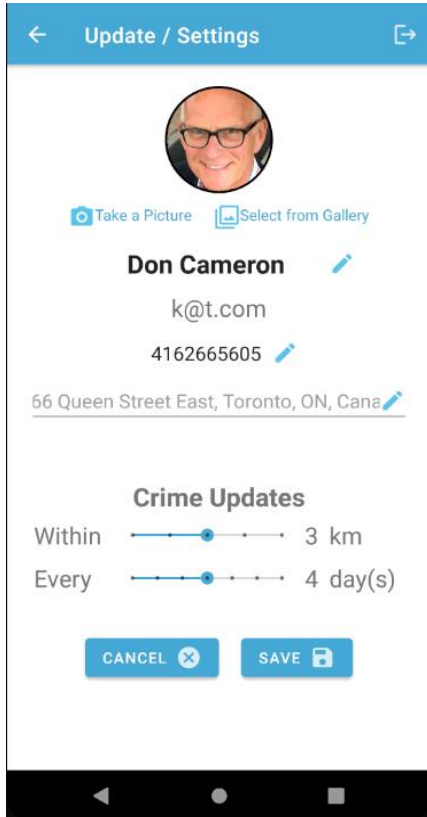
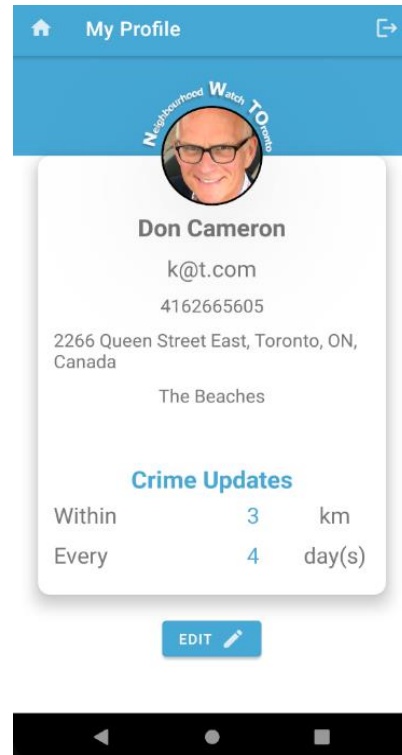


## 2.1.4. The Profile/Settings Screen

Profile data can be viewed and updated on the Profile/Settings screen.

Crime incident reports and statistics are collected for the App based on the selections made by the User for:

- the distance from the User's home address, in kilometers; and
- the reporting period, in days.



The default setting for these parameters is 5 km and 1 day.

The 'EDIT' button allows the User to adjust these parameters using slide controls.

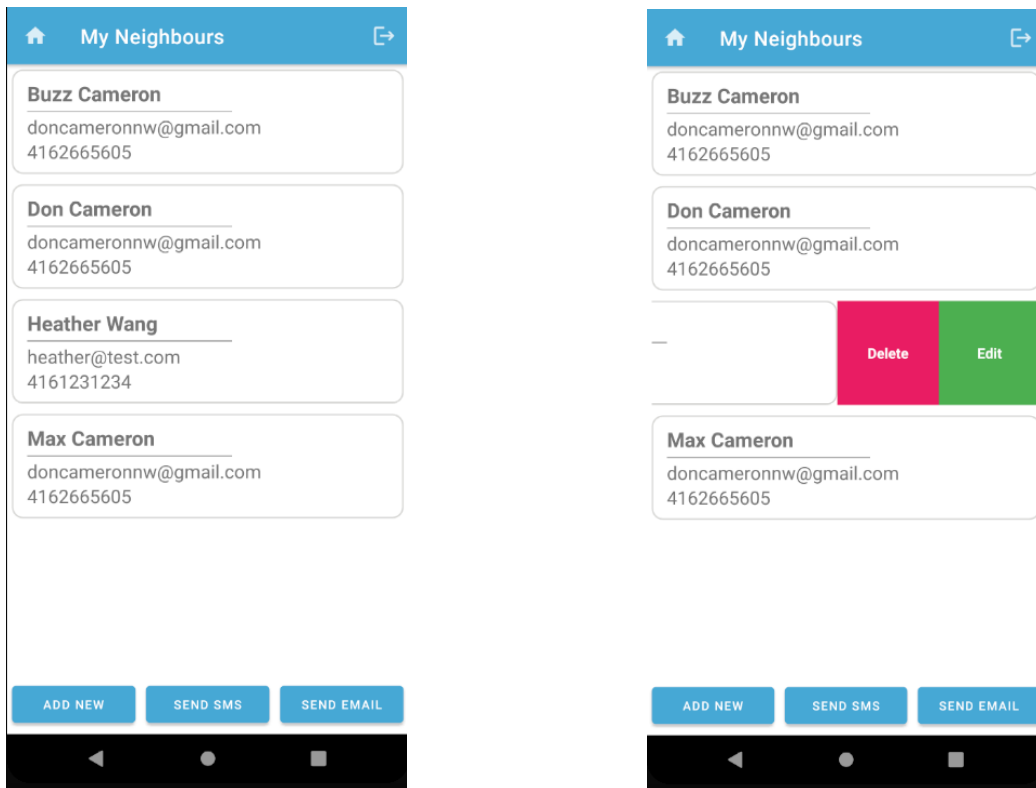
## 2.2. Communication

### 2.2.1. Communication with Neighbours who are not App Users

It was assumed that not all Neighbours would be App Users, so the App's communication functionality was built accordingly.

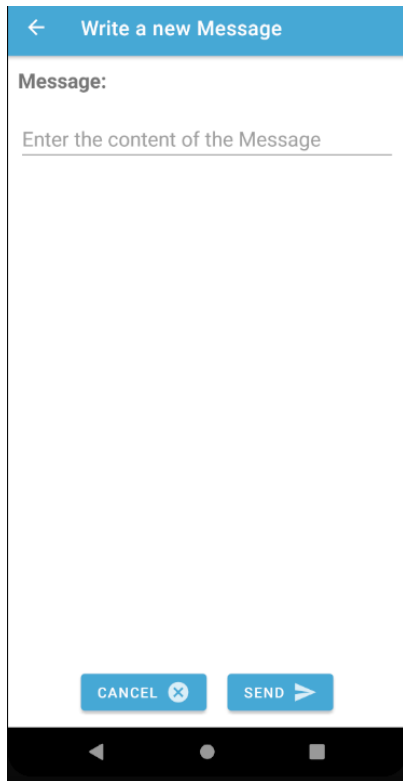
The User can communicate with Neighbours using the phone's built-in email and text messaging systems. The User enters the names and contact information for Neighbours in the App's "Neighbours" screen.

The User can add or delete a Neighbour or update their contact information.



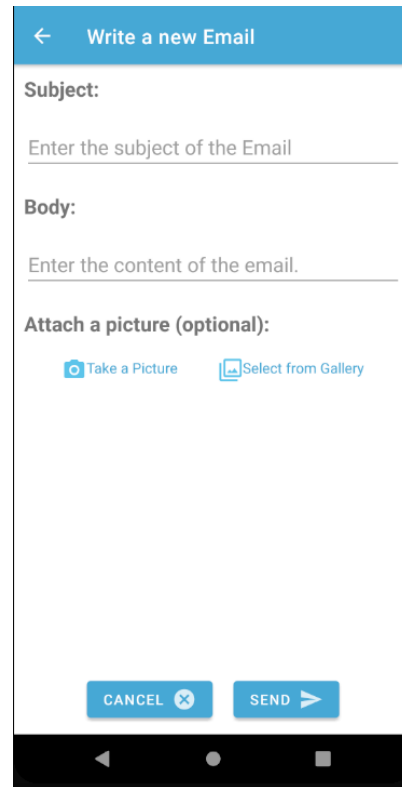


By using the appropriate button on the lower menu, the User can message Neighbours, via an email or SMS text messaging. All Neighbours receive the same message.



The screenshot shows a mobile application interface for sending an SMS. At the top, there is a blue header bar with a back arrow and the text "Write a new Message". Below the header, the word "Message:" is displayed. Underneath, there is a text input field with the placeholder text "Enter the content of the Message". At the bottom of the screen, there are two blue buttons: "CANCEL" with a close icon and "SEND" with a right-pointing arrow icon. The Android navigation bar is visible at the very bottom.

via SMS text message



The screenshot shows a mobile application interface for sending an email. At the top, there is a blue header bar with a back arrow and the text "Write a new Email". Below the header, the word "Subject:" is displayed. Underneath, there is a text input field with the placeholder text "Enter the subject of the Email". Below that, the word "Body:" is displayed, followed by another text input field with the placeholder text "Enter the content of the email.". Underneath the body field, there is a section titled "Attach a picture (optional):" which contains two options: "Take a Picture" with a camera icon and "Select from Gallery" with a gallery icon. At the bottom of the screen, there are two blue buttons: "CANCEL" with a close icon and "SEND" with a right-pointing arrow icon. The Android navigation bar is visible at the very bottom.

or via email

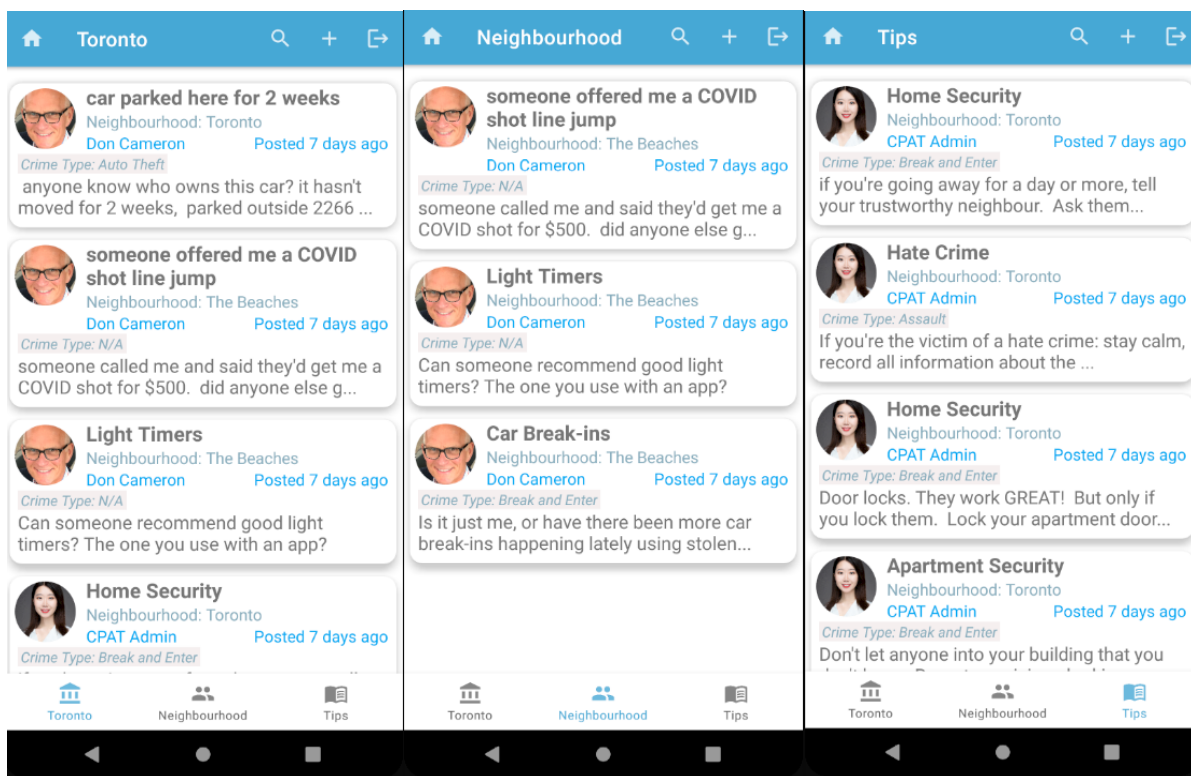
The User can add an image as an attachment to an email (e.g. a screenshot of any App screen, or a photo previously taken and stored in the User's photo gallery).

## 2.2.2. Communication with App Users: Discussions

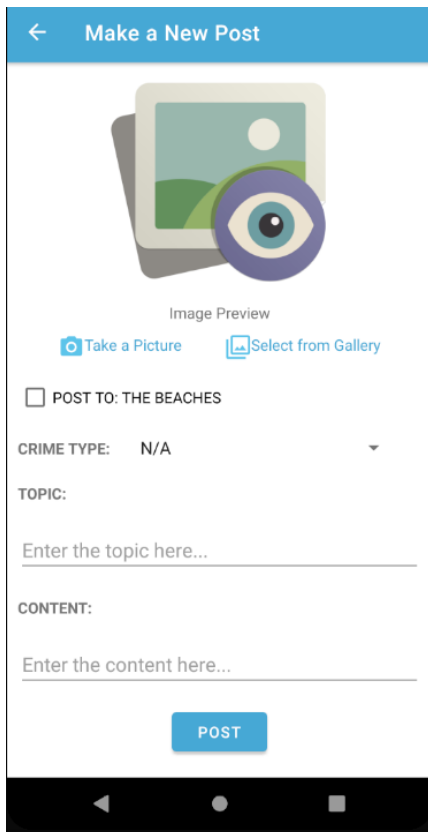
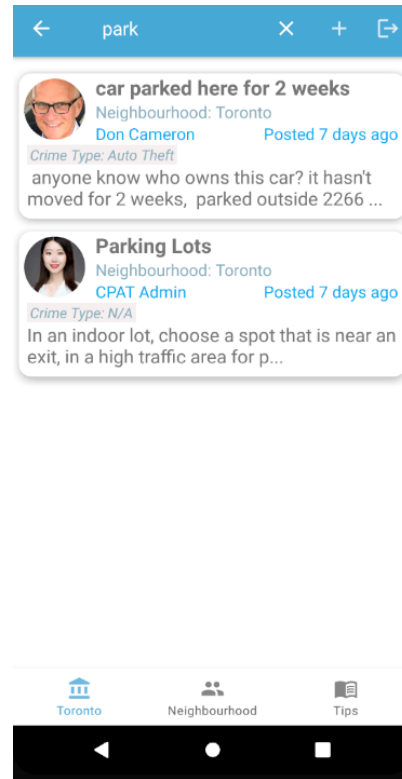
The App Users communicate with each other via Discussions.

The Discussions features three channels:

- across Toronto;
- the User's city-defined neighbourhood (e.g. for Don Cameron, "The Beaches"); and
- Tips (crime prevention tips) from CPAT, posted by an Administrator.



After clicking the “find” icon in the top right corner, the User can filter the topics by searching the keyword in the subject or content of the topic, the neighbourhood name, username, or Crime Type (e.g. for this search, “park”).



By clicking the “+” icon, the User can make a new post.

In addition to entering the topic and content, the User can select the crime type from a drop down list, which is added to the post as a tag for filtering.

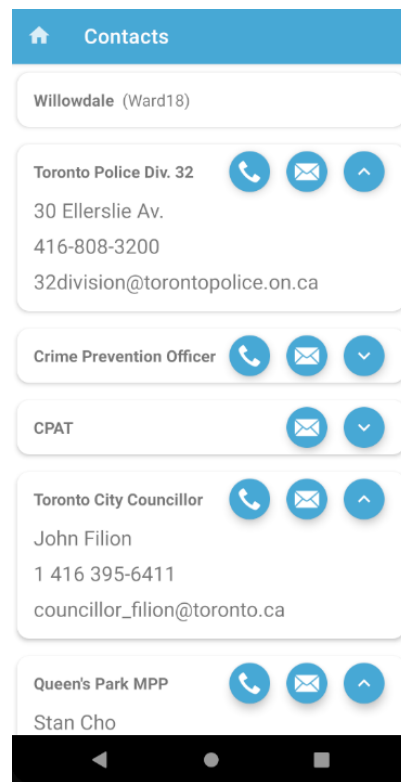
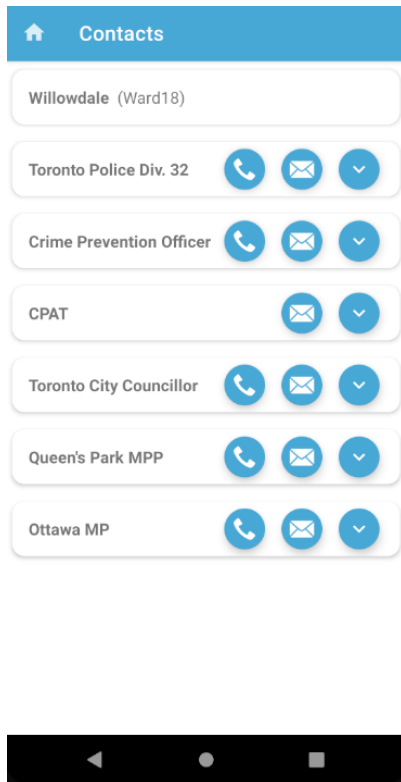
The User can select to post only to his/her neighbourhood or, if not selected, to across Toronto.

## 2.3. Contacts

Based on the User's address, the App locates contact information for local officials, using the following public databases:

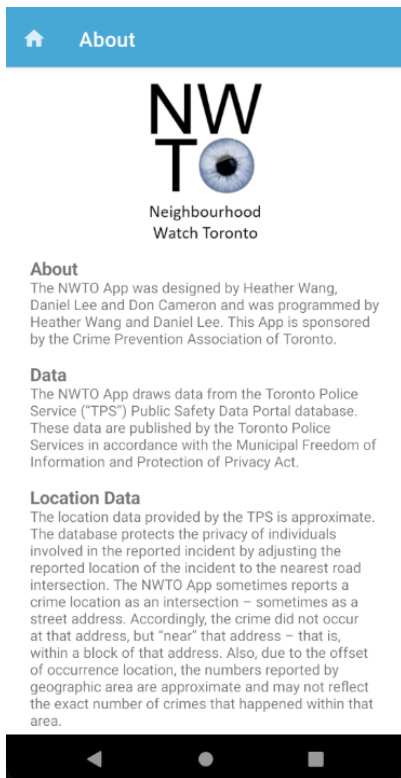
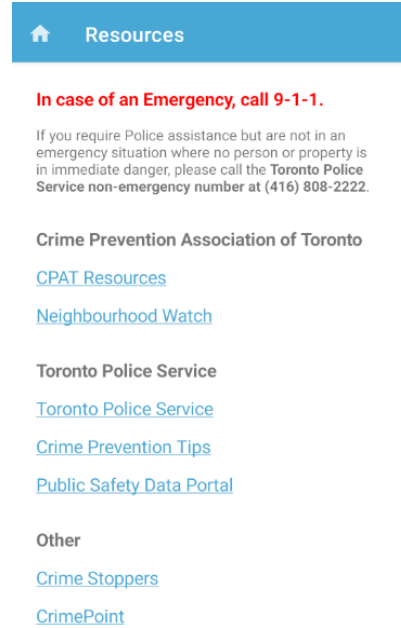
- Police Division boundaries (the City of Toronto API);
- Crime Prevention Officer (from the TPS website); and
- City Councillors, Members of the Ontario Provincial Parliament (MPPs), and Federal Members of Parliament (MPs) (from Open North).

Each contact can be called or emailed from the App.



## 2.3. Resources/About NWTO

The Resources screen provides hyperlinks to the CPAT, TPS, and other web-based crime prevention websites.



The “About NWTO” screen contains information about the App.

## 2.4. Crime Statistics

The Crime Statistics functionality has 3 features: Recent Crimes, Map and Comparisons.

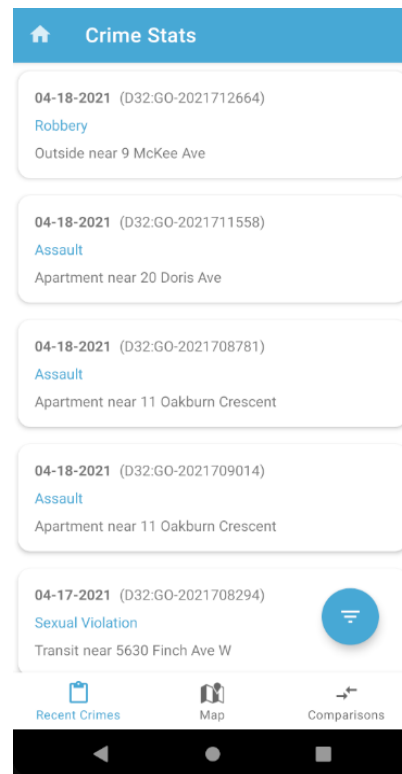
### 2.4.1. Recent Crimes

Using the User's distance and reporting period parameters, the App queries the Toronto Police Services Public Safety Data Portal ("TPS Portal") and displays the crime incidents, ordered chronologically, with the most recent crime occurrences at the top.

Each crime report includes:

- the date the crime was reported;
- the Police division number and the unique crime ID;
- the crime type;
- the premise type; and
- the approximate address where the crime occurred (anonymized by TPS by disclosing an approximate address instead of the actual address).

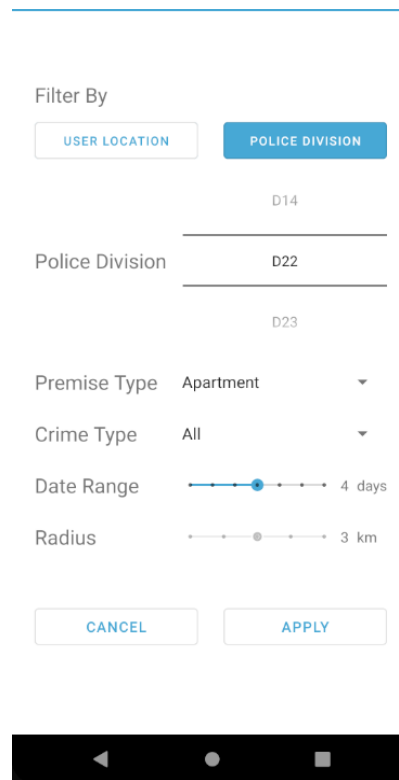
The blue filter icon takes the User to another screen that allows the User to choose different parameters that displays the crime data accordingly.



On the Filter screen, the User can filter by premise type, crime type, date range, and radius.

The User can instead search by entire TPS Division number.

The filtering done on this screen is only temporary. It does not modify the parameters in the Profile/Settings.

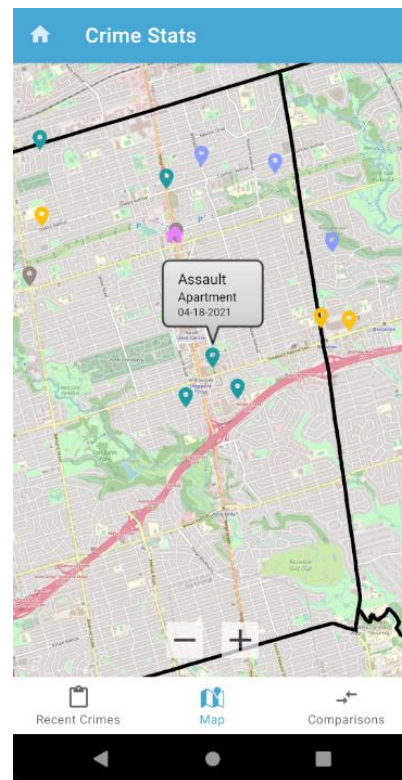
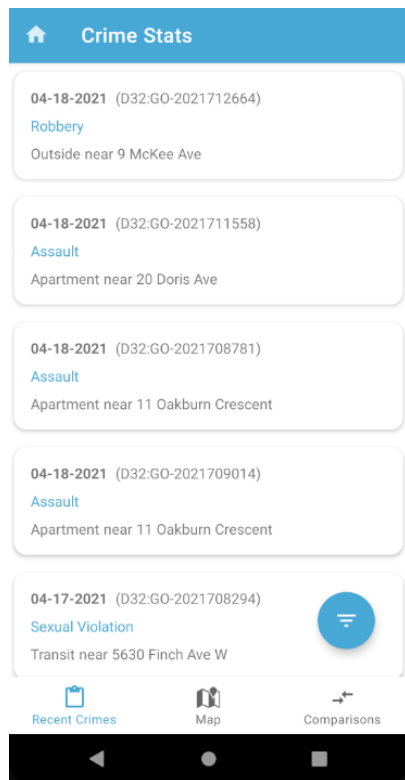


## 2.4.2. Map

Clicking the Map icon on the bottom menu of the Crime Incident screen presents the same crime incident on a map that features:

- a house icon at the home address;
- boundaries of TPS Divisions; and
- crime incidents by colour-coded flags (with the same colour for same crime types).

The User can click on a flag and see the crime type, premise type, and date of occurrence.





### 2.4.3. Comparisons

Crime data cannot be properly understood without context. TPS crime statisticians compare recent crime statistics to the averages of crime incidents over the last 3 years. The Comparisons feature of this App does likewise.

Crime data for the previous month, for the area within the reporting distance from the User's home, is compared to the monthly average for each crime for that same area, over the previous three years.

Two different comparisons are provided, each with 2 types of display (by numeric data in a table, or by that data displayed in a graph).

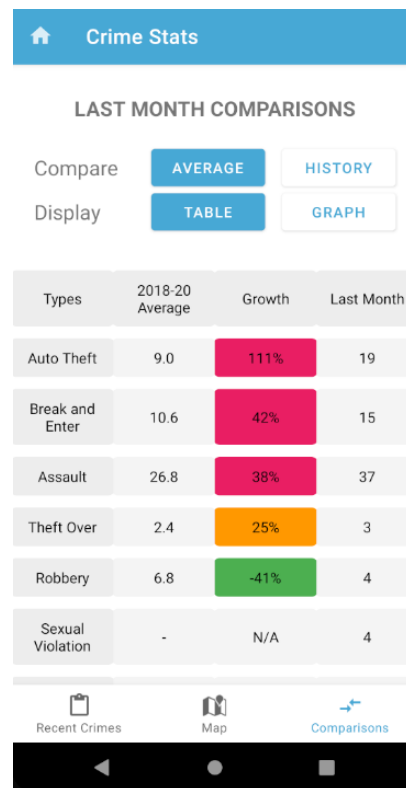
#### 1. Compare by Average:

This screen compares the crime numbers from last month in the User's area (in the 4th column) to the average per month over the last 3 years (in the 2nd column). The App calculates the percentage "Growth", shown in the 3rd column.

The percentages in the "Growth" column" are ranked highest to lowest. The colours provide an intuitive "crime thermometer" where:

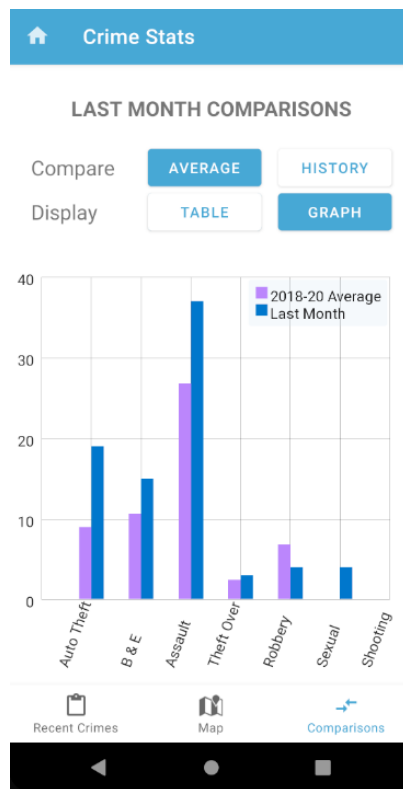
- increases more than 30% are red;
- changes within +/- 30% are yellow; and
- decreases more than 30% are green.

(Sexual Violations and Shootings numbers are displayed at the bottom. No previous years' data are currently available from the TPS Portal).



The “Graph” button presents the same data as a comparative bar chart.

The data are similarly ranked: largest percentage increase on the left, and lowest on the right.

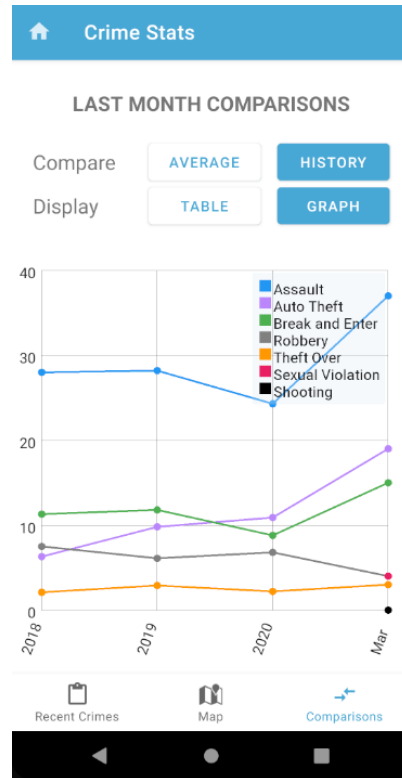
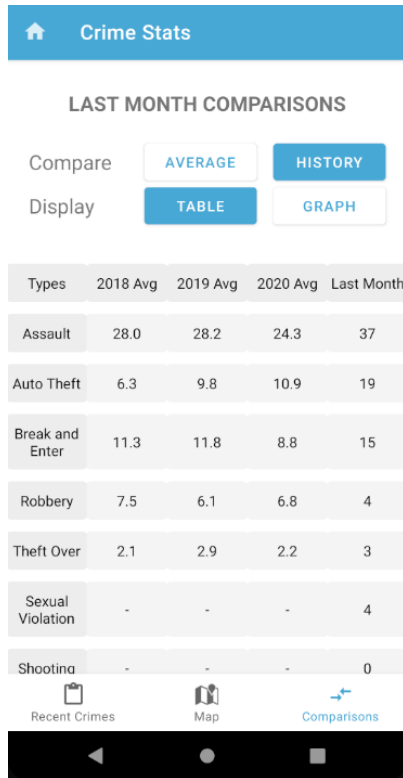


## 2. Compare by History:

Clicking the “Compare” “History” button presents data for monthly averages for each of the past three years as the comparators to last month’s crime numbers.

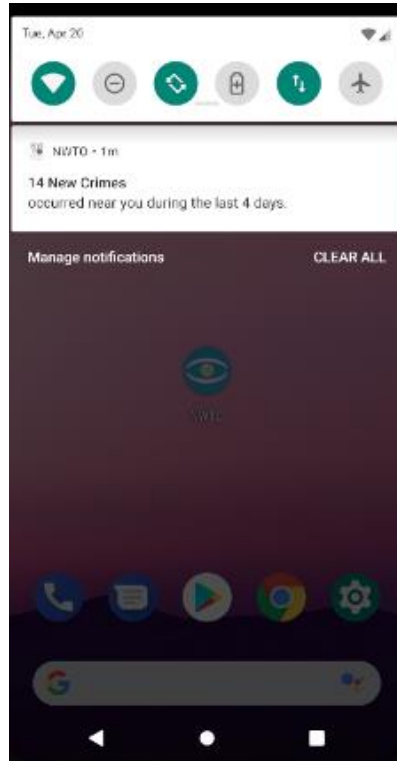
As with the “Average” data presentation discussed above, these data can be viewed as a table or as a graph.

The graph shows the magnitude of the trends.



#### 2.4.4. Notifications

The App automatically generates a notification to the User's phone if a crime has occurred within the last reporting period in the User's area.



#### 2.5. Administrator User Functionality

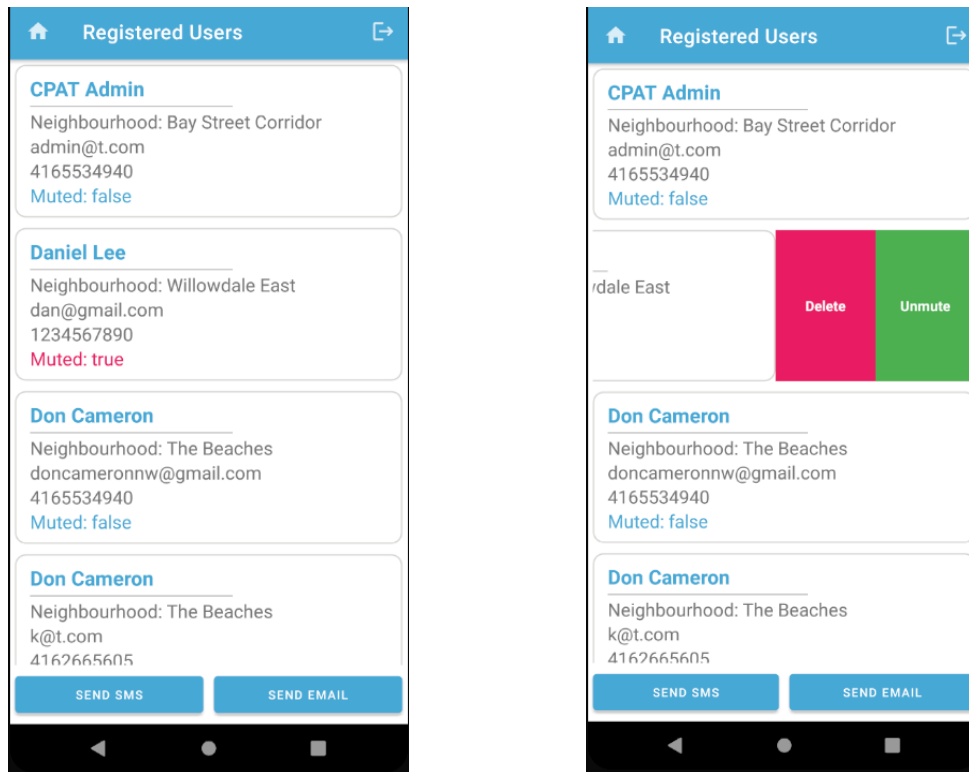
An Administrator User (“Administrator”) has control over the use of the App by regular Users.

All newly registered Users will be seen as regular User accounts. Administrators are assigned from the backend.

For an Administrator, the “Neighbours” screen shows each registered User’s full name, contact information, neighbourhood name, and muted status.

An Administrator can mute a User for bad behaviour, unmute, or delete a User. Users who are muted cannot make new posts or reply to other posts in the Discussions.

Deleting a User deletes all that User's posts and comments, as well as other Users' comments on the deleted posts, so it should be used cautiously. The Delete User operation will delete the User's Profile in the database, but it will not delete the User in Firebase Authentication, because Firebase forbids this. If the User needs to be deleted completely, further manually deletion in Firebase Authentication would need to be done.

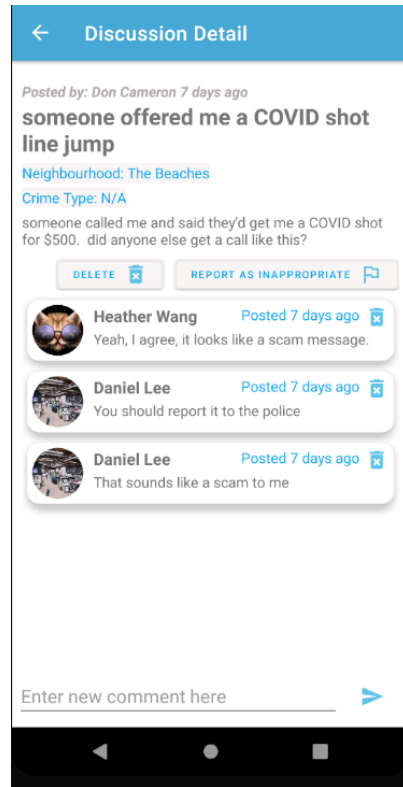
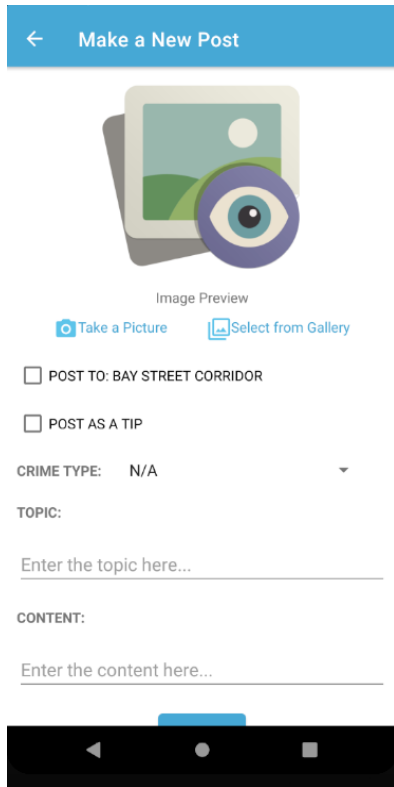


The Administrator can make two types of Discussion posts:

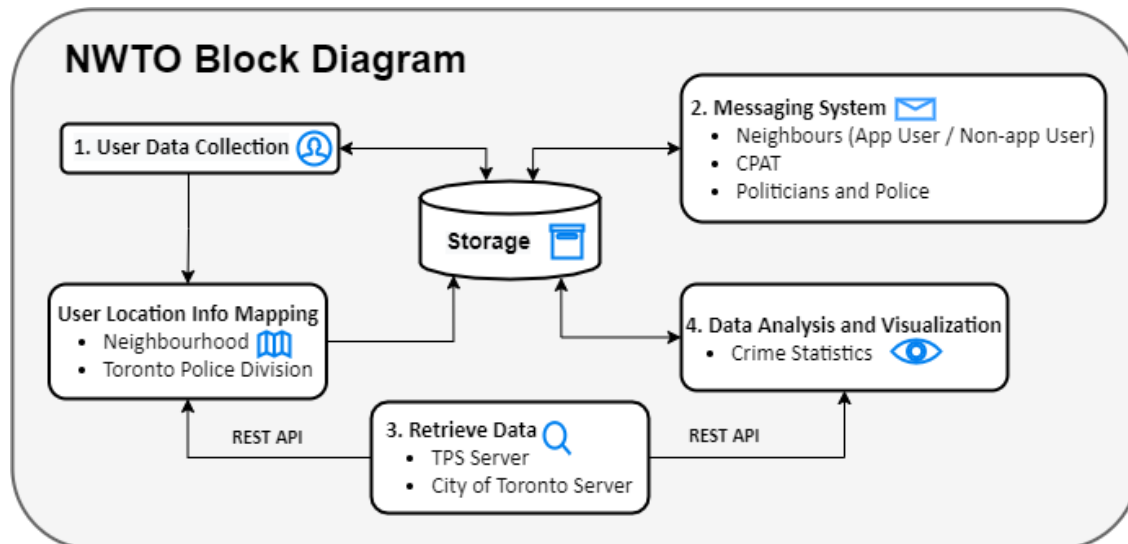
- a regular post; or
- a Tip. Only Administrators can post Tips. Recall that Tips are a separate channel in Discussions. New Tips are to be posted weekly either by a CPAT Administrator or another Administrator (e.g. civilian Community Police Liaison Committee Chairs). TPS personnel will not be Administrators, to keep the App community run.

If the Administrator goes to the Discussion Detail screen of one of the posts, he/she can delete any post, no matter who made it. This deletion will likewise delete all comments

made to this post. The Administrator can also delete any single comment by any User, by clicking the delete icon.



### 3. Overall Design



The App has 5 major modules. All modules use FireBase for back-end server storage for important information including the User's location, account, and communication data. The Firebase services used are Authentication, Firestore Databases and Storage.

After the User has successfully registered, the User Data Collection module (#1) uploads User information (e.g. full name, address, email) to the FireBase.

Google's Places API is used to generate geographic coordinates and postal code, which are then stored in the Firestore Databases. These data are used in several modules (e.g. the postal code is used to locate local politicians).

The Messaging System module (#2) uses the phone's inherent SMS messaging system and email system for non-app User communication. Users create their own contact list in "Neighbours", make new posts and reply to other posts in Discussions. Neighbours, Posts and Comments collections are stored in the Firestore Databases.

The Data Retrieving module (#3) connects to several external Open Data sources for retrieval of parameter-specific data. There are two main types of data retrieved:

- Toronto's neighbourhoods and Police Division boundary data from the City of Toronto public APIs; and
- crime information from the TPS Portal API.

The User Location Info Mapping module maps the User's location to the local city neighbourhood and Police Division by using these data. Once the User is mapped to the local neighbourhood and Division, OpenNorth APIs are used to draw contact information for government officials that are within the User's area.

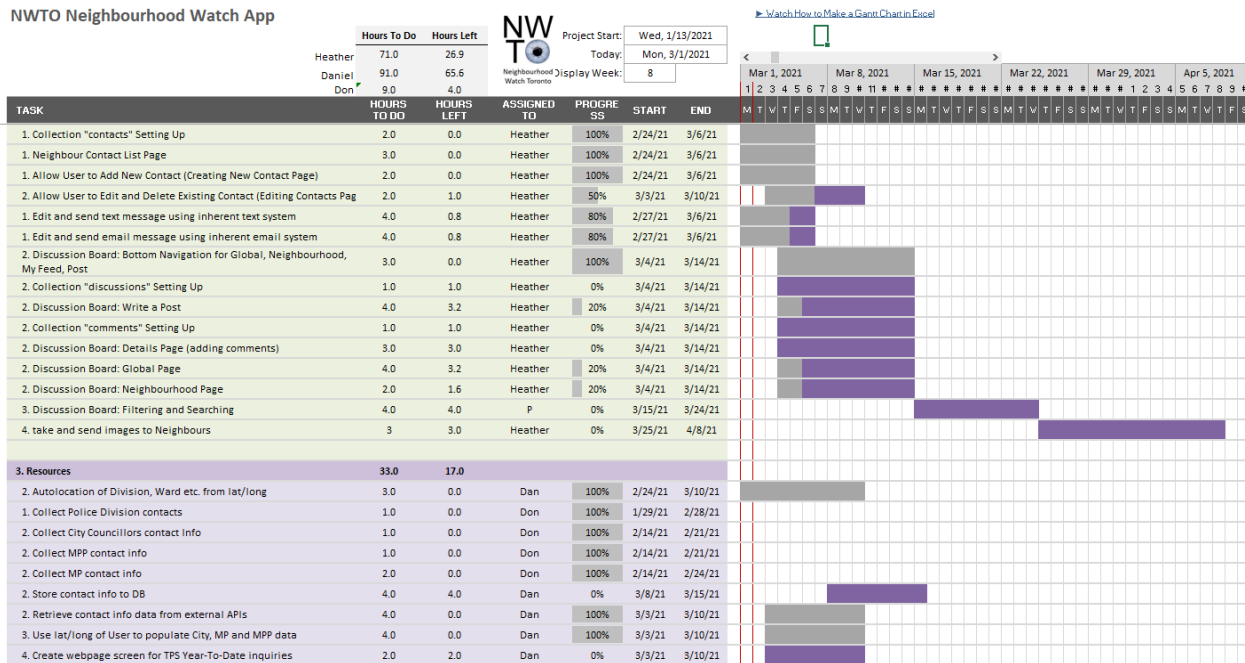
The User's nearby crime information is drawn from the TPS Portal, using location data to filter for recent and previous years' crime data. The Data Analysis and Visualization module (#4) uses the crime data to calculate and analyze the trends over the past years, and displays them to the User in a variety of visually efficient ways.



## 4. Reflections

Designing and building an App prototype is an engineering design project.

For project management, a GANNT chart (updated weekly) was used to assign primary design responsibilities, budget time, schedule milestones, and adjust schedules as the project progressed.



The design was collaborative. On (at least) weekly video calls, the team discussed design and programming progress, which allowed pivoting and redesigns when necessary.

Feedback from future Users & Police staff in mid-design, helped hone the final design.

If we were starting over, we would:

- after macroscopic functionality was achieved, articulate earlier, in more detail, how each screen communicates with the others (e.g. how the data passed to the next screen and how sub-features worked);
- use Github's issue tracking sooner;
- improve the UI/UX; and

- for greater efficiency, use the Android phone's database for some structured data instead of relying heavily on FireBase.

## **5. Contribution by each group member**

All three team members participated in the overall App design, and report and presentation writing.

Don, as the current President of CPAT, articulated general functionalities, studied other App designs, and found sources of Police and crime data. Don also managed the GANNT chart.

Daniel was the chief programmer for the Crime Statistics, Contacts, Resources, Notification, and About NWTO features.

Heather was the chief programmer for the User Registration, Communications (SMS, email and Discussions), and Administrator features.

## **6. How this App will help CPAT**

CPAT intends to use this prototype App to develop either a fully functional:

- cross-platform App; or
- Android App and iOS App.

We will be demonstrating the App to a variety of future Users, Police and City of Toronto staff, and potential funders to ask for their assistance in the further development, deployment, and maintenance of the App.

This App has the potential to re-energize Neighbourhood Watch and increase awareness of crime prevention across Toronto.

CPAT is very grateful for the tremendous work done by Heather and Daniel in designing and programming this App, and to Professor Jonathan Rose for allowing the idea for this App to become a course project and an amazing prototype.

## **7. Future Work**

This prototype has shown the potential for a fully developed App that could include:

- An improved “look” (UI/UX) for the App, with more sophisticated graphics;
- Strengthened security of the User’s data;
- Use of the internal database on the phone instead of Firebase for some of structured data.

Future new features could include:

- enhanced filtering to allow searching crime incidents by neighbourhoods (once the TPS Portal releases such information in their Year-To-Date database);
- a legal consent form for the Sign-up screen; and
- allowing the User to report an inappropriate post in the Discussion Board.

## **8. Permissions**

The team members give their unanimous consent to post publicly this Final Report and the video of our Final Project Presentation.