NASA Space Apps Challenge 2017

The Protego Application User Guide

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The Protego application is targeted for both fire fighters and the general public, and has two main features; viewing fires, and submitting danger reports.

1 The View Fires Tab

1.1 The Protego Map

At present, the Protego Application uses the Google Maps API, which has a simple implementation and ease of update. The map provides a bird's eye view of all hazards, by taking into consideration the Protego data, a UAV live feed report, and the Near Real Time data from the MODIS and VIIRS Satellites. Users can choose between 4 different map layers to view the hazards. These are:

1. View fires and dangers from the Protego sensors
2. View fires from the MODIS satellite
3. View fires from VIIRS satellite
4. View and hazards reported by users
5. View areas prone to landslides and flooding

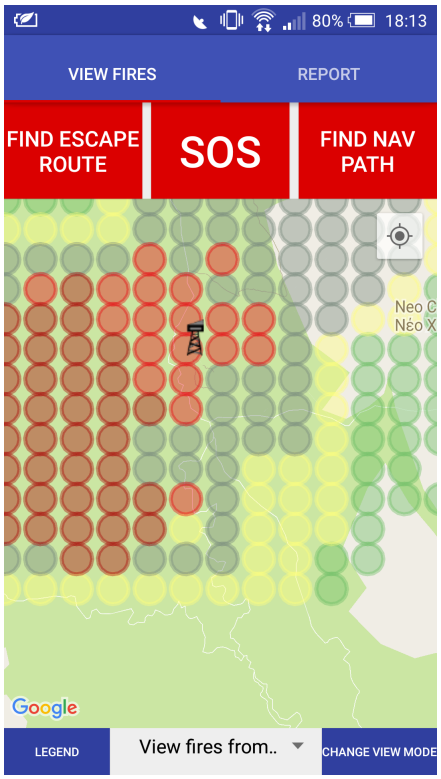

Figure 1: The first Screen Visible When Opening The App

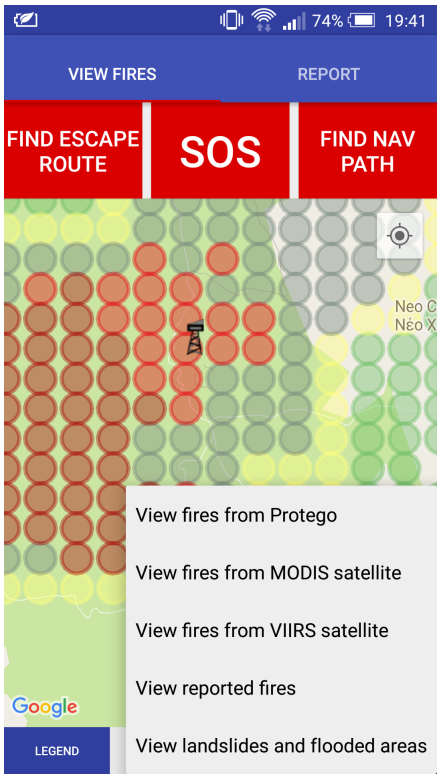

Figure 2: Clicking on the dropdown at the bottom of the screen shows the various layer view options

1.1.1 Protego Data

The Protego Sensor Network sends data in specific time periods, to a central server. If the transmission lines are not available (i.e the network is down), the sensor nodes send the data via a satellite uplink. This is then distributed to the central server(s), which is kept online at all times.

Situation No	Meaning	Map color [Ch. 5]	Data/minute
0	Everything OK	Green	Every 6 hrs
1	I know it's coming. Stand-by.	Yellow	Every 5 mins
2	I smell smoke	Grey	Continuous
3	I see fire	Vivid Red	Continuous
4	Kamikaze Enabled	Dark Red	Continuous

Figure 3: The different upload times of the Protego Sensor Network Devices

1.2 MODIS and VIIRS data

The data from MODIS and VIIRS is downloaded via FTP. For this demo app, the data was converted via Matlab into csv files, which contain the latitude and longitude of each FireMask variable, according to the value (7-9, where 7 is a low confidence level of fire, and 9 is a high confidence level of fire). The files were then stored locally and embedded into the app. However, it is necessary to set up a server and database that connects to the FTP server automatically and periodically, in order to update the satellite data, store it into a database, and transmit such data to the application device.

Due to the satellites only being Near Real Time, they are not recommended for tackling fires live. This is why the Protego app also takes into consideration the Protego Sensor Network, and the live User Reports as necessities for accuracy and fast response times, in order to quench the fire before it becomes uncontrollable.

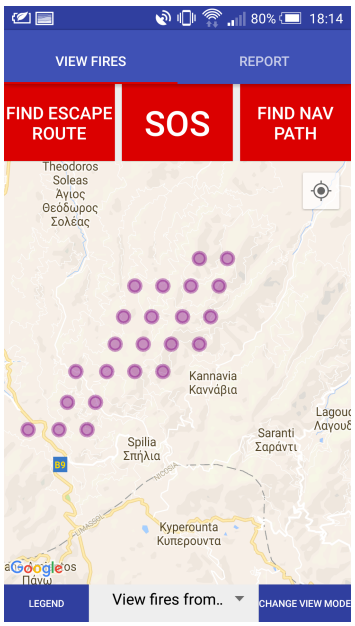

Figure 4: The MODIS Satellite data is visible when selected. In this example, the Soleas fires of June 2016, in Cyprus, are visible.

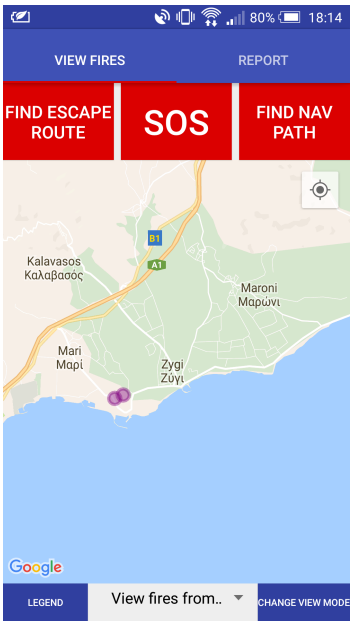

Figure 5: The VIIRS Satellite data is visible when selected. In this example, the fires of the past 8 days(from 5/5/2017) are visible.

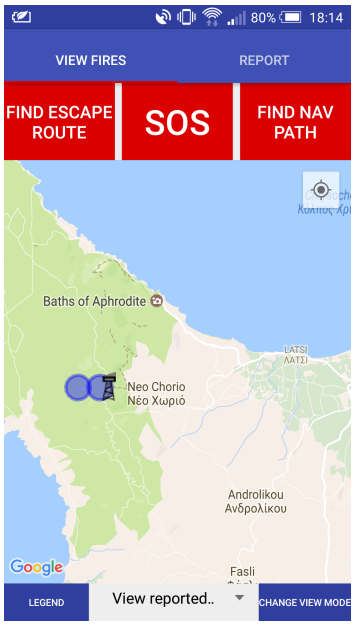

Figure 6: The User reports are visible when selected. In this example, there are some fires in the Akamas National Park, in Cyprus.

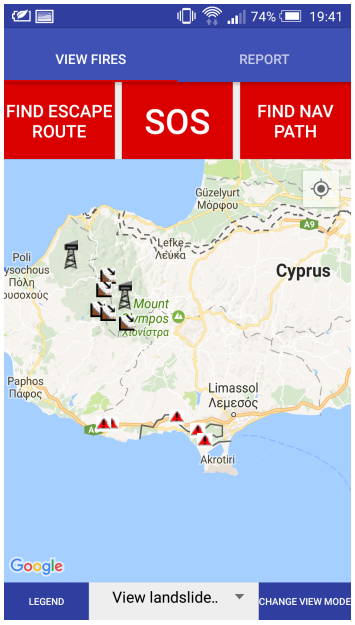

Figure 7: The areas that are prone to landslides and flooding are visible. In this example, there are some flood warnings in Limassol, and some landslide warnings in the Troodos mountains of Cyprus

1.3 The Find Escape Route Button

The application can be used to find an escape route from the wildfire by clicking on the 'FIND ESCAPE ROUTE' button at the top left hand corner of the screen. The user's current location is sent to a central server, where an algorithm is run in order to calculate the best route of escape. This route is then sent back to the device, and displayed on the map.

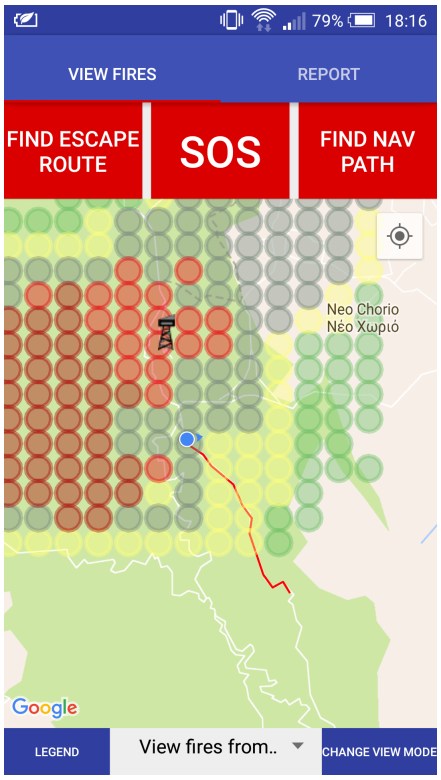

Figure 8: Clicking the FIND ESCAPE ROUTE button shows an escape route from the fire, taking into consideration the user's current location, where the fire is, and where it is spreading.

1.4 The SOS Button

1.4.1 SOS Reports

It is critical in times of emergencies for people to be able to submit an SOS alert to the authorities. Using the application, an SOS alert is sent via the internet to a central server, where it is relayed to the necessary authority, such as the Fire Brigade.

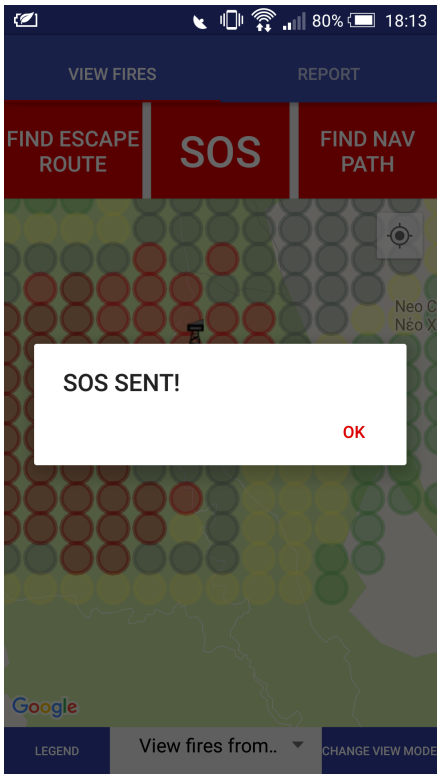

Figure 9: Clicking on the SOS button sends an SOS

1.4.2 Communication With a Medic

After clicking the SOS report, the user is prompted with an option to contact a medic live. If the connection allows, a live call is established with an available medic to advise the user with instructions for first aid, and to better establish a location and directions for when paramedics arrive.

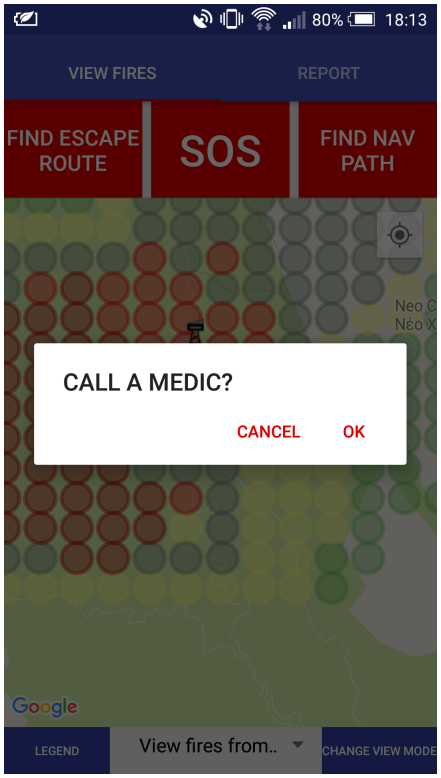

Figure 10: Then, a user given the option to contact a medic live

1.5 The Find Nav Path Button

The application can be used to find a path to navigate the fire, from a firefighter's perspective, by clicking on the 'FIND NAV PATH' button at the top right hand corner of the screen. The user's current location is sent to a central server, where an algorithm is run in order to calculate the best route of navigating to the fire. This route is then sent back to the device, and displayed on the map.

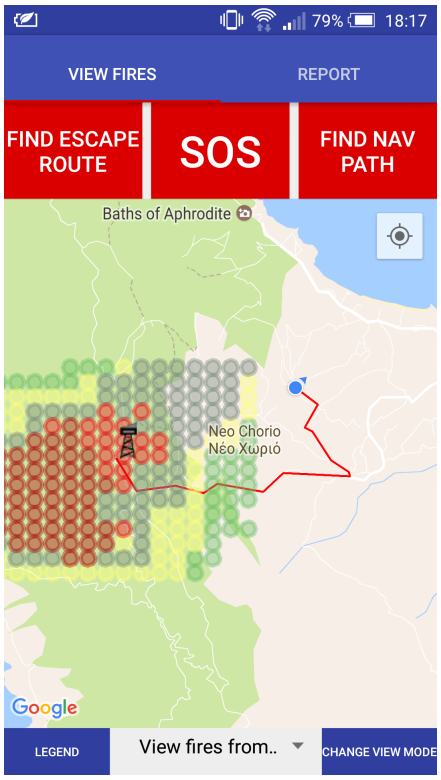

Figure 11: Clicking on the FIND NAV PATH button shows a pathway for the firefighter to navigate towards the fire.

1.6 The LEGEND Button

By clicking the 'LEGEND button', users can see the details that explain the map overlays.

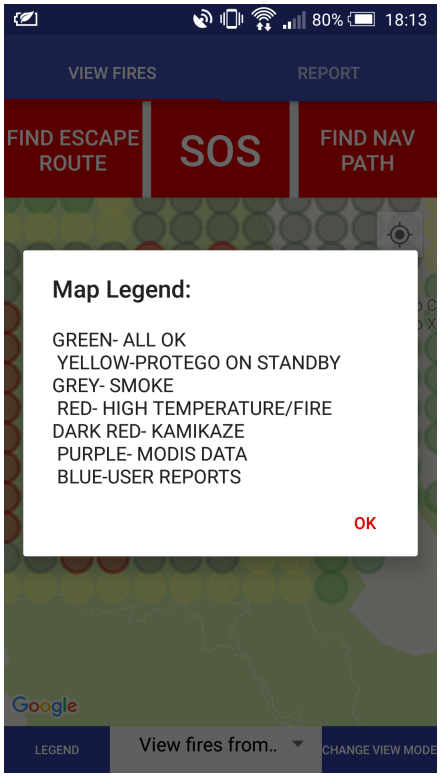

Figure 12: Clicking on the LEGEND button shows the map legend details

1.7 The Change View Mode Button

By clicking on the 'Change View Mode Button' users can switch between viewing the map as satellite imagery, or as hybrid imagery. This allows for a clearer view of the endangered areas.

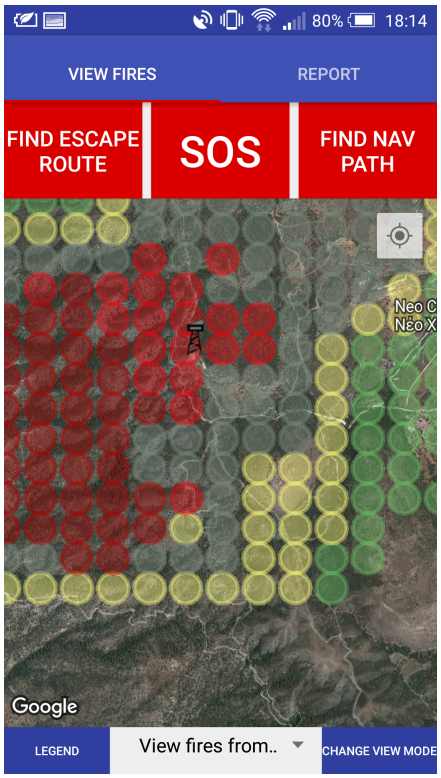

Figure 13: Clicking on the Change View Mode button changes the map from satellite to hybrid mode

2 The Report Tab

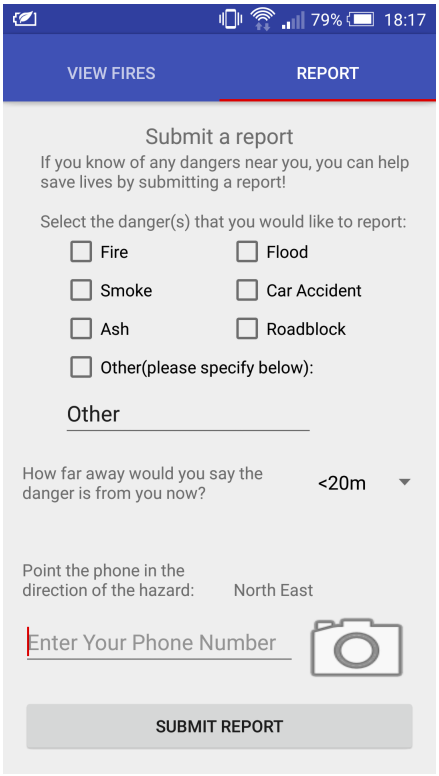

Figure 14: The second tab is for users to submit danger reports

Users can quickly and easily submit a report on any nearby dangers. These are divided as:

- Fire
- Smoke
- Ash
- Flood
- Car Accident
- Roadblock
- Other

2.1 Getting A Bearing Of Dangers

In addition, the user also submits how far away they are from the hazard, and they are able to also submit the direction of the danger, by utilising the in-app compass. This is done by simply pointing the phone in the direction of the device. This helps in producing a bearing, which will be used to triangulate the exact locations of dangers. In doing so, response times are diminished greatly, false reports are minimized, and the fire brigade is properly utilised in the sense that the correct force will be sent.

2.2 Submitting Images

Furthermore, users can submit images of the danger. This improves accuracy, at the expense of a longer report submission time, and server storage costs. However, it is necessary, and simple to implement via a database such as FireBase.

2.3 Tackling False Submissions

When distributing such an important service to a large user base, false, or prank submissions are bound to occur. However, the Protego application counters this with a number of ways. Firstly, the GPS location of the device is submitted in each report, along with the direction the device is facing, thus creating a easily locatable bearing. Secondly, with the image submission, the danger is verified. Lastly, the user submits their mobile phone number, to be called once authorities arrive on scene.

3 Push Notifications

Lastly, users are notified of any possible dangers to be vigilant about in their vicinity, via Push Notifications. Using the FireBase interface, messages are sent to the devices and alert the users.

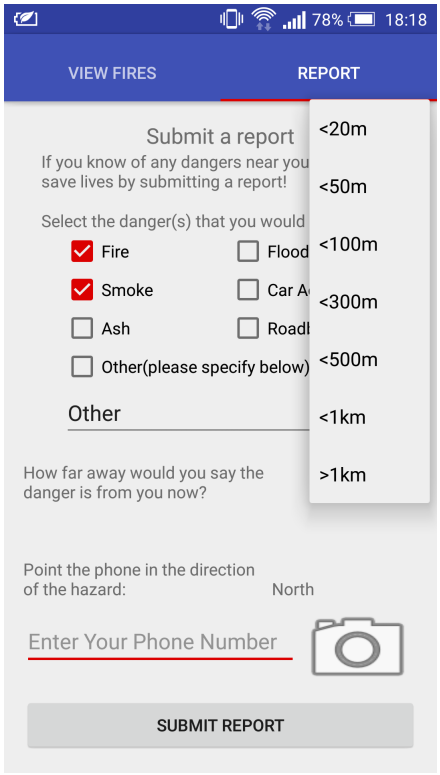

Figure 15: The user can input the distance of their location from the danger. In addition, the application takes into consideration the direction the device is pointed, in order to assist further. Lastly, the user can submit an image of the danger, which will be used to assist and assess the dangers further.

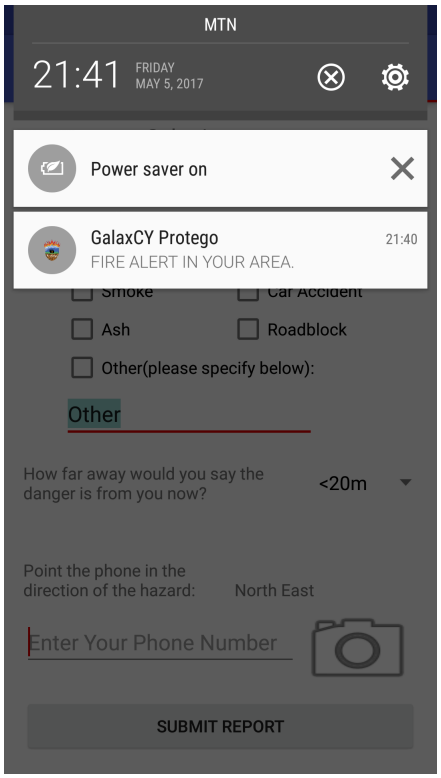

Figure 16: Users are alerted of the dangers through Push Notifications