Development of geo-collaborative application for animal support

by

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Abstract

As the number of stray animals in Armenia is getting higher, the government is not able to solve the issue of feeding and caring for those animals in a humanly way. However, there are a lot of individuals and some organisations who try to help with little resources they have by providing food, shelter and veterinary services. It is important that people, who want to make a contribution to the solution of this problem, have means to organise the process in an efficient and timely manner to make the most out of the present resources.

This work introduces a geo-collaborative website which allows users to help animals by interacting with each other. The website can be accessed on various devices. It allows users to mark the places of the animals they see on the streets and add relevant information. Users can also add information about their lost pets. The website allows users to view the georeferenced information uploaded by others.

1. Introduction

As the number of stray animals in Armenia is getting higher, the government is facing more difficulties to solve the issue of feeding and caring those animals in a humanitarian way. As stated by the activists promoting this cause, the government hires companies to sterilise dogs, which, however, shoot and kill the animals instead[1]. Despite the situation, there are a lot of individuals and even some organisations (e.t Dingo team[2]) who try to help with little resources they have by providing food, shelter and veterinary services. However, most of the efforts (especially of the individuals) are not properly organised and relay on social media for most of the necessary communication they need to accomplish their work. It is important that good-hearted people, who want to make a contribution to the solution of this problem, have means to organise the process in an efficient and timely manner to make the most out of the present resources.

This work proposes a geo-collaborative application which will allow users to help animals by interacting with each other. Users will be able to mark the places of the animals they see on the streets mentioning the number and type of animals, if they have any injuries, upload photos and other relevant information. Other users of the app whose location is in close proximity (ordinary people and partner organisations such as vet clinics, restaurants, shop owners, animal shelters, etc.) can see the added markers on the map and can view the information added by users. Users should also be able to add information about lost dogs by uploading the picture of the lost dog and the necessary information such as owner's phone number and the approximate location where the dog was lost. The application should also show some locations where users can leave food for the animals. For motivating the users each time they make a good deed through the app, they will be given points or badges, which can be shared by social media.

After the completion of this project there should be a working website, which can be accessed from smartphones, tablets and personal computers. It should allow users to use all the functions listed above. It should access device's GPS and be able to get location. It should have a possibility of connecting to user's social network accounts and allowing them to interact with each other. The

[1] https://globalvoices.org/2011/06/28/armenia-animal-activists-demand-end-to-stray-dog-killings/

[2] https://www.facebook.com/dingoteam/

website should include a map, where users will add data and a news feed, which will show the added data sorted by time. After completing the implementation of the website, it will be tested among users. The feedback will be collected and improvements will be made to the system. Similar projects have already been successfully implemented in Armenia. One of the examples is KillZibil mobile application which allows users to take picture of a polluted area and add it to the map. Users can also upload a new picture with already cleaned area in the comments below the first picture. Developers of the application think that this app will become a communication tool between the citizens, authorities and structures, responsible for sanitary cleaning and waste collection[3].

2. Literature Review

2.1. Geo-collaboration and crowdsourcing

Geographic information more often becomes the key factor in the decision-making processes in many application areas. Collaboration enabled by geoinformation is often referred to as geo-collaboration. [1]

Depending on the time of the interaction two forms of geo-collaboration can be distinguished: 1. asynchronous, where different individuals or groups use shared information at different times, or 2. synchronous, where information is shared among the parties at the same time. Viewing the term "collaboration" to identify cooperative activities of two or more individuals working together on a single task, constructing and maintaining a shared problem conception, Maceachren and Brewer (2004) consider computer-supported geo-collaboration to involve a committed effort on the part of two or more people to use geospatial information technologies to collectively frame and address a task involving geospatial information. [2]

Crowdsourcing, as defined by Estellés-Arolas and González-Ladrón-de-Guevara (2012) is a type of participative online activity in which an individual or an organization proposes the voluntary undertaking of a task to a group of individuals of varying knowledge and heterogeneity via a

[3] http://www.mediamax.am/en/news/society/24750/

flexible open call. This process in which the crowd should participate bringing their work, money, knowledge and experience, always entails mutual benefit. The users will receive the satisfaction of their needs such as social recognition, economic and self-esteem needs, or the development of individual skills, while the crowdsourcer will obtain and utilize the valuable outputs of that collaboration. [3]

An example of crowdsourcing in a geo-collaboration project dedicated to open-source knowledge sharing is TIDES program (Transformative Innovation for Development and Emergency Support) which was developed by US Department of Defense to promote sustainable support to populations under stress – post-conflict, post-disaster, or impoverished. Through previous experience during Haiti earthquake in 2010 they have discovered that a group of volunteers has done a great amount of cartographic work in less than two weeks. This led to sharing satellite imagery to communities like OpenStreetMap to help catalyze these types of free volunteer mapping efforts after future disasters. [4]

2.2. Uses of geo-collaboration, results

Geo-collaboration has been used in a number of spheres, having applications in disaster and emergency response, e-government, resources management, data production, and collaborative mapping and spatial modelling. Real-time collaborative geographic information systems (RCGIS) allow decision makers to interact virtually overcoming space and time limitations. These systems possess features common to general real-time systems, and the ability for users from different domains to collaborate on solving spatial problems and making spatial decisions simultaneously from different locations. [5]

2.3. Volunteered geographic information (VGI)

Volunteered geographic information (VGI) can be an important part of some geo-collaborative projects. VGI describes any type of content that has a geographic element and has been voluntarily collected. In other words, ordinary users; without a professional training, can participate in generating and using the spatial information.

Usually the participants of VGI are motivated by different factors which have been classified by Budhathoki (2010) into intrinsic (personal enrichment, fun, learning, altruism, etc.) and extrinsic types (community, networking, monetary return, career, reputation, etc.). [6]

Coleman et al. (2009) offer varius motivations for participation in VGI that are based on empirical research from Wikipedia and the open source community. These include: altruism; professional or personal interest; intellectual stimulation; protection or enhancement of a personal investment; social reward; enhanced personal reputation; participation providing an outlet for creative and independent self-expression; and pride of place. [7]

One of the ways suggested by Deterding (2012) to increase the motivation of VGI participants is the gamification of the system. The burden of contribution is lowered through gamification which adds the factors of fun, networking, community and others to the otherwise boring process. [8]

2.4. Case studies

To illustrate the use of geo-collaboration systems in different spheres the following case studies have been discussed below.

NextCampus as a geo-collaborative tool to aid urban planning [9]

In 2008 researchers from University of Hamburg have created an online serious game based on geo-collaborative systems, to encourage public participation and to assist the urban planners, government, and citizens of Hamburg. One of the campuses of University of Hamburg needed to be either relocated (fully or partially), renovated or demolished and rebuilt. To choose the best scenario, the stakeholders such as students, university staff, government, urban planners, small businesses operating in the current campus area, were all invited to participate in a online serious game the allowed them to make different decisions (including financial ones) and see the actual consequences of those decisions. The participants of the game were able to choose from different locations on a map to relocate the campus, they could see how much funds would be needed in

that scenario. The game was aimed to increase public participation in urban planning activities, to start a dialogue and find a joint solution desired by most.

Through this application of geo-collaboration, the stakeholders were motivated to participate in urban planning activities in an engaging way. The citizens become involved with the urban planning situation in a playful way while receiving specific information about the area under discussion, dealing with the current situation and improving their understanding of the possible consequences of their opinions. However the game did not provide information whether the selected option was an actual wish of the player (for example to demolish or relocate the campus), or just a playful approach to see what would happen in an extreme case scenario. Although the format of the game may attract more stakeholders to participate, but it might not show the real picture.

Use of geo-collaboration in emergency management

As the number of safety threats like environmental disasters or terrorist attacks increases, Crisis Response has become an important application field for development of new information technologies, especially of geo-collaboration tools. During emergencies and disasters most of the tasks are critical and time demanding, and saving minutes can result in saving people's lives. The information integration in emergency scenarios could help government agencies and volunteer organizations to communicate and act in a coordinated way.

Several projects and applications have been created to help the coordination of emergency teams during disaster situations.
WORKPAD Project was designed for that purpose, having a two-level architecture: a first level deployed on the spot and a second level involving the servers of the different rescue organizations. [10] There are several front-end teams on the field, each of them has several rescue operators. Rescue operators are equipped with PDAs and their work is coordinated by a Process Management System which runs on the PDA. The Process Management System supports the execution of emergency-management processes by orchestrating the human operators with their software applications and some automatic services to access the external data sources and sensors. At the

back-end side data sources from several servers are automatically integrated and the result is a single virtual data source that front-end devices can query, and get information from several sources. The two levels in the architecture and the strong focus on user evaluation is a novelty compared with other relevant research projects in the area of emergency management.

Another project called CIVIL also supports map-based decision-making. The project integrates map services that people are familiar with, allowing users to add personal comments and drawings that overlay on maps. It also provides both shared and private maps as well as supports the transfer of information between them, providing visualization tools to present information and help information analysis.

The open-source tool Big Board, which can be used in the browser or as a mobile application, facilitates distributed synchronous collaboration by teleconferencing over maps to enable situational awareness. However, spontaneous integration of actors from other organizations is not supported. Another mobile geo-collaborative application named MobileMap was designed to help firefighters arrive faster at the emergency scene, to allow them to exchange digital information during emergency response processes and to reduce the need for radio communication. [11]

Applications of geo-collaboration systems in education

Geo-collaboration is also used in education. These kind of applications allow students to not only learn about a specific object or building, but also with the use of map based technologies, experience real-life objects in their actual locations.

Zurita, Baloian and Frez (2013) describe an application named “Learning with patterns” in which teachers can create tasks for the students by marking a specific path, an area or a point on the map. The students have to follow the path or find the specified places in order to collect data on a specified assignment. When students find objects satisfying the requirements set by the pattern specified by the teacher, they create instantiations of this objects. Instantiations can include texts or images. The application allows teacher to monitor students’ work. Teacher can see the student's location and communicate with them in real time by sending messages. This application gets the map from Google Maps, it uses Google Authenticator for managing accounts. The application gets

access to user's phone GPS and Camera. It also has a server where the data of the assignments and students work are stored.

In this paper the scientists suggest that the developers of "Situated Learning" applications take advantages of cloud services for geo-information and communication. As these services are developed to serve many users and are very stable, the developers can implement them with less effort and more reliability. The other advantage of cloud services is that most of the future users of application will know how to interact with them as they have most probably used them (such as Google Maps for geo information or Facebook and Twitter for communication) in other scenarios. [12]

Conclusion

By examining the most relevant literature and cases we have distinguished several features that we are going to use in our application. In the first example of urban planning, the application attracted many users because it was designed as an interactive game. So our application will also have a game like interface and users will gain points after completing different tasks. However to avoid disinformation our app's users can report who has posted false information. We also decided to use cloud systems when developing our application. As the third case suggests, it has many advantages such as reliability and easy implementation.

3. Software requirements

3.1. User requirements

- Users of the application should be able to add geo-referenced information about dogs they have spotted on a street. Users should be able to put a marker on the map where they have spotted the dog, they should be able to upload a picture, write a description of the dog and check whether the animal might be someone's lost pet or is a street animal.
- Users should be able to post geo-referenced information about their lost dogs. User should be able to upload picture of their lost dog, add information for contacting the owner, and add a marker on the map pointing to the location where the dog was lost.
- Users should be able to see the map with markers added by other users and markers for "Food Points" added by website admin.
- Users should be able to filter the markers on the map by some categories (recently added, lost dogs, spotted dogs, etc.)
- Users should be able to view the information about the spotted dogs added by other users. They should see the location, the uploaded picture, the description provided by other user and get directions to the location.
- Users should be able to view the information about the lost dogs added by other users. They should see the approximate location and the uploaded picture of the lost dog as well as the personal information of the owner (email, phone number, etc.).
- Users should be able to view the information about the "Food Points". They should see the location and get directions.

3.2. Functional requirements

The application should provide users with the possibility of viewing the geo-referenced information uploaded by other users. When users enter the website, the homepage should include a map with markers on it. The system should load the longitudes and latitudes of the markers added by other users and show all the markers on the map. The user interface should have buttons for filtering the markers shown on the map. When users click on the "Recently added" button the

system will only show the markers that were added recently. When users click the “Spotted dogs” button only the markers that are showing the locations of the spotted dogs will be left on the map.

When users click on one of the markers the system will go to another page and the information of the dog at that location will be loaded from the database. The users should see all the information that the other user uploaded including the picture and the description.

The system should also load pictures of the recently lost dogs and show it on the homepage. When a user clicks on one of those pictures the information about that lost dog will be displayed including the approximate location where the dog was lost and the owners’ personal information.

The homepage should also include two buttons for adding geo-referenced information about spotted dogs and lost dogs. When users click on one of this buttons they will go to another page where a submission form will be displayed. The form should include a function of adding a marker on the map, uploading picture, adding some additional information and a “Submit” button. After clicking the “Submit” button the system should store the longitude and the latitude of the marker, the uploaded picture and the additional information in the database.

4. Implementation

For developing the front-end of the website React was used. React is a Javascript library which uses JSX syntax which allows to mix HTML and Javascript codes. React allows to divide the UI/UX development into small components. The created components can be reused and combined, which makes the development faster and easier.

The website is a single-page application which means it interacts with the user by dynamically rewriting the current page rather than loading entire new pages from the server. React Router was used in order to provide the perception and navigability of separate logical pages in the application.

The application is communicating with the server behind the scenes by fetching or submitting data through an API which serves as a back-end for the application. The back-end was written in PHP - it's a RESTful API that returns data in JSON format. MySQL database was used for storing data.

The application can be opened on various browsers on computers as well as mobile devices and tablets. The application allows users to either publish geo-referenced information or view data uploaded by others. The website can be found on this address (https://www.scorebat.com/shoon/build/).

4.1. Description of the application

At the top of the homepage (Figure 1) users can see the pictures of dogs that were lost recently, if they click on one of the pictures they will be directed to that lost dog page (Figure 5). The system will get users location by GPS and the markers which were put by other users and are near the user's location will be displayed on the map, including "Food Markers". The longitude and the latitude of those markers on the map are loaded from the database.

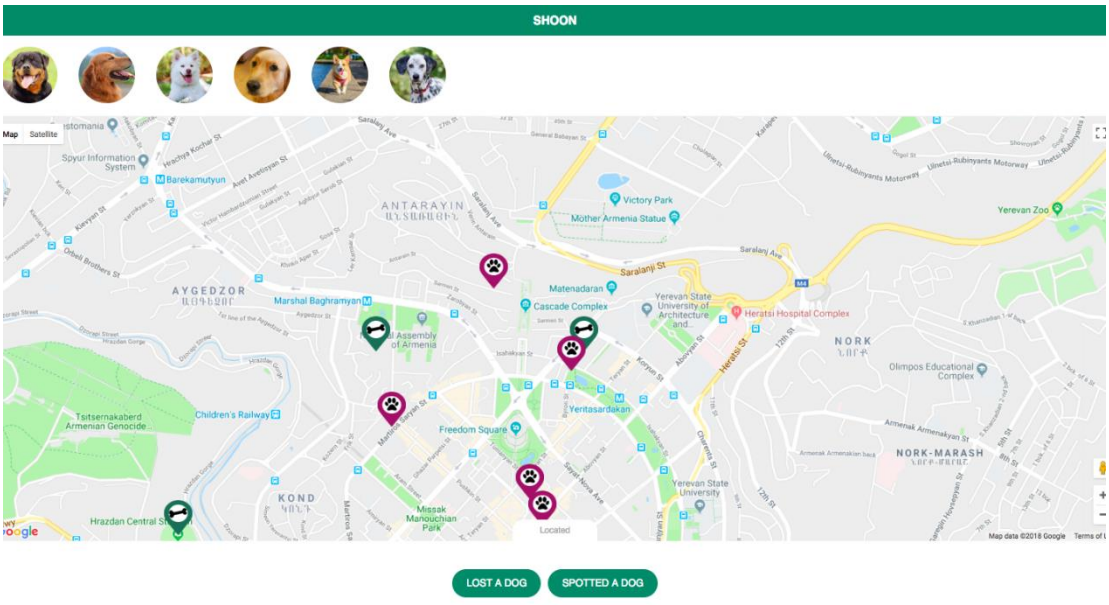

Figure 1. Homepage

After clicking on one of the markers the page of the animal in that location will be displayed (Figure 4). The two buttons at the bottom of the page are for submitting data, the respective pages will be opened when user clicks on one of them.

Users can publish two types of data. They can choose to fill the submission form of spotted dogs or lost dogs. In both cases users are provided with a submission form where they should put the required data.

In order to publish data about a spotted dog users need to fill the form in Figure 2. The map will get users location by GPS and the marker will point to the location of the user. Users can also drag the marker to their desired location. Users also need to upload a photo of the animal they have seen, write a description in which they can share any information they think is important.

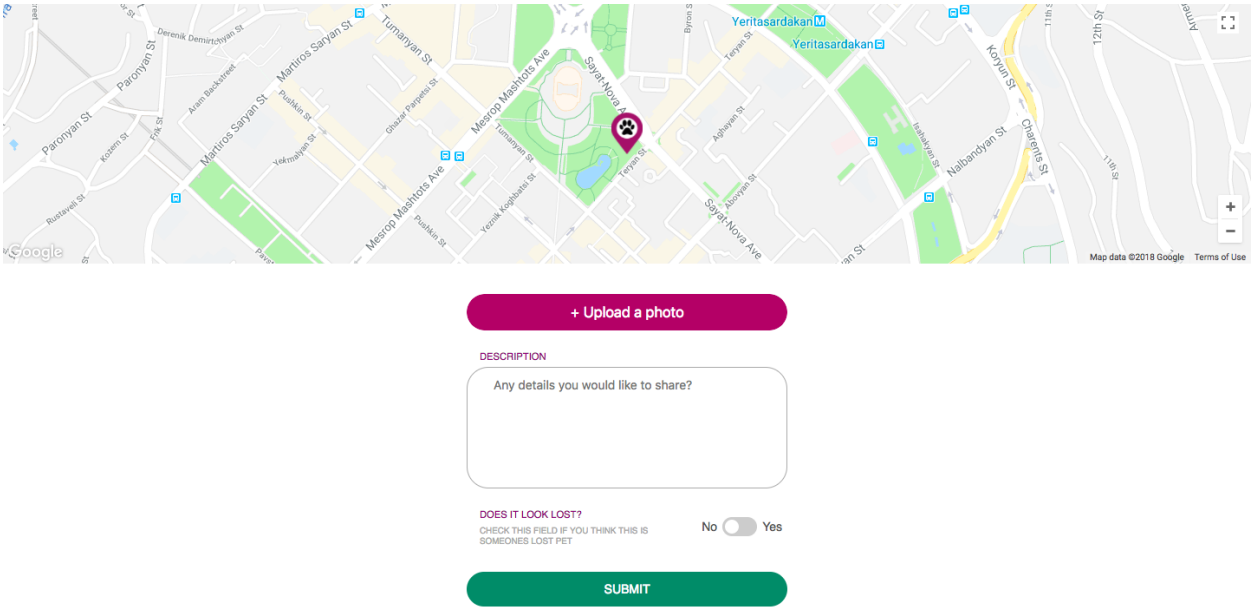

Figure 2. Submission form for spotted dogs

If users think that this animal might be lost they have to switch the “Does it look lost?” field to “Yes”. After clicking “Submit” the system will store the longitude and the latitude of the marker, uploaded picture, description and whether the animal looks lost or not in the database.

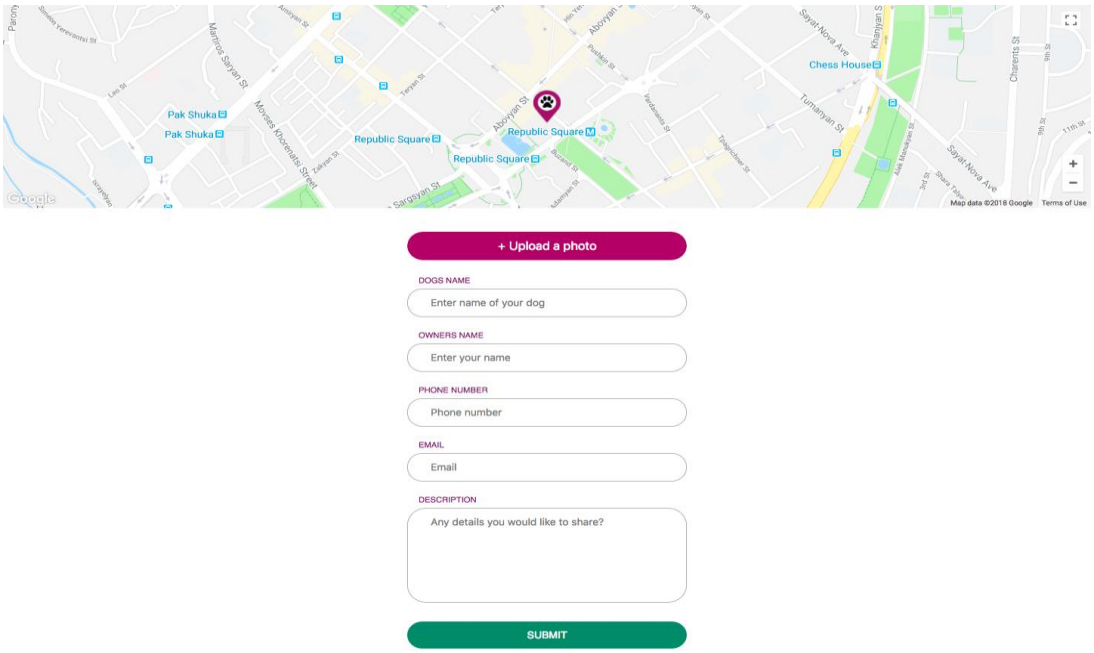

Figure 3. Submission form for lost dogs

In order to publish information about a lost dog users need to fill the form in Figure 3. The map will get users location by GPS and the marker will point to that location, user can drag the marker to an approximate location where the dog was lost. User has to upload a picture of the lost dog. The dog's name, owner's name, phone number and email as well as some description about the dog are also required fields that the user should fill in. After clicking "Submit" the system will store the longitude and latitude of the marker, uploaded picture and data from the other fields will be stored in the database.

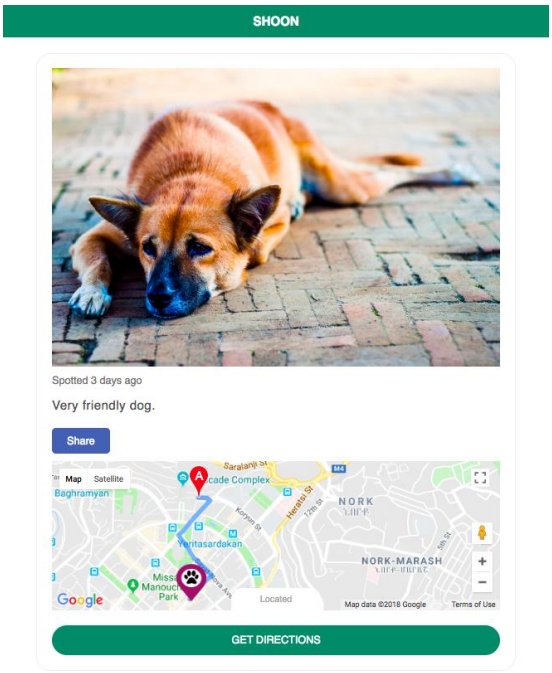

Figure 4. Spotted dog

When user clicks on one of the markers information about the dog is displayed. The page loads a picture of the dog uploaded by another user from the database, the time the data was uploaded, a short description about the dog, the map with the location. The user can choose to see the directions by clicking on the “Get Directions” button.

Users can also view announcements about lost pets published by others. This page allows a user to see the picture of the pet, the area where the pet was lost, how to contact the owner and other information posted by the other user.

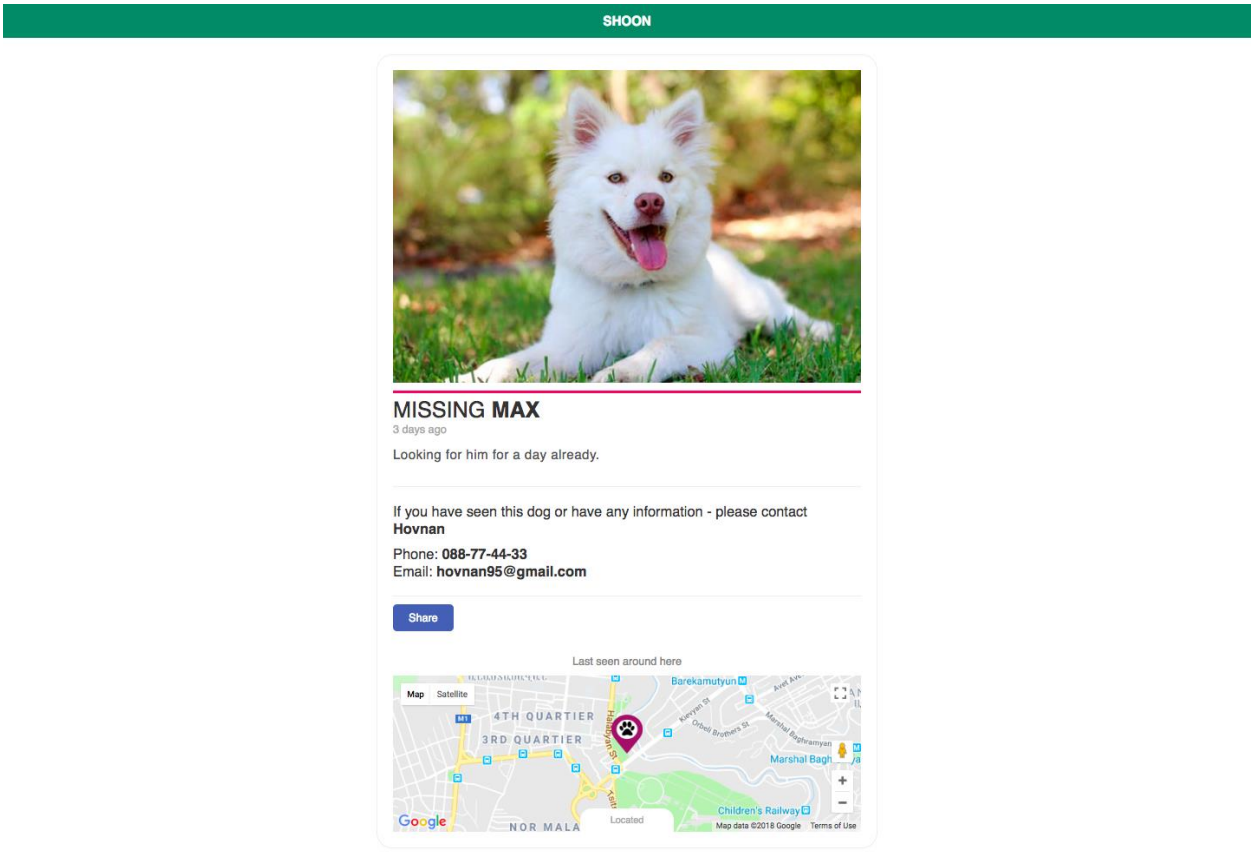

Figure 5. Lost dog

If user clicks on one of the green markers information about “Food Point” will be displayed. User can see the location and get directions by clicking on the “Get Directions” button.

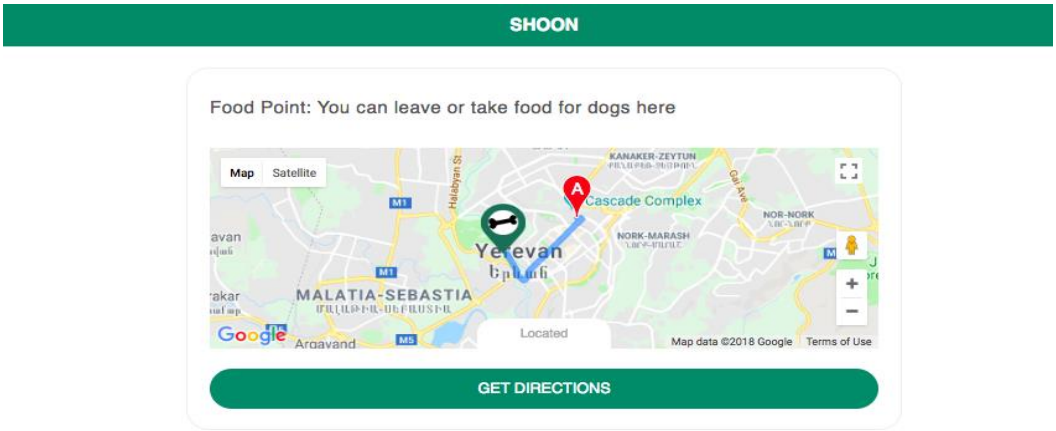

Figure 6. Food point

4.2. Promotion

The developed website will be presented to all individuals and organisations who are trying to help stray animals. As now the announcements are done in various social media pages and it is difficult to follow all of them in order to find the announcements needed.
In case someone finds a lost animal he/she must look in all of these pages in order to find a post where the owner of that animal reported about losing it. This takes a lot of time and it is not guaranteed that the person who found the animal will know about that specific social media page where the announcement was posted. It is important to present the website to all these organisations and individuals who have this kind of pages in order to centralize the information in one place.

Those vet clinics that are willing to help stray animals can also collaborate. With their permission the locations of their clinics will be added to the map. This will help people who have found an injured animal on the street to quickly find the nearest vet clinic and take the injured animal there.

The website will also be presented to the organisations who manage animal shelters. Several locations around the city will be marked on the map where users can donate food for the shelters.

5. Conclusion

After reviewing the literature about geo-collaborative projects and examining applications a website was developed that allows users to locate and help stray or lost animals. The website has most of the proposed features such as submitting geo-referenced information about animals and viewing the information uploaded by other users. The web application can be accessed from smartphones, tablets and personal computers.

As a future development the connection with social networks should be implemented in order to allow users to create accounts and log in to the web application with their existing social network's accounts. This will allow to create a feature of notifications, which will be sent to users who had reported a lost dog and someone else submitted information about a found dog in the similar area. The system will also allow users to flag other who post inappropriate or false information, after several flags, the reported user's account will be blocked for a period of time.

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