Personalised GeoNotes

Joseph Michaels

Supervisor
Associate Professor Judy Kay

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School of Information Technologies
The University of Sydney
Australia
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Abstract

Geonote related applications are increasing in popularity. This has the potential to create an information overload of virtual notes, particularly in areas with a high population density such as cities and tourist attraction spots. Over time, more and more messages are posted to a finite space. The problem of information consumption quickly becomes apparent. Even if all the notes are informative and interesting, it is simply unlikely that we can view them all. Many of the notes will not be interesting to everyone. Personalisation offers a way to reduce this noise. By allowing the message author to provide additional tags, or interest keywords, such personalised geonotes can be targeted to just relevant users.

This thesis introduces PeGeon, a personalised geonotes system which was created to explore a novel way to personalise geonotes.
Acknowledgements

One idea, two months to code, three months to compose, a lifetime learned.

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Chapter One

1 Introduction

This thesis aims to explore a new form of geonotes system. We discuss some of the existing architectures and designs, highlighting their strengths and weaknesses. We present a novel approach to addressing some of these challenges by introducing PeGeon – The Personalised GeoNotes System. A qualitative evaluation of this system is also performed to gain insight into the advantages of introducing personalisation. To address the challenge of information overload, only information relevant to the user should be delivered. Here relevance is determined by the profiles of the sender, potential recipient and target audience. We present a personalised approach to geonotes whereby the messages are consumed according to the user’s profile and tags created by message authors. The author of a PeGeon note decides the nature of the message, hence influencing its visibility to the reader. Attributes in the recipient’s profile are also considered.

A user study is performed to evaluate the effect of this personalised approach, followed by an analysis of the results. The evaluation determines the relevance of applying personalisation to geonotes and assesses the usability of user profile and message based filtering.
1.1 Motivation

Positioning technology has gained widespread popularity in the form of the electronic navigation system. This proliferation has given rise to many other applications that exploit geographical location data. One of the more socially oriented applications is the GeoNote system. A GeoNote is a virtual annotation attached to a physical location.

While the concept of posting virtual notes in the physical world dates back to well over a decade, humans have been annotating space for thousands of years. Unlike its virtual equivalent, the physical wall provides only a limited surface for posting messages. However, the virtual wall whilst theoretically able to hold huge numbers of notes is not without its obstacles.

In existing systems of geonotes, a message posted to a virtual location may be seen by all users near that location. Over time, more and more messages are posted to a finite space. By its very design, this makes the system inherently prone to noise and can become difficult to navigate. It leads to a rich information space, but information overload soon becomes a problem.

This thesis presents a novel personalised approach to geonotes where the messages are filtered according to user’s profiles. The message author decides the nature of the message hence influencing its visibility. This has the potential to addresses the challenge of information overload as only information relevant to the user is presented. The key problems relate to the increased complexity of the application, particularly in the user interface. This thesis explores this new approach and how to deal with these challenges. It describes PeGeon and presents an evaluation design to assess whether the additional usability burdens associated with personalisation were overcome by the design. The results of this evaluation are also discussed.

1.2 The GeoNote

What is a GeoNote?

GeoNotes connect pieces of digital information to a specific latitude-longitude coordinate via some mobile device, thereby ‘attaching’ them to a specific place in space (Espinoza et al., 2001). It is a system for abstracting location information for location-aware applications. The system architecture supports shared information for mobile devices, exactly to associate notes with specific places for other users to be read. A user creates and
stems notes to certain places, where other users can read them (Hofer et al., 2003). These notes are called geonotes. Consider the following illustrative scenario;

At some time during her adventurous trek through Europe, Wendy enjoys a cappuccino at a little café in Bairro Alto, Portugal. She decides to express this by leaving a geonote; “I’m enjoying a great coffee at Noo Bai Café”. Jonathon has just flown in from London and decides to take a break. Like many tourists, he is unfamiliar with Bairro Alto so he looks to his mobile device for comments left by others. He likes Wendy’s geonote and decides to walk over to Noo Bai for a coffee.

The geonote offers an alternative form of social interaction as well as an additional source of tips, comments and, as this thesis will present, a personalised spatial information knowledgebase.

1.3 Challenges

A system allowing any user to act as content provider will encounter new design challenges (Espinoza et al., 2001).

A key design in the past was to prioritise and endorse an open information space so that at any given location all users would be allowed to author an infinite number of notes and all of the notes are visible to everyone in the system (Persson et al., 2003).

If we allow users to annotate digital space en masse and without restrictions, we may achieve a socially rich environment, but the information space will become cluttered with unstructured information. They key issue here is determining the relevance of the note to its user.

Consider a position that contains many thousands of notes. How will the user sift through those messages? How does the system know which messages should be shown to the user? These are some of the challenges that are still being addressed.

One particular approach would be to group users who share the same interests by analysing their historical activity. A recommendation system can then use this information to suggest relevant content.
Notes can be targeted at a single user or a whole user group. Equally, a user can create and apply filters to only a subset of the notes associated with a certain place (Hofer et al., 2003).

An alternative approach is to introduce personalisation.

1.4 Personalisation

Personalisation is defined as “to make or change something so that it is especially suitable for a particular person” (Macmillan-Dictionary, 2010).

We aim to personalise the user’s experience by displaying only suitable notes for this particular person. The targeting of messages to users enriches the experience as only relevant information is being presented. Consider the following scenario where a personalised geonotes system is used as an education tool in a museum;

1. Alice teaches third grade. She is preparing for her class visit the Australian Museum as part of their studies of spiders, to gather information for creating a poster. The children are working in groups of 3-4, with each student allocated their one aspect; one child is studying the spiders that live in the school area; another on typical spider habitats and diet; a third on how they make people’s lives better; and optionally a fourth on how dangerous they are and how to treat bites. Alice uses the Museum geonote authoring system to place geonotes from the class e-portfolio system, with each child’s own poem about spiders linked to locations in the museum (to help them see the link between that poetry writing activity and this visit). Also, each child gets a set of the core information. But each also gets their information according to their role in the group work for the poster.
2. When the class visits the museum, each child uses a mobile phone to access their own notes in each part of the museum. They can augment the notes with their own, additional information, based on the materials in the museum. Later, each group comes to a tabletop display, releasing all their notes to the table so they can discuss them to assemble the information for the poster.

3. A month later, Bob, a teacher of a 4th grade class plans to bring his class to the museum to study spiders. They will do individual poems about spiders and how they help people. He finds Alice’s collection of geonotes and decides to reuse some of them. He also creates some variants, extra geonotes and changes the personalisation so that a selection of the notes is presented to every child in his class.

4. Later, David, a retired entomologist, visits to the museum. He discovers a geonote left by a child, during a class visit. He leaves some follow on geonotes that answer the questions posed in this note.  

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This extended scenario demonstrates two key ideas: the potential of geonotes in cultural heritage settings and the need for personalisation to enable the visitor to find notes that are most relevant to them, at that right time, and context. In studies of the reasons that people visit museums, Falk points to the potential importance of just this sort of personalisation technology (Falk, 2009), accounting for the user's motivations in the visit and the context (Brem et al., 2010).

In this scenario, all users receive geonotes relevant to them. Without personalisation, each child in the class would have to sift through hundreds or more messages to find those pertaining to their interests.

1.5 Contributions

This thesis presents a novel approach to personalised geonotes. We define, develop and demonstrate the first novel architecture for a personalised geonotes system and assess whether the additional usability burdens associated with personalisation are overcome by the PeGeon design.

The PeGeon system was created to explore a novel approach to delivering filtered location based messages to the user. We also describe the design and implementation of a qualitative evaluation of the usability of PeGeon. The purpose of this evaluation is to gain insight into how well users interact with the PeGeon system when composing and reading messages. We set out to determine the effectiveness of the proposed personalised method and inform future research of this approach.
Chapter Two
2 Background

There has been much research in the area of geonotes. This chapter will discuss the influence of the physical note, its social usage and the relationship to its digital form. We will also discuss some significant and proposed GeoNote systems, some related work, their contributions and discoveries, as well as identifying some of the obstacles found along the way. This chapter describes key related work that informed the design and approaches of this thesis.

2.1 Introduction to Information Positioning

The primary function of a location-based information system is to position information. This information, or message, is attached to a coordinate via a mobile device. Users can then read that information with the impression that the message is actually attached to the location (Persson et al., 2003). The experience is the virtual equivalent of reading a note left on a refrigerator or wall in the physical world. Some systems have even attempted to increase the realism of the experience by introducing devices that provide an augmented reality view (Figure 2-1) of these notes (Hansen, 2006) and specialised messages (Esbjörnsson and Brunnberg, 2001). So what was the influence behind such a platform? What social usages could such an environment have?
2.2 The Physical Note and Its Influence

There are several ways we can physically convey messages in the analog world. Some examples include the post-it note, graffiti, signs and posters. These forms of messages have different characteristics. An understanding of these characteristics is critical before designing their digital equivalent.

The post-it note is typically used to share a quick message between friends, colleagues or peers. It is typically used in the home or office resulting in short informal messages. They are also used as reminders to oneself. By its very design, this annotation system allows information to be positioned directly on or within the annotated resource, leveraging context and location. A Post-it note with the text “read chapter 4 and 5 in this” attached to a book does not have to reference the author of the book or the book’s title to explain, which chapters the annotation refers to. This is also called a spatial deixis, since the interpretation of the annotation depends on the spatial context of the Post-it note, which in this case is on the books cover (Hansen, 2006).

In contrast to the post-it note, graffiti is mostly anonymous and public in nature. Typical usages include political, philosophical or social expression. It provides a convenient way to convey an anonymous message to the public.
Table 2-1: The Physical Note and its Characteristics

<table>
<thead>
<tr>
<th>Physical Note Type</th>
<th>Length</th>
<th>Privacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-It</td>
<td>Short</td>
<td>Private</td>
</tr>
<tr>
<td>Graffiti</td>
<td>Short, Long</td>
<td>Public</td>
</tr>
<tr>
<td>Signboards and Posters</td>
<td>Long</td>
<td>Public, Limited</td>
</tr>
</tbody>
</table>

Another common way of conveying a message is the signboard or poster. These can be used publicly or privately. They may communicate a local community event such as the annual fair. In another example, a billboard may convey messages of a commercial interest such as advertisements for a local real estate agency.

These are all forms of expression from various sources in the community.

A highly influential paper by stated that social and communicatory functions have been often overlooked in digital location-based information systems (Espinoza et al., 2001). It is argued that a vast number of digital information systems on the web contain professional content. This is akin to the billboard advertisements described earlier. The goal is to let the information space be free, to encourage contributions from various sources - especially the everyday user. This will result in a more socially rich platform. It was claimed (Espinoza et al., 2001) that there should be more post-it notes and more private signs in the digital world. It is also suggested (Persson et al., 2003) that authoring and accessing information will not take place in offices and homes, but rather in public spaces, including streets, squares, pubs, public transportation, churches, café’s, galleries, malls and libraries. Potentially, the ways in which information is produced and consumed will be transformed by the spatial context.

2.3 Early Work

One of the earliest significant contributions in location modelling is the Active Badge location system at Olivetti Research Cambridge. It was the earliest system to track members of staff by wearing badges that transmit signals providing information about their location to a centralised service. This centralised service had a notify mechanism that generated an audible indication when a named badge was next sighted. This was
used to deliver an urgent message to a member of staff who is out of the office on business for long periods of time (Want *et al.*, 1992).

Brown proposes the stick-e note which he models based on the electronic equivalent of the Post-It note (Brown, 1995). This is the earliest significant description of the GeoNote. The importance of generality and simplicity in the creation and content of the GeoNote is emphasised. Brown also proposes it not be limited to that of just the context of location but to consider others such as time and critical states.

Pascoe extends this work, providing a model upon which the context-awareness can be used to enhance user interfaces (Pascoe, 1997).

![Context Hierarchy (Pascoe, 1997)](image)

**Figure 2-2 : Context Hierarchy (Pascoe, 1997)**

Pascoe's architecture subscribes to the model-view-controller (MVC) design pattern separating code to use the view for display, the model for the internal representation and the controller which drives the operation based on the context represented (Pascoe, 1997). The increase in the number of contexts known to the system increases the 'awareness', or sensory layer. Location itself is a context which all GeoNote systems exploit. Another context - “Light” for example, can be added to the hierarchy (*Figure 2-2*) by introducing a photosensor (a device to sense light). As a result the system can detect light via strength signals. The GeoNote system could determine whether the user is indoors or outside in the sunlight and use this information to deliver certain messages or decide to display visual cues. The concept of hierarchical contexts focuses on providing more inputs for a geonote to use. In contrast, *personalisation* exploits the contexts along
with the user’s profile and interests to decide which messages are relevant to a particular user.

Hjelm and Nilsson present the idea that one may personalise the user experience by considering the context of location and time (Hjelm and Nilsson, 2000). We are introduced to an example of a tourist in a foreign city. Location and time are both factors when touring a museum to plan the day around the interests of the person.

“For instance, working in our own city, we may be interested in finding the restaurant that is closest to our work, but when we are tourists in a foreign city, we may be interested in the locations of all the city’s museums. The location relevance is determined by many factors, not just one. Time can be a factor, for instance (we are more interested in museums in the morning, when planning our day, and interest in lunch increases around noon), as can the mode of locomotion (when travelling by car we will not be able to stop suddenly, as a walking person would, nor will we be able to use restaurants without finding a parking space first).” (Hjelm and Nilsson, 2000)

Hjelm and Nilsson extend Pascoe’s work by proposing a general metadata-based system for context-based information using an existing (RDF) standard.

Another early system, Guidebook (Fleck et al., 2002), developed for the Exploratorium in San Francisco, supported two communication functionalities: the rememberer enabled the visitors to capture a record of their experiences to consult during and after their visit; and the communicator which helped visitors communicate via electronic bulletin boards for individual exhibits, instant-messaging, and/or beaming information between handheld devices.

Many museum and tourist guides allowed their users to send notes and leave virtual notes (geonotes) at specific physical places. The PIL project (Kuflik et al., 2007) allowed museum visitors to leave virtual post-its for other members of their group visiting the museum. The post-its had an intended audience (an individual or a group), a time to live (including forever) and context-aware content, commenting on a specific exhibit or specific presentation about an exhibit. PeGeon also implements the time to live (or

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stickiness) capability for geonotes as part of its inline tagging features (discussed in Ch 3.2.1).

CyberGuide (Abowd et al., 1997) was a mobile, context aware tour guide that allowed a user to leave messages to exhibit owners and to send reports about their location to a central service, making them accessible to others. Similarly, PeGeon build upon this basic functionality and extends it to personalise the tour guide. Instead of displaying the same messages for everyone at a location, different material (educational or otherwise) can be targeted to enhance the tour guide experience.

2.4 The GeoNote Composition

There are common elements across early geonotes systems. One of these is the geonote composition.

Most GeoNote systems define the GeoNote as having several mandatory components or key pieces of data (Espinoza et al., 2001) suggests;

- a title, which often serves as a header in a list of notes.

- a recipient, to which the note is addressed. This could also be open to any user.

- a signature, which is either contact information or an arbitrary user id representing anonymity.

- a place label or tag, which defines the location to which the object is posted.

Organisation of the notes based on labels presents a key design challenge. A location can be part of another location, so the granularity of the place label is called into question. How does the user describe the location of the note? Is it placed on a tree? Or the tree outside St Mary’s Cathedral? Or perhaps its Sydney, Or just Australia?

The most obvious solution would be to allow the composer to choose the most appropriate scope based on the context of the message.

Espinoza et al., (2001) suggests label sharing to influence the behaviour of future authors. This has several advantages. It promotes a reuse of existing labels, which in turn aids categorisation. Labels can also be predefined by using local directory information.
Figure 2-3 shows a free text entry field for the title. The “to” and “from” fields are selectable from a drop down style pick list. This allows the user to quickly and easily select commonly used values without having to retype them with each note.

![Figure 2-3: Posting a GeoNote. System 1 (Espinoza et al., 2001)](image)

Here the understanding of how the position is associated is also very important. How clear is the creator and recipient’s understanding of this? The user must have the ability to access the notes easily. Functions such as searching and browsing for notes should be intuitive and non-obstructive. Is there any filtering of messages? How is relevance measured in this case? The GeoNote should be composed of a title, recipient and signature of the creator.

This actually serves as a useful measure of the effectiveness of the system. Questions such as how the system allows users to create annotations are posed.

This follows the work on modelling a place rather than a location as in BeaconPrint (Hightower et al., 2005). From the semantic information provided by geonotes one can automatically determine rich semantic descriptions of locations in terms of available
symbolic maps, where these were designed to help the user see the parts of a complex space that are relevant to them (Brem et al., 2010).

Several notable architectures were created to solve these recurring issues such as context handling and place labels. CoBrA (Context Broker Architecture) was introduced in 2003 to overcome perceived limitations of earlier context-aware systems such as inability to reason about context (Chen et al., 2003). SOCAM (Service-Oriented Context-Aware Middleware) is another ontological context-framework designed to support smart spaces (Gu et al., 2004).

![GeoNotes Main Message Window (Persson et al., 2003)](image)

Figure 2-4: GeoNotes Main Message Window (Persson et al., 2003)

A place label is also suggested. The user should have the ability to create or invent a place label in the case that the position coordinate is inaccurate or content of the note is dependent on another semantic. Figure 2-4 shows user defined place labels of Biblioteket (library), Forum Aula, Restaurant and computer.
2.5 Navigating Notes

Another common element across early geonotes systems is the navigation of notes.

Espinoza et al., (2001) described several methods a user can retrieve notes. A search method allowed the user to enter a keyword that searched the local area for matching content.

The notification method allowed a user to be alerted when a high-ranking note is nearby. This of course, presented some design concerns. How would the system avoid exploitations resulting in spam? There must be a filtering solution applied. PeGeon addresses this concern by a combination of sensitivity settings and interest matching. Increasing sensitivity produces more alerts based on user’s interests whilst a low sensitivity setting reduces these alerts.

Espinoza et al., (2001) proposed that filters be based on both content and usage. Messages would be considered highly relevant if the content shares an overlap with the user’s interests and keywords, and also exhibits a history of being highly viewed by other users. PeGeon builds upon this suggestion of matching the content (or notes) to the user’s interests and keywords. No implementation of this feature was presented by Espinoza et al. “In GeoNotes, such a [feature] is yet to be implemented.” (Espinoza et al., 2001) and it is believed PeGeon is the first to do this. In addition to this, the simple matching of user interests to content is expanded further into the use of inline tags and plugins to accommodate complex matching (discussed further in Ch 3.2.1).

By having a history of highly viewed notes by other users, trends can be formed and subscribed to. Filters to follow friends can also be useful, but cause limitations.

Persson et al., (2001) suggested all content should be accessible to all users. There can be no restrictions placed on messages to be read by a certain user or users. This promoted transparency but did not address the resulting issue of irrelevant notes and information overload.
The geonotes system by (Burrell and Gay, 2002) allowed a user to create either a public or private note. A public note is readable by all users of the system at the location which it was posted.

The user could also create reminders that are triggered the next time the location is visited. The trigger can be configured to alert the user once upon the next visit, or each time the user visits the location.

For example, Bob sets a reminder to himself to pick up the milk. He configures it such that it alerts him once a week as he passes the convenience store on the way to campus. The system will only alert Bob of this reminder if:

- Bob is near the convenience store
- Bob has not yet been alerted by this reminder for the week.
The Active Campus (Griswold et al., 2004) system presented a map view for the geonotes. It provided an alternate perspective on messages and their location. The map was limited to the campus and provided an annotated overlay displaying only the author name of the note.

### 2.6 A Comparison of GeoNotes Systems

There have been some very influential and novel contributions made to geonotes systems. One of the more popular implementations is that of Espinoza et al., (2001) in which they also discusses the implications for the design of a more open and social geonotes system. Some of these are discussed below, contrasted with PeGeon (see Table 2-2).

<table>
<thead>
<tr>
<th>System</th>
<th>Structure of the GeoNote</th>
<th>Information Overload (Scalability)</th>
<th>Access Mechanism (Navigation)</th>
<th>Location Modelling</th>
<th>Ontology</th>
<th>Other Notable Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System 1</strong></td>
<td><strong>GeoNotes</strong></td>
<td><strong>Title, Recipient, Creator, Placement, Message.</strong></td>
<td><strong>Explorative Browsing. Pie Chart of Categories. Popularity</strong></td>
<td><strong>Search, Browse, View Categories.</strong></td>
<td><strong>Coordinate System Custom Labels.</strong></td>
<td><strong>None.</strong></td>
</tr>
</tbody>
</table>

![Figure 2-6: Active Campus (Griswold et al., 2004)](image-url)
### Table 2-2 – Comparison of key geonotes systems

| System 1 | System 2: Active Campus (Griswold et al., 2004) | System 3: Hydrogen (Hofer et al., 2003) | System 4: ComMotion (Marmasse and Schmandt, 2000) | System 5: Foursquare (Foursquare, 2010) | System 6: PeGeon |
|----------|---------------------------------------------|----------------------------------------|-----------------------------------------------|--------------------------------------|-----------------
| There is no provision for deleting or hiding unwanted notes, creating clutter. | Lacks Push, but uses periodic refresh (HTML). | Context Driven – Time, Location, Custom. | Browse Virtual location name | Browse by place labels and friends. | Browse Map and List of notes matching interests and other targeted notes. |
| Prepopulated location list. | None. | Coordinate System | None. | Label system | Coordinate System |
| Narrow Scope – Mainly focussed Campus and classes. User location information is known to peers. | Multilayered framework for defining contexts. | Abstracted Location Learning Agent | Game play encourages repeat visits to location to accumulate badges | Inline tagging. Targeting of users through extensible plugins. |

System 1 (Figure 2-3), System 2 and System 5 all conform to a structured geonote message composition. These three systems contain a recipient, author (or creator) and message body (discussed further later in this chapter). They also contain a title, barring System 5. Systems 3 and 4 have a free (or unstructured) layout - due to being framework oriented and allowing for custom layouts. System 6 PeGeon has a semi-structured format. Targeting users is not done by entering the recipient in a dedicated “To Recipient” field, but rather *inline* the username in the body of the message or targeting other attributes of their user profile.
Information overload, noise and clutter are addressed by System 1 and 6. In System 1 popularity measurement is based on reading, saving and ignoring any individual GeoNote. Popularity of a GeoNote increases when saved and decreases when ignored, and the total popularity weight of a note is calculated using the formula: \( \text{timesRead} + (2 \times \text{timesSaved}) - (2 \times \text{timesIgnored}) \) as described by Espinoza et al., (2001). System 6 uses the power of personalisation to deliver only relevant notes to the user.

Systems 1, 4, 5 and 6 support notes navigation through browsing. Systems 1, 2 and 6 go further and provide a map view of the notes. Systems 1 and 2, however, are rather limited as they only support a small predefined map of an institutional campus. System 2 is confined to delivering view updates through a periodical refresh of an HTML based browser. System 3 is context driven, providing alerts only.

Location modelling usually falls under two categories; the coordinate system and the place label. The coordinate system is based on geographical coordinates and referenced by longitude and latitude. Systems 1, 3 and 6 used this approach. The place label, on the other hand, is typically user defined. For example, a user may post a note to the location “Joe’s Pizza”. This is a user defined label, which when introduced, can be reused by others. System 4 and 5 use this approach, while System 2 uses a rigid predefined list of locations.

Ontologies are rarely used by GeoNote systems as it raises the complexity in design. System 6 – PeGeon, offers a limited ontology by using WordNet (Miller, 1995). This further discussed in Ch 4.5.1.5.

Each of the 6 systems compared have a unique notable feature. System 1 introduces the delivery of notes using both push and pull methods. Both browsing and searching are pull methods. Alerts and updates are push methods. System 2, whilst limited in supported area also provides an advantage. User locations are known to peers, so labels are fixed. As a result, there are no redundant labels. System 3 supports an extensible context framework by design and System 4 features an abstracted location learning agent. System 5, a commercial system with the largest geonotes userbase is game-play oriented (Siegler, 2010). The distinguishable feature of System 6 is its personalisation features. User profile targeting and inline tagging provides unprecedented fine-grained targeting capabilities.
Earlier architectures focussed less on relevant notes delivery and more on context-awareness.

One such system is the Hydrogen system (Hofer et al., 2003). In fact, context was central to its design. The Context Server was core in the management layer (Figure 2-7). This Context Server served as layer of abstraction on the Adaptor Layer which comprised of the user information, location information and system hardware sensors such as time and network monitors. The abstraction allows the application layer to access the contexts via a uniform protocol (XML over TCP/IP).

The core component is storage for the context, which can be queried by applications, called ContextServer. Context is stored once for the whole device and provided to all applications. In addition to issues concerning the aimed devices application development is simplified and reusability and exchangeability of sensors and adaptors increases (Hofer et al., 2003).
The ComMotion system also focuses on contexts, particularly location. The Location Learning Agent’s sole responsibility is to determine the location of the device and translate this to its virtual equivalent as defined in the Message Engine.

The ComMotion architecture is distinguished by its offline mode.

Reminders sent from other users are immediately downloaded to the client device where they are stored until delivery time. Since all position tracking and analysis are done on the client device, these would not suffer from lack of connectivity. If the server cannot access the client, these new reminders are saved until connectivity is re-established and they can be downloaded. Lack of Internet connectivity means information from on-line sources will not be accessible; likewise, no maps or related information can be downloaded (Marmasse and Schmandt, 2000)

By comparison, PeGeon is only functional when online; i.e. the client must have connectivity to the server as there no data stored on the client. Connectivity is also essential for map information.
A notable GeoNote system is Foursquare; a location-based social networking application. It is predominantly game oriented with the goal of accumulating badges by checking in to locations frequently. User can also create to do lists for private use and add tips to locations for others to read.

![Foursquare Interface](image)

Figure 2-9: Checking in a location using Foursquare

Its popularity has grown significantly. “It took Foursquare just over a year to get to a million users. By comparison, it took Twitter about 2 years to get one million users” (Siegler, 2010). However, this popularity has come at a price - foursquare have had scalability issues (Saint, 2010) and problems with spam. Unlike PeGeon, Foursquare does not take any user profile attributes into consideration when displaying any (notes or game related activities). Users of foursquare cannot be matched on interests but rather on place labels. Unfortunately, fake place labels can be created along with spam tips. This is inherent in its design as any user can create a place label, leaving it wide open to abuse.
Chapter Three

3 User Overview of PeGeon

This chapter describes the user view of PeGeon; a novel system that takes a personalised approach to filtering geonotes based characteristics found in the user’s profile.

We will also discuss its personalisation features.

3.1 Overview

The application developed in this work was named "PeGeon" (is a portmanteau of Personalised Geonotes and is pronounced the same as pigeon).

PeGeon is built on a framework for the creation and delivery of personalised geonotes.

3.2 Personalisation

PeGeon uses several methods to determine the messages to display to any given user. A combination of the User Profile Chapter 3.3.1, Interests Chapter 3.3.3 and rules provided by the Personalisation Plug-ins Chapter 4.5.1 are used. These will be discussed in this chapter.

3.2.1 Inline Tags

Inline tags are used to compose messages to target specific users by;

- Username (\#username)
• Profile Attributes (e.g. #age)
• Interests (#<keyword> where <keyword> is replaced with the actual interest)
• Distance (#range) to posted message
• Time to live/Stickiness (#duration)

A note can be targeted to specific user or a group of users. Using the #username tag in the message will ensure visibility only to the specified user.

Tags are prefixed with the hash (#) character to denote reference to a user attribute or profile variable. Consider the following notes of varying styles:

3.2.1.1 Internal Memo Style

   Free cupcakes at the school canteen today for all third-graders! #age:8-9 #HarwoodHigh

   This message is only visible to users aged between eight and nine years old that have an interest in HarwoodHigh.

3.2.1.2 Educational Style

   The following scenario applies a personalisation experience to adults and children visitors of a museum.

   Many #spiders have unusual body shapes and colours. #age:5-15

   This message is only visible to users interested in spiders and aged between five and fifteen.

   Worldwide there are about 70,000 species of #arachnids of which 36,000 are #spiders. #age:16+

   This message is only visible to users interested in spiders and aged sixteen or over.

3.2.1.3 Reminder Style

   #user:bobbarker Can you please leave the book here when you are done reading it? Thanks #duration:2weeks
Chapter 3. User Overview of PeGeon

3.2. Personalisation

This message is only visible to a single user - bobbarker. Bob is able to view this message for two weeks since the time of posting.

#user:self Don’t forget the milk! #duration:1year

This message is only visible to a single user – the user that composed the message. Bob

This message is visible one year since the time of posting

3.2.1.4 Community Notice Style

#range:1km Sausage sizzle $2 available today only
#duration:1day

This message is only visible to those within a one kilometre range of the posted location. The note is visible for one day only.

3.2.1.5 Social Networking Style

I’m looking for a #tennis partner to improve my game and general #fitness. There is free entry to the tennis court at #CoogeeHigh on weekends. Is anyone interested? #range:4km #duration:4weeks

This message is only visible to users listing tennis, fitness or CoogeeHigh as their interests, within a four kilometre range of the posted message. The message is only visible for four weeks of posting.

3.2.1.6 Commercial Advertising Style

End of season #fashion clearance #sale. 50-60% off all #clothing. Limited time only!
#duration:1week #gender:f #age:15+ #range:30km

This message is only visible to all females within thirty kilometres listing fashion, clothing or sale (or any variation of) as their interests.

3.2.1.7 Inline Processing

If the message contains multiple inline tags of type interest, recipients must have at least one of those interests listed in their profile. However, messages with inline tags referencing multiple profile attributes are only visible to users satisfying all the conditions.
For example, the note in 3.2.1.6 is only visible to all females aged 15 and over (denoted by (#gender:f #age:15+). Both these conditions must be satisfied since they are profile attributes. The note has additional condition. The user must have an interest of fashion or clothing (as denoted by the interest tags #fashion #clothing). Only one of these needs to be listed as a profile interest to qualify as a recipient for this note.

3.3 Usage Scenarios

The PeGeon user interface adheres to the Apple design guidelines where applicable.

This paper presents the PeGeon System. The application provides the following functionality:

3.3.1 Register with the Application

To use PeGeon, the user must first register. The registration screen presents the user with basic profile fields as shown in Figure 3-1. The user enters the attributes which then makes up the User Profile.

![Figure 3-1: Registration Credentials 1](image-url)
Registration includes the following attributes:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The first and last name of the user. This is used as the display name in the application.</td>
</tr>
<tr>
<td>Login</td>
<td>The login name is the unique identifier used to distinguish this user from others in the PeGeon system.</td>
</tr>
<tr>
<td>Password</td>
<td>A password used to sign onto the system.</td>
</tr>
<tr>
<td>Email</td>
<td>An email address which can be used by other PeGeon as an alternative means of communication.</td>
</tr>
<tr>
<td>Describe Yourself</td>
<td>Free form text field allowing the user to provide a description of oneself.</td>
</tr>
<tr>
<td>Gender</td>
<td>The gender of the user. This may be used later to filter messages targeted for a specific gender.</td>
</tr>
<tr>
<td>Date of Birth</td>
<td>The date of birth can be valuable for personalisation. It can be used to target a certain age group when composing a message.</td>
</tr>
<tr>
<td>Profile Visibility</td>
<td>The user is presented with the option of keeping the profile private, or to share personal attributes with the world.</td>
</tr>
<tr>
<td>Avatar</td>
<td>The avatar allows the user to provide a profile portrait, or image representing one’s mood.</td>
</tr>
</tbody>
</table>

Table 3-1: Profile Entry Fields
Once the user registration process is complete, the data is stored as the User Profile in the PeGeon database.

The registration screen Figure 3-2 features a Back button to return to the previous screen and a Done button to save all entered data. The profile information entered can be amended later via the User Profile accessible from the main menu.

3.3.2 Login and Logout

The login screen (Figure 3-3) presents the user with the option to create an account or log into the application. Selecting the Create my PeGeon account button will present the Registration process Figure 3-1.
Chapter 3. User Overview of PeGeon

3.3. Usage Scenarios

The login details used here is the login name and password chosen during registration Figure 3-1. This begins the user’s session in PeGeon until the application ends or the user chooses to logout of the application Figure 3-4.

Logging out of the application is not required. Upon application exit, last login details are stored automatically. These credentials are then used to login the same user automatically upon the next launch of PeGeon. This is a convenience feature as it is typical that the iPhone mobile device is mostly used by the one owner/user.

It is important, however, to note that the log off function is available in the event that another user wishes to login to the application (as shown in Figure 3-4).
The current user is also displayed in the settings screen. This user represents the current active session in PeGeon.

### 3.3.3 Interests

The *Interests Screen* displays a collection of the user defined interests in a visual list format *Figure 3-5*. This list is used by the personalisation engine to filter messages. By providing an easy to maintain list, the user is able to add, delete and edit existing interests. It is important that the user is able to enter these quickly and easily (Persson *et al.*, 2003).

To add an interest, the user first selects the `edit` button at the upper left corner of *Figure 3-5*. This enters the screen into edit mode. The user then selects the `(+)` add button and is presented with a text field in which to enter the new interest (see *Figure 3-7*).

The interests that are entered here become directly associated with the User Profile *Figure 3-1*. If the same interest is entered on both the User Profile screen and on the Interest screen the duplicity will not influence the personalisation engine.
For example, if the user is interested in spiders, coffee, basketball, stamps, skydiving and jazz – then these can be entered in the Interests screen Figure 3-5. Alternatively, the user may choose to enter this information in the Describe Yourself section of the User Profile screen Figure 3-1 with the following entry:

“I enjoy drinking coffee with friends in my downtime. My interests include collecting stamps and researching spiders. I enjoy playing basketball and am currently learning how to skydive. I am also a bass player in a jazz band”.

Here the user has used a free text field to describe his/her interests and hobbies.

The Interests list along with the Describe Yourself entry is submitted and stored on the server in an SQL database. The personalisation engine uses this data to determine which messages should be visible to the user.

Figure 3-5 : User Interest List
Entering a new or editing an existing Interest is done in the Enter User Interest screen Figure 3-6. Interests can be entered as individual word (e.g., equestrian) or as a multiple word entry or phrase (e.g., monster trucks). The user is provided with a back button to return to the previous screen and a save button to commit the entry.
A user’s interest may change. This could be due to a change in preference over time, or a sudden change of interest due to travels in a new country as a tourist. A user can remove an interest using the Interests Screen as shown in Figure 3-7. For example, to delete the entry skydiving, the user taps the edit button. This will change the screen into edit mode. A series of red circular bullet glyphs appear at the left of the screen. On selecting the red bullet alongside skydiving, the delete button appears. This serves as a confirmation step for the user. To cancel the delete, the user then presses on the same red bullet. To delete, the user taps the delete button and the entry is then removed.

3.3.4 Post a Message

A core function of a geonotes system is the ability to post a message at the current location. To compose a message, the user selects the Compose Message Icon as shown in Figure 3-8.
Figure 3-8 Compose Message Icon

The icon is at the upper right on both the Message Map Figure 3-10 and Message List Figure 3-12 views.

In PeGeon, the message has two user entry components;

1. The message.

2. The keywords (or metadata) used for personalisation.

For example, the user may share some information about spiders by posting the message;

“Spiders belong to the ancient group of animals called the Arachnida.”

This constitutes the actual display message presented to the recipient upon reading the message.

The keyword component however is not displayed to the reader. The author uses this section to enter keywords related to the message. In this case, it is simply “Spiders”. The keywords may or may not be present in the display message itself. There is no requirement for this. It is perfectly acceptable to enter keywords that do not appear in the message.

Take for example the following GeoNote

“I’ve just spotted the biggest Daddy Long Legs I have ever seen. It’s on display here for 3 weeks. Come check it out!”

Keyword: Spider

In this case the keyword spider did not appear in the message, yet clearly it is a reference to a type of spider. By providing the context in the keywords section, the personalisation engine does not need to determine the topic of the message. This is useful in many situations including the abovementioned example.
Persson et al., (2001) states that “In order to promote (en masse) annotations, a basic user requirement is that authoring and placing should be quick and easy. A GeoNote should be neither difficult nor time-consuming to produce, and the interface has to allow such spur-of-the-moment authoring in ergonomically uncomfortable and noisy mobile circumstances (cf. the Post-it note). At the same time, it should be filled with content that is meaningful and somewhat structured, in order to support readers’ navigation of them”.

PeGeon follows this recommendation by providing an easily accessible Compose Message Icon and minimal message entry fields for the user to post a message Figure 3-9.

The user is provided with a back button to return to the previous screen and a save button to commit and post the entry.

When the post is saved, the composed message, metadata and currently location is sent to the server and stored in the SQL database.

3.4 Message Delivery

The message delivery mechanism allows users to read notes left by others.
There are several methods of presenting message lists, details and statistics to the user. Some examples have been discussed such as that of Griswold Figure 2-6: Active Campus and Persson Figure 2-4: GeoNotes Main Message Window. PeGeon presents multiple views of the message list. Two of these views are as follows:

- Message Map View
- Message List View

3.4.1 Message Map View

The Message Map View Figure 3-10 provides a geographical representation of the messages left by PeGeon users. Each pin represents exactly one message.

![Figure 3-10: Message Map View](image)

The iPhone implementation of PeGeon allows a pinch-zoom gesture to allow the user to zoom in and out of the map. The number of pins (or messages) shown can be controlled by this action. The user can zoom out to see notes left in a wider area of the map. Conversely, zooming in focuses on a smaller area results in fewer pins displayed.
To see the actual message represented by the pin, the user taps the screen over the pin itself. The action then activates the breadcrumb view above the pin (Figure 3-11). A part of the message is shown along with the user name and avatar.

![Breadcrumb Message](image)

Figure 3-11: Breadcrumb Message

By tapping on this breadcrumb the user is then displayed the full message in the Message Details View Figure 3-13.

### 3.4.2 Message List View

PeGeon provides an alternate view of the message list. Upon selecting the List button from the main menu, the user is presented with a tabular view of the messages. The messages shown are determined by the rules set in the Map View Figure 3-10.
Figure 3-12: Message List View

Each message displayed Figure 3-12 shows the following items:

- The author’s name within PeGeon- this is the name of the author that composed the message. The first message on the screen Figure 3-12 shows bob barker as the author.

- The author’s avatar within PeGeon - the avatar of the author appears on the left of the message.

- A snippet of the message – this is a small part of the actual message. As with the breadcrumb on the web, it provides a preview to the complete message and often provides enough of the message for the user to decide to either ignore or choose to view it in its entirety. The first message on the screen Figure 3-12 reads “A few spider species have invaded the ocean’s edge, living in the rock and coral crevices of…” This snippet is only a preview of the full message.

- Details Icon – By tapping the Details Icon (represented by the right facing arrow) the user is presented with message details Figure 3-13.
3.4.3 View Message Detail

Viewing Message Detail is achieved by either selecting a pin from the Message Map View Figure 3-10 or selecting a row from the Message List View Figure 3-12. Several components of the message is displayed (Figure 3-13);

- The Author Name. The author of the note, Alice Amber, is displayed clearly near the top of the screen.
- The User Name – Alice’s username aliceamber is displayed. This is useful for replies to a specific user.
- The User Email Address – If the author provides an email address in the user’s profile, it will optionally appear along with the note.
- The full message left at the selected location – The full message appears in the middle of the screen in its entirety. If the message can contain hyperlinks and
phone numbers, these items are recognised by PeGeon as such and are automatically hyperlinked as a result. The user may click on a hyperlink to launch the web browser (for URLs) or to launch the phone dialler (for phone numbers).

- Profile Interests of the User (if marked public). The author may nominate to have their profile interests made public with each note.
Chapter Four

4 System Architecture

4.1 The Overview

This chapter describes the high-level architecture and technical implementation details of the PeGeon system.

4.2 High Level Architecture

PeGeon is comprised of two main systems – the server side and the client side application. The server side comprises of a web application and a SQLite database\(^3\). The web application (WAR) is developed in Java\(^4\) and deployed to Apache Tomcat\(^5\). The client application is an iPhone\(^6\) application (IPA) developed in Objective-C and deployed to the iPhone platform.

The architecture of an application plays a significant role. It is the architecture which makes the application development either simple or complex. It is the architecture that addresses elements such as performance, scalability and maintainability. PeGeon is developed with the \textit{n-tier} paradigm.

\(^3\) SQLite, http://www.sqlite.org, 2010
A tier is a functionally separated hardware and software component that performs a specific function.7

The first tier is responsible for the presentation and user interaction. The user interacts with the PeGeon client (iPhone) application. The client contains first tier components which enable the user to interact with the second tier process in a secure and intuitive manner.

The second tier is the application logic layer. The PeGeon server runs a Java application deployed to Apache Tomcat. The first tier communicates with this server via RESTful JSON over HTTP. A HTTP request is typically sent to the web application for each user action. For example, the user enters and submits login details. A HTTP request is initiated and received by the web application. The web application processes this request and returns a response. During this processing, the web application requires login validation.

To do this, it accesses a third tier – the data layer. The PeGeon database resides in this tier. It is the storage facility for all users and their interests, tags and messages.

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7 Scaling the N-Tier Architecture, Sun Microsystems, 2000
8 Communication security provided with HTTPS – (optional)
This separation of concern (SoC) is beneficial in several ways. Distinct features are isolated with as little overlap as possible. As a result, components can be optimised independently of each other and failure of one subsystem does not cause another to fail. The architecture is also easier to design, manage and scale (see Ch 4.6).

4.3 Database Schema

The SQLite database is a lightweight transactional SQL database engine and is found in the third tier. The web application communicates with the DBMS using a Type-4 JDBC driver.

The database is split into several normalised tables;

- messages; PeGeon notes are stored in the messages table, including associated position information (longitude and latitude) and posted date.
- users; registration information and account details are stored in this table.
- interests; user interests are stored in the interests table.
- tags; message tags are kept in the tags table.
• sessions; an audit of all logins are recorded in the sessions table.

4.4 Implementation

PeGeon is comprised of both the server side component used for data persistence and personalisation, and the client side component responsible for the user interface. These are discussed here;

4.4.1 Client

The iPhone client was developed in Objective-C. The user interface adheres to the iPhone idiom and leverages this using the UIKit in the Cocoa framework. The communications protocol between the client and the web application server is RESTful JSON. JSON (JavaScript Object Notation) is a lightweight text-based open standard designed for human-readable data interchange. PeGeon uses both the YAJL-objc (a JSON library for Objective-C) and ASIHTTPRequest. ASIHTTPRequest is wrapper in Objective-C providing a straightforward interface for submitting data to and fetching data from webservers. All requests are sent in JSON format using a HTTP POST. All requests are sent via HTTP POST (see Appendix D for full protocol definition);

Request format: { "method": "method name", "params": ["JSON encoded request params"], "id": session token }

Response format: { "result": "JSON encoded response", "error": null or error object , "id": session token}

The JSON request is triggered by a tier one component as a result of a user action. Once the request is processed, the JSON response is returned and reflected in the user interface. For example, a user navigates the user interface to login. The following JSON request is generated;

---

In this example, the method is defined as login, passing in parameters of *bobbarker* and *mypass* as the account details.

The first tier represents a *thin* PeGeon client. The bulk of the application control logic is handled on the server, which is discussed in the following section.

### 4.4.2 Server

The second tier contains the PeGeon server. Several third-party libraries are used by the web application for communications and the plug-in extensions.

- **SQLiteJDBC** is a Java JDBC driver for SQLite (Crawshaw, 2010) and is used to provide data access to the PeGeon web application.

- **GSON** is a Java library that can be used to convert Java Objects into its JSON representation (Leitch, 2010).

- **JWI** (the MIT Java WordNet Interface) is a Java library for interfacing with WordNet (Finlayson, 2010). This is discussed in Ch4.5.1.2.

The PeGeon web application server has been designed and implemented using the MVC (Model-View-Controller) design pattern. MVC organises an interactive application into three separate modules:

- The application model with its data representation and business logic,

- The views that provide data presentation and user input,

- The controller to dispatch requests and control flow.

The package entities package contains the application *model* (Figure 4-3), which comprises of Interest, Message, Session, Tag and User representing the core model for the application.
The _view_ is found in the _results_ package. The view to the client mainly consists of JSON messages which are then converted back to the model in the PeGeon client. The controller on the server is the ServiceCore class. This calls on the corresponding delegates for each thread request received from the client.
4.5 Personalisation Engine

Every message posted is stored in the PeGeon database. As uptake of the system grows, so does the number of messages created. The database size will also increase to accommodate its growth. The system must be designed with scalability in mind. This is discussed in chapter 4.6. Over time, there will be millions of messages available in small regions on map. This is particularly true of densely populated areas such as cities and urban dwellings. Without any filtering mechanism, the user is overwhelmed with notes (see Figure 4-4). Navigating a screen with so many messages can be difficult. It can also be ineffective since the user will have to sift through so many to find one relevant or interesting.

Figure 4-4 : Unfiltered Messages

One solution to this problem of noise, as previously discussed, is personalisation. PeGeon uses a pluggable personalisation engine to deliver personalised (relevant) notes to users. This is achieved by applying several filters across the personalisation plugins. These plugins are discussed in chapter 4.5.1.
4.5.1 Plugins

The plugins provide an extension point to the PeGeon personalisation engine. By allowing these custom plugins, one may enhance the targeting abilities of PeGeon personalisation.

Figure 4-5: Flow Logic

Plugins determine whether a user interest matches a message (or message tag). This then determines whether the message is delivered to the user forming the core of the Personalisation Engine. The flow begins at step 1.1, with the user navigating the map on the PeGeon client (see Figure 4-5). The coordinates at the corners of the viewable map determine the range of messages to process. If the user zooms out of the map, the coordinates will encompass a larger geographical area. Conversely, zooming into the
map decreases the area encompassed by the coordinates. These coordinates are sent to the server with each map refresh or change in the map view. Having received this information, the web application retrieves all messages from the database that lie within the encompassed area defined by these coordinates. The Personalisation Engine calls on each plugin to process (or filter) the messages. The plugin will either accept or reject (Step 1.5) the message determining its visibility to the user. If any plugin declares a match, the note is considered relevant to the user. All plugins must reject the message for the note to be filtered.

![Personalisation - Class Diagram](image)

**Figure 4-6 : Personalisation - Plugins**

### 4.5.1.1 Match Plugin

The Match plugin tests whether string representation of the *message* tag is equal to that of the *profile interest*. A case insensitive string equality check is performed. For example, if the user has listed “spider” as an interest in the User Profile screen (*Figure 3-5*) and a
message contains a tag of “spider”, then the message will be considered a match and result in the message being flagged as relevant to the user.

In this case interest matches tag exactly (spider = spider)

4.5.1.2 Partial Match Plugin

Sometimes a user may list an interest such as “football”. Messages tagged with “footballer” do not match exactly according to the Match plugin (Ch 4.5.1.1). The Partial match plugin will perform a substring check. In this example, interests match partially (Football = Footballer).

4.5.1.3 Profile Match Plugin

Some messages may be of interest to a user, if another user shares similar interests. In this case, the Profile Match plugin completely ignores message tags and checks whether the message author has common interests with the user (recipient). In this example Bob’s interests (Bob being the author) match Alice’s interests thus all messages of Bob within range is relevant.

4.5.1.4 Singular-Plural Plugin

The Singular-Plural tests whether interests match tags after a plural or singular format conversion. For example, if Bob’s interest is “mice”, this plugin will recognise a match with messages tagged with “mouse”. To implement this plugin, knowledge about the language used is required. A snippet of the algorithm providing singular to plural (and reverse) conversion is presented in Appendix C.

The simplest algorithm for generating arbitrary English plurals is simply to add -s to each word (clam -> clams, storey -> storeys, bag -> bags, etc.). Of course, this approach fails on many special cases (class -> classes, story -> stories, box -> boxes), and on the hundreds of irregular plural English nouns (criterion -> criteria, stigma -> stigmata, ox -> oxen). Nor does it cater for verbs (classifies -> classify, stores -> store, bobs -> bob) or adjectives (my -> our, her -> their, Bob’s -> Bobs’).

More complex algorithms that cope with specific suffixes (-ss -> -sses, -y -> -ies, etc.) can be specified, but pure suffix-based approaches will still be prone to exceptions and meta-exceptions. For example: -y becomes -ies, except after a vowel (when it becomes -ys), except for soliloquy (which uses -ies).
A usable pluralisation algorithm must therefore cope with three categories of plural formation: universal defaults, general suffix-based rules, and specific exceptional cases (Conway, 1999).

A Java port of this algorithm (see snippet in Appendix C) was used in PeGeon.

### 4.5.1.5 WordNet Plugin

WordNet is a large lexical database of English. Nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept (Miller, 1995). This is required for effective personalisation as the same objects or classes can be represented by different words or one object may belong to, or is related closely with another. For example Bob is interested in Arachnids and Alice has posted a note about spiders. Since spiders belong to the family of Arachnids, the interests of Bob and Alice in this scenario is the same. WordNet recognises this relationship and using this plugin, the message is flagged relevant i.e. (Arachnid = Spiders).

### 4.5.1.6 Target Plugin

This plugin enables notes to include inline hash tags for purposes of targeting notes to a specific user or groups of users based on their profile attributes. Hash tags are used inside the actual note. This is done by prefixing the tag with a hash symbol (#). This denotes a user interest or target user attribute.

e.g #user:aliceamber, can you please prepare the museum content for the third-grade students today?

The above message is only visible to aliceamber.

e.g. Only a few species of spiders can inflict bites that are potentially fatal to humans. 
#age:8-9

Here, the message is targeted to users aged between eight and nine years old. Inline tags are discussed in detail in Ch 3.2.1.
4.6 Scalability and Performance

PeGeon was designed with scalability in mind. The design consists of several tiers, each providing opportunity to scale vertically as needed to cope with increased usage.

PeGeon is implemented to take advantage of the multithreaded web container. This is the same design used in popular production servers handling high amounts of traffic.

To test the performance of the application, a small Java client was implemented to send JSON formatted requests to the web container (second tier). The client was used to simulate 300 users concurrently logging in to the PeGeon application. Each thread representing a user was started half a second (0.1s) apart to closer simulate a real-world scenario. Hence the test was complete in approximately 30 seconds (30s).

The results showed 100% of responses successfully completed. The simulation is configurable to allow increasing the number of threads (limited only by the operating system allowance).
Chapter Five

5 Evaluation Design

The goal of this thesis was to create a personalised geonotes system and assess whether the additional usability burdens associated with personalisation were overcome by the PeGeon design. The PeGeon system was created to explore a novel approach to delivering filtered location based messages to the user. This chapter describes the design of a qualitative evaluation of the usability of PeGeon. The purpose of this evaluation was to gain insight to how well users interact with the PeGeon system when composing and reading messages, to determine the effectiveness of the proposed personalised method and inform future research of this approach.

5.1 Evaluation Goals

The primary goal of this evaluation was to compare the personalised approach to delivering geonotes to that of unfiltered message delivery (i.e. no personalisation). Using the performance factors outlined by (Newman et al., 1995), the following aspects will be discussed:

- User interface and learnability
- Fundamental understanding of virtual notes
- Ease of use
Chapter 5. Evaluation Design

5.1. Evaluation Goals

- Effectiveness of personalisation
- The number of errors that occurred
- The method of error recovery
- Affective aspects of user preferences

5.1.1 Learnability

Learnability is a measure of the degree to which a user interface can be learned quickly and effectively (Newman et al., 1995). The time taken to learn the function or set of functions to complete a task is a typical measure. Generally, the more intuitive the user interface, the less time required for learning.

Having an intuitive User Interface was a key design goal for PeGeon. We followed the iPhone UI idiom to remain consistent with the expectations of the existing iPhone users. At the same time, the design was intended to be easy to learn, even for users unfamiliar with the iPhone. We aimed to create an interface that users could explore and discover functionality without training or the need to follow instructions.

The effectiveness of the user interface and the resulting learnability will be evaluated through a user study where participants are introduced to PeGeon for the first time.

5.1.2 Fundamental Understanding

A user may navigate through the screens of the application and seemingly use the functionality without really understanding the concept that the application has aimed to provide.

A fundamental question during design was - how can the system allow users to annotate geographical places by posting virtual notes on a mass-scale via their mobile devices? The composer’s and reader’s understanding of the place/position of the annotation becomes crucial. The user needs to understand that, similar to other geonotes systems, each message posted using PeGeon always has a virtual location associated with it. Unlike SMS messaging, geonotes have a geographical context and are generally visible to the world.
It is imperative to assess whether the user has grasped this concept during the user study.

### 5.1.3 Ease of Use

Another goal of PeGeon was *ease of use*. This is the measurable *success* of completing the tasks quickly. Usability is paramount when creating a geonotes system. We aimed to create an interface for users with varying technical strengths. If the application is easy to use, it is more likely to gain widespread adoption. With increasing popularity, there will be more contribution resulting in a socially richer information space. Consider the task of composing a message. “In order to promote (en masse) annotations, a basic user requirement is that authoring and placing should be quick and easy. A GeoNote should be neither difficult nor time-consuming to produce, and the interface has to allow such spur-of-the-moment authoring in ergonomically uncomfortable and noisy mobile circumstances” (Persson *et al.*, 2003).

This ease of use will be assessed through a user study where participants are introduced to PeGeon. The study design will track success and errors when performing the set tasks.

There are several aspects that require analysis in the PeGeon user study. The most obvious aspect is whether the users were able to successfully complete the set tasks provided.

First, the user may be unable to find the desired function in the application. It is important that the functions are obvious to the user when required. If the user wishes to compose a message, then the action required to initiate this must be readily accessible and intuitive to use.

Second, the user will be presented with potentially large amounts of information. The map and list view of messages show thousands of messages when there is no filter in place. This may be initially daunting for a user when being introduced to the application.

### 5.1.4 Effectiveness of Personalisation

One of the main goals of this thesis is to measure the effectiveness of the personalisation of geonotes. This is a challenging task as there is no standard guide. We propose measuring the effectiveness of personalisation by evaluating users’ feedback. By presenting the personalised messages in a given task and comparing the result with an
unfiltered list of messages, the user may decide whether the personalisation has successfully filtered unwanted items.

Since the goal of personalisation is to increase the user’s social awareness, decrease noise and unwanted message, user feedback is invaluable when determining the success of the personalisation engine.

### 5.1.5 Error Frequency

In the context of this thesis, an error is defined as any incorrect movement through the application that does not achieve the desired result as set out in the user study. The number of errors made is recorded on a per-task and per-participant basis. This is a critical aspect to consider because of its impact on adoption. Refer to Ch 5.1.3.

### 5.1.6 Error Recovery

In the context of this thesis, error recovery is defined as the ease with which a user can recover from any errors as defined above. The ease of recovery is determined by:

- Analysing if the user can recover without assistance.
- Return to the previous path of exploration and correct their error by taking an alternate path or start an entirely new path of exploration that leads the user closer to completing the task.

Error recovery must be evaluated to determine the impacts of making an error, refining and considerations in the user interface, and success in task completion.

The error frequency (Ch 5.1.5) and return path was recorded as part of the user study.

### 5.1.7 Affective Aspects

Another important aspect is to explore the user perception of their experience. The purpose of evaluating affect is to determine what people perceived when using PeGeon. Perceptions on the effectiveness of personalisation are also a critical aspect to consider.

### 5.2 Experimental Design

The experiment was designed to consist of three main sections:
Chapter 5. Evaluation Design

5.2. Experimental Design

1. a questionnaire regarding their background experience;

2. a series of tasks; and

3. a post-experiment questionnaire regarding their experiences competing tasks.

5.2.1 Experiment Participants

Background information was gathered from the participants in the form of a questionnaire. This information is required to conduct a careful and meaningful analysis obtained in the experiment. Participants were chosen to represent a range of different ages, genders, occupations and skill. It was also important in this evaluation to gain a sense of how familiar each participant is with the iPhone, previous exposure to similar mobile applications and general demographic information. The information obtained included the participant’s occupation, average number of times they use other phone applications a week, a description of what types of applications used and other background questions.

<table>
<thead>
<tr>
<th>User</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>30</td>
<td>27</td>
<td>39</td>
<td>29</td>
<td>52</td>
<td>36</td>
<td>30</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Occupation</td>
<td>Human Resources Manager</td>
<td>High School Teacher</td>
<td>IT Professional</td>
<td>Construction Management</td>
<td>Secretary</td>
<td>Pharmaceutical Rep</td>
<td>Tradesman</td>
</tr>
<tr>
<td>Skill Level</td>
<td>Competent</td>
<td>Skilled</td>
<td>Advanced</td>
<td>Limited</td>
<td>Limited</td>
<td>Skilled</td>
<td>Competent</td>
</tr>
<tr>
<td>Primary mobile device is iPhone</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
A total of seven people participated in the experiment. A summary of participant demographics is shown in Table 5-1. Participants are referred to by participant number.

Apart from P5, ages ranged from 27 to 36, which is an age group that is more familiar with technology (see Figure 5-1). Participants from four women and three men were selected with varying skill levels to characterise the population. Users were asked to rate their skill in the questionnaire (Appendix A) varying from no skill to advanced;

- (N) None
- (L) Limited
- (C) Competent
- (S) Skilled
- (A) Advanced

All seven participants owned a mobile phone, however only four of those were iPhones. Since users of the iPhone were already familiar with the iPhone idiom, we needed to
consider this in our analysis. Some were more familiar than others. This is quantified by the *months of usage* as shown in Table 5-1.

Participants were selected from a diverse range of backgrounds – the occupations of participants included a teacher, human resources manager, IT professional, construction manager and secretary.

### 5.2.1.1 Limitations

There are several limitations in the user study design that are worth noting. The demographics of the participants, particularly the age group, are more familiar social networking applications and technology in general. All but P5 in the user study belong to the 25-35 and 35-44 bands as shown in Figure 5-1. This is a definite bias toward a group that is more likely to embrace new applications and technological concepts.

![Average age distribution across social network sites](image)

*Figure 5-1: Average age distribution across Social Network Sites (Nurmi, 2010)*

The sample size of seven is also another limitation. While the group can provide invaluable feedback in the evaluation study, it may not accurately represent the population. The goal of this thesis, however, is to create an intuitive, easy to use *Personalised Geonotes* system and this should give useful insights for this range of users.

### 5.2.2 Experiment Conditions and Briefing
Participants were asked to partake in the usability study individually. The experiment took place in a small room with a desk, the questionnaire (*Appendix A*) and writing material. The experimenter (the author) was also present for the duration of the experiment. Each participant was briefed with the following:

- the purpose the experiment,
- a description of the application;
- followed by the process of the experiment.

These were items were explained as follows;

“Welcome to the PeGeon usability study. You have been selected to participate in an experiment to test the usability of a new application.

The experiment consists of two parts.

The initial part is a request for background information in form of a questionnaire. This is a series of questions based on your age, occupation and experience with applications on your mobile device. Your personal information (i.e. name) will not be required. Information recorded will remain anonymous to protect your privacy.

The second part of the experiment will involve you executing tasks on the iPhone which will be supplied to you. You are expected to *think-aloud* when carrying these tasks. Think-aloud is as it implies “to say out loud what you are thinking” whilst using the application. The purpose of this is to learn the ways in which people use the application for purposes of improving the design. For example, if a certain task requires many numbers of steps to perform, or is too confusing for the user to carry out, then this will indicate a need for improvement in those design areas. You will be assisting the quality and usability of future revisions with your feedback.

I will now present you with a description of the application.

The application, called *PeGeon* (a portmanteau of Personalised Geonotes) allows users to create and post notes to virtual locations. These notes are
similar to SMS messaging in length and composition, but are usually targeted to a wider audience and are always associated with a geographic location. The notes can then be read by other users of the application. Their visibility to any given user is determined by the interests and other elements in the user profile of that user. This is called personalisation.

If you are now ready to begin, please proceed to fill out the questionnaire in front of you.

We will then begin with the tasks.”

The concurrent think-aloud (CTA) feedback approach is used as the user executes the tasks as it is less intrusive to the participant during the experience (Karahasanovic et al., 2009) and leads to more precise results than the feedback collection method (FCM). FCM is used however near the end of the experiment for feedback in the form of an open discussion.

The demographics for questionnaire feedback was collected and presented in Table 5-1.

The list of tasks each participant follows is discussed in Chapter 5.2.4

### 5.2.3 Hypothesis

We aim to prove several hypotheses in user study. These are listed in Table 5-2.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>The user is able to identify and launch the application.</td>
</tr>
<tr>
<td>H2</td>
<td>The user is able to easily navigate through the application menus.</td>
</tr>
<tr>
<td>H3</td>
<td>The user can easily find and read notes posted by others.</td>
</tr>
<tr>
<td>H4</td>
<td>The user can easily compose and post a note.</td>
</tr>
<tr>
<td>H5</td>
<td>The user understands the relationship between different views of the notes.</td>
</tr>
<tr>
<td>H6</td>
<td>The user understands the association of notes to location.</td>
</tr>
</tbody>
</table>
5.2.4 Participant Tasks

This section of the experiment was designed so that users followed a series of predefined tasks to be executed using the PeGeon application. The output of these tasks will be used as the input for analysis in Chapter 6.

Each participant was asked to perform the experiment on their own without any help or support from one another. No questions were to be asked while the experiment was in progress. The PeGeon application was preloaded with test data (see Appendix B).

The tasks in the user study are split into the following sections:

- Initiation and Account creation
- Map View tasks
- List View tasks
- Message Detail tasks
- Message Composition
- Interests
- User Profile tasks
- Login/Logoff the application

The tasks in each section are described as follows, with explanations of their design and purpose:

<table>
<thead>
<tr>
<th>Task #</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>H7</td>
<td>The user understands the use of tags.</td>
</tr>
<tr>
<td>H8</td>
<td>The user understands the personalisation feature.</td>
</tr>
</tbody>
</table>

Table 5-2: The Hypotheses for User Study
| ET1 | Start the PeGeon application. |
| ET2 | Create an account based on the details outlined in Table 5-4. |
| ET3 | Describe the account creation process. Why is this required? Would you add or change any of the information requested in this process? If so, why? |
| ET4 | Logout out of the application, then login to the application again. |
| ET5 | Using the standard pinch and spread gestures, navigate the map to the Australian Museum located at 6 College St, Sydney. |
| ET6 | Locate three (3) pins and read aloud the breadcrumb message and the note author. Record what you deduce each note to be about. |
| ET7 | Locate the List view of notes. Read aloud three (3) notes that were composed by different authors. When was each note posted? |
| ET8 | How is the number of notes shown in the List view associated with those shown in the Map view of the previous task? |
| ET9 | Locate the GeoNote left by Bob Barker with the message “Only a few species of spiders can inflict bites that are potentially fatal to humans.” What are the tags associated with this note? |
| ET10 | Post a note to the current location containing the following text (refer Ch 5.2.4.5) |
| ET11 | Compose a second message to the current location containing the following text (refer Ch 5.2.4.5) |
| ET12 | What do you suggest the tags are used for? |
| ET13 | How is posting a message in PeGeon different from SMS messaging? |
| ET14 | Locate the Interest screen and enter the following interests (refer Ch 5.2.4.6). |
| ET15 | What is the purpose of doing this? |
| ET16 | Remove the interest "spiders" from the Interests screen. Now navigate to the Map view and notice the number of messages displayed. |
5.2.4.1 Initiation and Account Creation

**ET1. Start the PeGeon application.**

The very first step in using any application is the launch action. The user was required to start the application from the iPhone *Springboard*. The iPhone Springboard is the standard launch menu for the iPhone platform. At the start, the PeGeon icon appears as shown in Figure 5-2. Users familiar with this platform were expected to fare better than those that were unfamiliar.

![Figure 5-2: The PeGeon Launch Icon](image)

**ET2. Create an account based on the details outlined in Table 5-4;**
<table>
<thead>
<tr>
<th>Entry Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Joe Bloggs</td>
</tr>
<tr>
<td>Login</td>
<td>joebloggs</td>
</tr>
<tr>
<td>Password</td>
<td>password123</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:joebloggs@mail.com">joebloggs@mail.com</a></td>
</tr>
<tr>
<td>Describe Yourself</td>
<td>I am a postgraduate student at the University of Sydney. I enjoy playing squash, tennis and football. I also like to watch movies and go out to dinner with friends.</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
</tr>
<tr>
<td>Birth date</td>
<td>29 April 1975</td>
</tr>
<tr>
<td>Profile Visibility</td>
<td>Show my profile to everybody</td>
</tr>
<tr>
<td>Avatar</td>
<td>Take a picture of yourself using the camera option and use as the avatar</td>
</tr>
</tbody>
</table>

Table 5-4: Details for the account creation task.

This step required users to locate the button to register an account with the application and enter the details as shown in Table 5-4. Basic iPhone skills are required to complete this task. It demonstrates that the user is familiar with:

- Basic data entry using the keyboard
• Basic navigation on this particular platform

• Ability to use the widgets available to the iPhone idiom (e.g. date selection, and photo selection tools)

It is also intended to introduce the concept of a PeGeon account.

**ET3. Describe the account creation process. Why is this required? Would you add or change any of the information requested in this process? If so, why?**

This questioning assists in evaluating if the participants understand account creation. It forces the participant to think about the data being provided. It is designed to prompt discussion about which details would be useful in sharing with others and those which could potentially lead to a privacy concern.

**ET4. Logout out of the application, then login to the application again.**

When a user registers with PeGeon for the first time, the application remembers the user and password login information until such time the user explicitly logs out. This allows the user to launch the application in future without having to enter login information each time. This is a feature provided purely for convenience.

The user, of course, has the option to log out of the application. This task tests the user understands the login/logout process and the stickiness of their account credentials.

### 5.2.4.2 Map View tasks

**ET5. Using the standard pinch and spread gestures, navigate the map to the Australian Museum located at 6 College St, Sydney.**

A core design objective for PeGeon is the ease with which the participant navigates the map to find elements such as a street, suburb or geographic location is. The map is one of several methods to find a GeoNote. Metrics are taken on how effective this method is.

**ET6. Locate three (3) pins and read aloud the breadcrumb message and the note author. Record what you deduce each note to be about.**

One of the most fundamental requirements of any GeoNote application is the ability to read messages posted by others. These messages must appear to be associated with a
location and at a minimum contain an author (who may be anonymous or have an alias) and a note.

5.2.4.3 List View tasks

*ET7. Locate the List view of notes. Read aloud three (3) notes that were composed by different authors. When was each note posted?*

The List view presents an alternative representation of the geonotes. All messages are ordered by time of creation and are shown accompanied with an avatar of the author. Selecting specific messages requires basic navigation and understanding of the GeoNote composition.

*ET8. How is the number of notes shown in the List view associated with those shown in the Map view of the previous task?*

The messages shown in the List view is constrained by those messages displayed in the Map view. By zooming out of the map, messages (represented by pins) increasingly appear. Conversely, by zooming into the map, messages increasing disappear. The user can control the amount of messages displayed by using this action. These same messages appear in the List view in a tabular format.

5.2.4.4 Message Detail tasks

*ET9. Locate the GeoNote left by Bob Barker with the message “Only a few species of spiders can inflict bites that are potentially fatal to humans.” What are the tags associated with this note?*

The message detail is the only screen which provides the user with the complete message. It also shows the associated tags of the message, email address, author name and username.

The participant should understand the composition of the message and the importance of the associated tags.

5.2.4.5 Posting a message
ET10. Post a note to the current location containing the following text;

“One of the most dangerous of all spiders is the Sydney Funnel-web spider.”

Enter (associate) the following tags for this note;

- spiders
- funnel-web
- danger

ET11. Compose a second message to the current location containing the following text;

“Be sure to see the latest exhibition at the Australian Museum!”

Enter (associate) the following tags for this note;

- exhibition
- museum
- historical artefacts
- education
- paintings
- sculptures

ET12. What do you suggest the tags are used for?

One of the most fundamental requirements of any GeoNote application is the ability to compose a message and post to a location for others to see. This task is designed to be intuitive to initiate and quick to complete. The participant will be measured on the time taken to post the message.

Another important concept is the tagging of the message. Since these will determine the message visibility, it is imperative the participant demonstrates and understanding of the role of the tags.

ET13. How is posting a message in PeGeon different from SMS messaging?
Unlike SMS messaging, geonotes have a geographical context and are generally visible to the world. The user demonstrates an understanding by explaining the difference between the familiar and our novel geonotes system.

5.2.4.6 Personalisation

There are various methods employed by PeGeon to determine which message is displayed to any given user. A combination of the User Profile Chapter 3.3.1, Interests Chapter 3.3.3 and rules provided by the Personalisation Plug-ins Chapter 4.5.1 are used

ET14. Locate the Interest screen and enter the following interests;

- museums
- education

ET15. What is the purpose of doing this?

ET16. Now navigate to the Map view and notice the number of messages displayed.

ET17. Explain the result.

The interests listed determine the messages displayed. By drawing on the participant’s interests, PeGeon was able to personalise the messages and only present those relevant to the user.
Chapter 5. Evaluation Design

5.2. Experimental Design

Collectively, the experiment tasks satisfy the hypotheses of evaluation design (Table 5-5).
The Hypotheses are listed in Table 5-2.

<table>
<thead>
<tr>
<th>ET7</th>
<th>X</th>
<th>X</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ET8</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>ET9</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET10</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET11</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ET12</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>ET13</td>
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<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>ET14</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Table 5-5: The Related Tasks for each Hypothesis
Chapter Six

6 Evaluation Results

This chapter presents the results of a qualitative user study of PeGeon, the Personalised Geonotes system, and explores the critical aspects of its usability. Analysis into the novel approach of personalised geonotes is also presented.

6.1 High Level Results

Table 6-1 lists the main high-level results obtained in the evaluation. These were based on the participants’ think-aloud process during the experiment.

The tasks were either measured based on success of completion or level of understanding. A task requiring navigation or entry of data to complete was measured by the number of attempts the participant had taken. A value of one (1) represented a successful completion on the first attempt, a value of two (2) represented a successful completion on the second attempt and a value of three (3) represented a successful completion on the third attempt. If the task was not completed, then the participant scored U representing an unsuccessful completion.

If the task was a question or request for feedback, then the level of understanding was graded. A value of one (1) represented a correct understanding, a value of two (2) represented a partial understanding, and a value of three (3) represented a weak understanding. If the feedback demonstrated the participant did not understand, then U represented the score.
### Table 6-1: Task Execution Results

<table>
<thead>
<tr>
<th>Tasks</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>2</td>
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<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ET10</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ET11</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ET12</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>U</td>
<td>1</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>ET13</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ET14</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ET15</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>ET16</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ET17</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

1 = Success - 1st Attempt (or level of understanding)

2 = Success - 2nd Attempt (or level of understanding)

3 = Success - 3rd Attempt (or level of understanding)
6.2 Usability Results

Each task is scored and represented in Table 6-1. In this section, the tasks are discussed further detail.

**ET1**

All participants were able to find and launch the application. Both, users familiar with the iPhone and unfamiliar alike, quickly located the PeGeon icon found on the SpringBoard and tapped it correctly to activate the application.

**ET2**

When prompted to create a new account participants P2, P6 and P7 mistakenly entered the login and password data from Table 5-4 without first selecting the “Create my PeGeon Account’ button (as seen in Figure 3-3). These three participants had taken approximately thirty seconds to realise they had entered data for the login process instead of the account creation process and corrected their steps by selecting the create button. Participants P1, P3, P4, P5 and P6 all began the create account process correctly by selecting the create button.

There was also some confusion as to the length of the profile as presented by the screen at any one time. Without scroll bars present, participants P1, P4 and P5 entered the data only for the fields visible on the screen. They then prematurely clicked on the done button without further scrolling down to complete the rest of the fields in the registration process.

Case sensitivity was only adhered to by Participants P1, P2 and P3. These participants entered the data exactly as shown in Table 5-4.

The text entry auto-completion feature proved more of a hinderance than helpful during registration. Particularly the fact the auto-complete produced an extra space when activated. This extra space was problematic in the username field as this extra character, while invisible to the user, was not trimmed and was recorded as part of the username upon registration. Only participant P2 knew how to use the auto-complete feature effectively.
ET3

When asked for feedback on the registration process, most participants had little to add about the information entered. They did, however, ask that the entry process be made more intuitive. Participant P1 suggested that the lack of scrollbars failed to indicate there were more fields in the registration process than was visible. P1 suggested a message “scroll down to continue” be present to alert the user there are more fields found below.

Participant P2 suggested that the user should have “interests” associated, and that these should be directly found in the registration screen.

Participant P6 was “sufficiently pleased enough”. P6 liked the registration process and the fact that all entry fields were found scrollable and in the one place. No participant raised any issues regarding privacy concern or any concern relating to irrelevant or meaningless profile information.

ET4

All participants clicked through the menus in search of the Logout button Figure 3-4. Since this button is used very rarely, this was not highlighted as a concern.

All participants were able to login successfully the first attempt except for P1 and P7. Participant P1 used the auto-complete feature when entering the username which automatically appended a space character causing login to fail. Participant P7 click on the create button to login again. It was not long before the participant realised this was a mistake and made corrections.

ET5

Participants were asked to find a particular location on the map. The starting position was roughly thirty kilometres out. All but participant P7 used the spread gesture to zoom out of the map, and then pinch to zoom into the pins. P7 found the pins eventually by simple navigation. All were successful in finding the location.

ET6

Participants were asked to locate three pins on the map and read the associated message for each pin. All participants completed this task successfully.
When asked to find the List View (Figure 3-12), all were successful in locating it from the menu. The navigation of messages in this view was natural to all users. All found and read the required messages easily.

ET8

The following question was presented to the participant;

“How is the number of notes shown in the List view associated with those shown in the Map view of the previous task?”

Participants P1, P2, P3, P5 and P6 recognised the fact that the number of pins shown in the Map view was the same as those show in the List view. Furthermore, they correctly determined that the notes available within the geographical confines of the Map dictated those notes presented in the List view. Participants P4 and P7 were unsure if both view were related and guessed that the number should be fairly close in range between the two. Participant P4 did, however, did recognise that the List view was useful in the case when hundreds of pins/messages were located in the same area on the map.

ET9

All participants were able to find the requested message of this task and identify the tags associated with the message.

ET10

Posting a note is a primary feature of any geonotes system. It is important that this is quick and easy for the user to execute. Only participants P2 and P6 took a substantial amount of time to determine where the compose message icon (Figure 3-8) was located. All entered the message part of the note correctly. There was hesitation by some participants on where the tags should have been entered. Participants P1, P4 and P5 questioned whether the field “Keywords/Metadata” (Figure 3-9) was the appropriate place to enter the tags. After searching for other possibilities, these participants continued to enter the tags correctly. Participant P2 entered the message note part without any tags. The done button was clicked prematurely. An attempt was then made to search for the note that was just posted and attempt to edit it. After about a minute, P2 realised that editing of existing (posted) messages was not permitted. In a second attempt, P2 created another note and correctly entered the tags.
ET11

Task E11 required all the participants to create another note. This second note was successfully entered along with the tags. As it is essentially the same task as ET10, the participants were now familiar on how to correctly post a message.

ET12

Feedback on Task E12 determines whether the user understands the role of the tags in the message. Does the user know that the tags, as part of personalisation feature of PeGeon, are used to match the message to user interests?

Participant P1 explained that tags were required as part of the note such that “people can look up those keywords…If the note is about spiders, then you can use this as a keyword search”. P1 clearly understands that tags are used to match messages to users. However, there no search functionality provided. P1 eventually realises this and offers the suggestion that it is the interests that are match to the tags.

Only P2, P3 and P5 clearly stated an understanding of the relationship between tags and interests. P4, P6 and P7 know that the tags are important in determining message visibility, but are not quite certain how these are related to the user profile.

ET13

Comparing PeGeon notes to a more familiar technology such as SMS messaging was forces the participant to think about the differences between the two. All participants correctly explained that PeGeon notes had an association with a geographic location or “pin on the map”. Only P1, P2, P3 and P5 went further to mention the PeGeon note, unlike the SMS, is intended for public consumption. Whilst the SMS is a private message typically sent to one recipient, the PeGeon note can be seen by many. Participant P4, P6 and P7 also demonstrated this understanding when this specific comparison was made.

ET14

All participants located the Interest screen (Figure 3-5) in their first attempt. To navigate to this screen, the user selects Interests from the main menu. Participants P2, P3, P4 and P7 entered and saved the interests as instructed. P1, P5, P6 and P7 managed to enter the interests into the list, but did not complete the final step of clicking on the save button. Doing so is required as part of the iPhone idiom for all table views.
The purpose of maintaining a list of interests for each user was clearly explained by Participant P3;

“The point of entering a list of my interests into PeGeon is to tell it what kinds of messages I should be looking it. My interests will directly influence what notes I see on the map around me.”

This is the most accurate explanation given amongst the test group.

P1 offers the following explanation;

“The purpose of entering my interests is to match me up with other users that share the same interests. This allows me to meet (communicate) and share notes with them.”

Participants P2, P4, P5 considered the recording of interests as additional information for the purpose of sharing this with other users, whilst P6 and P7 were unsure why this was required at all.

All participants deleted the “spider” entry from the Interests list and navigated to the Map view successfully.

Every participant recognised that deleting the “spider” interest (in task ET16) caused many of the pins on the map (Figure 3-10) to disappear.

P3 explained this correlation;

“Upon removing the interest for spiders from the list, all of the spider-related messages were no longer visible on the map. This includes all messages that contained spider or spider-related terms in the tags of the messages”.

All participants were aware that the interest list acted as a filter for messages presented to them.
Chapter Seven

7 Conclusion

This section presents the results obtained from the observation and participant feedback. The analysis addresses the hypotheses outlined in this thesis.

The seven participants attempted seventeen tasks set out in Table 5-3 to satisfy the hypotheses as listed in Table 5-2.

Figure 7-1 shows the results. Since the user study only allowed the participant three (3) attempts for each task, we used the value four (4) in the chart to represent an unsuccessful attempt.

A value one (1) corresponds to a successful first attempt. This was the most common result indicating a highly intuitive application. No instruction or training was required for the participants to complete tasks in their first attempt. This translates into a high usability factor.

It is also clear from the chart that when participants failed to complete a task successfully, they were performing one of the following three (3) tasks; ET8, ET12 and ET15. In addition to this, ET2 required a couple attempts from most participants to complete. These are discussed as follows;
Experimenter observation and participant feedback resulted in the following:

**ET2 - Create an account based on the details outlined in Table 5-4.**

Six (6) out of the seven participants (86%) required two (2) attempts to complete this task successfully. These participants followed the same initial and return path. Experimenter observation revealed that when one of these participants was asked to create an account according to the details outlined in Table 5-4, the participant began filling in the login user name and password into the login fields. Without first clicking the “Create my PeGeon Account” button (Figure 3-3), the participant soon realises there is no place to enter the next field in the table – which was the email field.

The return path the participant followed was the correct path – clicking on the “Create my PeGeon Account” button. The participant now enters the details in Table 5-4 in its entirety.
The observed behaviour for this task indicates the need to separate the “Create my PeGeon Account” button from the Login screen to avoid confusion.

**ET8 – Question - How is the number of notes shown in the List view associated with those shown in the Map view of the previous task?**

Two out of the seven participants (29%) failed to complete this task, while the rest of the participants successfully completed the task with their first attempt.

This question (task) was aimed at testing whether the participant understood the relationship between the Map and List views.

The messages shown in the List view is constrained by those messages displayed in the Map view. By zooming out of the map, messages (represented by pins) increasingly appear. Conversely, by zooming into the map, messages increasingly disappear. The user can control the amount of messages displayed by using this action. These same messages appear in the List view in a tabular format.

User feedback from Participant P4 suggested a total count of pins/notes displayed in List and Map views. According to Participant P4, this will assist the user to understand the relationship.

**ET12 - What do you suggest the tags are used for?**

This task was also designed to test the participant’s understanding. In this case, the question focused on the need for tags.

Three (3) users failed to identify the purpose, whilst another (Participant 1) took a significant amount of time to answer (> 2 mins), but did so unassisted.

**ET15 - What is the purpose of doing this?**

This task was also designed to test the participant’s understanding. This question focused on interests. It followed a related task requiring the participant to enter data into the Interests screen (*Figure 3-6*).
The results show two (2) participants failing to answer this question satisfactorily. Three (3) participants took a significant amount of time to explain, but did so unassisted. Another participant (P1) explained it after a short delay (> 1 min).

Interestingly, all participants understood this requirement upon completing the next task – Task E16. By removing an interest of spiders and seeing the result due to personalisation, the need for the *interests* screen became clear.

In conclusion, this thesis has demonstrated a well designed and implemented geonotes system – PeGeon.

A usability study was performed on PeGeon with seven participants.

The results show that ninety-four percent (94%) of all tasks were successfully completed within 3 attempts across all the participants. This indicates a very *learnable* geonotes system.

All participants understood the personalisation concept and the value it brings to a geonotes system. This indicates a highly usable *Personalised geonotes system*.
Chapter Eight

8 Future Work

This design has the potential to serve as a foundation for exploration of ways to provide additional personalisation features to future geonotes systems.

While the user study indicated PeGeon was learnable without instruction and easy to use for the particular population represented by the participants, it will be important to conduct additional evaluations with more participants from a broad range of technical expertise and broad age range.

Another aspect of future work is to enhance the user interface. For example, each interest listed in the interests screen could be colour coded to match the corresponding pins in the map view.

PeGeon could also be further enhanced to allow users to order interests by priority and only allow a certain priority level to trigger alerts.

Future work might also explore grouping interests into profiles. The user will then be able switch between profiles. This would be useful for frequent travellers, or simply to accommodate for changes in mood.
Chapter 8. Future Work

6.2. Usability Results

Biblography


Hightower, J., Consolvo, S., LaMarca, A., Smith, I., Hughes, J., 2005. Learning and recognizing the places we go, pages 159-176.


Behaviour & Information Technology 28, 139--164.


Appendix A

Background Questionnaire

This appendix contains the background questionnaire presented to the participants in the evaluation experiment.

The questionnaire was designed to capture important information regarding the participants’ use of applications on their mobile phones, the type of applications used and frequency on which they use them.

Background Questions

Name: __________________________________________

Age: __________________________________________

Gender:

☐ Male

☐ Female
Occupation: __________________________________________

How would you rate your level of skill at using the applications on your mobile phone?

☐ None
☐ Limited
☐ Competent
☐ Skilled
☐ Advanced

Please describe the type of applications you use on your mobile phone. State whether any of them require you to create, post or send any messages.

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Do you use an iPhone? If so, how long have you been using it?

☐ Yes   ____ months
☐ No
Have you previously used a GeoNotes application?

☐ No.

☐ Yes. Foursquare.

☐ Yes. Loopt.

☐ Yes. Gowalla.

☐ Yes. Other. Please specify -

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________
### Appendix B

#### Evaluation Test Data

<table>
<thead>
<tr>
<th>User ID</th>
<th>Name</th>
<th>Login</th>
<th>Pwd</th>
<th>Email</th>
<th>Gender</th>
<th>DOB</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Ms Sandra Silva</td>
<td>sandrasilva</td>
<td>password</td>
<td><a href="mailto:ssilva@pegeon.net">ssilva@pegeon.net</a></td>
<td>F</td>
<td>12-Feb-71</td>
</tr>
<tr>
<td>5</td>
<td>Bob Barker</td>
<td>bobbarker</td>
<td>password</td>
<td><a href="mailto:bbarker@mail.com">bbarker@mail.com</a></td>
<td>M</td>
<td>3-Sep-75</td>
</tr>
<tr>
<td>6</td>
<td>Alice Amber</td>
<td>aliceamber</td>
<td>password</td>
<td><a href="mailto:aamber@mail.com">aamber@mail.com</a></td>
<td>F</td>
<td>14-Dec-80</td>
</tr>
<tr>
<td>7</td>
<td>Eliot Epson</td>
<td>eliotepson</td>
<td>password</td>
<td><a href="mailto:eepson@mail.com">eepson@mail.com</a></td>
<td>M</td>
<td>21-Aug-02</td>
</tr>
<tr>
<td>8</td>
<td>Joe Bloggs</td>
<td>joebloggs</td>
<td>password</td>
<td><a href="mailto:joe@hotmail.com">joe@hotmail.com</a></td>
<td>M</td>
<td>21-Mar-76</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User ID</th>
<th>Note</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Sydney Museum</td>
<td>-33.79</td>
<td>151.25</td>
<td>20-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Visit the Australian museum!</td>
<td>-33.78</td>
<td>151.24</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>I just saw a little redback spider</td>
<td>-33.87</td>
<td>151.27</td>
<td>20-Apr-10</td>
</tr>
</tbody>
</table>

Table 8-1: Evaluation Users Data
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Come visit <a href="http://australianmuseum.net.au">http://australianmuseum.net.au</a> for great spiders on show!</td>
<td>-33.80</td>
</tr>
<tr>
<td>4</td>
<td>Spiders belong to an ancient group of animals called the Arachnida.</td>
<td>-33.87</td>
</tr>
<tr>
<td>4</td>
<td>Arachnids include scorpions, ticks and mites, harvestmen and false scorpions.</td>
<td>-33.80</td>
</tr>
<tr>
<td>4</td>
<td>The primary source of food for spiders is, and probably always has been, insects.</td>
<td>-33.82</td>
</tr>
<tr>
<td>4</td>
<td>Arachnologists have calculated that every year spiders eat the weight of the whole human population in insects.</td>
<td>-33.87</td>
</tr>
<tr>
<td>4</td>
<td>It has been suggested that insects evolved the power of flight to get away from spiders.</td>
<td>-33.82</td>
</tr>
<tr>
<td>4</td>
<td>Spiders developed new ways of catching insects, such as spinning webs.</td>
<td>-33.83</td>
</tr>
<tr>
<td>4</td>
<td>The great diversity of spiders means that, wherever an insect goes there is a spider that can catch it.</td>
<td>-33.80</td>
</tr>
<tr>
<td>4</td>
<td>There is even a rare spider that lives and hunts among rocks in the intertidal zone of Sydney Harbour foreshores.</td>
<td>-33.83</td>
</tr>
<tr>
<td>4</td>
<td>Worldwide there are about 70,000 species of arachnids of which 36,000 are spiders.</td>
<td>-33.81</td>
</tr>
<tr>
<td>4</td>
<td>Approximately 2,900 species of spiders are found in Australia.</td>
<td>-33.79</td>
</tr>
<tr>
<td>4</td>
<td>Only a few species of spiders can inflict bites that are potentially fatal to humans.</td>
<td>-33.82</td>
</tr>
<tr>
<td>4</td>
<td>One of the most dangerous of all spiders is the Sydney Funnel-web Spider.</td>
<td>-33.83</td>
</tr>
<tr>
<td>4</td>
<td>There have been no fatalities from Sydney Funnel-web bites since the development of effective antivenom.</td>
<td>-33.81</td>
</tr>
</tbody>
</table>
### Usability Results

<table>
<thead>
<tr>
<th>4</th>
<th>You can see spiders by day and especially by night in just about any habitat.</th>
<th>-33.78</th>
<th>151.22</th>
<th>16-Apr-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>The forests, woodlands and heathlands of our national parks are good places to see a wide variety of species.</td>
<td>-33.81</td>
<td>151.28</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Most gardens and parks will have a spider population; a night-time search of your backyard is a good place to start.</td>
<td>-33.85</td>
<td>151.31</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Spiders are arachnids not insects, but both spiders and insects belong to the largest group of animals on Earth.</td>
<td>-33.85</td>
<td>151.28</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Spiders have 2 main body parts, 8 walking legs, simple eye, piercing jaws/fangs, abdominal silk spinning organs, anterior abdominal genital opening.</td>
<td>-33.83</td>
<td>151.27</td>
<td>15-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Spiders and their relatives are called arachnids.</td>
<td>-33.85</td>
<td>151.22</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Spiders are the only arachnids that have special glands in their abdomen which produce silk.</td>
<td>-33.83</td>
<td>151.31</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>A few spiders are so small and live such hidden lives that most of us never see them, they are enormous.</td>
<td>-33.86</td>
<td>151.31</td>
<td>15-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Some of the smallest spiders in the world are anapid spiders, sometimes called armoured spiders.</td>
<td>-33.78</td>
<td>151.31</td>
<td>21-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Small spiders like anapids are usually found in damp, cool habitats like forest leaf litter and moss.</td>
<td>-33.89</td>
<td>151.23</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>The largest spiders in the world include the South American Goliath Tarantula, some so big their legs can span a dinner plate.</td>
<td>-33.90</td>
<td>151.22</td>
<td>21-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>The larger spiders may take decades to reach such a size.</td>
<td>-33.89</td>
<td>151.22</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Many spiders have unusual body shapes and colours.</td>
<td>-33.89</td>
<td>151.22</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>Bizarre bodies can be helpful to spiders to deceive and ambush prey, to capture particular sorts of prey, to avoid being eaten and to attract mates.</td>
<td>-33.89</td>
<td>151.23</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td>#</td>
<td>Text</td>
<td>Lat</td>
<td>Long</td>
<td>Date</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------------------------------------------------</td>
<td>-------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>4</td>
<td>Spiders live in almost every habitat on earth.</td>
<td>-33.89</td>
<td>151.23</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>4</td>
<td>The only places where there are no spiders are the polar regions,</td>
<td>-33.89</td>
<td>151.23</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td></td>
<td>the highest mountains and the oceans.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A few spider species have invaded the ocean’s edge, living in the</td>
<td>-33.89</td>
<td>151.22</td>
<td>20-Apr-10</td>
</tr>
<tr>
<td></td>
<td>rock and coral crevices of the intertidal zone.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Spiders belong to an ancient group of animals called the Arachnida.</td>
<td>-33.83</td>
<td>151.23</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Arachnids include scorpions, ticks and mites, harvestmen and false</td>
<td>-33.82</td>
<td>151.25</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td></td>
<td>scorpions.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The primary source of food for spiders is, and probably always has</td>
<td>-33.83</td>
<td>151.24</td>
<td>20-Apr-10</td>
</tr>
<tr>
<td></td>
<td>been, insects.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Arachnologists have calculated that every year spiders eat the</td>
<td>-33.82</td>
<td>151.23</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td></td>
<td>weight of the whole human population in insects.</td>
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</tr>
<tr>
<td>6</td>
<td>It has been suggested that insects evolved the power of flight to</td>
<td>-33.79</td>
<td>151.25</td>
<td>19-Apr-10</td>
</tr>
<tr>
<td></td>
<td>get away from spiders.</td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Spiders developed new ways of catching insects, such as spinning</td>
<td>-33.78</td>
<td>151.24</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td></td>
<td>webs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The great diversity of spiders means that, wherever an insect goes</td>
<td>-33.87</td>
<td>151.27</td>
<td>16-Apr-10</td>
</tr>
<tr>
<td></td>
<td>there is a spider that can catch it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>There is even a rare spider that lives and hunts among rocks in the</td>
<td>-33.80</td>
<td>151.30</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td></td>
<td>intertidal zone of Sydney Harbour foreshores.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Worldwide there are about 70,000 species of arachnids of which</td>
<td>-33.87</td>
<td>151.23</td>
<td>19-Apr-10</td>
</tr>
<tr>
<td></td>
<td>36,000 are spiders.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Approximately 2,900 species of spiders are found in Australia.</td>
<td>-33.80</td>
<td>151.24</td>
<td>21-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Only a few species of spiders can inflict bites that are potentially</td>
<td>-33.82</td>
<td>151.31</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>One of the most dangerous of all spiders is the Sydney Funnel-web Spider.</td>
<td>-33.87</td>
<td>151.21</td>
<td>20-Apr-10</td>
</tr>
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<td>---</td>
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<td>---</td>
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</tr>
<tr>
<td>6</td>
<td>There have been no fatalities from Sydney Funnel-web bites since the development of effective antivenom.</td>
<td>-33.82</td>
<td>151.25</td>
<td>19-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>You can see spiders by day and especially by night in just about any habitat.</td>
<td>-33.83</td>
<td>151.31</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>The forests, woodlands and heathlands of our national parks are good places to see a wide variety of species.</td>
<td>-33.80</td>
<td>151.22</td>
<td>20-Apr-10</td>
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<td>6</td>
<td>Most gardens and parks will have a spider population; a night-time search of your backyard is a good place to start.</td>
<td>-33.83</td>
<td>151.25</td>
<td>20-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Spiders are arachnids not insects, but both spiders and insects belong to the largest group of animals on Earth.</td>
<td>-33.81</td>
<td>151.22</td>
<td>19-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Spiders have 2 main body parts, 8 walking legs, simple eye, piercing jaws/fangs, abdominal silk spinning organs, anterior abdominal genital opening.</td>
<td>-33.79</td>
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<td>6</td>
<td>Spiders and their relatives are called arachnids.</td>
<td>-33.82</td>
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<td>16-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Spiders are the only arachnids that have special glands in their abdomen which produce silk.</td>
<td>-33.83</td>
<td>151.30</td>
<td>19-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>A few spiders are so small and live such hidden lives that most of us never see them, they are enormous.</td>
<td>-33.81</td>
<td>151.26</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Some of the smallest spiders in the world are anapid spiders, sometimes called armoured spiders.</td>
<td>-33.78</td>
<td>151.22</td>
<td>18-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>Small spiders like anapids are usually found in damp, cool habitats like forest leaf litter and moss.</td>
<td>-33.81</td>
<td>151.28</td>
<td>17-Apr-10</td>
</tr>
<tr>
<td>6</td>
<td>The largest spiders in the world include the South American Goliath Tarantula, some so big their legs can span a dinner plate.</td>
<td>-33.85</td>
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<td>15-Apr-10</td>
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<tr>
<td>6</td>
<td>The larger spiders may take decades to reach such a size.</td>
<td>-33.85</td>
<td>151.28</td>
<td>19-Apr-10</td>
</tr>
</tbody>
</table>
6. Many spiders have unusual body shapes and colours.  

6. Bizarre bodies can be helpful to spiders to deceive and ambush prey, to capture particular sorts of prey, to avoid being eaten and to attract mates.  

6. Spiders live in almost every habitat on earth.  

6. The only places where there are no spiders are the polar regions, the highest mountains and the oceans.  

6. A few spider species have invaded the ocean's edge, living in the rock and coral crevices of the intertidal zone.  

5. Spiders belong to an ancient group of animals called the Arachnida.  

5. Arachnids include scorpions, ticks and mites, harvestmen and false scorpions.  

5. The primary source of food for spiders is, and probably always has been, insects.  

5. Arachnologists have calculated that every year spiders eat the weight of the whole human population in insects.  

5. It has been suggested that insects evolved the power of flight to get away from spiders.  

5. Spiders developed new ways of catching insects, such as spinning webs.  

5. The great diversity of spiders means that, wherever an insect goes there is a spider that can catch it.  

5. There is even a rare spider that lives and hunts among rocks in the intertidal zone of Sydney Harbour foreshores.  

5. Worldwide there are about 70,000 species of arachnids of which 36,000 are spiders.
### Approximate 2,900 species of spiders are found in Australia.

| 5 | Approximately 2,900 species of spiders are found in Australia. | -33.90 | 151.22 | 21-Apr-10 |

### Only a few species of spiders can inflict bites that are potentially fatal to humans.

| 5 | Only a few species of spiders can inflict bites that are potentially fatal to humans. | -33.90 | 151.23 | 17-Apr-10 |

### One of the most dangerous of all spiders is the Sydney Funnel-web Spider.

| 5 | One of the most dangerous of all spiders is the Sydney Funnel-web Spider. | -33.89 | 151.23 | 16-Apr-10 |

### There have been no fatalities from Sydney Funnel-web bites since the development of effective antivenom.

| 5 | There have been no fatalities from Sydney Funnel-web bites since the development of effective antivenom. | -33.89 | 151.23 | 17-Apr-10 |

### You can see spiders by day and especially by night in just about any habitat.

| 5 | You can see spiders by day and especially by night in just about any habitat. | -33.89 | 151.23 | 15-Apr-10 |

### The forests, woodlands and heathlands of our national parks are good places to see a wide variety of species.

| 5 | The forests, woodlands and heathlands of our national parks are good places to see a wide variety of species. | -33.89 | 151.22 | 19-Apr-10 |

### Most gardens and parks will have a spider population; a night-time search of your backyard is a good place to start.

| 5 | Most gardens and parks will have a spider population; a night-time search of your backyard is a good place to start. | -33.89 | 151.23 | 21-Apr-10 |

### Spiders are arachnids not insects, but both spiders and insects belong to the largest group of animals on Earth.

| 5 | Spiders are arachnids not insects, but both spiders and insects belong to the largest group of animals on Earth. | -33.89 | 151.22 | 16-Apr-10 |

### Spiders have 2 main body parts, 8 walking legs, simple eye, piercing jaws/fangs, abdominal silk spinning organs, anterior abdominal genital opening.

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### Small spiders like anapids are usually found in damp, cool habitats like forest leaf litter and moss.

| 5 | Small spiders like anapids are usually found in damp, cool habitats like forest leaf litter and moss. | -33.90 | 151.23 | 19-Apr-10 |
Chapter 8. Future Work

6.2. Usability Results

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>5</td>
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<td>-33.89</td>
<td>151.23</td>
</tr>
<tr>
<td>6</td>
<td>Great coffee here at the Seymour Theatre!</td>
<td>-33.89</td>
<td>151.19</td>
</tr>
</tbody>
</table>

Table 8-2: Evaluation Notes Data

Both Table 8-1 and Table 8-2 are related by User Id.
Appendix C

Inflector Implementation

Extract from Inflector - Transforms words to singular, plural, humanized (human readable), underscore, camel case, or ordinal form.\(^\text{11}\)

```java
protected void initialize() {
    Inflector inflect = this;
    inflect.addPluralize("$", "s");
    inflect.addPluralize("s$", "s");
    inflect.addPluralize("(ax|test)is$", "$1es");
    inflect.addPluralize("(octop|vir)us$s", "$1i");
    inflect.addPluralize("(octop|vir)i$s", "$1i"); // already plural
    inflect.addPluralize("(alias|status)$", "$1es");
    inflect.addPluralize("(bu)s$", "$1ses");
    inflect.addPluralize("(buffal|tomato)s$", "$1oes");
    inflect.addPluralize("([ti])um$s", "$1a");
    inflect.addPluralize("([ti])a$s", "$1a"); // already plural
    inflect.addPluralize("sis$s", "ses");
    inflect.addPluralize("(?:(\[^f\])fe|([lr])f)$", "$1$2ves");
    inflect.addPluralize("(hive)$", "$1s");
    inflect.addPluralize("([^aeiouy]|qu)y$", "$1ies");
    inflect.addPluralize("(xch|ss|sh)$", "$1es");
    inflect.addPluralize("(matr|vert|ind)ix|ex$s", "$1ices");
    inflect.addPluralize("([m|l])ouse$s", "$1ice");
    inflect.addPluralize("([m|l])ice$s", "$1ice");
    inflect.addPluralize("(^ox)$", "$1en");
    inflect.addPluralize("(quiz)$", "$1zes");
}
```


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Chapter 8. Future Work

6.2. Usability Results

// Need to check for the following
// words that are already pluralized:
// irregulars

inflect.addPluralize("{people|men|children|sexes|moves|stadiums}$", "$1");
// special rules
inflect.addPluralize("{oxen|octopi|viri|aliases|quizzes}$", "$1s");
inflect.addSingularize("s$s", "s");
// '-us' and '-ss' are already singular
inflect.addSingularize("s|si|u)s$s", "$1s");
inflect.addSingularize("(n)ews$s", "$1ews");
inflect.addSingularize("[(t)i](a)s$s", "$1um");

inflect.addSingularize("{(a)naly|(b)a|(d)iagno|(p)arenthe|(p)rogno|s|ynop|(t)he)ses$s", "$1ses");
inflect.addSingularize("(\^analy)ses$s", "$1sis");
// already singular, but ends in 's'
inflect.addSingularize("(\^analy)sis$s", "$1sis");
inflect.addSingularize("([f]ves)$", "$1fe");
inflect.addSingularize("(hive)s$s", "$1");
inflect.addSingularize("(tive)s$s", "$1");
inflect.addSingularize("([l]ves)$", "$1f");
inflect.addSingularize("([aeiouy]|qu)ies$s", "$1y");
inflect.addSingularize("(s)eries$s", "$1eries");
inflect.addSingularize("(mov|v)e$s", "$1ov|e");
inflect.addSingularize("(shoe)s$s", "$1e");
// already singular, but ends in 's'
inflect.addSingularize("(cris|ax|test)is$s", "$1is");
inflect.addSingularize("(cris|ax|test)es$s", "$1is");
inflect.addSingularize("(octop|vir)i$s", "$1us");
// already singular, but ends in 's'
inflect.addSingularize("(octop|vir)us$s", "$1us");
inflect.addSingularize("(alias|status)es$s", "$1");
// already singular, but ends in 's'
inflect.addSingularize("(alias|status)$", "$1");
inflect.addSingularize("(ox)en", "$1");
inflect.addSingularize("(vert|ind)ices$s", "$1ex");
inflect.addSingularize("(matr)ices$s", "$1ix");
inflect.addSingularize("(quiz)zes$s", "$1x");

inflect.addIrregular("person", "people");
inflect.addIrregular("man", "men");
inflect.addIrregular("child", "children");
inflect.addIrregular("sex", "sexes");
inflect.addIrregular("move", "moves");
inflect.addIrregular("stadium", "stadiums");

inflect.addUncountable("equipment", "information", "rice", "money", "species", "series", "fish", "sheep");

}
Appendix D

Protocol Definition

The JSON protocol definition used by PeGeon is listed as follows;

Registration

Request
  method: register
  params:
    name (text)
    login (text, 10 character limit, Alpha Numeric)
    password (text, 15 character limit)
    email
    about (multi-line text)
    gender (int, 0 - male, 1 - female)
    birthday (date)
    available (boolean or 0|1)
    photo (optional, text, base64 encoded image)

Successful registration response
  Response:
    id (int, User ID)
    session (Guid, session token)
    error: null
    received session token is used the next request id

Unsuccessful registration response
  result: null
  error: default error object

Interests

Set Interests Request
  method: setInterests
  params:
    array of
name (text)

Successful Set Interests response
result: null
error: null

Unsuccessful Set Interests response
result: null
error: default error object

Get Interests Request
method: getInterests
params: null
Successful Get Interests response
result:
array of
name (text)

Default error object
If the response contains no errors then the object is null
If the response contains a error / errors that an object id
code (int, error code)
description (text, error description)

Login
Request
method: login
params:
login (text)
password (text)
Successful login response
result:
id (int, User ID)
session (Guid, session token)

error: null
received session token is used the next request id

Unsuccessful login response
result: null
error: default error object

Messages
Request
method: postMessage
params:
msg (text, 160 character limit)
long (longitude, floats of size 10,6)
lat (latitude, floats of size 10,6)
tags (array of string)
Successful Post a Message response
result: null
error: null

Unsuccessful Post a Message response
result: null
error: default error object

Get a list of Messages Request
method: getMessages
params:
  long1 (longitude of upper left corner of the map, floats of size 10,6)
  lat1 (latitude of upper left corner of the map, floats of size 10,6)
  long2 (longitude of bottom right corner of the map, floats of size 10,6)
  lat2 (latitude of bottom right corner of the map, floats of size 10,6)

Successful Get a list of Messages response
result:
  array of messages info
    msg (text, 160 character limit)
    long (longitude, floats of size 10,6)
    lat (latitude, floats of size 10,6)
    stamp (date time)
    login (text, creator login)
    avatara (text, url to creator image)
    tags (array of string)
  error: null

Unsuccessful Get a list of Messages response
result: null
error: default error object

Profile Request
method: getProfile
params:
  login (text, 10 character limit, Alpha Numeric)

Successful profile response
result:
  name (text)
  login (text, 10 character limit, Alpha Numeric)
  email
  about (multi-line text)
  gender (int, 0 - male, 1 - female)
  birthday (date)
  available (boolean or 0|1)
  avatara (text, url to creator image)
  error: null

Unsuccessful profile response
result: null
error: default error object
Appendix E

Resources

The accompanying video entitled “PeGeon – Personalised GeoNotes” was shot on 30 May 2010 at the Australian Museum located 6 College St Sydney, Australia.

Video Narrative

“The following video demonstrates PeGeon, a Personalised geonotes system developed at the University of Sydney. PeGeon was implemented for the iPhone platform allowing users to post personalised notes to virtual locations for others to read.

Alice is walking by the museum and receives a mobile phone alert. She identifies PeGeon as the source of the alert and launches the application.

Upon starting the application, several pins on the map appear. Each pin represents a note left by another person.

By selecting a pin, a breadcrumb view appears containing a preview of the note along with its author.
Selecting the preview shows the details including full message and time posted. This particular message contains a URL which, when selected, launches the Australian Museum website.

Impressed by the information about the displays, Alice decides to see the exhibition.

Eliot is in the third grade. Here we see Eliot's profile. These attributes and more can be used to personalise notes.

His teacher has organised a school excursion for his class and has instructed the children to add "spiders" to their list of interests.

Upon selecting the Map view, PeGeon now shows additional personalised messages relating to spiders.

Eliot now has access to third-grade level educational material provided by his teacher. Since they are targeted to third-grade students, Eliot finds them easy to read.

He chooses to read them in a convenient list view and selecting a note from the list, Eliot is able to read the message in full.

Alice enjoyed spider exhibition at the Australian Museum, and decides to leave a note at this location.

Selecting the post message screen, Alice enters the note along with relevant tags.
These tags are designed to target the interests of other people. They allow the PeGeon personalisation engine to determine the relevance of a note to each user. Once posted, Alice's message appears on the Map view for others to see.

It has just occurred to Alice, that she is no longer seeking accommodation. She decides to remove this from her list of interests. PeGeon will no longer trigger alerts related to this interest.

Later that day, Jamie walks by the museum and gets alerted. PeGeon knows that he has an interest in spiders and displays Alice's message which was left nearby.

Impressed by the message Alice left; he too decides to enter the museum.”