Paw-rrrow
Borrow-A-Pet Service

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1 Introduction

1.1 Objective

Dealing with college is hard enough, but the difficulty level goes up a notch when you have to deal with mental or physical disorders. The University DRES offers service dogs specially for students to take with them to class or keep in their living space. Unfortunately, students who have mental health problems cannot always acquire a service or therapy animal as easily. Also, many students who have a pet back home which they cannot bring to campus due to housing or roommate restrictions.

On the other hand, many pet owners who work full-time or have classes may not be able to give their pet the required daily social and physical activity. Thus, there currently exists a gap between giving students and local at-home-pets to have an opportunity to engage in an open and safe environment. Our proposed solution is Paw-row, a university specific cellular application and a GPS collar monitor that can be used to connect pet owners and students looking to borrow a pet. Our application would seek to provide non-pet owners on college campuses a brief amount of time to look after a pet. Pet owners and pet borrowers would match on the app based on profiles created by each individual. After the interaction of borrowing the pet, the pet owner and the borrower would have the option to rate the experience.

1.2 Background

Students on the University of Illinois campus are interested in interacting with cats and dogs. From events shared on Facebook to pet a pup for charity fundraisers to therapy dogs before finals to asking on reddit where they can find a dog to pet [1, 2, 3]. Animals have been found to be useful in creating positive environments for people. Pets can also influence people in a positive manner for their health [4]. For stressed students in college, having a cat or dog to interact with can help the students relax as well [5]. By providing a service to students to be able to find a pet on campus that they could continually interact with could help create a more relaxed and less stressful college experience for those students. Even if someone does not have a documented case to show that a therapy animal would help them, many students would be able to benefit from the Paw-row services.

1.3 High-level requirements

- The SAFETY of all involved parties, pets included will be monitored based on standards of care [6]. For example, the accurate number of shots, access to water and food for sessions longer than one hour, and other considerations given in the Standards of Care for Cats and Dogs Regulations made under section 39 of the Animal Protection Act [6].
- An accurate LOCATION services will be provided using the GPS collar. The GPS location should be accurate within 4.9 m [7].
- There should be a TIME AND PAYMENT agreement between pet-owner and pet-borrowers. A set dollar amount, no less than $2 per ten minutes, $5 per 30 minutes, and $9 for an hour should be standard in the interaction between pet-owner and pet-borrower.

2 Design

2.1 Block Diagram

As shown in the block diagram above this project can be divided into a hardware component (the collar) and a software component (the mobile application).

The first and third high-level requirements are fulfilled by the mobile application. Each user is required to create a profile on the application either as a borrower or a lender. ‘Lenders’ will be asked to provide detailed information on their pets including their habits, personality and rules for care. ‘Borrowers’ will be asked to undergo safety training through a safety video and quiz to ascertain their level of expertise with pets.

The second high-level requirement is satisfied by the collar with a tracking unit. It will send real-time location information to the application so that lenders may always keep track of their pets.
The hardware (tracking unit) consists of four main components:

1) Microcontroller
2) GSM/GPRS Module
3) GPS Module
4) Power

**Microcontroller**
The microcontroller is the central controller for the tracking unit. We plan on using the Arduino UNO board for our project. The board has multiple input/output pins, a USB connection, a power jack and a reset button. The recommended input voltage to the board is 7 - 12 V for it to operate at 5V. Both the GSM and GPS Module will operate based on how this Arduino is programmed.

**GSM/GPRS Module**
This module provides a way to use the GSM cell phone network to send and receive data from a remote location through Audio, SMS or GPRS service. The GPRS module is compatible with the Arduino board. It is controlled via its UART. We plan on using the SIM900 GSM/GPRS Module. The GPRS/GSM shield needs external power supply to guarantee reliable operations. It will be mounted on the Arduino UNO and connected to an external power supply.
GPS Module
The GPS Module is a small electronic circuit that connects with the Arduino UNO to get position, altitude, speed, date and time on UTC (Universal Time Coordinated). It transmits the data using the standard NMEA protocol via serial port. We will use the SkyNav SKM58 Series with embedded GPS antenna.

Power
The Arduino UNO and the GSM Module require external power supply. The input power supply range of SIM900 is from 3.2V to 4.8V. The transmitting burst will cause a voltage drop and the power supply must be able to provide sufficient current up to 2A. The USB port on the arduino cannot supply such a large current so we need to power the GSM module externally.

We plan on using a 12V battery as our power supply and 4 LM7805 Voltage regulators to regulate the 12 volts input voltage to 5 volts. Each LM7805 generates an output voltage of 5V and output current of 0.5A. So in order to meet the requirements of the GSM module we will use 4 of these voltage regulators.

2.2 Block requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Power supply</td>
<td>a) Output Voltage - 12V [8]</td>
</tr>
<tr>
<td></td>
<td>b) Output Current - 50mAh [8]</td>
</tr>
<tr>
<td>2) Microcontroller</td>
<td>a) Operating Voltage - 5V [9]</td>
</tr>
<tr>
<td>Arduino UNO</td>
<td>b) DC Current per I/O pin - 20mA [10]</td>
</tr>
<tr>
<td>LM7805</td>
<td>b) Output Current - 0.5A [11]</td>
</tr>
<tr>
<td>4) GPS accuracy</td>
<td>Should be within ± 4.9m [7]</td>
</tr>
</tbody>
</table>

2.3 Risk Analysis
The GPS Module block is most likely to fail or give inaccurate information to our application. This may happen due to one of the following reasons:
- Satellite signal blockage due to buildings, bridges, trees, etc.
- Indoor or underground use
- Signals reflected off buildings or walls ("multipath")
3 Ethics and Safety

The biggest safety concern in this project is making sure that the pet is taken care of properly and the location of the pet is always known to the owner. For example, a pet harness may be used in place of a collar for smaller animals to prevent injury to the pet. The collar/pet harness will include a GPS tracker with protection circuitry to prevent tampering of the GPS. The GPS location will be determined independent of the phone’s systems to prevent user distortion of the location of the pet. Both the pet-borrower and pet owner should be honest in terms of their capabilities and the traits of the pet, to make sure there are no misunderstandings [12].

To ensure the pet-borrower understands the basics of looking after a pet, a online training session along with a quiz modeled with the standards of cat and dog care [6] and additional resources regarding the individual pet should be provided. An additional optional training can be provided by the pet owner to ensure they feel comfortable with the pet-borrower looking after their animal. An additional check for safety that would be worked into the application is the rating system that occurs after the pet borrowing has ended where the user can honestly rate the pet, the pet owner or the pet borrower without discrimination [12].

To try to ensure that they pet-borrower can be trusted, the user sign-up will have to include their university email. This would also ensure the application is being used by the intended audience: college students. If any rules or regulations are broken or a pet owner or pet-borrower gets too low ratings, the user’s application would be suspended pending additional training or investigation. Multiple suspensions may lead to the removal of the account and termination of using Paw-rrow services.
References


