



I-Tracker: Warranty Tracking

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I have a Ph.D. in Computer Science, M.Sc. in Engineering, and B.Sc. in Electrical Engineering. Currently I serve as Professor of Computer Science at School of Engineering and Computing, National University. I am also the Program Lead for MS in Computer Science and have also served recently as the lead for BSc in Information Systems, the co-Lead for MSc Computer Science and Program Lead for MSc in Database Administration programs. My association with ABET (Accreditation Board of Engineering and Technology) US dates back to 2001, as a certified program evaluator for BSc in Computer Science and BSc in Information Systems. At present I serve as Program Evaluator for BSCS and BSIS programs, I also served as the Commissioner for the Computer Accreditation Commission (CAC). Previously, I have taught at 6 different countries for over 30 years. I have been privileged to be part of the DESY Group (Deutsches Elektronen Synchrotron), Hamburg Germany, as a research fellow, and worked with an MIT group, led by a Nobel laureate.

On the research side, I have been fortunate enough to secure a number of grants and have served on numerous international Ph.D. Thesis committees, been a member of the editorial boards for 7 international journals, and served as the Chair and Co-Chair for 12 international conferences. For recognition of my research activities, I have been invited to a number of international conferences as Invited Speaker, chaired panel discussions and numerous international conference sessions. I have served on more than 200 international conference program committees. Furthermore, I have published number of articles in peer-reviewed international journals and conferences. I am also an active member of ACM, ASEE, ASEE/PSW and CSAB.

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Ashley Pratt was born in Fontana, California and from an early age she had high expectations for herself. One of her first career aspirations was to be an astronaut, she begged to attend science camps, requested telescopes and NASA memorabilia for every birth day and Christmas gift. It wasn't until her sophomore year of high school that her aim changed, her grandmother was diagnosed with the early stages of dementia. This caused Ashley's goals to shift focus to medicine. She graduated high school and majored in Neuroscience at University California Riverside, learning all that she could about the brain and how it functions, and treatments and causes of dementia. After graduating she worked in medicine for 4 years before realizing engineering was actually her passion and she wanted to find a way to tie her medical background in with her vigor for engineering. This led her to pursue and obtain a Masters of Software Engineering from National University. Currently, Ashley is on track to developing and maintaining a surgical navigation system and robotic arm for her current company and continually searches for ways to help others who have family members with dementia.

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Sophie Nguyen graduated from the University of California, San Diego with a Bachelor's in Cognitive Science specializing in Clinical Aspects of Cognition and from National University with a Master's in Computer Science specializing in Software Engineering. Sophie works for Los Angeles County in handling client management and developing subject-matter programs for employees. Sophie enjoys a good TV binge, and learning languages through observations and self-teaching.

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ABSTRACT

Have you ever purchased a warranty for an electronic appliance and then completely forgot about it or misplaced it? Many of us have purchased warranties and with time have no clue of their terms or how to access these. Maintaining multiple warranties can be difficult, due to each manufacturing company having their own terms of warranties and the possibility of a customer purchasing a third-party warranty. Additionally, the method of retrieving the expiration date is different for each warranty, for some companies the customer must call the warranty company, while for others the customer is required to create an online account and maintain the required credentials for each manufacturer to attain information on the warranty in question. However, it is very easy to forget login credentials for the various websites that hold warranty information, customers may also forget which type of warranty they have, or how to even get information on their warranty. I-Tracker is a web application which makes keeping track of manufacturer or third-party warranty much easier. In this application, all types of warranties could be maintained on a single website. The website could manage, search, and sort the warranties by expiration date, and notify the user, via email, when a particular warranty is nearing expiration. With I-Tracker application, the user would only be required to remember one username and password and will automatically receive notification by email.

Introduction

We have observed that frequent innovations of electronic appliances in recent years have led not only to reduction in prices of appliances but also contributes to drop in the sale of extended warranty. To increase sales and profitability, [1] proposes offering flexible duration extended warranties. However, the continuous flow of documents reaching company back offices that deal in tracking warranty credits, completing purchase orders and replacing equipment, among other things, can present substantial financial risks.

Many of us have also purchased warranties for electronic appliances and then completely forgot about it or misplaced it with time and have no clue of their terms or how to access them and/or when these will expire. Maintaining multiple warranties can be difficult, due to each manufacturing company having their own forms of warranties and the possibility of a customer additionally purchasing a third-party warranty. The method of attaining or retrieving the expiration date is different for each warranty, for some companies the customer must call the warranty company or while others require customers to create an online account to attain information on the warranty in question. It is very easy to forget login credentials to the various websites that hold warranty information, users may also forget which type of warranty they have, or how to even get information on their warranty. Is the warranty a manufacturer warranty or did they purchase a third-party warranty? How do I know when my warranty term has reached expiration? After realizing this recurring misfortune, we propose the idea for an application that would allow users to create a personal profile, upload their appliance's warranty information, sort their warranties, and automatically be informed, via email, of its expiration.

Authors in [2] highlight the significance of automating tracking of replacement medical devices and passing the credits on to Medicare. Research on warranty tracking also reports that warranty for trucks is time sensitive, because of their busy schedule trucking company often have a very narrow window of time for replacement of a faulty part. Adding to the complexity of the process is the need to do everything perfectly in order to submit a successful warranty claim. Telematics companies [3] that track truck data often also get involved in warranty tracking process. M2 PRESSWIRE [4] is another warranty management system that effectively automate the warranty

management process which includes warranty coverage, administrating campaigns and product registrations, contract management, warranty and contract tracking, part return and supplier cost recovery. In [5] authors considered a complex system such as a custom-built product, where multitude components and conditions must be taken into account.

Web Application

Warranties are hard to keep track of; generally, manufacturers have different websites and the user is required to create and maintain the credentials for each of their appliances. By converging all the warranties at one location, the user will not have to remember what company, how long the warranty term is, and lastly, they will not have to remember how to get hold of warranty information for each appliance. We propose a web application, I-Tracker, that is intended to make it easier to keep track of manufacturer's warranty or third-party warranty's expiration date and smooth the process of warranty tracking for users. Moreover, the user would only be required to remember one username and password, rather than having to track multiple credentials for various websites. Additionally, the user will be automatically notified via email when warranty expiration date is nearing or expired for an appliance, dependent upon the users selected notification settings. The user will also have the ability to manage, search, and sort the warranties by expiration date. These features will collectively aid the user to have a timeframe of when to act on warranty covered repairs, prior to the warranty's termination. This will also help the user save money by not having to fully replace their appliance if they do not seek repairs within the time that their appliances are under warranty or pay out of pocket for warranty covered repairs.

I-Tracker, like any other web application, must be able to meet users' needs in terms of ease of use and speed; there would be no greater failure than creating a hard-to-use and slow web application. To further expand on the user experience, we also validated that the web application is visually appealing, and the flow of the web application is intuitive. Additionally, the user interface design maintains its simplicity by utilizing familiar icons in the navigation bar at the top of the I-Tracker application page. The icons included in the navigation bar are the home icon represented by a house, settings icon represented by a gear, a magnifying glass for search, question mark for viewing/asking questions and a logout button. These icons are utilized with many of the applications and websites that we visit on a regular basis, like on Facebook and Instagram, thus making the icons well known and easy for the user to understand and navigate through the website.

We created a simplistic layout, with color-coded sections, indicative of the length of time remaining on the warranty term and utilizing one click solutions. The user may discover more about this information by clicking on the "details" option on the right side of the warranty description of interest. Once the user clicks on said warranty, they should be redirected to another page that displays the expanded warranty information, which includes purchase date information, warranty start and end dates, item serial number, purchase location, and the nickname the user selected for the said item.

The proposed web application uses a database to store the data contingent on the relationship amongst the data stored in the database. To organize our data into the database, MySQL is used for database server. The web application use MySQL dump command to backup, and MySQL source command to restore the data, which guarantees the data recovery in case the web application data

is lost or broken. The web application may be visited through the client's browser on their desktop or laptop computer, as well as, various devices like tablets and mobile phones. The web application will demonstrate the responsive GUI according to the screen size of the client's devices. The web application uses HTTPS protocol based on Tomcat web server, which encrypts the transformed data onto the internet to avoid the data from being easily hacked.

I-Tracker Functionality

I-Tracker allows users to register by creating a username and password combination. The password user creates is then encrypted by AES. After users complete the registration process, the web application will send an activation link to the registered email address. Users can activate their account by clicking the link in the activation email, which should redirect the user back to the web application's homepage.

User Login: The web application authenticates the user with the correct username and password combination. When the authentication is successful, the web application will redirect the user to the dashboard page.

Forgot Password: The web application allows user to reset the password by the feature of "Forgot Password." Once the "Forgot Password" option is selected, users enter the email address to receive the token link to reset the password.

User Dashboard: After users log in, the web application allows users to view the dashboard page. Initially, the dashboard presents color-coded boxes, which correspond to the amount of time the user has remaining on the warranties they have submitted to the web application. The color-coded boxes correspond to the colors as follows:

- Green Box: more than 2 months left on the warranty.
- Yellow Box: 1 to 2 months left on the warranty.
- Orange Box: 2 weeks to 1 month left on the warranty.
- Red Box: 2 weeks or less left on the warranty.

Beneath the color-coded timeline boxes, one table displays all items to their corresponding column, warranty number, status, and the company providing the warranty. Upon clicking on a color-coded timeline box, the table should display the user's warranty information for the corresponding timeframe.

Add Items with Warranty: After users log in, the web application allows user to add a new item with its warranty number and associated information as shown in Table #1.

Filtering Function: The user may filter the warranties displayed on their dashboard by warranty company name, warranty start/end date, warranty number, and item name. Once the user chooses the way they would like their information to be shown, the warranty information should now be displayed to meet the user's requests.

Item Warranty Tracking Detail: The dashboard table displays the summary of the items under warranty. Additionally, the tracking detail displays all necessary information about the item, including: the time under warranty remaining, the items' identification numbers (serial number and model number), warranty start date, warranty company, and purchase information.

Item name	Purchase date
Purchase from	Manufacturer
Model number	Serial number
Warranty number	Warranty start date
Warranty term period	Warranty company
Warranty type (manufacturer or third party/extended warranty)	

Table 1: Warranty Information

User Preference Setting: Each user can set the preference timeline of warranty termination warning, from a specified time-based criterion. For example, users may select to be warned when they have 6 months left on their warranty or to be warned when there is 3 months left on the warranty. Once the preference setting is changed, the dashboard shall be updated accordingly.

Frequently Asked Questions (FAQs): The web application allows users to submit the questions on how to use the specific functions on the web application, and the problem that users come across on the web application. The FAQs page also displays the questions that have been requested more than ten times.

Securing Information

Security is also a concern for our application due to user's needing to provide personal information and creating login credentials, we would not like that our user's information to be easily accessible to malicious intent. To provide security to our user's information, we utilized Spring Security, which provides the HTTPS protocol, password encryption, and customized authentication settings, this is shown in Figure #1. With these security measures in place, users can be assured that their warranty information is secure.

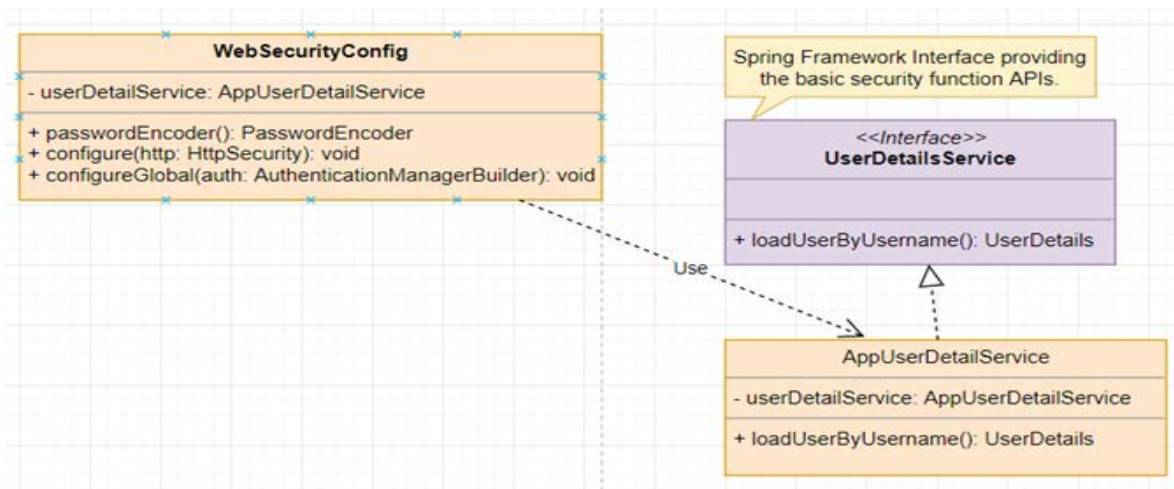


Figure 1: Security Access Class Diagram

System Architecture and Working

Figure # 2 shows components of the architecture for I-Tracker. Figure #3 shows how a user would navigate through I-Tracker. To begin, the user enters his or her information (registered username and password and a working email address) for registration purposes. The information is stored in the User Database. After that, the user would use his or her username and password to enter as their login information, a record of each login attempt is stored in the User Database. Also, while logged in, the user has the ability to set up their preferences, particularly regarding the four boxes of timeline settings. These will be stored in the User Database, as well; and could be accessed through the main page, called the Dashboard, which is a data-driven display that will show the warranty information.

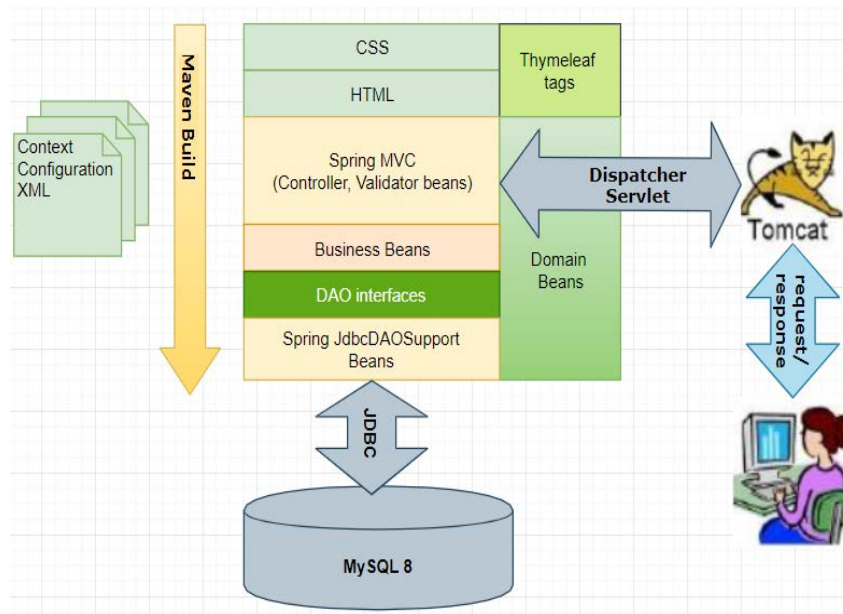


Figure 2 Architecture Diagram

There are four timeline boxes that are featured as widgets on the Dashboard and are color-coded as red, orange, yellow, and green. Each one has a default option constructed to be whether for 2 weeks or less left (red box), 2 weeks to 1 month left (orange box), 1 to 2 months left on the warranty (yellow box), and more than 2 months left on the warranty (green box). A user can change the settings to these four boxes in accordance with their choices. For example, if the user makes the red box for more than 6 months left on the warranty, then the yellow box will be changed accordingly to 3 to 6 months left on the warranty. The orange box will be for 1 to 3 months left, and the red box will be for 1 month or less left. The four boxes pull from the User Database, as well as, filter multiple items' warranty information based on its timelines.

In addition, the user has a place in the web application to enter information about the appliance. Upon submitting the form all the relevant information, will be stored into the Warranty Database. Within, the system arranges the information in a certain order based on warranty periods, oldest to newest or vice versa. The information shall end up being presented on the Dashboard page.

Lastly, a user can ask any question about the web application, for help or assistance. These questions are submitted as a question form. All user questions are gathered and stored in the FAQs Database. Depending on what questions are recurring and appear often, it might either lead to Frequently Asked Questions (FAQs) being published with an answer or to a tutorial video being created as a step-by-step visual aid. These shall be posted, as instructional information, on a page with the FAQs section.

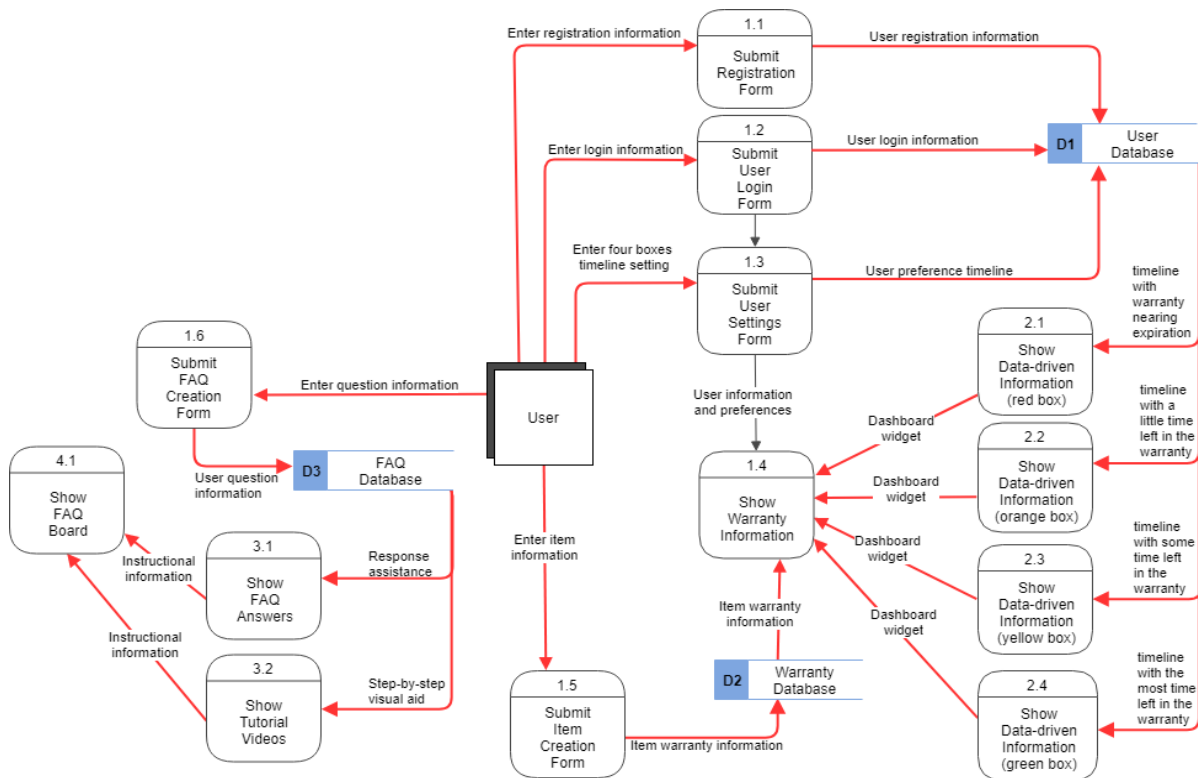


Figure 3: Web Application working

User Interface Design

Various pages on the web application were designed using Adobe XD. There are interactive actions that can take a user from one page to another page and even back to a previous page. As an example, one click will direct a user from the User Dashboard page to the page where an appliance's information can be added. Another click, onto the 'Save' button, will redirect the user back to the User Dashboard page. In addition, there are 'Home' icon, 'FAQs' icon, 'Search' icon, and 'Settings' icon. The 'Home' icon on any page will redirect a user to the User Dashboard page. The 'FAQs' icon links to the page of Frequently Asked Questions (FAQs) that are displayed as a collection of emailed or messaged questions users commonly had inquired about. If the 'Search' icon (which is a magnifying glass icon) is clicked, a search text box will be generated. By selecting the 'Settings' icon (which is a gear/cogwheel icon), the user will be taken to the User Preferences/Settings page. Users also has the ability to set email preference notifications and provide the option of receiving or not receiving emails in regard to a warranty's termination. Lastly, upon registration, the user receives a confirmation email to verify that they are the individual that created the account, this

authentication feature allows users to ensure that they are in fact, the individual requesting an account with I-Tracker. Figures 4 to 8 show the screenshots of the different pages from the I-Tracker web application proto type:

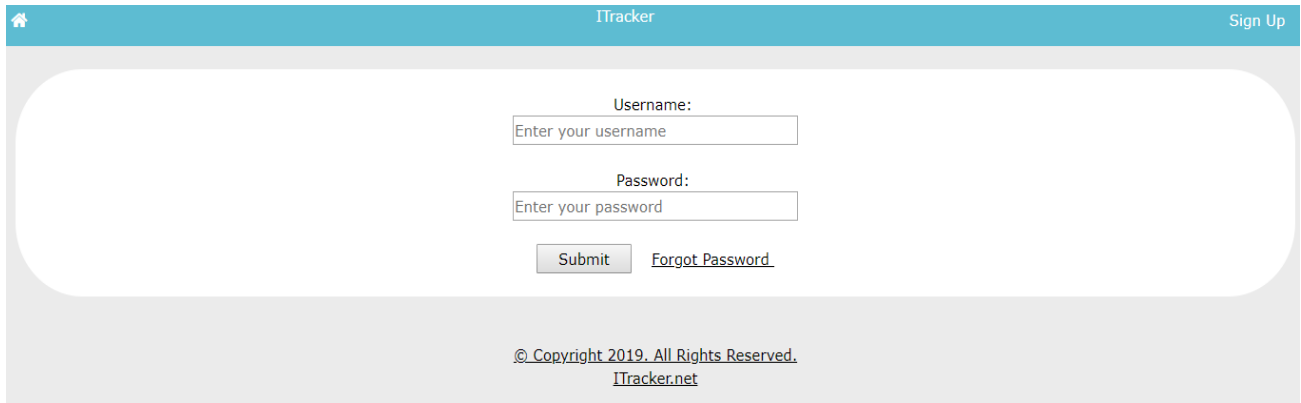


Figure 4 - Login Page

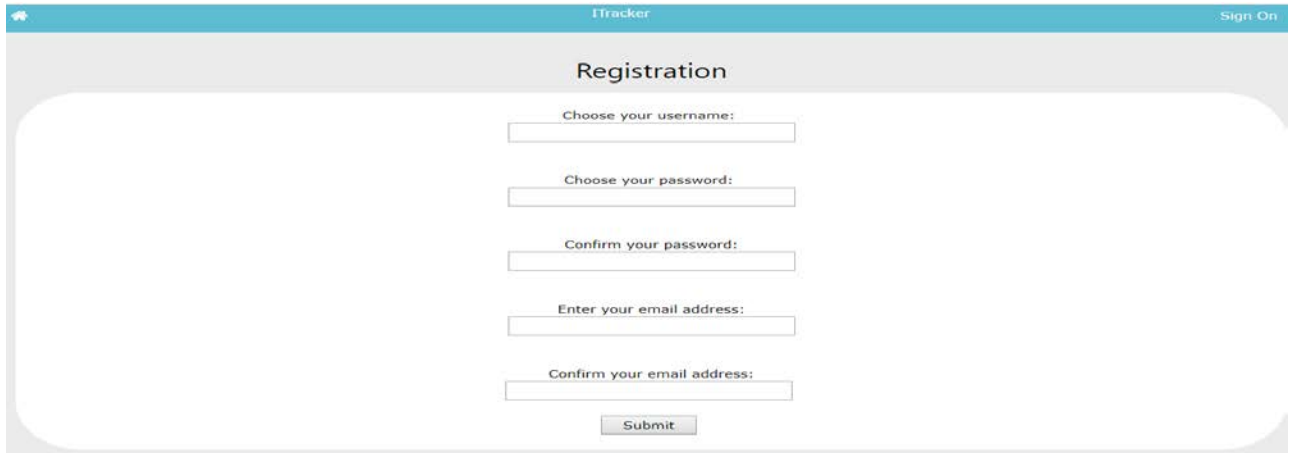


Figure 5 - Registration Page

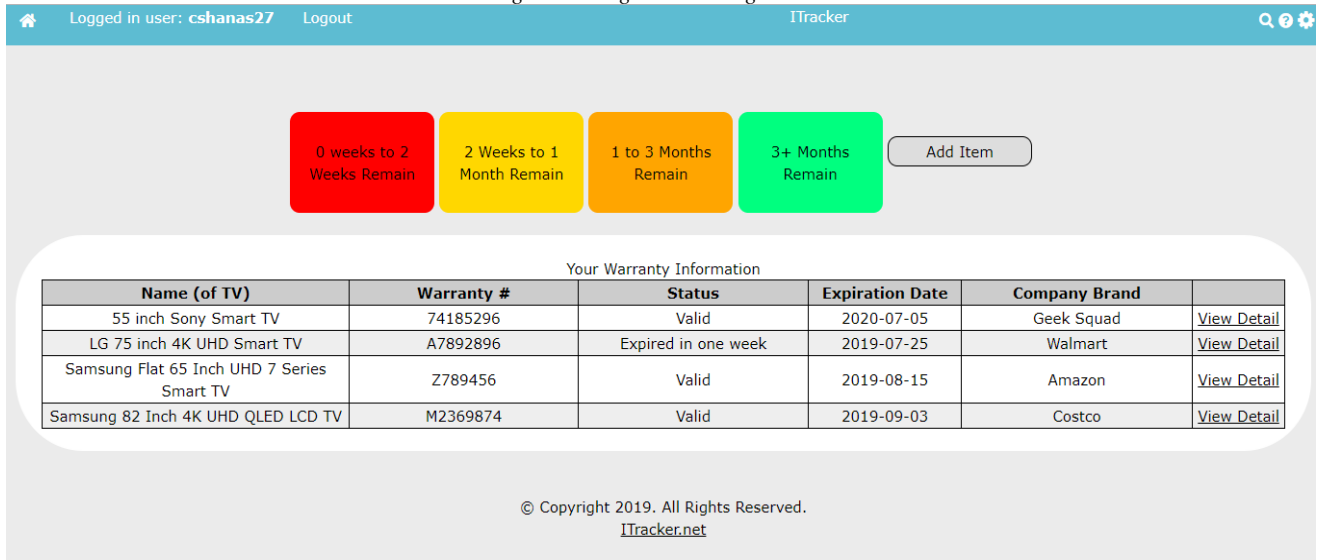


Figure 6 - Dashboard

Logged in user: cahanas27
Logout

I-Tracker

Add Items

Item Name:

Purchase Date:

Purchase from:

Manufacturer:

Model #:

Serial #:

Warranty #:

Warranty Start Date:

Warranty End Date:

Warranty Company:

Warranty Type:

Submit

Figure 7 - Add Items Page

Time Remaining: 349

Item Name:
55 inch Sony Smart TV

Purchase Date:
2019-07-05

Purchase Location:
Best Buy Mira Mesa

Manufacturer:
Sony

Model #:
XBR55X800G

Serial #:
123456789

Warranty #:
74185296

Warranty Begin Date:
2019-07-05

Warranty End Date:
2020-07-05

Warranty Company:
Geek Squad

Warranty Type:
Limited 1 year warranty

Back

Figure 8 - View Details Page

CONCLUSION

This web application is intended to centralize and store data on one's warranties in one place and would require only one set of credentials. It can record and catalog certain information about each warranty that a user has stored. This system eliminates the need for user to remember several usernames and passwords for multiple accounts, that holds information to their different warranties. I-Tracker web application also alerts users and customers via email when a warranty period is nearing its expiration date. I-Tracker web application provides login/logout, user registration, new item registration, user dashboard, individual warranty, FAQs, and forgotten username/password pages.

FUTURE WORK

In future iterations of the I-Tracker application, have four key features that we would like to add to enhance the overall user experience. The future releases of the I-Tracker application shall include warranty tracking for customizable time frame settings for the timeframe widgets, a mobile application, and the professional appraisal/resale feature for the electronic devices under warranty. The final two features that we plan to add in a future release is the addition of a mobile application and the resale feature. The mobile application will allow the users to have access to all the information on the web application in the form of a mobile app, this will help the user enter new warranties easier and allow the user to get notifications sent directly to their phone rather than just the email. Lastly, the addition of the appraisal/resale feature allows the user to sale items that may be nearing their warranty ending, ensure that they are selling the used electronic for a fair price, or if the user may be undercharging/overcharging for the resale of the said electronic item.

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