ABSTRACTS

Cryptographic Hash Functions using Expander Graphs and their Practical Applications
Thu Bui

A hash function is critical and valuable in Information Security as it offers both data reliability and security for many practices. Even non-cryptographic hash functions have numerous applications, ranging from compilers and databases to video games and computer networks. Thus, in this study, we propose constructing collision-resistant hash functions from expander graphs. It is typically called expander hash function or expander hash and used to map a string with an arbitrary length to a number. We try to apply fundamental mathematical results from Number Theory and Graph Theory on Expander Graphs because Expander Graphs give good randomness properties, which are already widely used in the field. Moreover, it is proved that the distribution of the final nodes reached by the random walk asymptotically tends to the uniform distribution. We implement our hash function for several Expander Graphs constructed by Explicit and Random Methods and compare their output distribution and speed with the most non-cryptographic hash functions. Some applications of non-cryptographic hash functions are also explored.

A Real-Time Object Detection Aid for the Visually Impaired
Alisa Levin and Rahul Mitra

2.2 billion individuals world-wide suffer from visual impairment. Current technology-based aids are expensive and inaccessible. In our project, we leveraged advances in microcomputer technology to create an efficient, easy-to-use, real-time object detection system for the visually impaired. This system consists of a Jetson Nano microcomputer which receives video input from an attached camera. The Nano uses a deep learning model to identify objects in the user's immediate environment in real-time. This information is then relayed to the user auditorily through an iOS smartphone application that interfaces with the Nano. To achieve this, we implemented a pre-trained object detection model, SSD Inception v2, as well as a Bluetooth GATT server on the Nano. We developed an iOS application in order to facilitate the real-time wireless transfer of this model's classification labels from the Nano to the user's smartphone. The system was mounted on a white cane to enhance a tool already commonly used. We hope our system is a step towards an open source and affordable alternative to current visual aid technologies.

Persistent Virtual Graffiti
Hunter Moore, Wayne Sassano, and Tyler Somerville

Persistent Virtual Graffiti (PVG) is a project to enable messaging and creative expression take root in an Augmented Reality setting, allowing users to publish a painting on a real world wall that will be displayed to other users if they were to walk past that same wall and look at it through our app. Graffiti is a divisive subject given a growing disparity of viewpoints, aesthetic sensibilities, and preferences of people all living in the same area. PVG lets sharing ideas, messages, or art be nondestructive yet still public, and trivially simple to filter out art that isn't to one's taste. Currently, there are platform bound graffiti apps but the artwork vanished when the session ends, and there are cross platform messaging apps, but no persistent AR writing / messaging app across iOS and Android devices. ARKit and ARCore both use different systems to store world anchors to 'remember' rooms but Apple's will not work with Google's and vice versa. Our system is platform agnostic and enables the focus to stay with the users and their content. With millions of colors to draw in and support for a billion devices, PVG is in a good position as AR only becomes more widespread.

TrinTrade
Ted Tierney

At the beginning of every school year new as well as returning students find themselves looking to buy new furnishing for their rooms whether it's a fan or a bed. This makes dorm living more expensive as well as

arduous to complete for college students who may not have flush bank accounts or a car to go pickup items, we can solve this with our own Trinity unique shopping/selling site. throughout the course of this year I have completed both the design phase and development stage of creating this website using InVision to create a wireframing of the user interface and react in coordination with firebase to develop the application. While this does fall short of my initial goal of having the application hosted by this time, I am satisfied with my work.

RecipeMe App
Erika Bates

Society's high pace lifestyles have significantly affected the way communities prepare day to day meals. People often struggle to put together meals using the ingredients they already have, unaware of the quantity of items within their food storage. This leads to more significant problems such as food waste, unhealthy eating, and inability to track food budget. This mobile application aims to ease the task of preparing meals with a practical system of food management. I will present my mobile application that allows users to store an inventory of items, find meal and drink recipes that use your current ingredients, explore Ketogenic, Pescetarian, Vegan, Vegetarian, and regular recipes, as well as desserts. My goal for this project was to create a user friendly cross-platform application that promotes dietary health and lessens food waste, while also easing the stress that meal planning may cause.

Adaptive Agenda Assistant
Ryan Gress and Will Laroche

Time management in the modern era has become simultaneously more important and more difficult. This project aims to streamline the process of managing deadlines by keeping track of its users tasks, building them custom schedules each day, and adapting them as things change, ensuring that every deadline is met while minimizing the effort required on the user's end. This minimization is extremely important; human inconsistency is a common and traditionally difficult to avoid pitfall in otherwise robust scheduling and time management efforts. By significantly cutting down the time needed to both construct a schedule, and reconfigure it when things change, users will therefore be more able to adhere to the plans put forward by the application, thus staying on top of all their responsibilities and deadlines with ease. This tool takes the form of a web application accessible on both mobile and desktop. Events are added by giving descriptions including deadlines and total time needed, and they are automatically scheduled for the users based on when free time is available. Smart suggestions beyond simply scheduling are made. For instance, larger projects, which take significant time, are broken up and distributed for the user across multiple days. The key difference between this and other tools is its flexibility. If a previous task goes too long, or the user doesn't start on time, the rest of the day will be moved around to fit the changes. Rather than just moving everything forward, tasks are rearranged so the user can end their day of work at the same time as usual, with more important events prioritized, and others moved to other days of the week. Likewise, if something is finished early, it allows users to get ahead by finding them something to do with their gained time. Overall, it hopes to optimize both users' approach to time management, and in doing so optimize their schedules and maximize productivity.

Squash Program Manager
Min Jie Teh

The goal of this project is to develop a functional web-based squash program management system that will help improve the communication and administration system that is currently in place at the New Haven Lawn Club Squash Program. Using this software, the Director of the Squash Program will be able to share up to date information with clients, which includes the types of services they provide, coaches profiles, and program updates. He will also be able to coordinate and share data through a portal that will only be accessible by himself and his assistant coaches. Using the data as a guideline, coaches will be able to plan programs that are specifically tailored for each client. They can also revisit and update the database, so the

client profiles match their current performance. The data can also be shared with clients so all parties can share a mutual understanding on what needs to be improved in order to help clients achieve their best potential in the sport.

Smart Scheduling Buddy
Julian Garcia-Sanabria, Lewis Nikuze, and Ziad Sakr

The Trinity ID office has a ticketing system used to inquire on ID requests, yet they do not have a system to schedule appointments in a user-friendly way. Before the pandemic, clients could walk up to the desk and inquire about their issues; a staff member would create a ticket for the user, the user and staff would correspond via email, and the client would come in at their convenience to find in-person assistance as needed. Now, with the pandemic, if any in-person assistance is needed, appointments are required. Because of this, it is harder to find a time that works for the clients and staff, as well as finding an efficient way to keep everyone safe. Therefore, we seek to make this process more direct and easy for everyone. Using Angular, Firebase, and DialogFlow, we have developed the Smart Scheduling Buddy, a web application that will allow users to schedule appointments at their convenience. This application will help in finding common times to receive assistance, and with the help of a chatbot, cut down on unnecessary appointments as well as get users the help they need as soon as possible.

Menstrual Cycle Tracking for the Contraceptive Pill User
Kelly Ido

Even though there is a number of menstrual cycle tracking apps today, there are two main problems with current tracking apps. Firstly, the prediction of the app is often inaccurate. Secondly, users would not come back to the app daily even though daily input is crucial to give an accurate prediction. To solve those issues, Menstrual Cycle Tracking for the Contraceptive Pill User will be developed. This app will make the prediction using the hormone level according to the users' medication. Moreover, it allows users to record the time that the medication is taken by simply holding the NFC tags sticker on an NFC tag reader, which is an iPhone. As the first step, formula to predict the expected date of menstruation is developed using the hormone levels and the sample data. Then, the basic features such as the function to predict the date of the period and the function to keep track of past data are implemented. After that, a function that makes it easy to record the time that the medication is taken with an NFC tags sticker will be included.

Get Home Safe
Kevin Klotz and Kyle Long

Get Home Safe is an iOS app that helps students at Trinity College get back to their rooms safely and efficiently. The app allows students to track the location of the campus bus and a function that locates emergency blue light phones around campus. This project is meant to solve the problem of the campus shuttle being an underutilized resource at Trinity. Most students opt to not use the shuttle because its whereabouts are unknown and as seniors, we wanted to create an application that has the potential to improve the quality of life on campus. Our app is powered by installing an old iPhone that will act as a beacon for the shuttle to transmit the location to our server where the shuttle's location will be logged and then distributed to the users of the Get Home Safe app. When opened, the application tracks the shuttle bus in real time and displays the locations of blue light phones for the user.

Playlist Pro
Aidan Lee

Playlist Pro is an iOS music application for Spotify users to make the perfect playlists. Quickly import an existing Spotify playlist into the application and then add any music available on YouTube as well. They can then be played together through the Playlist Pro App. This is achieved by finding a YouTube video of the same audio for each of the Spotify songs and all the audio is downloaded through YouTube. Playlist Pro gives you full control to cater the playlist experience: you can crop individual songs, add crossfade

transitions between songs, and change the playback speed of songs, alongside all the basic playlist management features you would expect from a music application. With Playlist Pro you can make the perfect mix for any occasion, entirely on your iOS device.

Mobile Data Collection in Field Sampling Environments
Giles Lemmon

This project greatly simplifies the process of collecting data when sampling in the field. These field surveys are common in Environmental Science, where a researcher goes out into the environment, and records the same type of information repeatedly (species of tree, and height, for 100 different trees, for example). This process is vastly simplified with this mobile application, enabling researchers to create surveys, add samples to those surveys, and then export the underlying data in an easy to access excel format. This application was developed using the SwiftUI framework for deployment on iOS devices.

Pairs Trading Analysis: A Look into the S&P 500 Constituents and the Best Pairs to Trade
Gabby Rogers

In finance, pairs trading is a market neutral strategy, meaning it can provide excess returns irrespective of the overall market trends if implemented correctly. The pair of securities share a common economic link, and the price spread of the two securities remain constant throughout time. However, at times, there may be a divergence in the spread in which one stock moves up while the other moves down relative to each other. If you expect this divergence to revert to normal with time, you can make a pairs trade by selling the outperforming stock and buying the underperforming stock. This past year, I have developed a software system that computes the underlying statistical analysis of S&P500 data for the user. I specifically narrow in on the Communication Services and Information Technology sectors of the S&P500, and the most profitable trading pairs within those sectors.

Re-imagining Cinestudio's Ticketing Solution
Will Estony and Erkin Verbeek

Cinestudio is a non-profit arthouse-style cinema founded in 1970 on the campus of Trinity College in Hartford, Connecticut. For years Cinestudio has relied on volunteers to keep itself running; however, the current ticketing software they use is slow, unreliable, and difficult to learn. For this reason, we intend to develop an efficient and intuitive ticketing system replacement for the theater. We interviewed many people involved with Cinestudio so that we could get a strong idea of the issues our solution should address. Over the course of the past year, we have utilized the JavaFX front-end framework to implement a full-fledged point of service (POS) application. Our application stores customizable users, events and donors in a secure database, protected by 128-bit AES encryption. Our project also interfaces with the Square Terminal API to ensure a reliable transfer of funds from patron to Cinestudio takes place every time a ticket is sold. We are confident that our modern and straight-forward interface will appeal to users from any technological background.

ArtFlow
Quinn Luong

Creating art is an explorative experience. Artists do not make art only to reach the end goal of how the art piece should look, but also immerse themselves in the process of art creation. Thus, it is common for artists to take pictures of their work in progress (WIP). While numerous platforms such as Instagram and DeviantArt exist for artists to upload their WIP photos, they are not designed to record the journey, but to present the "perfect" final product. My project goal is to develop an iOS application that focuses on the progressive and transformational aspects of art creation. I used XCode as my IDE and Swift as the main language to create the iOS application. CoreData is used for the database of the application. Figma is utilized for the design process to create the user interface and an enjoyable user experience.

BESUCHA: The Better Enrollment Software Using a Conflict Handling Algorithm

Edwin Aldrich, Logan Drescher, and Bettina King-Smith

Our project, BESUCHA, or the Better Enrollment Software Using a Conflict Handling Algorithm, is a proof of concept desktop application that could replace or supplement Trinity's current course registration system. We think that the current course enrollment system used by Trinity, one in which students are arbitrarily enrolled into sections on enrollment day, is a system that could be improved with an algorithm. Therefore, we designed an algorithm that matches students with courses, based on a ranked list of preferred courses provided to us by students, and returns a proposed list of student-course matches. We believe that using an algorithm to match students and courses can increase student satisfaction with the resulting course schedules, and additionally reduce stress and labor for the Registrar's Office. Thus, we hope that BESUCHA can increase student, faculty, and administrator satisfaction with the course registration system.