

Kart

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Honor Code

I pledge my honor that I have not violated the Honor Code during this project, including and not limited to this paper or Kart's code.

Abstract

This paper details the design, development, and evaluation of Kart, a social e-commerce web application. Kart provides a fundamentally new way of shopping through displaying products *only* via short, user-generated videos, as opposed to text and pictures. Kart aims to merge social media and e-commerce to create an entertaining, authentic, and interactive shopping experience.

Introduction

In 2020, Instagram — the most popular social network for millennials and Gen-Z — released a major update: Shops. Shops allow brands to sell their products via influencers to directly tag products to their posts. This is a clear signal that the largest social media platforms are recognizing that there's a huge opportunity to merge e-commerce with media. To understand how this trend came about, we must first understand the history of social media and e-commerce platforms.

When e-commerce and social media platforms first emerged in the early 2000s, they were completely distinct experiences. E-commerce was an individual online shopping activity and

social networks were for engaging with friends about puppies. Platforms of this era include Amazon, Facebook, and Twitter.

The widespread adoption of mobile phones and increased phone camera quality brought about a new kind of platform starting in 2010. Companies like Instagram and Snapchat offered a fundamentally different kind of social experience, as their platforms were centered around pictures and videos as the primary medium of communication, as opposed to text. Content exploded — every person became a photographer. Brands started partnering with influencers to create high-quality content that showcased their products.

Today, we are seeing the world of social media and e-commerce combining to form a new type of platform: social e-commerce. Where previous e-commerce platforms were single-player, social e-commerce apps are multiplayer, meaning the core product experience includes engaging with other users. In the following ‘Related Work’ section, we will take a look at the different social e-commerce categories.

Problem Background and Related Work

Related work

As the line between social media and e-commerce has become increasingly blurry, four main types of social e-commerce platforms have emerged:

Category	Companies
Livestream-shopping	Popshop Live , Whatnot ,
Democratized influencing	Trendsi , 21buttons , Depop
Teambuying	Pinduoduo , HeyCosmic
Content-based commerce	Instagram , SuperGreat , Tiktok

Livestream shopping platforms allow brands to engage customers in real-time by showing their products over a livestream. This kind of platform is very authentic and engaging, but the downside is that it requires users to be online at a certain time. Since videos on Kart are displayed asynchronously, users can watch videos at any time.

Democratized influencing platforms allow people to sell products on behalf of brands. These “sellers” promote the brand’s products on social media or to their offline social circles and earn

a commission for every sale they drive. Previously, only established influencers could sell products in exchange for a commission, but these platforms make it possible for an average person to do the same. These platforms allow people to get “credit” for sharing products with friends, but they feel sales-y. Imagine a friend constantly bugging you to buy clothes that you know they get a commission for. These platforms feel like advertisements; the product is not “entertaining.”

Teambuying platforms enable people to receive discounts by purchasing with other people. This was pioneered by Groupon but taken to a whole new stratosphere by Pinduoduo in China, which scaled from \$0 to \$100B market cap in only five years. These platforms are perhaps the best embodiment of “social” e-commerce because the core value proposition is collaborative and multiplayer. However, most platforms still display products through text-based posts (like Amazon and most traditional brands), as opposed to centering posts around user-generated photos or videos. The focus is on saving money, not on consuming content.

Lastly, there are content-based e-commerce platforms. Imagine normal social media (e.g. a network centered around consuming content), except some or all of the content are products. TikTok Shopping and Instagram Shops, are all examples of such platforms. The upside of these platforms is that the shopping experience is highly entertaining since it’s centered around media consumption. The downside is that the purchase UX is fragmented — users cannot buy the products directly in the app. Instead, they must go to a 3rd-party website to make the purchase.

Kart sits at the unique intersection of content-based e-commerce and democratized influence. It allows any individual to create and earn social/financial capital based on their content, while enabling users to purchase products directly on Kart.

The wedge

Kart’s wedge, or the starting target market, are food and beverages, specifically non-perishable snacks. Not only are these extremely high margin products, but it’s a fast-growing market as well. As the figure below shows, Covid-19 has accelerated food and beverage e-commerce sales.

Retail Ecommerce Sales in the US, by Product Category, 2020

	Sales (billions)	% change	% of retail ecommerce	% of total retail
Computer & consumer electronics	\$156.50	17.9%	22.0%	49.5%
Apparel & accessories	\$135.49	8.6%	19.1%	36.7%
Furniture & home furnishings	\$78.31	12.4%	11.0%	29.9%
Health, personal care & beauty	\$72.10	32.4%	10.2%	13.0%
Auto & parts	\$51.54	12.6%	7.3%	5.2%
Toys & hobby	\$51.23	20.9%	7.2%	47.8%
Books, music & video	\$42.30	13.9%	6.0%	62.7%
Food & beverage	\$41.52	58.5%	5.9%	3.7%
Office equipment & supplies	\$15.62	17.9%	2.2%	39.3%
Other	\$65.18	17.8%	9.2%	6.1%

The US snack market is projected to be worth \$45.8B in 2021.¹

Snacks are just the wedge in the market. Kart's concept of video-shopping can be applied to everything from fashion to beauty to toys.

Watching people eat food isn't a hypothesis either; people already do this. Mukbang is a popular phenomenon started in South Korea in which viewers watch other people eat food. Zach Choi, the top Mukbang YouTube channel, has 11.3M subscribers.²

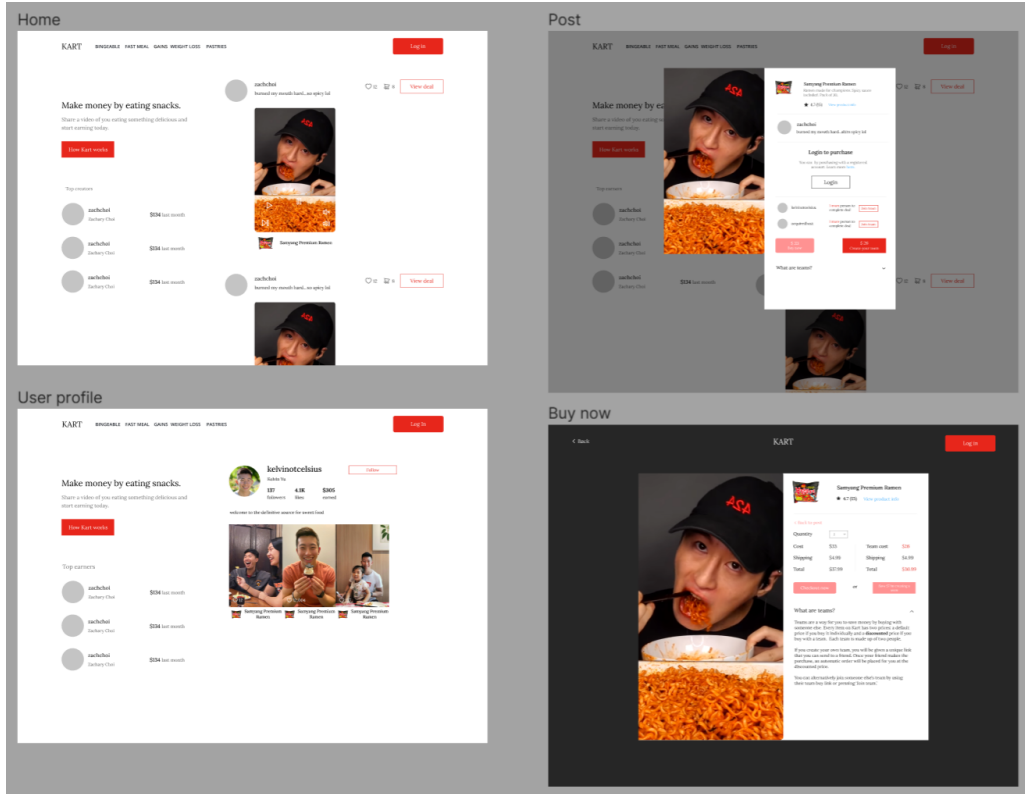
Approach

Design

I designed the application on Figma before building it. Here are the initial high-fidelity prototypes:

¹ <https://www.ibisworld.com/industry-statistics/market-size/snack-food-production-united-states/>

² <https://www.youtube.com/channel/UCI78Adil6f7VKhqW1i4B3Rw>



The screenshot above shows the Home (upper-left), Profile (bottom-left), and Post pages (right). The Home page consists of a feed of videos created by users. The profile page shows the videos posted by a single user. Lastly, the post page shows the video, the product, and allows users to purchase the product directly on the app.

Make money by eating snacks.

Share a video of you eating something delicious and start earning today.

How Kart works

Top earners

- zachchoi
Zachary Choi **\$134** last month
- zachchoi
Zachary Choi **\$134** last month
- zachchoi
Zachary Choi **\$134** last month



Samyang Premium Ramen

Ramen made for champions. Spicy sauce included. Pack of 30.

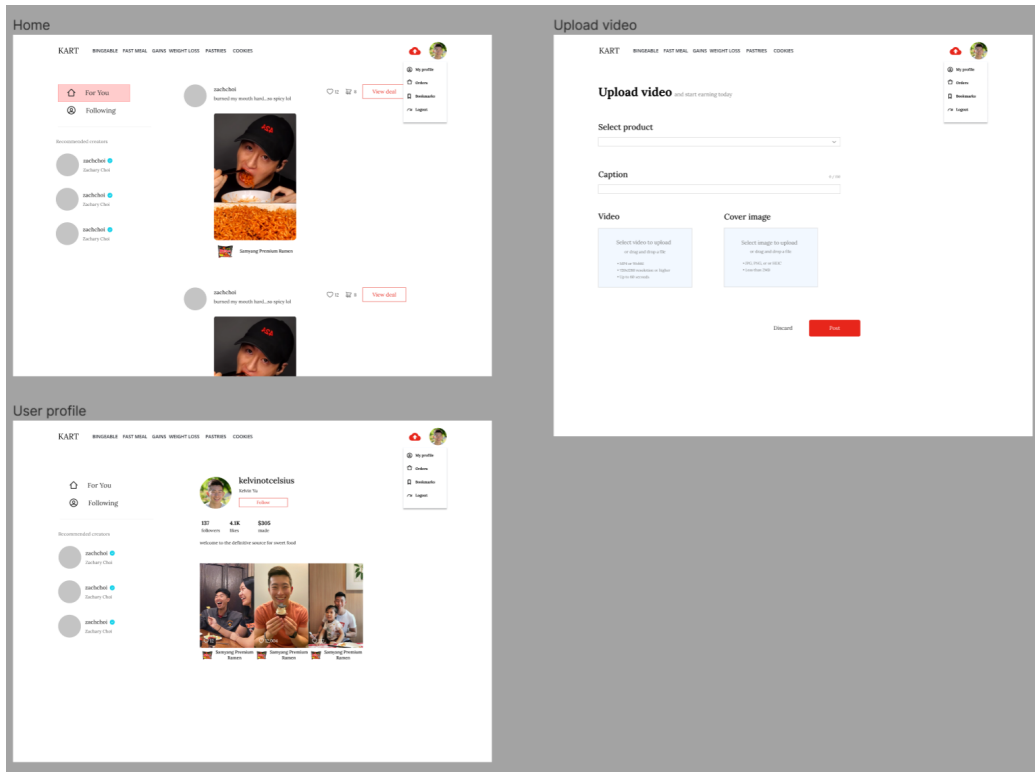
3K+ bought ★ 4.7 (15)

www.samyangramen.com

Most liked videos **New videos** Product info Reviews



The above screenshot shows the product page, which contains all the videos made for a specific product.



This screenshot shows the Home, Profile, and Upload Video pages for users who are logged in.

Notice the menu and the 'upload video' icon in the upper right-hand corner — these are only available to users who are logged in. The upload video page allows users to add videos to Kart *only* for products they've already purchased on the platform.

Value propositions

Kart services three distinct types of users: customers, creators, and brands.

Customers purchase products. Anyone can be a customer as long as they sign up for a Kart account. Creators make videos displaying the products. Anyone can be a creator as long as they've purchased the product. Lastly, all products on Kart are uploaded by partner brands (for the purposes of the IW, the products are scraped off the Internet). Since products come from vetted brands, a high bar for quality is ensured.

Let's clearly define the value propositions for each:

Creators

- Earn social capital (e.g. followers, likes) like other social networks
- Earn financial capital (10% commission)

Customers

- Shop for products you would buy anyway, in the most entertaining way
- See products displayed through videos, which are the most authentic medium (much harder to fake videos than photos or text)
- Videos are created by other individuals, not sponsored influencers -- this promotes authenticity
- Purchase products directly on the platform instead of leaving to a 3rd-party website

Brands

- Free content creation from customers
- Free customer acquisition channel -- it costs brands nothing to join

Implementation

Github

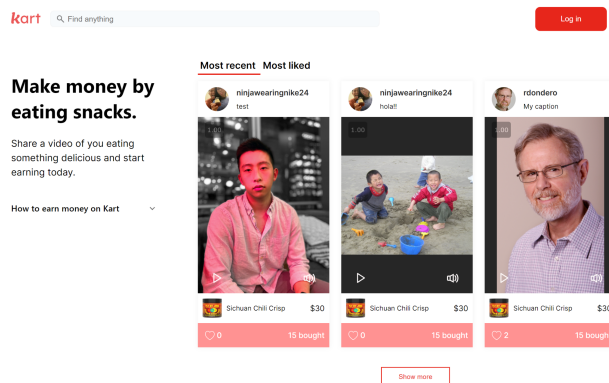
Here is the link to Kart's Github repo. I've shared access with rdontero@cs.princeton.edu and rdontero@princeton.edu.

Kart's codebase is made up of: 82.6% JavaScript, 16.5% CSS, and 0.9% HTML.

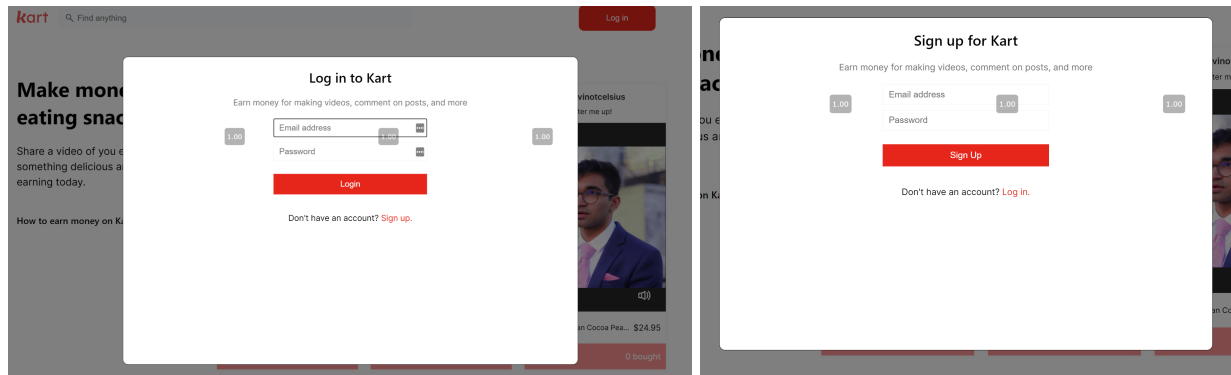
Functionality

The final version of Kart differed slightly from the original designs.

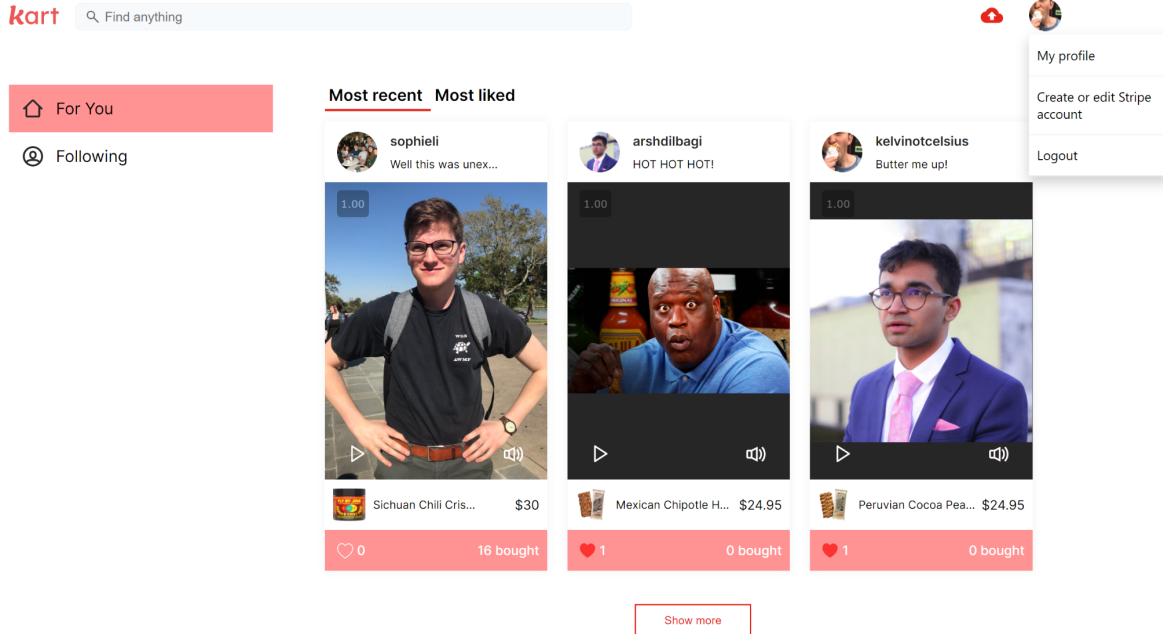
Here is the Home page, which is what unauthenticated users first see when they navigate to Kart's website. Notice that the video layout is different from the original designs, and the menu in the top right navbar is replaced with a search bar.



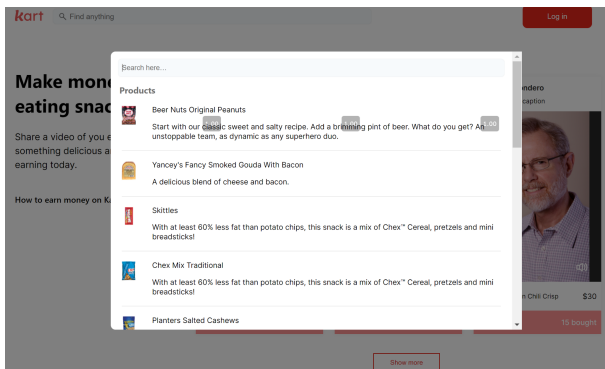
When you click the 'Log in' button, a modal pops up that allows users to log in. If you don't have an account, you can press the 'sign up' link in the modal, which will change the modal to a sign up modal.



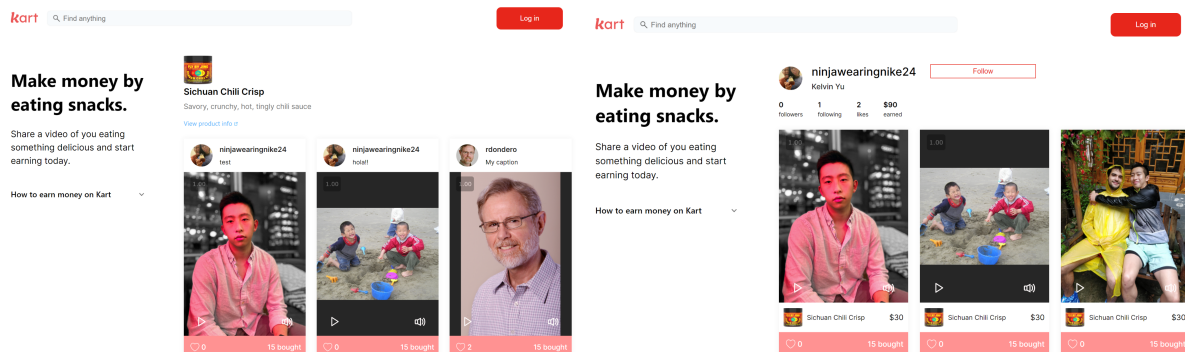
The home page looks different from authenticated users. On the left side, two filters appear: 'For you' and 'Following.' The former shows videos created by all users, the later only shows videos created by users that you follow. In the upper right corner, there is an upload video icon and a menu that appears when you hover over your profile picture.



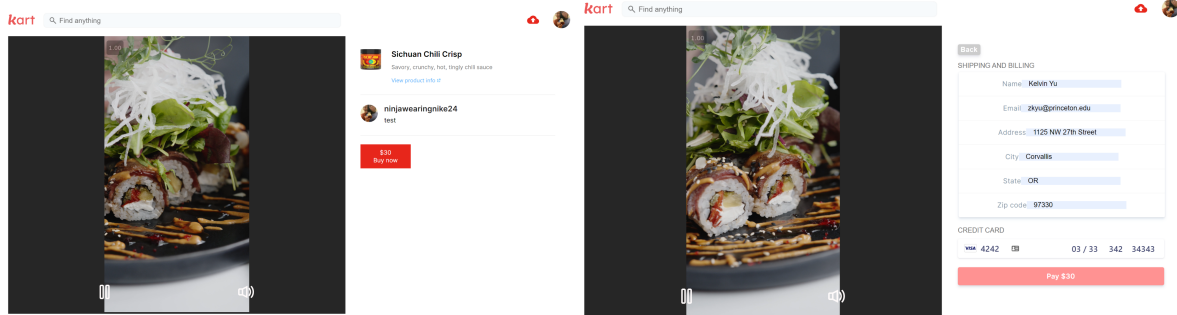
When you click the search bar, a search modal pops up that allows you to search for products, users, and posts, all within the same modal.



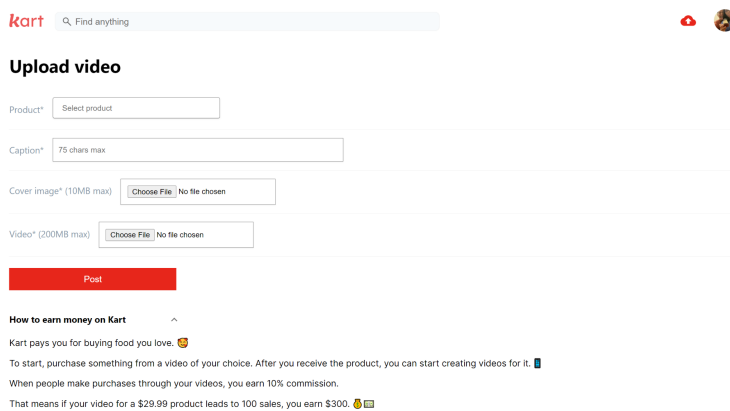
Another way to watch videos is by navigating to different product and profile pages, which show the videos made for that product or the videos made by a specific creator, respectively.



To purchase a product, one clicks a video from the home, product, or profile page, which takes you to the post page (shown below). One can then click 'buy now' to enter in their payment information.



Lastly, here is the upload video page. Users select the product they're making the video for, write a caption, and select the video and image preview files they want to use.



Backend routes

The following are list of the API routes that Kart utilizes, sorted by category.

Authentication

Route: GET api/auth

Description: Get user data

Route: POST api/auth

Description: Authenticate user, log in, and get token

Posts

Route: POST api/posts/product_id

Description: Create a post for a product

Route: GET api/posts/all/most-recent
Description: Get most recent posts

Route: GET api/posts/all/most-liked/
Description: Get most liked posts

Route: GET api/posts/following/most-recent
Description: Get top 12 most recent posts from creators that the authenticated user is following

Route: GET api/posts/following/most-recent
Description: Get top 12 most liked posts from creators that the authenticated user is following

Route: GET api/posts/:post_id
Description: Get post by post ID

Route: GET api/posts/products/:product_id
Description: Get all posts by product ID

Route: GET api/posts/user/:user_id
Description: Get all posts by user ID

Route: DELETE api/posts/:id
Description: Delete post by id

Route: PUT api/posts/like/:id
Description: Like/unlike a post

Products

Route: POST api/products
Description: Add a product

Route: GET api/products/all
Description: Get all products

Route: GET api/products/:post_id
Description: Get a product by the post ID

Route: GET api/products/:product_id
Description: Get a product by the product ID

Shop

Route: POST api/shop/:product_id/:post_id/:creator_id

Description: Create a order

Route: GET api/shop/:post_id

Description: Handle payment confirmation

Route: GET api/shop/stripe

Description: See if this creator has a Stripe account

Route: GET api/shop/stripe

Description: See if this creator has a Stripe account with transfers enabled

Route: POST api/shop/create-stripe-account/

Description: Create a Stripe account for creators seeking payout

Route: POST api/shop/stripe-payout

Description: Create a Stripe transfer from Kart to creator

Suppliers

Route: POST api/suppliers

Description: Add a supplier

Route: GET api/suppliers/all

Description: Get all suppliers

Users

Route: POST api/users

Description: Register user

Route: PUT api/users/profile

Description: Create user profile

Route: GET api/users/all

Description: Get all users

Route: GET api/users/:user_id

Description: Get user by id

Route: DELETE api/user

Description: Delete user and posts

Route: GET api/users/purchased_items

Description: Get current user's purchased products

Route: PUT api/users/follow/:user_id

Description: Follow or unfollow the provided user

Design

Technologies

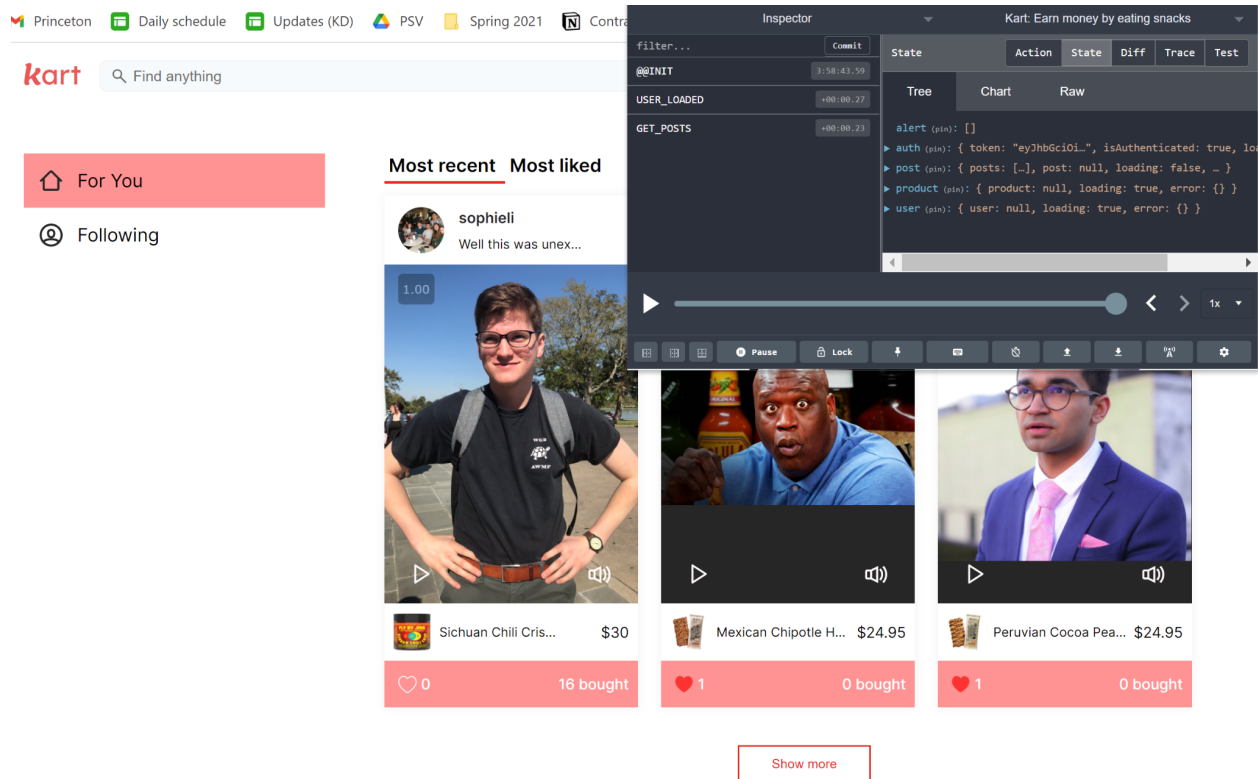
I mostly adhered to the Model-View-Controller (MVC) architecture by using the MERN stack:

- Model: MongoDB, Mongoose
- View: React, Redux
- Controller: Express, Node.js

I chose to use Mongo, a document-based database, instead of a SQL database because of the flexibility that the document model provides as opposed to tables. I used Mongoose to modify the Mongo database. Mongoose is an ODM (Object Data Model) for MongoDB in which you can directly perform operations on Javascript or JSON objects and then Mongoose translates the objects into the appropriate Mongo query and schema.

React is a Javascript library for building dynamic apps. React apps are composed of various Javascript 'components' -- for example, Kart has a Home.js component, a Post.js component, etc. Every component then has its own 'state,' which are the set of dynamic values associated with that component that may change. For example, the RegisterProfile form component has a form state that is updated every time the user updates any field in the form. Redux is another Javascript library that allows React apps to maintain a *global* state. This allows me to keep track of many things, such as whether a component has finished rendering, what data to show on the frontend, etc. Below is an example of my Redux state when I open a product page.

Express and Node.js are server-side technologies that allow apps to run their servers and API routes using Javascript, allowing for "one-language" apps.



To implement advanced features, I sometimes used 3rd-party APIs. Here's the list of services I used and why:

- Algolia: search
- Heroku: deployment
- Stripe: accept payments from customers, pay out brands and creators. Here's what the Stripe admin dashboard looks like:

Connected accounts Filter + Create Export

All accounts 33 Restricted 27 Restricted soon 0 Pending 1 Enabled 5 Complete 0

ACCOUNT	STATUS	BALANCE	VOLUME	TYPE	CONNECTED
Robert Dondero	Enabled	\$0.00	\$24.00	Custom	Mar 27
Kelvin Yu	Enabled	\$0.00	\$24.00	Custom	Mar 27
kelvin@hello.com	Pending	\$0.00		Standard	Mar 23
Kelvin Yu	Enabled	\$0.00	\$9.42	Custom	Mar 16

- AWS S3: store static image (e.g. profile pictures) and video files

Database schema

Here is the database structure. There are five collections: user, post, product, supplier, and orders.

- user
 - id

- username
- email
- password
- first
- last
- profile_pic
- bio
- birthday
- phone
- amount_earned
- verified
- address
 - city: String,
 - country: String,
 - line1: String,
 - line2: String,
 - postal_code: String,
 - state: String,
- stripe_id
 - Stripe connect account ID <https://stripe.com/docs/api/accounts/create>
- payout
 - How much is currently owed to the creator
- followers
 - Array of user_id's
- following
 - Array of user_id's
- orders
 - Array of order_id's
- purchased_items
 - Array of product_id's
- posts
 - Array of post_id's
- likes
 - post_ids
- transfers
 - Array of transfer IDs created when user creates a payout
<https://stripe.com/docs/api/transfers/create>
- order
 - id
 - post_id

- creator_id
 - buyer_id
 - product_id
 - quantity
 - total_paid
- product
 - id
 - name
 - description
 - price
 - picture
 - external_url
 - Links to product page on supplier's site
 - total_purchased
 - avg_rating
 - supplier
 - Array of supplier_id's
 - posts
 - Array of post_id's
- post
 - id
 - creator_id
 - caption
 - video
 - preview
 - date
 - product_id
 - comments
 - likes
 - buyers
- supplier
 - id
 - name
 - category
 - description
 - url
 - products
 - Array of product_id's

Issues

Here a list of the various major issues I ran into during development, and how I mitigated them (if possible):

- **Slow loading times when uploading large files**
 - The only solutions are to pay for more AWS computing power, or to deploy the app through a paid cloud deployment provider instead of the free Heroku service. In the interest of time and capital, I chose to stick with the free Heroku tier.
- **Slow loading time when initially opening app**
 - The first time a user navigates to the Kart app, it takes a long time to load. Again, this is because Kart is deployed through Heroku's free tier.
- **Custom payouts with Stripe**
 - Due to Stripe having many different APIs and each one having their own idiosyncrasies, I had trouble implementing a custom payout flow for creators to earn commission. With the help of a friend who has experience with Stripe, I was able to implement this successfully with the Stripe [PaymentIntent](#) and [Transfers](#) APIs.
- **Can't render .mov files**
 - Chrome doesn't allow rendering of .mov files, so I only allow users to upload .mp4 video files.

Evaluation

Task list

Every time I finished a major feature, I would give five users an open-ended task relating to the feature. For example, when I implemented the ability to register, log in, and log out, I had users go to the home page and told them to figure out how to perform those actions.

After completing the system, I had ten students (since Kart is targeted at Gen-Z) go through a task list consisting of all the previous tasks I made earlier in the semester.

- Create an account
- Buy a product
 - Use 4242424242424242 for the credit card number
- Upload a post for the product
- Logout
- Login
- Like a post

- View all posts for the product you purchased
- View your profile
- Find your post via the search bar

I conducted these interviews in-person so I could personally see how users interacted with the UI. The criteria for success was both qualitative and quantitative. Qualitatively, I wanted to see that most users could perform the tasks with ease. I also evaluated my system with Nielsen's usability heuristics. Quantitatively, I asked them to rate how easy it was to perform each task on a scale from 1 (very hard) to 4 (very easy).

If you (the reader) would like to test the system yourself, consider signing in with the credentials kelvin@me.com for the email and helloworld for the password. Since users can only post videos for products they've purchased, you can only test uploading a video if you have purchased a product (which you can do by using 4242424242424242 as your credit card number). However, if you wish to have instant access to all the products (and thus have a list of products to choose from when uploading your video), you can use the master account credentials.

User evaluation results

User interviews

From user surveys conducted throughout the semester and final user interviews, it was clear that users had no difficulties performing a single task. However, when asked to perform multiple tasks in a row, some users had trouble navigating from one task to the next. I continuously updated the UI/UX to make things more intuitive, such as providing more feedback upon actions, implementing a search bar, and more.

I noticed some repeating themes from user feedback as well. Here are a list of key takeaways from the surveys and interview:

- Users really liked the way videos/posts were displayed, and the fact that one could make a purchase directly from a post
- Users liked the fact that every creator and every product had their separate pages where one can view all the videos associated with that particular creator or product
- Users experienced long load times when uploading video files that were larger than 100MB
- Some users didn't like the fact that Kart forces you to upload a profile picture in order to make a profile. The intention behind this is to make Kart profiles tied to real identities.
- Some users wanted additional features from other social media and e-commerce platforms, such as adding comments to posts and leaving reviews for products

Full detailed notes from user interviews can be found in Appendix A.

Nielsen usability evaluation

Each dimension of Nielsen's heuristic was scored on a scale of 1-5 based on what we observed from user engagement.

Visibility of system status — 5

Whenever users complete a major task such as finish registration, upload a video, etc., dynamic messages containing relevant information are rendered, e.g. "Profile successfully created." When components are not yet finished loading, a spinning wheel will render until the component mounts to the DOM. Lastly, different colors are utilized to distinguish between different states, e.g. warning messages have a red background whereas success messages have a green background.

Match between system and the real world — 5

We designed our home page (i.e. the feed) like the Tiktok feed in the sense that they are the first thing users see when navigating to the site. This makes videos the primary focus of the application and allows users to scroll posts quickly. We chose to design our frontend like this because our target audience are Gen-Z college students who grew up accustomed to Tiktok.

User control and freedom — 4

Unlike most e-commerce websites, Kart does not have a navigable menu.

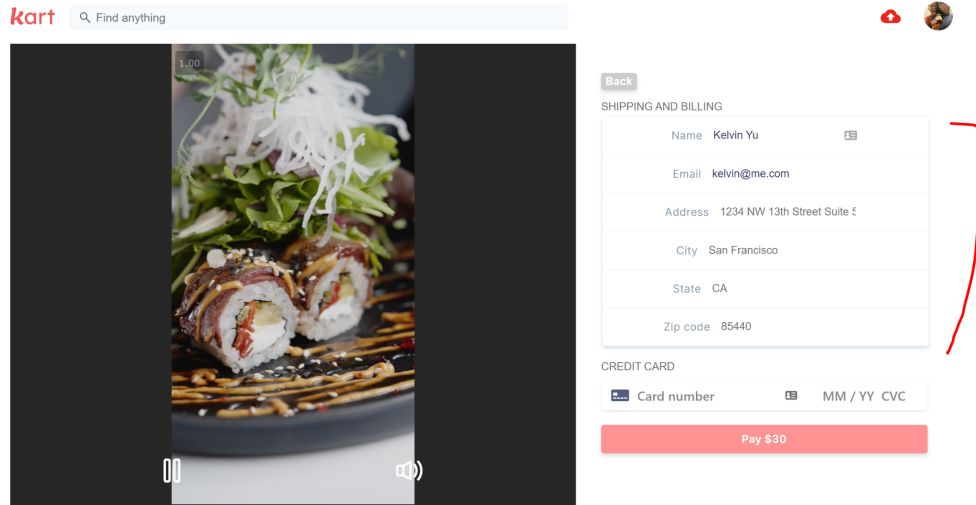
This was intentionally designed to foster a focus on watching videos as the primary method of product discovery. However, users can still search for individual products through the search bar.

Consistency and standards — 5

We designed our application in Figma before building anything and made sure we had a standardized design library with consistent colors, fonts, etc.

Error prevention — 4

On the server-side, we use try-except statements to catch errors in our routes. We then created an Alert frontend component to display error messages. We also set restrictions on certain form fields, e.g. certain fields cannot be empty, only certain file types are accepted, etc.. We also have error checks in our React code as an additional safeguard.



Aesthetic and minimalist design – 5

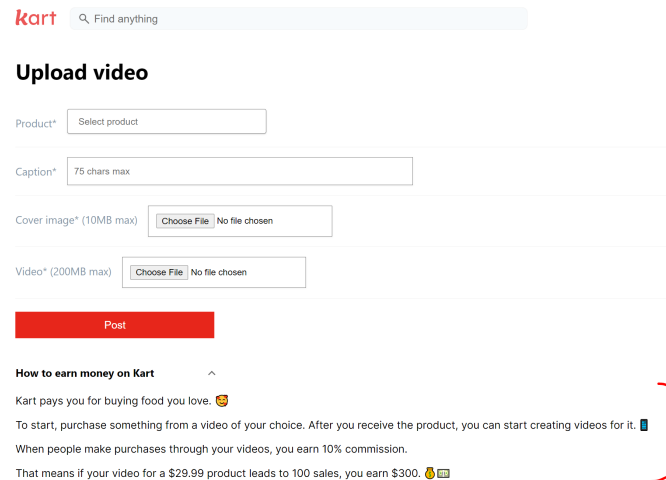
All designs, words, and icons are meant to convey an adequate amount of context to the user without complicating the overall user experience.

Help users recognize, diagnose, and recover from errors – 5

See error prevention section above.

Help and documentation – 3

The only documentation explaining how to use Kart is on the left-hand side of the home page for unauthenticated users, and on the upload video page for authenticated users. Given more time, I could build a full onboarding experience for new users.



Make money by eating snacks.

Share a video of you eating something delicious and start earning today.

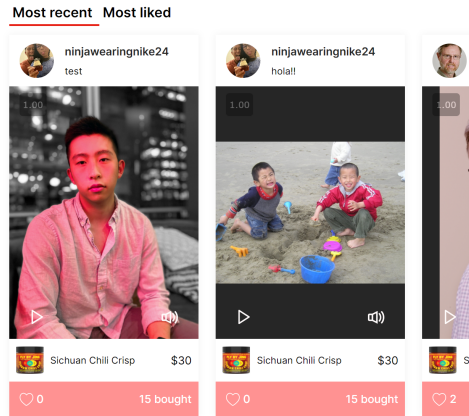
How to earn money on Kart

Kart pays you for buying food you love. 😊

To start, purchase something from a video of your choice. After you receive the product, you can start creating videos for it.

When people make purchases through your videos, you earn 10% commission.

That means if your video for a \$29.99 product leads to 100 sales, you earn \$300.



Conclusions and Future Work

I had a vision of building a platform that integrates social and e-commerce more closely than any platform before it. With this independent work, I successfully built an MVP with the MERN stack. With the help of Professor Dondero and my users, I iteratively improved upon the product over time with user feedback.

If I work on Kart in the future, the main feature I would work on is a personalized algorithm for recommending videos, like TikTok. Every Kart user sees the same set of videos on the website right now because the app just displays the most liked or most recent videos uploaded. Users are able to follow other users to see just their posts, but that's the extent to which there's personalization. On TikTok, users are recommended videos based on what videos they've viewed, liked, or commented on in the past, so Kart 2.0 would consist of that machine learning dimension.

Given time, I also would've liked to implement some of the minor feature suggestions from user interviews, such as enabling users to comment on posts and give reviews to products.

Appendix A. Interview Notes

User #1

- Average difficulty rating: 3.8
- Lowest scores
 - Create an account: 3
 - Buy a product: 3
- Additional feedback
 - Add reviews

- Don't like how one must upload a profile picture in order to create an account
- Add 'load more' button instead of rendering all videos on home page

User #2

- Average difficulty rating: 4.0
- Additional feedback
 - Make videos play/pause on hover, but otherwise loved everything

User #3

- Average difficulty rating: 4.0
- Additional feedback
 - Loved everything!

User #4

- Average difficulty rating: 3.6
- Lowest scores
 - Create an account: 3
 - Find your post via the search bar: 3
- Additional feedback
 - Implement confirm email feature

User #5

- Average difficulty rating: 3.8
- Lowest scores
 - Buy a product: 2
- Additional feedback
 - Allow users to like their own post
 - Credit card form threw an error when I submitted an erroneous CVV, had to refresh to make the component work again

User #6

- Average difficulty rating: 3.8
- Lowest scores
 - Upload a post for your product: 2
- Additional feedback
 - Adding post took too long
 - Add ability for users to comment

User #7

- Average difficulty rating: 3.2

- Lowest scores
 - Create an account: 2
 - Upload a post for your product: 1
- Additional feedback
 - Couldn't upload a .mov video file
 - Menu for authenticated users should appear on hover, not on click
 - Gray default photo picture confused me

User #8

- Average difficulty rating: 3.8
- Lowest scores
 - Create an account: 2
- Additional feedback
 - Add comments
 - Add ability to leave product reviews

User #9

- Average difficulty rating: 3.9
- Lowest scores
 - View all posts for the product you purchased: 3
- Additional feedback
 - Wish there was a DM feature so I could privately message other users
 - Add comments

User #10

- Average difficulty rating: 3.5
- Lowest scores
 - View all posts for the product you purchased: 3
 - Upload a post: 2
- Additional feedback
 - Uploading a post took too long
 - Took awhile to view the 'My profile' tab in the menu

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