ECE 1778: Creative Applications for Mobile Devices

Lecture 4
February 3, 2020
Today

1. Logistics – Plan, Assignments
   - Description of Assignment S3
   - Proposal
2. Block Diagrams + Living in Apps
3. Notes on Group Work
   - Working in Groups
4. External Sensors/Gadgets you may want to use
5. TeamChooser
   - Lessons from an App development experience
6. Informal Topic Discussions/Coordination
Logistics
Assignments

- S2 was due yesterday
  - Any comments/questions?

- S3 will now posted on course website

- P2 is due next Tuesday

- S1 and P1 are being graded
Assignment S3

Due Tuesday February 9

All assignments are on both Course website and on Quercus
Assignment S3 – for Specialists

- Assignment S3 is tuned to help with Project
- The goal is to stimulate ideas for different features of the App in your project, and to aid discussion within team

First:
1. Ask you to reprise your field description from S1.
2. Give best current version of your project description at the same level as the Approval-in-Principle
Part 3 – Consider what is possible

- Consider the goals/needs of the people using the app together with what technology can do
  - Suggest ‘walking through an example’ use – pretend
    - Gave this feedback to almost all groups
  - Think about phone/internet/computers
  - Draw from your own knowledge of what you’ve seen apps/computers can do
Part 3 – Describe/Invent Features!

- Conceive & Describe **separable Features** that you want in your app
  - **without** worrying about the resource, time or complexity
  - (want to free your mind from the constraints to begin)

- But what is a feature?
  - And what does separable mean?
What is a Feature?

- It is a separate piece of functionality in software
  - it might be essential to the basic operation
  - It might be a ‘nice-to-have’ but not essential part.

Example:
- Essential: in app that gives list of ski-related products, the list itself is essential
- Having the ability to sort the list based on price is a feature
  - Or sort on other aspects of the product

How to do this? “Live In” your app
- Concrete examples in a moment
3. Rank features in order of importance and describe why they are high or low
   – Crucial, was done poorly last year!

4. Determine with programming partners what order to build
   – Based on your joint understanding of what is necessary and how difficult features are
   – This list can be bigger than what you do in the actual project.

Purpose – to direct your creativity, and to start the process of figuring out what is practical
Good Examples

Here are two good examples of this assignment:

2. https://www.dropbox.com/s/eqa5vaw5wr4zgyg/example2.pdf?dl=0

- Feature ranking wasn’t done as well as it should be
Project
Project Stages

1. Forming Groups
   - done

2. Project Topic Approval-in-Principle
   - Wrapping up

3. Project Proposal/Plan
   - Document Due February 15th

4. Proposal & Plan Presentations
   - February 17th - see lecture 3 for details
   - NOTE EXTRA LECTURE Wed February 17th, 6-8pm

5. Spiral 2 & Spiral 4 Presentations
   - 2: March 10/17 4: March 24/31

6. Final Presentations
   - Weeks of April 7/14

7. Final Report Due April 21st
# Approval-in-Principle in Good Shape!

<table>
<thead>
<tr>
<th>Approval in Principle</th>
<th>OS</th>
<th>Project Name</th>
<th>Specialist</th>
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Proposal/Plan Due Monday Feb 15 @ 6pm

1. Describe Goal, make more precise
   - What & Why

2. Rough design of what the user of the App sees
   - Screen designs
   - Can use Marvel App - https://marvelapp.com
     • From Specialist Assignment 2
     • Any drawing package will do

3. Block Diagram overview of planned code
   - The large pieces (roughly 5) of the system
     • With short description of each (below picture)
   - Should be linked to the screens
   - I will discuss creation of block diagrams shortly
Plan, continued

4. Statement of Risks/Issues
   - What roadblocks/issues/challenges do you foresee?
   - Software, Hardware, Ethics, Data …

5. What do you need to learn that you don’t know
   - all members

6. Important: Specialists
   - Submit a 500 word essay on
     1. How App relates to field of Specialist, and
     2. How the Specialist will contribute to project
     - Need to be an active participant; want clear thought here
     - Issue Tracking on Github?

- Document must have these sections; will lose marks if missing

(16)
Proposal/Plan Document

- length: 1500 words max
  - not including Specialist essay (#6)
  - include word count as part of document, penalty for overage

- Seeking clarity, not quantity of words
  - Omit needles words

- One member of group should submit for group
  - Under “Proposal Plan” for your group, under its name

- Worth 10% of grade
  - including in-class presentation done following week

- Document Due Monday February 15th at 6pm
A Note on Block Diagrams

And the creative process
In Proposal you’re asked to give a block diagram of your planned software
- In past, many have not understood this

A Block diagram describes the major pieces of the project’s functions (roughly 5)

Is the first step in the standard divide & conquer approach

Draw blocks, give each block a name
- Name gives a sense of what it does
- Provide several sentences that give more detail of function of each block
Block Diagrams

- Lines between blocks show communication
- May need to break blocks themselves down
  - In a hierarchy, in a subsequent part of your plan document
  - This example has too many blocks, too small font
Better, but maybe too simple
Good
Example App/Block Diagram

The Covid Connector App
Let’s Work Through an Example

- I came up with this idea recently

- Problem:
  - There’s a highly contagious pandemic going on (this one, and maybe the next one)
  - Transmission occurs through the air, and with proximity
  - People are used to getting together, and it is hard to visualize, and conceive how transmission can happen

- Goal: To visualize the human-to-human connectivity “picture” that shows pathways of virus transmission
  - For You and your friends/contacts and family
Personal Story

- I was concerned that my family didn’t understand this
  - Asked everyone to meet on Zoom, so we could discuss
  - Realized that it would be helpful to draw a picture of who connected to who.

Why picture of funny dog?
Here’s the Picture
It’s People Connected By Links

- People in a box live together and are regularly exposed
- A link means that those people also meet
- In one of four ways:
  1. Un-masked, close proximity
  2. Un-masked, but with social distancing
  3. Masked, close proximity
  4. Masked, social distancing

- Some links connect to “infinity”
  - child goes to school
  - Roomate’s boyfriend has unknown contacts
  - Infinity is scary; just seeing that (and agreeing) is informative)
Possible Goals of App

1. Allow people to draw picture and annotate links
   – Enable a discussion

2. Allow two separate ‘pictures’ (aka Graphs) to be joined when one learns of connections between two people in separate graphs

3. Voluntary Contact Tracing
   – If learn one member has contracted disease, can immediately notify everyone who is linked
     • There are various levels of notification, depending on risk tolerance (link through mask less likely, e.g.)
You get the idea. There are more possible ways to use (and abuse) this basic notion.

Try to ‘live’ this app, and imagine how else it might be used.

- ‘play with it’
- Look from inside
- Imagine you’re a health specialist
- Imagine some communities that don’t believe what the “Government” is telling us.
App Goal:

- Build and Use the Covid Connectivity Picture
  - 

- How could you do this with a phone?
Let’s Make the Block Diagram

- What are the main components?
  - Switch to iPad
A Note on Group Interaction
Now that groups are formed, it is very important for you to meet regularly and coordinate your activities.

Each of you will need to be assigned tasks, and make commitments to do those tasks at a particular deadline.

The expectations that each group member has of the others must be made clear:

1. I suggest that these be written down.
2. Each meeting in which tasks are decided:
   - Tasks should be recorded at end of each meeting -> emailed/web
     - What
     - Who
     - When
“When” is a guess

- **Just** because you thought you could get something done, doesn’t mean you will be able to
- Tasks deadlines may have to ‘slip’ because of under-estimation
- is reality of engineering and indeed all work
  - A key opportunity to learn how to estimate work!

- Group must be forgiving of missed tasks
  - **But must** communicate slip and re-organize goals
Difficulties Can and Do Happen

- Most of the difficulties that have occurred in this course have been because expectations were not made clear.
- Sometimes, group members consistently failed to live up to commitments.
- If this happens, please report it to me as soon as it is something that you cannot handle with internal discussion & resolution.
  - We will help you resolve it.
- Disagreements are part of all human relationships.
  - One distinguishes oneself by how well you deal with them.
What is a good way to communicate?

- Your favourite messaging app
  - Whatsapp, FB Messenger, WeChat,….


- Skype/Google Hangouts/Zoom

- Github Issue tracking
That’s About What Could Go Wrong

- What about doing things to make it go right?
  - See above about basic organization

- What is a good way to create a successful group?
  - Get to know each other – find out goals and interests
  - have some meals together – breakfast lunch or dinner.
  - Practice the notion of listening and giving everyone’s ideas a fair hearing.
GitHub Requirement

- We require you to use GitHub for storing software and tracking issues
  - Aside: what is source code control?
  - Demo issue tracker on github.com

- I will create the repository for you, and make all group members collaborators
  - Including specialists
  - Repository will be private

- Your immediate task, by this Friday:
  - Send me your **GitHub ID** so I can connect you to the repo
  - If you don’t have ID, go to [github.com](http://github.com) and sign up
    - Then send your GitHub ID to me with group name
    - I will link you to the repository
Class Participation & Peer Review
Class Presentations

- A key part of what happens in this course is the contribution you make to other's projects.

- You will do many presentations in this class:
  - Indeed, one side-effect of this project course is some real practice in giving high-quality, concise & clear communication.
  - Most presentations will be 5 minutes in length.
  - Must be geared so that most people in the class will understand.
Peer Review

- Want everyone to come, listen & provide useful feedback
- Expectation that you’ll listen and provide thoughtful feedback and suggestions to other’s presentations

In Addition
- For each of Proposal, Spiral 2, and Spiral 4 you’ll be asked to provide a written peer review for one other group; these will be graded
- Means you’ll need to be here for every lecture, not just when you’re presenting.
Peer Review for Proposal

Will be asked to answer questions such as:

1. In your own words, what was the goal of the project?

2. What parts of the proposal did you understand, and what parts could be more clear?

3. What was the best thing about the proposal?

4. What one thing could be improved the most?
External Hardware for your Project
External Hardware/Gadgets

- If you know of some external hardware that will enable your project, you can request to have it purchased
  - I try to collect these for this course and research
  - No guarantee, depends on cost & function, but ask if you see something interesting!

- Some Examples ....
Texas Instruments Sensor Tag 2

- Bluetooth Connection
- Sensors:
  - 9 axis
  - Magnet sensor
  - Light
  - Ambient temperature
  - IR temperature
  - Humidity
  - Air pressure
  - Two Buttons, two lights, quiet buzzer!

- I can order these as needed
- Demo
Muse Head Band

- Measures ‘brain activity’ through measurement of electro-magnetic waves brain produces
- Have 1 of these
Note where things are, where they were lost!

- [https://www.thetileapp.com](https://www.thetileapp.com)
- [https://youtu.be/WG7BdW7iFzo](https://youtu.be/WG7BdW7iFzo)
- Don’t have any, but could order
- There is an unofficial API documented/coded here:
  - [https://github.com/bachya/pytile](https://github.com/bachya/pytile)
Other External Devices I have

- **Wahoo Tickr (1)** – heart rate monitor strap
  - bluetooth connected
  - Direct live heart rate
  - Actually now have several of these

- **Mbientlab device** (older now, can get newer one)
  - See [https://mbientlab.com](https://mbientlab.com)
  - Smaller than TI device
My App: TeamChooser

Solving a Problem in Pick-up Team Sports
Kids Who Play Want Games to be Fair!
So Do Adults!

- When playing friendly games there is a need to choose who is on which team.
- A common method is to have team captains, and they alternate choosing people, in a very public way.
- How many people have been picked first? 😊
- How many people have been picked last? 😞
I’ve Been Playing Hockey for Many Years

- A friendly game, but still have problem choosing teams:

- Classic Canadian method:
  - Put players’ sticks into middle
  - One person randomly throws sticks to either side!
  - Random outcome!

- I once chose teams for a few years in friendly game
  - People complained a lot!
Play in Two Different Friendly Games

- **Wednesday** Game: terrible chooser (Agar)
  - People always complaining
  - Games often lopsided, much distaste
  - No-one else took over, though (didn’t want the hassle?)

- **Sunday** Game: excellent chooser (Paul)
  - Paul had a natural ability to pick great teams!
  - Even when teams didn’t look right, many more times than not, the game was fair
  - Became known as the ‘algorithm’
The Solution: TeamChooser

- Wouldn’t it be great if an App made the teams?
  - No one to yell at
  - Possibly give better teams

- Who needs this?

- Every pick-up hockey, soccer, basketball game around!
TeamChooser: How It Works

- Enter every player’s information in advance of game day
  - Player’s name
  - Preferred position (offence or defense)
  - A rating, from 1-10, as to how effective player is
    - Rating is the trickiest part

- On game day – select all players present
- Push ‘Make Teams’
  - And voila, two evenly matched teams
Do Demo! Entering Players

AmdurWedFri has 99 players
Name: B Brousseau
Level (0-10): 7 (e.g., 5.4)

Offense  Defense

Pre-assign: On
Light  Dark

Save  Delete
Selecting Present & Making Teams

14 players selected (D:4 O:10)

Back  AmdurWedFri  Make teams

Offense

Jack

Offense

Jamie

Offense

Jason

Offense

Jessie

Offense

Joachim

Offense

Jonathan Rose

Defense

Jordan D

Defense

Jordan T

Offense

Josh

Offense

Edit...  Unselect all  Select all  +

Teams  Freeze  Tweak

LIGHT A:6.1 D:1 DA:7.5 O:3 OA:5.7

Jason

Craig Boutilier

Jessie

Brendon

DARK A:6.3 D:1 DA:6.3 O:3 OA:6.3

Jonathan Rose

Connor

Frank

Jordan T
Example Game

Dark Team

Light Team

DARK 5.6 D:5.0 O:5.7 COUNT: 6

LIGHT 5.6 D:5.4 O:5.7 COUNT: 7

Cole Zeme
Brian Dow
Pavel
Raj B
Matt Zale
Rich Zemei

Raj
Brian
Rich
Cole
Matt
Pavel

Gurpreet
Miles
Paul
Fred
Jonathan

Jay
David

Gurpreet Rattan
Final Score in that Game

A Victory for Team Chooser!
Team Selection Method (‘Algorithm’)

Step 1: Sort Players in Order of Rating, Highest to Lowest

Step 2: Alternate Team Assigned Going Down List

Team A  Team B
6       6
5       5
4       4
3       3
2       2
1       1
Team Selection Method

- Gets more complicated when add features!
  - Balance offense and defensive player count
  - Pre-assigns
  - Balance quality of offense and defense

- Many discussions from CS and ECE Professors over algorithms in hockey game!
Relating to Assignment S3
Features in App – Current and Desired

1. Input System – entering names and ranks
2. Choosing process and display
   – Very neat choosing + rating feature!
3. Randomized Order of Team Lists
   – So no-one is picked last
4. Large Font Button for far-sighted old folks!
5. Constraint: put selected people on fixed side
6. Constraint: equalize # of offence and defence-minded on each side
7. Late Arrival feature
8. Infer people’s rating based on result
9. Email/Share team files amongst multiple people
10. Print Out Chosen Teams for Posting
Does it Work?

- Yes!

- I’ve been using it with friends in roughly 600 hockey games and it has often done a good job.
  - We’ve tweaked it’s algorithms here and there
  - Added some features
  - Occasionally very unbalanced games, bad luck?
On iPhone App Store Since May 2010

- Free!
- 6500 total Downloads
- Mostly in US/Canada, but a few in UK, Ireland, Japan, Norway, Romania, Portugal, Australia, Denmark, Finland

Do you play friendly pickup sports, like hockey, soccer or basketball? Would you like help choosing which players to be on each team, so that everyone enjoys the game? Then TeamChooser is the app for you! TeamChooser will work for pretty much any two-team game you can think of: rugby scrimmages, volleyball, baseball, and flag football.
Lesson Learned

- From last time: Ratings of players, key part of engine, must be kept secret!
- Can add password to App so no-one can grab phone and look at their ratings or anyone else’s
Sad Outcome: Agar

- The day after the first use of TeamChooser on Wednesday
  - Recall very poor chooser – Agar
  - Folks joked and called it the iGar.

- Agar never played again on Wednesday!
  - Still plays hockey, but not with team he played with for decades
Feature: No-One Chosen Last!

- The order that people are listed (and spoken out loud by user) is randomized.
- There is no way to infer rating.
Downloads Over the 30 Days Feb 2020

- Is delightful to see people using!
Is Anyone Using it Who Bought It?

- Instrumented both with Apple Analytics & Firebase analytics
  - Very easy to insert into any app

- Reports:
  - # of users sessions, amount of time spent on app
  - Specific pages/events, as you wish from each user
  - Location of user, if already use GPS (no other ID).
  - Anything I wish to report!
Session Report from Apple Analytics

App Store Connect  App Analytics  TeamChooser

Overview  Metrics  Sources  Retention

APP STORE
Impressions
Product Page Views
SALES
App Units
In-App Purchases
Sales
Paying Users
USAGE
Installations
Sessions
Active Devices
Active Last 30 Days
Crashes
Deletions
COMPARE TO
None

View By  Add Filter

2,391 Sessions
Opt-in Only

30

20

10

Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

Jan 2019
Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec  Jan 2020

Jonathan Rose
Jan 25, 2018-Jan 25, 2020

Line  Days

(80)
Stream View – Live!
Event Logs

(data)

Event count

Count | Users
--- | ---
(total) 183 items | 357 | 26
(not set) | 15 | 1
Sunday Night ...3 BDef 8.00 | 9 | 1
Sunday Night ...3 BDef 7.75 | 9 | 1
Sunday Night ...0 BDef 8.25 | 8 | 1
Hudson Hock... BDef 24.00 | 7 | 1
Bowling AAVsg...0 BDef 0.00 | 6 | 1
AmdurWedFri ... BDef 7.73 | 5 | 1

Event location

Country/Region

Canada
United States
Norway
United Kingdom
Australia
Sweden
Topic Discussion Time
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Brad