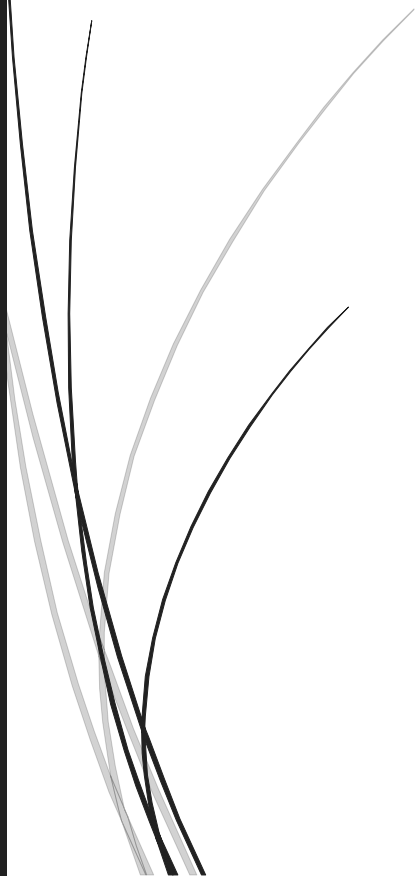
Zachery Utt's Project Portfolio

In each of the following projects, I wrote all the code and designed each interface. All source code can be viewed publicly on GitHub.



Exam Software for the Ministry of Education in Saudi Arabia

Project Brief: After administering a city-wide English examination for the students of Jeddah, the Ministry of Education needed custom software to score custom answer sheets quickly and accurately- and scalable to function on thousands of scanned sheets.

My Contribution: I was tasked with designing the software to scan and score each answer sheet. After scoring, the program uses identifiers on the exam (a student ID bar code) to pass the exam information to the Ministry of Education's student database system. I collaborated with other engineers on how to export data from my program with existing student information systems.

My Solution: My program uses the OpenCV library to identify circles within the image of the sheet (Image 1). It then aggregates concentric circles into single objects and uses a custom algorithm to look for a grid pattern based on the center points of these circle objects and identify sections of the exam [shown in different colors] (Image 2). Circle objects that are darker (have a higher average pixel color) are identified as the answer choice selected by the student (Image 3). The software is multithreaded and optimized to work on hundreds of sheets in linear time.

المملكة العربية السعودية
وزارة التعليم
الادارة العامة للتعليم بمحافظة جدة
مدرسة الامام الذهبي المتوسطة

وزارة التعليم
Ministry of Education

المادة	اللغة الانجليزية
الصف	3
الزمن	ساعتان
رقم اللجنة	1

اسم الطالب : احمد سعد معوض المرواني الجهني

001-1262050

1262050

Student Condition
Absent
Cheat

Multiple Choice

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D
21	A	B	C	D
22	A	B	C	D
23	A	B	C	D
24	A	B	C	D
25	A	B	C	D
26	A	B	C	D
27	A	B	C	D
28	A	B	C	D
29	A	B	C	D
30	A	B	C	D

Pairing Questions

1	A	B	C	D	E	F	G	H	I	J
2	A	B	C	D	E	F	G	H	I	J
3	A	B	C	D	E	F	G	H	I	J
4	A	B	C	D	E	F	G	H	I	J
5	A	B	C	D	E	F	G	H	I	J
6	A	B	C	D	E	F	G	H	I	J
7	A	B	C	D	E	F	G	H	I	J
8	A	B	C	D	E	F	G	H	I	J
9	A	B	C	D	E	F	G	H	I	J
10	A	B	C	D	E	F	G	H	I	J

True / False

1	T	F
2	T	F
3	T	F
4	T	F
5	T	F
6	T	F
7	T	F
8	T	F
9	T	F
10	T	F

Completion

1	0	1
2	0	1
3	0	1
4	0	1
5	0	1
6	0	1
7	0	1
8	0	1
9	0	1
10	0	1

Subjective

1	0	1	2	3	4	5	6
2	0	1	2	3	4	5	6
3	0	1	2	3	4	5	6
4	0	1	2	3	4	5	6
5	0	1	2	3	4	5	6

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مدرسة الامام الذهبي المتوسطة

وزارة التعليم
Ministry of Education

المادة: اللغة الانجليزية
الصف: 1
الزمن: ساعتان
رقم اللجنة: 105

اسم الطالب :

السجل المدني

رقم الجلوس

Student Condition
Absent
Cheat

Multiple Choices

1	A	B	C	D	11	A	B	C	D	21	A	B	C	D
2	A	B	C	D	12	A	B	C	D	22	A	B	C	D
3	A	B	C	D	13	A	B	C	D	23	A	B	C	D
4	A	B	C	D	14	A	B	C	D	24	A	B	C	D
5	A	B	C	D	15	A	B	C	D	25	A	B	C	D
6	A	B	C	D	16	A	B	C	D	26	A	B	C	D
7	A	B	C	D	17	A	B	C	D	27	A	B	C	D
8	A	B	C	D	18	A	B	C	D	28	A	B	C	D
9	A	B	C	D	19	A	B	C	D	29	A	B	C	D
10	A	B	C	D	20	A	B	C	D	30	A	B	C	D

Pairing Questions

1	A	B	C	D	E	F	G	H	I	J
2	A	B	C	D	E	F	G	H	I	J
3	A	B	C	D	E	F	G	H	I	J
4	A	B	C	D	E	F	G	H	I	J
5	A	B	C	D	E	F	G	H	I	J
6	A	B	C	D	E	F	G	H	I	J
7	A	B	C	D	E	F	G	H	I	J
8	A	B	C	D	E	F	G	H	I	J
9	A	B	C	D	E	F	G	H	I	J
10	A	B	C	D	E	F	G	H	I	J

True / False

1	T	F
2	T	F
3	T	F
4	T	F
5	T	F
6	T	F
7	T	F
8	T	F
9	T	F
10	T	F

Completion

1	0	1	6	0	1
2	0	1	7	0	1
3	0	1	8	0	1
4	0	1	9	0	1
5	0	1	10	0	1

Subjective

1	0	1	2	3	4	5	6
2	0	1	2	3	4	5	6
3	0	1	2	3	4	5	6
4	0	1	2	3	4	5	6
5	0	1	2	3	4	5	6

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وزارة التعليم
Ministry of Education

المادة: اللغة الانجليزية
الصف: 1
الزمن: ساعتان
رقم اللجنة: 105

اسم الطالب : عمر محمد علي المعبدي

السجل المدني: 1132115757

رقم الجلوس: 0725012 8

Student Condition
Absent
Cheat

Multiple Choices

1	A	B	**C**	D	11	A	B	C	**D**	21	**A**	B	C	D
2	A	**B**	C	D	12	A	B	**C**	D	22	A	**B**	C	D
3	A	B	C	**D**	13	A	B	C	**D**	23	**A**	B	C	D
4	**A**	B	C	D	14	A	B	**C**	D	24	A	B	C	**D**
5	A	B	**C**	D	15	**A**	B	C	D	25	A	B	C	D
6	A	**B**	C	D	16	A	**B**	C	D	26	A	B	C	D
7	A	B	C	**D**	17	A	B	C	**D**	27	A	B	C	D
8	**A**	B	C	D	18	A	**B**	C	D	28	A	B	C	D
9	A	B	**C**	D	19	A	**B**	C	D	29	A	B	C	D
10	**A**	B	C	D	20	A	**B**	C	D	30	A	B	C	D

Pairing Questions

1	A	B	**C**	D	E	F	G	H	I	J
2	A	**B**	C	D	E	F	G	H	I	J
3	A	B	C	**D**	E	F	G	H	I	J
4	**A**	B	C	D	E	F	G	H	I	J
5	A	B	C	D	**E**	F	G	H	I	J
6	A	B	C	D	E	F	G	H	I	J
7	A	B	C	D	E	F	G	H	I	J
8	A	B	C	D	E	F	G	H	I	J
9	A	B	C	D	E	F	G	H	I	J
10	A	B	C	D	E	F	G	H	I	J

True / False

1	**T**	F
2	T	**F**
3	**T**	F
4	T	**F**
5	**T**	F
6	T	F
7	T	F
8	T	F
9	T	F
10	T	F

Completion

1	0	**1**	6	0	**1**
2	0	**1**	7	0	**1**
3	0	**1**	8	0	**1**
4	0	**1**	9	0	**1**
5	0	**1**	10	0	**1**

Subjective

1	0	1	2	3	4	5	**6**
2	0	1	2	3	4	5	**6**
3	0	1	2	3	4	5	**6**
4	0	1	2	3	4	5	**6**
5	0	1	2	3	4	5	**6**

Education Technology Software

Project Brief: As users move through an online engineering course meant to teach 3D CAD modeling skills to students in underserved schools, assessment data must be aggregated and displayed in a way useful to instructors on how to better serve their students.

My Contribution: In addition to designing the data collection and database systems, I also designed an instructor dashboard to give teachers insights onto areas of weak student performance.

My Solution: In addition to focusing on assessment averages, my data algorithm attempts to quantify student engagement by tracking response time in answering questions, time spent without user activity, clicks recorded, and video replay counts. This factor is aggregated into a single multiplier and applied to assessment scores to track student progress.

ACU Inventor Study Guide

Instructor Dashboard

Home

Demo Data

NEW FOLDER

EDIT USER

DOWNLOAD DATA

Name ▼	Course Progress	Last Login	Total Activity
► Aziz, Sherif		10/3/2019	02:39:30
► Barger, Debra		9/20/2019	02:20:30
► Bell Wade, Brittnaie		9/20/2019	00:18:00
► Dixon, Tishanna		9/30/2019	03:08:30
► Dtorres, Sylvia		9/20/2019	00:10:30
► Fox, Matthew		9/20/2019	02:14:00
► Hoayun, John		9/19/2019	01:33:30
► Howes, Elizabeth		9/20/2019	03:30:00
► Hutton, Josh		10/1/2019	02:29:30
► Jane Pack, Mary		9/20/2019	03:10:00

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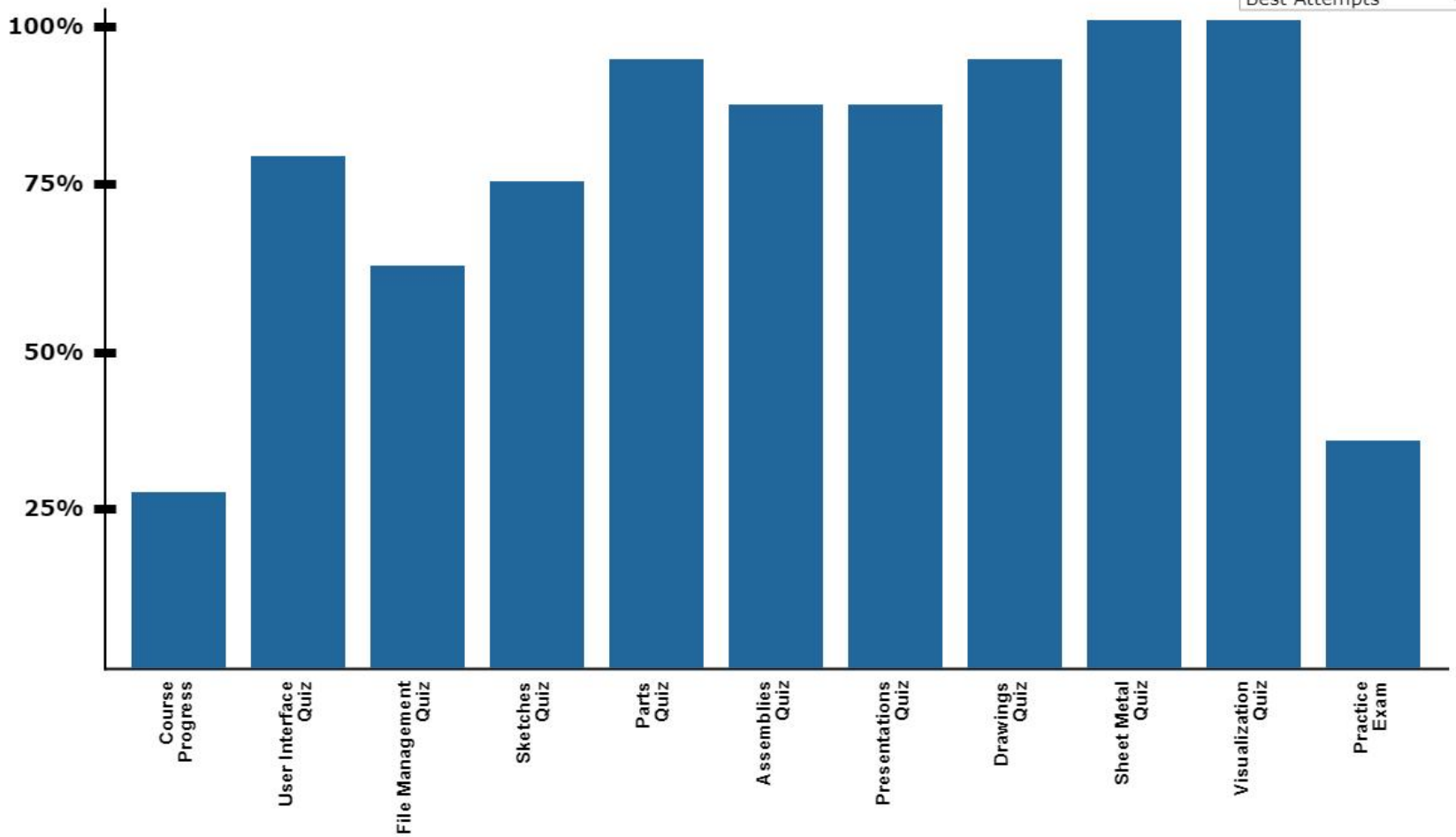

Campaign Website

Project Brief: Campaign websites serve as a metaphor for the candidate themselves; websites that are generic, difficult to use, undermaintained, lack translations represent a lack of polish and effort on the part of the candidate to connect with voters in the community.

My Contribution: I worked as the only programmer with campaign staff to engage voters through the site and help Phil Dodds win the nomination. I tested my designs in focus groups with voters and incorporated their feedback into the final design. Additionally, I took actions to ensure that all data collected for volunteers and contributors were collected securely and not vulnerable to foreign or domestic hackers.

PHIL DODDS

US HOUSE-FL DISTRICT 3

Home Meet Phil Issues Donate

Cyber Security Research

Project Brief: One sign that a user may be a bot instead of a human is the click patterns associated with a particular IP address. To look for ways to understand how suspicious click patterns can be detected and flagged, researchers needed a tool to simulate bot clicks at a certain click rate. Researchers wanted to control the spread of the random distribution to write better algorithms to detect bots.

My Contribution: I designed both the interface and the background program used to create a click distribution at a specified average and spread.

My Solution: The program splits a second (1000 milliseconds) into the A sections (where A represents the number of clicks per second), with each section getting a completely random number from 0 to 1000, representing the time to wait between clicks. A scalar multiple is applied to each section to get the total wait time to 1000 milliseconds. A scalar is subtracted from each term such that the average wait time is A). Each term is corrected by a such that an increase in one term towards the average is countered by a decrease in another, to control the degree of spread.

Figure 1: User Display

Figure 2: Click Distribution with average at 10 clicks / second at high random spread

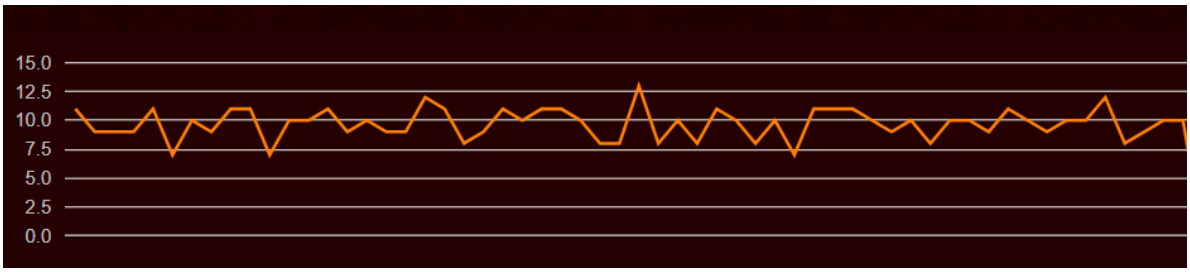

Figure 3: Click distribution with average at 10 clicks / second at medium random spread

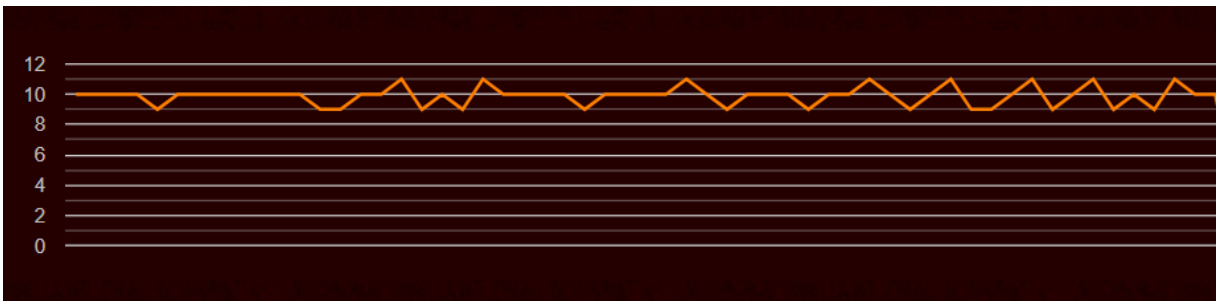

Figure 4: Click distribution with average at 10 clicks / second at low random spread