**CS6.301: Design and Analysis of Software Systems** **Spring 2021**

# End Term Paper

*Released: 3rd April, 2021* *Deadline: 25th April, 2021*

## Instructions

- You will be writing a research paper with 16% weightage instead of End semester exam.
- This has been designed to give you a nice exposure to the world of research and help you get familiar with software systems research principles.
- You will be writing a classic academia style research paper in a 2-column LATEX document, named as rollnumber.pdf. You can use the IEEE template here or the CVPR one here. Note that you will be submitting the tex files as well. You can also create your own template.
- This is an individual assignment and you are free to choose whatever problem statement you like. In case you want to work on your own problem statement, contact Eesha once for approval. For any clarifications in the given statements, please ping the concerned TA.
- Plagiarism detectors will be run on all submissions, so please do not copy from anyone. If found, you would be given a straight 0.

## Problem 1: Institute Vaccine Management Solution

**Concerned TA: Eesha Dutta**

**Statement:**

Amid the second wave and cases sprawling within, the Institute CHMC has decided the only way to continue safe operations within the campus is through an efficient and effective vaccination of all faculty, staff and students. With around 400 people on campus, and with the already occupied Aarogya doctors and nurses, manually managing doses within a short period can be a mess.
Thus by the time the government allows for independent procurement for all age groups, the institute wants to be ready with a centralized solution to tackle this problem of effective mass management. They want you to suggest a software solution capable of handling the registration, distribution and scheduling vaccines distribution within the campus. The solution should have separate interfaces for the healthcare staff to register and update their schedules, for campus residents to book a slot, and for CHMC admins to view the statistics. You may also think your own points, for example, assigning a vulnerability index on basis of past hstory or age, and prioritising as per the index.
Think independently, and suggest some good solutions, we may consider mailing some of them to CHMC. Hopefully, we all get through this together and return to campus safely.
Stay safe and Take care!

**Resources:**

1. https://www2.deloitte.com/us/en/pages/public-sector/solutions/vaccine-management-system.html
2. https://www.accenture.com/us-en/services/public-service/vaccine-management-solution
3. https://www.pwc.com/az/en/publications/assets/COVID-19_Vaccine_Distribution_System_Offering.pdf

## Problem 2: Lockdown Monitoring

**Concerned TA: Vikrant Dewangan**

**Statement:**

With the alarming growth of cases within the campus, it is clear that the second wave has reached inside too. With the institute on the brink of a lockdown and the gocoronago app not installed widely, institute has felt

the need of identifying clusters of people via surveillance, and to try and restrict the movement of residents in the campus until it becomes normal.
You want to help by devising a software solution to study the areawise distribution of clusters of various outdoor places at different times during the day. You are armed with multiple robots (say ground or aerial vehicles), each of which is equipped with some sort of sensor. Your task is to build a software solution capable of detecting groups of people across the campus through sensor feed, prepare a heatmap, and to alert an individual if they approach a group of say $> 5$. You may also assign each cluster as safe/not safe by recognizing if they have worn masks or not and for how long and upto how close have they been together. You may explore computer vision ideas for crowd detection, and control algorithms for managing the robots. You may also treat them as a black-box, with the emphasis on software solution and how it overcomes the problem of surveillance. The solution must be capable of displaying live maps to all users at all points, and notifications in case of close approach to a cluster to the user as well as administration. You may also alert if they are found to roam without masks.
The institute wants to make the solution robust and easy to manage, and something which all campus residents, the staff, faculties and students can install and use. You can assume that institute has settled all privacy concerns by some sort of agreement regarding data collection at the time of entry for campus residents.

**Resources:**

1. MRCNet
2. SSDMNV2: A real time DNN-based face mask detection system
3. Smart technologies driven approaches to tackle COVID-19 pandemic: a review

## Problem 3: Attendance!

**Concerned TA: Kanish Anand**

**Statement:**

Let's move back to the most memorable activity of offline semester: the sudden increase in the class strength as Badri Bhaiya arrives and as soon as he leaves, the class strength drops like a roller-coaster.

Professors are quite fed up from this situation. They want students to listen to them during whole class and not leave in between. They don't want to lock the doors because someone may need to go out due to some emergencies. Attendance policy is also not working here because students just come, mark the attendance and then go back. So you need to provide a solution which can store when students entered, left the class and attendance will be marked based upon this data. Along with this, attendance will be shown instantly (just after the class ends) on some software system to the students so that students can plan their leaves accordingly, as well as the professors so that they can monitor which class was more boring.

You can explore the field of Computer Vision or maybe Robotics and come up with great ideas for this. All this can be treated as a black-box and main objective is to design the software system around it which would store attendance data, provide features to students to monitor their attendance and professors to monitor class attendance for various topics, show reasons for marking someone as absent.

P.S: This is not going to be implemented in reality :xD So give your ideas freely.

**Resources:**

1. YoLo
2. FaceNet

## Problem 4: Course Allocation System

**Concerned TA: Devesh Vijaywargiya**

**Statement:**

In IIIT, up to 3rd year, course allocation is a breeze as students don't need to pick their courses, but from 3rd year onwards, students have to choose their own electives.

During course registration, students are given a choice to select only one preference per elective. Due to the limited number of seats in each course many students don't end up with the courses they selected. Hence, they are forced to take up other electives of the same course type (which they don't like) in order to satisfy the credits requirement. This process currently involves multiple rounds and is usually done manually by the academic office and is tedious for students, faculty and administration.

You need to design an efficient course allocation software system accessible to the students, faculty and admins. You can include features like Add/Drop, student priorities from faculty, multiple preferences for each elective etc. The goal is to have maximum number of students content with the allocated courses while reducing the burden on the administration.
You can take inspiration from the following course allocation strategies. 1, 2, 3, 4

## Problem 5: Automated Plagiarism Detection System

**Concerned TA: Aayush Goel**

**Statement:**

We know that most courses in IIIT have heavy weightage for assignments. These include a variety of assignments like coding assignments, typed reports, hand-written submissions etc. The faculty and TAs want to make sure that there is no copying involved.

For all these cases, checking for plagiarism is a tedious task for the TAs. This problem gets harder when each assignment has its own submission format (worse when students don't follow that). You decide to help them out by designing a software system that automates plagiarism checking. You can use existing plagiarism checking algorithms as black-box in your solution.

**Resources:**

1. Matching Handwritten Document Images
2. Plagiarism Detection in Handwritten Documents
3. Source Code Plagiarism Detection

## Major Sections

Your research paper must comprise of 6 sections, namely the Abstract, Introduction, Literature Review,System Architecture, Conclusion and References. We honestly don't care about how much you write,you should design your system well and convince the evaluator that you've done your research. 2.5 to 3 pages is a decent amount of content. Even if you write 5 pages, but if you don't design your system efficiently with a good architecture, then you'll lose marks.

### Abstract

Just a 3-4 sentence description of your solution to the problem in hand. Something like 'This is a major problem that people face and we propose XYZ, a novel software system application that will take as input yada yada yada.

### Introduction

Explain briefly about your problem and the difficulties that people face because of it. You must convince the reader that the problem is indeed a major one and that coming up with a solution is paramount.

### Literature Review

This is where you have to do some research and read papers and scientific articles online. You must talk about the ongoing research in the filed of your problem statement and the existing technologies out there that try to solve a similar problem that you're working on. You should explore existing products in the solution space, maybe study the existing data and convince the reader that you are well versed about the ongoing research related to your problem.

### System Architecture

This is the significant part of your research paper, where you design the software system and explain its overall architecture. You should explain the pipeline of your system, about the various interactions between the model, view and the controller, how the database is being updated etc.We expect a neat design that eloquently explains your system. Use classic software design principles for this, listing down the use cases and making use of UML sequence, state and class diagrams.You should present a nice blueprint of your system and convince the reader that it's an effective system and would have a high probability of succeeding in the real world. You don't have to code it up, maybe you can do that over the summer!

### Conclusion and Future Work

Conclude well and summarise your solution in 3-4 sentences. Talk about future work and how things can be improved in the coming times.

### References

Whatever you read online - research papers, scientific journal articles etc. - please cite them

## Deliverables

Submit a single <**RollNumber**>**.zip** file containing all the latex files, and the necessary images/diagrams/figures needed for compilation. In case, if the images are too big while zipping, you may put them in a drive folder and provide the link in the pdf.