Section 1: Complex Systems

Before proceeding towards the question, I would like to explain what I perceive complex systems to be. A complex system can be considered as one in which several entities interact with each other, aiming to achieve a particular task, learn, and adapt to the surrounding environment. Complexities are bound to arise in such systems. What appeals to me in such systems is that these may look overwhelming from a broader perspective. But there has to be a solution to everything, isn't it?
The phenomena that are practically invisible to the majority, beyond the boundaries of space and time can be said to somewhat fall under the ambit of what can be called complex systems.

As *Mr David Krakauer,* President, Santa Fe Institute has mentioned, the Institute has been studying the nearby, nearly invisible reality, working in interdisciplinary teams with a wide range of expertise to develop fresh ideas that will open up a complex reality to science and explore for order in the complexity of evolving worlds.

When I read this, I was intrigued and inquisitive to know how the brilliant minds at the SFI, with their thought process, brought about their research on complex systems. The SFI, as per its operating principles does not discriminate between age, wisdom, experience or anything else. I really admire this way of thinking.

With the SFI paving its way into various fields through impact in mathematical immunology, genetic algorithms, and the science of networks, I would love to, through the Undergraduate Complexity Research program, experience all of this at a closer level, and get a first-hand experience with the mentors, faculty members, as well as fellow peers and understand how exactly complexity study of systems is performed at the SFI

Section 2: Topics

Topic 1: Blockchain-based FIR Registration System

This idea came into my mind when I began studying Blockchain and Web3 in particular. This was largely based on a practical problem that is faced by citizens from several countries.
We all know that an FIR (First Information Report) is generally a complaint lodged with the police by the victim of a cognizable offence or by someone on his/her behalf. An FIR is a very important document as it sets the criminal justice process in motion. It is only after the FIR is registered in the police station that the police take up an investigation of the case.

However, in many cases, due to malpractices of bribery and corruption, either the FIR is not registered, or even if it is, it is tampered with to alter the case investigation. In both cases, it is the victim who suffers.

In order to solve this issue, I propose an idea of a blockchain-based FIR registration system. Since blockchain is a very secure protocol, it becomes very difficult for anyone to tamper with the data that is present inside it, which makes it suitable for the interest of the victim.

What will this project do?
In the first step, it will take in all the details of the user - their name, age, Aadhar Card (Aadhar is a unique identification card issued to every citizen of India by the Government) etc, and ask for all the details about their case. Once this is done, it will then be sent to a higher authority for verification, and post verification, it will be uploaded to a Blockchain test network for safe records. Once the FIR is registered, it cannot be tampered with or corrupted by any external influence.

Topic 2: Drowsy Driver Detection

Every city is flocked by cars 24x7. The safety of a passenger is largely dependent on the attentiveness of the driver. Drivers have to drive the car in different conditions - be it external or internal. External conditions like hot summers, cold winters, and snowy conditions, while internal conditions like fatigue, anxiety, lack of sleep and a lot more.

If the driver is not in a perfect state of health, it becomes very risky for the driver, passenger as well as the car itself. Long-distance travellers, bus and truck drivers, and taxi drivers all experience sleep deprivation. Therefore, it is quite risky to drive while fatigued.

With the help of drowsy driver detection, a mechanism can be developed that will sense whether the driver is in a drowsy state and in turn alert the driver (and possibly the passenger) accordingly. This can help avoid any adverse contingency.

What will this project do?

With the help of Python, OpenCV and Keras, we can read the driver's face through a webcam and find out whether their eyes are closed or open. Based on predefined proximity through trained datasets, we can then conclude whether the driver is drowsy or not, and generate an alert accordingly.

Section 3: Collaborative Work

I have been a team player since my school days. From being the School Prefect, managing the entire batch effectively, to organizing a global hackathon in my University that invited participants from all over the world, I have been defined as disciplined, focused, fun as well as a great leader among my peers. During my 3rd year (5th semester) of Engineering, me and my team at the Microsoft Learn Student Ambassador Community, KIIT (the premier technical community of my University) organised a workshop on DevOps. The workshop was attended by 900+ participants and the event was a grand success. Although the workshop was only for three hours yet it took weeks of planning and brainstorming to make it a success. From logistics to venue to marketing and promotions, bringing in sponsors for the workshop, as well as monitoring the content that had to be delivered on the D-Day - these were the preparations that I directly looked after, before the event. On the actual event day, being the event coordinator, I led the event as the introductory speaker, and then knowledge about DevOps was imparted to the participants.

About my other involvements, I have taken active participation as an Organizing Committee member for the official Hult Prize at my University. Hult Prize is an event that is organised by the Hult Prize Organisation in various universities across the globe to celebrate the spirit of entrepreneurship. Various teams pitch in their startup ideas, and the global winner gets a funding of 1 million dollars. Being the executive of the Judge and Logistics Facilitation committee, I was in charge of smooth running of the event on the D-Day, as well as facilitating judges with any kind of information or help they needed.

From all these experiences, I got to learn a lot. The most important quality that I analysed is handling the mentality of all the team members. When we work in a team, we get to work with people who have different thought processes. At times, our thoughts match, and at times, it doesn't. However, it is important to let the member know why their idea was accepted or rejected. If an idea is rejected without any proper explanation, the member feels as if their opinions do not matter, and that their place in the team is only to fulfil the task as needed. Until and unless a proper explanation for every action isn't discussed in the team, the workflow then does not look like that of a team - it looks like an hierarchy. A team does not work "for" someone, a team works "with" the cooperation of every team member. Keeping the morale of the team high has been my utmost priority as a team leader, and my utmost requirement as a team member.

Mayank Jain
For the Santa Fe Institute Undergraduate Complexity Research Program.