

GhostTracker: Preventing Ghost Teaching

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Abstract— The perception of ‘Ghost Teachers’ refers to those educators that are registered teachers in an educational institute. However, they are not active participants in teaching. In the context of Pakistan, ghost teachers aggravate issues of accountability and equity in educational institutions. The practice of ghost teaching further represents a decrease in the quality of education as it impacts the overall performance of a student in class. Additionally, the persistence of ghost teaching places an economic burden on the education system as they are paying salaries to ghost teachers, this further leads to misallocation of the limited educational resources in an already struggling economy. In response to these challenges produced by ghost teaching, a solution was provided by creating a user-friendly platform that incorporates features such as biometric system, performance analytics, and camera recordings to help track a teacher’s attendance, performance etc. during school hours. The solution was produced by implementing the HCD process, conducting interviews accompanied with user testing to ensure that the best solution can be introduced to resolve the problem. Through leveraging technological tools, a platform like ‘GhostTracker’ was created to help school administrations by collecting insights and real-time data to identify ghost teachers more effectively and proceed to implement appropriate methods to resolve the problem.

Keywords—ghost-teaching, ghost-teacher, attendance, education

I. INTRODUCTION

The concept of ghost teachers in Pakistan talks about individuals, specifically educators that are listed as certified teachers for an institute and receive salaries. However, they are not actively involved in teaching. With reference to multiple incidents, many of these educators are reported as absent upon submitting their official joining reports, or they allocate responsibilities to substitute teachers.

The problem of ‘ghost teachers’ raises concerns about the educational system in Pakistan. Students may receive inadequate education due to a teacher’s negligence, and this can impact their overall academic success. Furthermore, this leads to an inefficient allocation of resources, as teacher are included on the payroll of an educational institution, however, when they refuse to contribute to teaching, they are wasting the institute’s resources.

The proposed solution to help control this problem is to develop a user-friendly interface that helps educational administration track their registered teacher’s school related activities. This would help in promoting transparency, communication and accountability within educational institution. The interface would help generate individual profiles of each teacher. This would help administration to keep track of people that are registered as teachers within the institute.

The interface would include features like a integrating the biometric attendance system with the teachers location- this would require teachers to mark their attendance, and the system will keep track of the teachers location until the end of classes; the information would be recorded in real time and would also appear on the interface.

Additionally, the interface would display a teacher’s performance analytics on their user profile. This would provide the administration with useful information regarding the teacher’s activities i.e. how many classes they took, how many hours they worked etc. Moreover, an automated alert can be seen on the screen when a teacher is absent or late.

Another feature that would help ensure that teachers are actively participating in teaching activities; each classroom would have installed recording cameras that keep track of teachers’ activities and the recordings can be accessed on the interface dashboard

II. CONCEPTUAL APPROACH

A. Human-centered Design Porcess

To resolve the problem and design an effective solution, the human-centered design (HCD) process was employed from the beginning. To understand ghost-teaching and its implications, the double-diamond model of design was used. Before planning to solve the issue, it was important to make sure that ghost-teaching was a real problem and affected the quality of education in the country. In this way, the double-diamond model helped us in finding the correct problem before rushing to solutions.

After that, the process of observation started. It was important to understand who were the users? what were their expectations from the system? and what is their context? To understand these user requirements, silent observation and interviews were conducted. Later on, based on observation analysis, primary, secondary, and negative personas were created to help designers understand who they were creating the system for.

Following that, the process of ideation started. In the ideation phase, we focused on brainstorming and structuring the ideas. For brainstorming, “brainwriting” and “starbursting” were employed. To make sense of the ideas brainstormed, a concept map was created and the features of the system were finalized.

The next step in the HCD process is prototyping. To put our ideas into tangible form we created three different prototypes. Making the prototypes made it easier for us to understand the potential advantages, risks, and expenses of the system we were planning to develop. Besides that, the users’ feedback on low-fidelity prototypes made it

convenient for us to make changes and minimize the chances of error in the final prototype.

For testing, “heuristic evaluation” and “think aloud” techniques were used. The former allowed us to test the prototypes without the actual users and the latter permitted us to test the prototypes with actual users and understand the mental model of intended users. This how the HCD process was followed throughout the development of the *GhostTracker*.

B. Observation

For observation, a total of 5 users were asked. Two of them were officials of the Ministry of Education (MoE) including the District Education Officer (DEO) and the Assistant Education Officer (AEO) in Azad Jammu and Kashmir (AKJ). The other 3 were government teachers belonging to AJK who taught in remote areas where ghost-teaching is a common practice. In the silent observation, the users were observed in their workspace performing day-to-day activities. Observing the officials working in their natural environment could help designers empathize with the users and understand their needs more clearly. It is important to mention that, additional actors were involved in this as it was not possible for the designers to visit the place themselves.

In the interviews, the users were asked questions like, “What do they need to prevent ghost-teaching?” “Have they personally encountered or observed cases of ghost teachers in your institution?” “What are the current methods or systems used to track teacher attendance and monitor their presence in the classroom?” etc. The users were interviewed over the phone call as it was not possible for designers to travel.

a) User Requirements

The end-users, in this case, are the officials of the Ministry of Education (MoE) including the Secretary of Education, the Divisional Director, the District Education Officer, the Deputy Education Officer, the Assistant Education Officer, etc. To find out the MoE officials’ expectations from the interface, an applied ethnographic approach was adopted.

Firstly, the users were silently observed in their natural environment to understand the problems they face and explore opportunities to resolve these problems to improve their experience. It was revealed that due to the lack of an integrated biometric system, the MoE officials faced problems ensuring teacher accountability. The department relied on the reports provided by the Deputy Education Officer and Assistant Education Officer who in many scenarios can be facilitators in the ghost teaching phenomenon.

Secondly, interviews were also conducted with the officials to obtain the right requirements. For this purpose, pilot interviews were also conducted before interviewing the actual users. In the interviews, the users expected the system to have the following features:

- An integrated biometric system that shows the teachers’ attendance in real-time.
- Real-time camera surveillance to ensure transparency and accountability.

- Absent alerts in case teachers are absent from their jobs.


These features will be incorporated in the final interface design obtained through silent observation and interviews.

b) Personas

Based on observation and problem evaluation, three personas are created, primary, secondary, and negative persona.

Personas are generated in the HCD process to allow the designers to put themselves in the shoes of users and understand their needs. They serve as the reference point throughout the design process and help designers identify and prioritize features, functionalities, and user flows that align best with the needs of primary and secondary personas.

The primary persona, Mohammad Imran, is our primary user for the interface as he is the government officer regulating the interface and hence, track the teachers. Mohammad Imran's persona represents the target user group of our system whose needs must be catered for by our interface.



Mohammad Imran

Age: 40 years	Country: Pakistan
Sex: Male	Education: CSS
Marital status: Married	Occupation: Government Officer

BIO

Imran is a senior education officer responsible for monitoring government schools in several districts of Pakistan. He oversees multiple schools and teachers and plays an important role in ensuring quality education. He is well-versed in educational policies and administrative procedures. He remains worried because of the news he is receiving of ghost teaching in several areas in Pakistan and wants to address them as soon as possible.

GOALS AND HOBBIES

- Plays cricket
- Does volunteer work
- Reading books
- Development and advancement of Pakistan

SOCIAL NETWORKS

Twitter, Facebook, Instagram

PERSONALITY

Family Oriented: [Progress bar]

Thoughtful: [Progress bar]

Empathetic: [Progress bar]

Image 1: Primary Persona

Ayesha Khan, the secondary persona, represents a secondary user group that interacts with the system as she will be receiving important notifications and alerts from the system, but her needs and goals may differ from those of the primary persona. We can cater to this user group's needs if the requirements of primary user groups are fulfilled.



Ayesha Sabir

Age: 28 years	Country: Pakistan
Sex: Female	Education: Graduate
Marital status: Married	Occupation: Government Teacher

BIO

Ayesha is a government school teacher in a Karachi. She has been teaching for three years but is known for her lack of commitment and irresponsible behavior. Ayesha is not particularly passionate about teaching and is doing the job only for the purpose of earning. She often neglects her teaching responsibilities and is indifferent to the impact it has on her students' education. She prefers to spend her free time socializing with friends and shopping. She is a fan of Pakistani dramas and spends her evenings watching television shows.

GOALS AND HOBBIES

- Spend more time outdoors
- Make more Friends
- Buy a house
- Loves to watch Pakistani dramas

SOCIAL NETWORKS

Icons for Snapchat, Facebook, Instagram, and TikTok.

PERSONALITY

Materialistic: [Progress bar]

Judgemental: [Progress bar]

Extrovert: [Progress bar]

Image 2: Secondary Persona

The negative persona is also created to help the designer know whom they are not designing the interface for. It represents persons who might be interested in technology but are not involved in the education sector and their personal needs and goals do not align with the objective of the interface i.e. to prevent ghost teaching.



Sidra Zaidi

Age: 44 years	Country: Pakistan
Sex: Female	Education: Graduate
Marital status: Married	Occupation: Software Engineer

BIO

Sidra is a computer engineer, she is not directly involved in the education sector. She has a great deal of interest in technological advancements. However, she is lacking experience in education management.

GOALS

Stay informed about emerging technological trends and contribute to software development.

NEEDS

State-of-the-art technical features and innovative technological tools.

PERSONALITY

Curious and open-minded: [Progress bar]

Self-motivated: [Progress bar]

Multitasking: [Progress bar]

Image 3: Negative Persona

C. Ideation

To ideate possible solutions to prevent ghost-teaching and identify ghost teachers, brainstorming sessions were conducted. The purpose was to collect as many ideas as possible. "Brainwriting" and "starbursting" techniques were used to achieve this.

Besides that, to moderate the brainstorming sessions we also tried to practice the "six thinking hats" strategy. This provided us an opportunity to think from diverse perspectives and question different ideas.

a) Concept Map

After the problem identification through observation and taking user requirements into account, the brainstorming sessions for solution finding began. Three main solutions were found.

A biometric system can put an end to obsolete attendance sheets or registers. It is also fraud-resistant as the device scans distinguishing features like fingerprint or retina scans for face recognition etc. However, biometric systems are already in use and the ghost-teaching continues.

Another solution was carrying out regular inspections and audits by sending officials. Regular inspection will ensure that teachers attend to their jobs properly. However, due to budgetary constraints, it is not easy to send teams for inspection, and in most cases, inspection officers like the Deputy Education Officer and Assistant Education Officer facilitate the process.

One more solution was to design an interface that monitors attendance. However, there was a lack of clarity on how the system would monitor attendance as no such interfaces exist in the county.

After analyzing each one of them, the best solution combining the essence of the other two is selected for implementation. An interface that monitors teacher attendance in real-time through an integrated biometric system, real-time camera monitoring, and absent alters. The ideas are structured in the form of a concept map shown below.

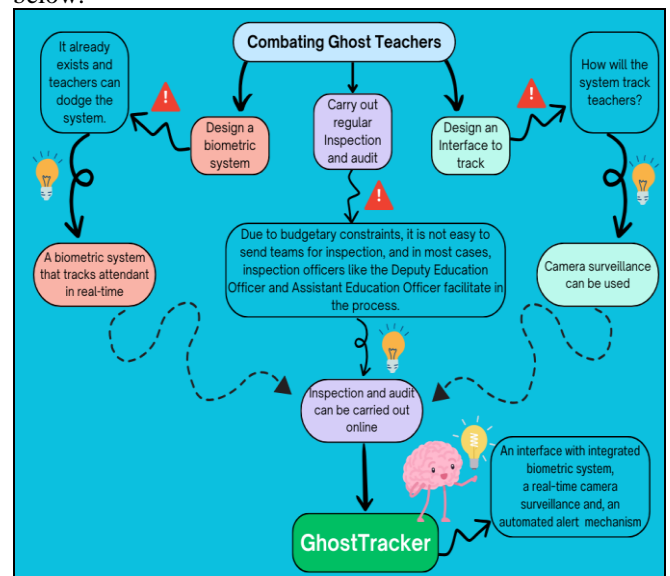


Image 4: Concept Map

b) Finalized Features

Keeping in view the user requirements, the following features are finalized.

- Integrated biometric system
- Real-time camera surveillance
- Automated alerts

D. Low-fidelity Prototypes

After observation and ideation, efforts were directed toward designing prototypes of the proposed solution. Initially, the low-fidelity prototypes are created as they are easier to design, are cost-effective, and allow for iteration.

a) Storyboarding Prototype

Image 5 shows the low-fidelity storyboarding prototype. The storyboard was created on *Canva*. The MoE official can log in to the system by using a username or email and password. On the dashboard, they can see general analytics in the center and navigation buttons on the left side. They can click on 'Attendance Record' to see the attendance track of the teachers. This enables them to see all the information about the attendance record of any teacher whose school is registered with the system. Similarly, 'Real-time Monitoring' allows them to select any school and see the real-time camera footage of any class. Lastly, 'Absent Alerts' allow him to check discrepancies in attendance.

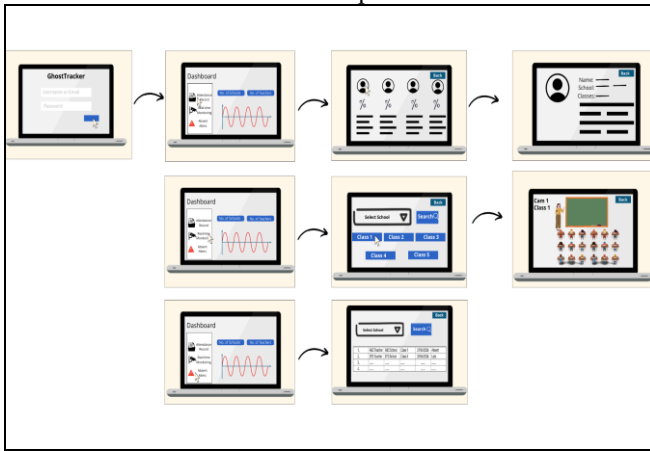


Image 5: Storyboarding Prototype

All these features ensure transparency and are effective in detecting any deviation in the attendance process. In this way, it is an effective tool for combating ghost-teacher phenomenon as it monitors the attendance process in real-time through integrated biometric systems, real-time camera surveillance, and absent alerts. Two other prototypes are also created.

b) Paper Prototype

Images 6 and 7 show the paper prototype.

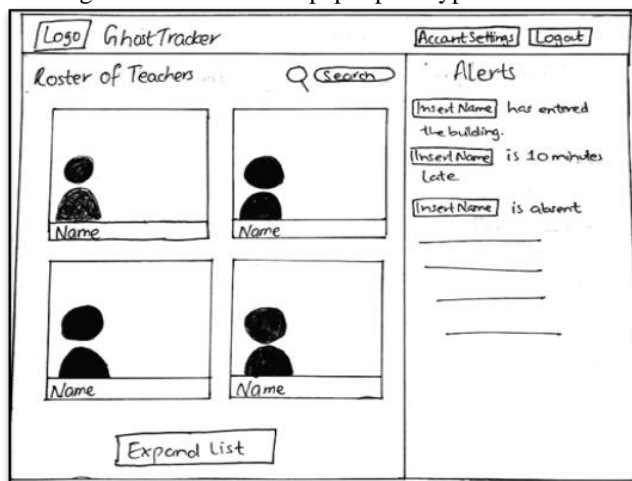


Image 6: Paper Prototype 1st Screen

After logging in, the first interface the human resource manager sees is the list of teachers that are registered within the educational institution. The prototype suggests that the HR manager will be able to see each teacher profile displayed on the screen, with the teacher's name and picture. The list can be further expanded, and there is a search bar if they want to type out the teacher they are trying to locate.

The prototype also shows an alert screen on the right side that displays information in real time. This explores the bio-metric attendance feature of our product. The alerts declare whether a teacher is present, absent, or late.

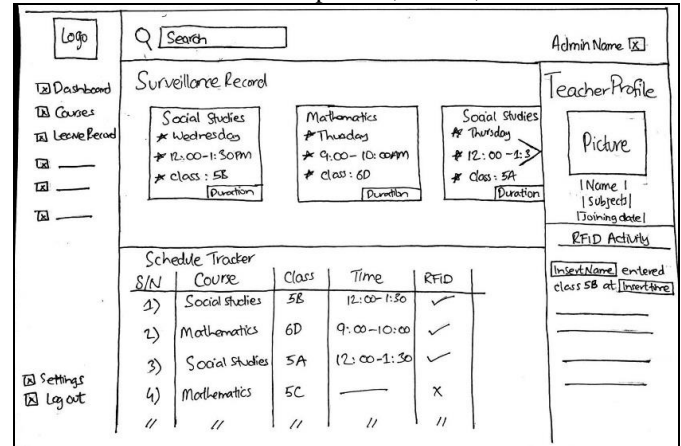


Image 7: Paper Prototype 2nd Screen

The second screen shows up when the HR manager clicks on a teacher's profile, it provides extensive information about the teacher. The right side of the screen shows the teachers picture, name, the subjects they teach, and their joining date. The section below provides information regarding their classroom attendance which is tracked through their RFID cards.

The surveillance section of the profile is also used as evidence that teachers have attended their scheduled classes. The teacher's lectures are recorded and the classes are categorized according to the teacher's schedule. This involves their respective subjects, day, time, and classroom number.

The schedule tracker displays the teacher's timetable for the day in a tabular form so that the administration can see whether the provided agenda is being followed accordingly. The table displays their courses, the relevant classroom, timings, and their classroom attendance.

c) Mobile Prototype

Lastly, the low-fidelity mobile prototype for the "Ghost Trackers" app is designed specifically for government officials.

Link:

<https://www.figma.com/file/Teb6hAhNS3xiBdvbFdwu1m/GHOST-TRACKERS--Low-Fi-Prototypes-Hiba-Shafqat?type=design&node-id=0-1&mode=design>

The app includes a sign-in feature only, as it is intended for authorized users who are already provided with unique login credentials. The prototype shows multiple sections and functionalities of the app, including the ability to view teacher attendance and track their locations. Users can search for teachers by area and school, view attendance records for specific teachers, and even access class recordings and transcriptions. The prototype aims to provide

government officials with a user-friendly interface to track and monitor teacher attendance and performance in educational institutions and deal with ghost teachers.

E. Testing

Initially 'Heuristic Evaluation', a variant of cognitive walkthrough was used to test the prototypes. The purpose was to test the prototypes without the actual users, 'Heuristic Evaluation' not only provided that but is considered suitable for early design. Also, it is relatively quick and cheap. To perform the evaluation, several independent HCI experts were requested to test the prototype. They were briefed about the purpose of the interface, details about the users it is intended for, and the task description.

After that, to test the prototypes with actual users 'Think Aloud' technique was also used. Since this method provides insight into the user's thinking, this can help designers understand the mental model of intended users. In the Smart Classroom, the users were asked to use the prototypes and comment aloud on what are they doing? and what is their objective. etc. Meanwhile, the designers noted their comments.

a) Storyboarding Prototype

In the storyboarding prototype, the users praised the attendance record and absent alert features. They liked the search button and school-wise organization of teachers' information in the 'Real-time Monitoring' feature.

However, most of the experts found the graph on the dashboard confusing. They could not understand what the graph signified. The interface lacked uniformity in terms of the pattern e.g. on the second screen the user is supposed to select a school and then a class. A similar pattern should have been used for the first screen i.e. to check the attendance record of the teacher, the user should first select a school and then select a particular teacher's profile unlike in the current version where various profiles of teachers are displayed without information about their respective schools. The current screen lacks sequence as the information is not sorted.

It was also noted that instead of adding a button for each class on the second screen, there should have been clickable links or tables as they can accommodate more information and are more suitable for the laptop screen. The prototype is also criticized for the relevant size of objects on screens as they are too big for a laptop screen. The 'Absent Alert' and 'Real-time Monitoring' features did not inform how the administrator or regulators will be notified about discrepancies in attendance. Apparently, they would not know about a teacher's absence unless they luckily pull forward the class at a specific time or watch the video feed all day.

Nevertheless, the users commented that the prototype is clear and concise, the functionality is obvious, and it is easy to navigate through.

b) Paper Prototype

In the paper prototype, experts suggested to add a homepage page that showcases how the users will access the platform. They stated that it could include enough information to help users navigate the platform seamlessly.

Additionally, regarding the presented prototypes, experts explained that the dashboard design was good. They identified that it was extremely detailed and clearly presented all the finalized features of the product. However, they did suggest to add a column for the teacher's name after the RIFD, and to include the school level next to the teachers name to help users identify which school's teachers they are looking for. Another criticism of the prototype was that it looked similar to a Learning Management System (LMS) and might cause confusion for the users.

c) Mobile prototype

There were positive observations and room for improvement in the tester feedback for the mobile app prototype. They also complimented the sign-in process for its simplicity, as it only required username and password, provided by the government officials. Positive comment was also given to the attendance monitoring tool for offering a thorough summary of a teacher's attendance history, including the number of classes attended, absences, % of attendance overall, and live video recording. Testers, however, expressed reservations over a few features of the prototype.

They suggested removing the location feature and incorporating a live class camera feature to enable real-time monitoring of classroom activities. There were also concerns regarding the clarity of certain screens, especially the 3rd screen, whether it serves as the home screen after login or not, and the absence of clear instructions on navigating to the Area and Schools screens. Testers also emphasized the importance of distinguishing between ghost teachers and genuinely absent teachers, as well as considering legitimate reasons for teacher absence.

The low-fidelity prototype evolved into the high-fidelity version through a series of user feedback and design iterations. The high-fidelity prototype, which incorporates all of the adjustments made in response to the data gathered during the earlier stages, is the polished, ultimate version of the system. One notable change was the removal of the location tracking feature, as it was not appreciated by the testers during the low-fidelity testing. Additionally, the high-fidelity prototype is a web-based version, providing a better overall view compared to the mobile-centric low-fidelity prototype. The high-fidelity system also includes comparison graphs, charts, and advanced analytics to help administrators better understand and monitor attendance patterns. Importantly, the high-fidelity prototype clearly defines the criteria for identifying ghost teachers, and provides a comprehensive list of ghost teachers, along with options for the government officers to issue warnings or report these teachers.

III. DISCUSSION AND FUTURE WORK

A. Strengths, Weaknesses and Limitations

The project's main strengths are its extensive user research and requirements collecting approach. One example of a human-centered design (HCD) method is shown by the creation of user personas by Mohammad Imran and Ayesha Khan, as well as the thorough observation of user demands. An important aspect of the project's strength is its emphasis on comprehending the target consumers and their problems.

Ghost teachers are a serious problem in Pakistani education. The *GhostTracker* technology offers a real-time tracking feature, integrated biometric attendance system, and camera surveillance. The defined user needs are well-matched with this technical solution, which also has the potential to improve accountability, transparency, and efficient monitoring of teacher attendance and performance.

The project report also highlights several potential weaknesses and limitations that the team will need to address. First and foremost, considering the sensitive nature of the information being collected—such as biometric data and classroom recordings—data privacy and security will be a critical factor to take into account. It will be important to guarantee the protection of both teacher and student data. Second, educators and administrators might object to the new technology-driven *GhostTracker* platform's introduction. This requires a gradual implementation approach and comprehensive training to support user adaptation and adoption.. Lastly, the report does not mention whether the platform will be integrated with any existing attendance or school management systems, and exploring such integration opportunities could help streamline data management and minimize duplicated efforts.

B. Lessons Learned

The project team has probably learned a great deal about the difficulties Pakistani educational institutions have in dealing with the ghost teacher problem through the process of gathering requirements and doing user research. Beyond only the obvious problems, these lessons provide a deeper grasp of the problem's complexity and intricacies, letting us focus on what the problem actually was. Teachers were available but they weren't teaching the students in classes, even if they go to schools. The team has also acknowledged the value of including important stakeholders in the problem-solving process, such as teachers, administrators, and suitable government officials, to ensure that the proposed solution addresses their needs and concerns. The group has also realized how important it is to utilize a human-centered design approach when creating a technology-driven solution that identifies the actual problem and actually solves it.

C. Future work

If we had more time and resources, there are several areas we could explore for future work. First, we could go past the design stage and put the *GhostTracker* platform into operation, carrying out trial installations in a few chosen educational institutions to get feedback and insights from actual users. Through iterative development, this data might then be utilized to improve the system's functionality, usability, and overall efficacy. We could also expand it vertically and add more features like teacher's profiles, their performance evaluation and an interface for teachers. Finally, we can develop a plan to ensure the long-term sustainability of the platform, including maintenance, updates, and ongoing performance monitoring, as well as assess its impact on improving teacher accountability and the overall quality of education over time.

IV. CONCLUSION

The educational problem that required attention was the existence of ghost teachers in Pakistan- these are individuals who have been registered as teachers in a school and earn a salary. However, they are not actively involved in teaching. With the identification of the problem, the solution was to create a platform that could help identify these teachers. Therefore, after implementing the HCD process-creating personas, designing three prototypes, conducting user interviews in order to finalize the user interface- what the platform looks like and the features that could help track ghost teachers, and also the user experience-how the user navigates through the platform. Consequently, the platform *GhostTracker* was created in order to resolve the problem of ghost teachers in Pakistan.

V. WORK DISTRIBUTION

Tasks	Done By
Abstract, Introduction, Paper prototype and Conclusion	Eshal Javed
HCD process, Observation (User requirements), Ideation and Storyboard	Namra Hashmi
Personas, Mobile prototype, High-fidelity prototype and Discussion and future work	Hiba Shafqat