

## **Systems Design for Institute for Child Development Recording Interface**

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**Abstract:** The Institute of Child Development (ICD) at Binghamton University is currently struggling to access and record videos for its early intervention and school age assorted services for the autism spectrum disorder community. Cameras are extensively used to assist with diagnostic and assessment activities and analysis of complex behavior patterns. The team's primary goal is to ensure that video recordings are completed reliably and successfully while also significantly reducing the time it takes to initiate a recording using a Flutter/ Dart User Interface (UI) that permits high levels of security compliance. The logical steps of the UI will also allow staff members to schedule recordings in advance and include notes for easier cataloging and retrieval. The UI connects to the ICD's current video system, WOWZA API, via a PHP script that is secured and accessed through the ICD's core FileMaker application, which is available to all staff members.

**Keywords:** User Interface, Video Recording, HIPAA, Web Application, Autism Spectrum Community, Flutter/ Dart, Claris FileMaker, PHP Script, WOWZA API, Android IDE

### **1. Introduction**

#### **1.1 ICD Background**

The project is through the Institute of Childhood Development (ICD). The ICD provides many programs and resources to the autism spectrum disorder community such as providing early intervention and school age services and much more (Institute for Child Development, 2022). The ICD extensively uses cameras to aid in the diagnosis, assessment, and analysis of complex behavior patterns. Their facility is equipped with 30 internal IP cameras in their classrooms and hallways as well as 6 external IP cameras in their outdoor social learning environment. The cameras are all streamed through a WOWZA REST API external network. The ICD must follow the NYS Department of Health and NY public school regulations. The User Interface (UI) is needed to access the cameras through the ICD's WOWZA Server and be able to record in advance or at a moment's notice. It needs to be intuitive to minimize any mistakes in the recording process. The 60 core staff members all have distinct levels of security that determine which cameras they have access to record as well as what video recordings they can view.

The ICD's current system is very insufficient as only one person has the skill and access to manually initiate recording by the cameras, the head of the IT department. For a camera to be recorded, the staff member must find the head of IT and he must go to the server room to manually start the recording. The entire process takes on average 21 minutes, which is too long to be able to record spontaneously, such as recording a child's seizure for later medical review and does not permit scheduled recordings and take notes. Storing videos in the ICD server also requires manually naming and storing the videos once they are done recording, for which the head of IT is also responsible.

## **1.2 Project Objective**

The project's primary goal is to improve the ICD's current recording system to allow the staff to quickly record or schedule recordings in advance. The UI will remove the need for the head of IT to go to the server room to manually initiate recording. The interface will also improve the retrieval system of the recordings with the ability to take notes on the recording before, during, and after the recording is taken. The project will relieve the head of IT and the co-director of the ICD from unnecessary work and the intuitive design will eliminate user error significantly. The UI can be implemented smoothly with little to no training due to the logical and visual nature of the user steps.

## **2. Literature Review**

Autism spectrum disease affects roughly 1 in 44 children, according to the CDC's Autism and Development Disabilities Monitoring (ADDM) Network. Autism is presently more difficult to diagnose than other prevalent disorders as no biochemical or physical tests can diagnose the autism spectrum disorder. However, the use of cameras in the diagnosis process allows for an analysis of complex interactions, multiple viewing and reviewing, a permanent and complete record, and much more (Asan & Montague, 2014). Thus, easier access to cameras for recordings can aid the ICD in the diagnosis of autism spectrum disorder, as well as ongoing assessment and evaluation of services. Video reviewing is recognized as an important tool in the service delivery process through its ability to preserve both quantitative and qualitative aspects of the child's behavior in a natural setting (Intelligent Video Solutions, 2022). Furthermore, when a child with autism is having an emergency, a spontaneous recording can be used to capture the episode to aid in subsequent treatment. For example, a third of the autistic disorder community suffers from epilepsy, which can trigger seizures (Autism Speaks, 2022).

The team created an accessible and clutter-free user interface for the staff to use. The Interaction Design Foundation describes major concepts to consider when developing any user interface, including system visibility, consistency between the actual world and the system, user control, standards and consistency, error prevention, minimalist and customized interfaces, and so on (Wong, 2022). The team believes designing a user interface without considering cognitive ergonomics will take the staff longer to navigate the system and cause delays in initiating the recording. The model validation section further elaborates on how the designed UI follows the ergonomics guidelines for ease of use.

## **3. Methodology**

The team used Flutter to code the User Interface with Android Studio as an IDE (integrated development environment). IDE is an editing environment that allows users to create and edit text files as needed through a graphical user interface. Flutter is an open-source framework founded by Google for constructing UIs and many platforms such as mobile, web, desktop, or embedded applications (Google, 2022). Flutter uses various widget functions to describe the appearance and function of the UI. Widgets can be seen as building blocks of the UI, and they have a hierarchical system with other widgets. Dart is the programming language that is used to code the Flutter Web Application. It can deploy the mobile app to the web from the same codebase, which is an important reason for its use as per request by the client.

The PHP scripting language can integrate data from FileMaker databases with the team's Flutter Web Application, providing access to databases hosted by the Claris FileMaker server. Claris FileMaker is a sophisticated rapid development relational database that includes industry-standard protections for securing the data - both in the cloud and on-premises. FileMaker Cloud maintains certifications in compliance with ISO/IEC 27001 for information security management and ISO/IEC 27018 for personal data in the cloud (Claris, 2021). The team's recording interface Web Application is integrated into the ICD's existing comprehensive Claris FileMaker system to automate the workflow. The ICD Administrations tried using other platforms; however, Flutter allows for the long-term goal of converting a web browser to a web app. Since the team's Web Application is integrated into an already established environment, there is no cost associated with it. Also, ICD staff prefer the Flutter platform for their everyday use.

## 4. UI Design and Process Flow

### 4.1 Process Flow Chart

The team worked closely with the client to create a design that both meets all stakeholder needs and lends itself to a quick-build process. The team wanted to make sure that the design was as simple as possible while including all the functionality that the client needed for the Web Application. This led to a design where the front security and login process were to be covered by the client’s pre-existing FileMaker servers. This way, there would be no need for any security to be built into the app, as the only way to access would be to first have access to the client’s VPN, and then have the proper login credentials to access the FileMaker server. Since most functions carried out by the staff of the ICD are already done in FileMaker, this was an intuitive decision.

Figure 1 shows how the current system takes on average 21 minutes to initiate a recording which results in missing important details. The new system takes less than 1 minute to initiate the spontaneous recording or schedule recording.

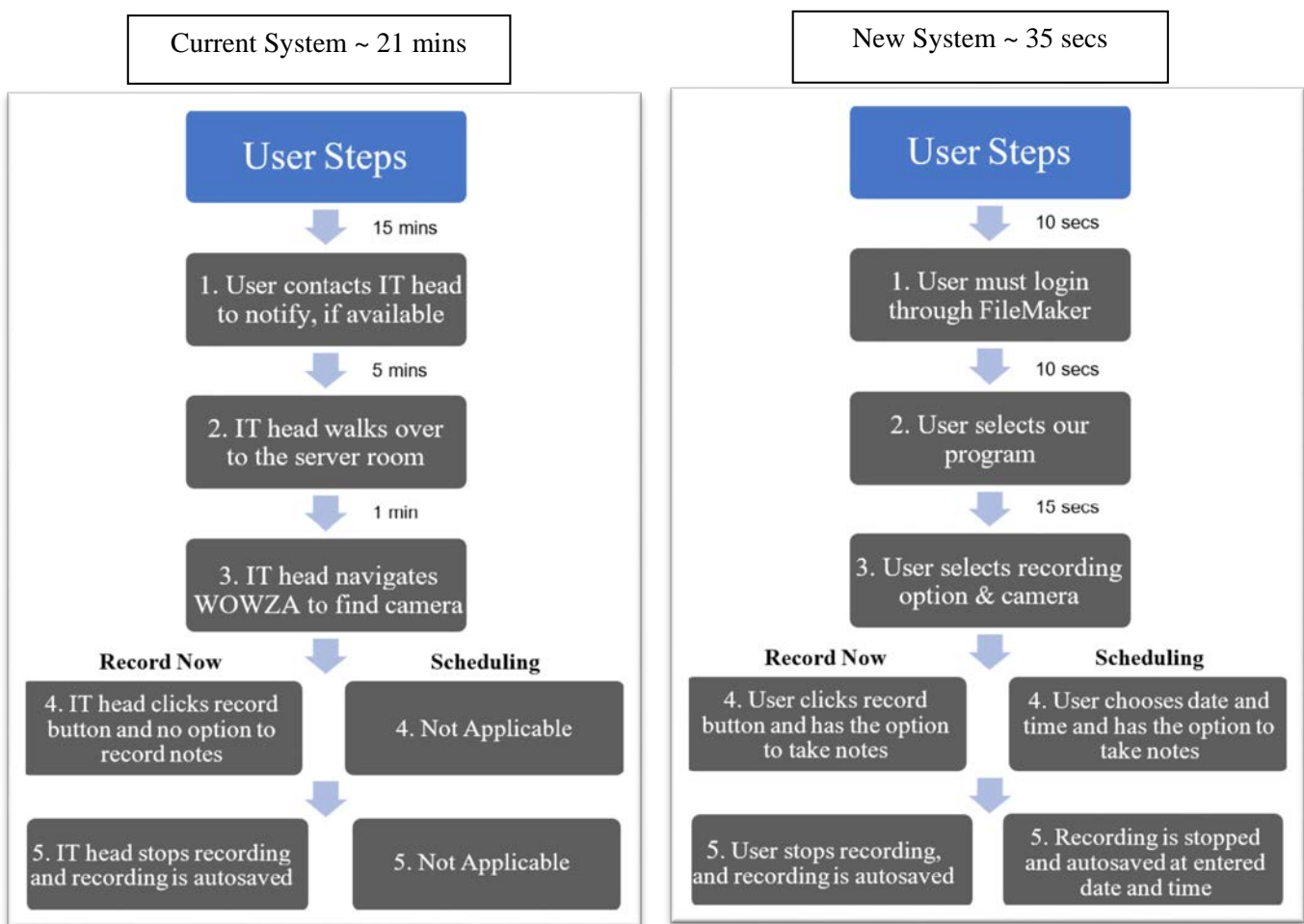


Figure 1. Comparison of Current System and New System Process Flow

### 4.2 Camera and Recording Type Selection

Once the user logs into FileMaker and pulls up the Web Application, the first screen seen would be a camera selection menu. User Experience (UX) and ease of use were a high priority while the team designed the Web Application, so a multi-dropdown menu was used here to make camera navigation as smooth as possible. The user first selects which group of cameras

they would like to choose from, then the dropdown menu below populates with all the cameras inside that selected classification. An example of the UI is shown below in Figure 2. At the bottom of the UI, the user then has the option to select whether they would like to record with the selected camera at that moment or schedule a recording for the future. The client expressed the desire to have both options, as the record now option covers the possibility of capturing spontaneous needs, while the schedule recording feature would allow for easy capture of planned child sessions. Depending on the user selection, the data will then be written to the database, and it will trigger the PHP code at the proper time to conduct the recording.

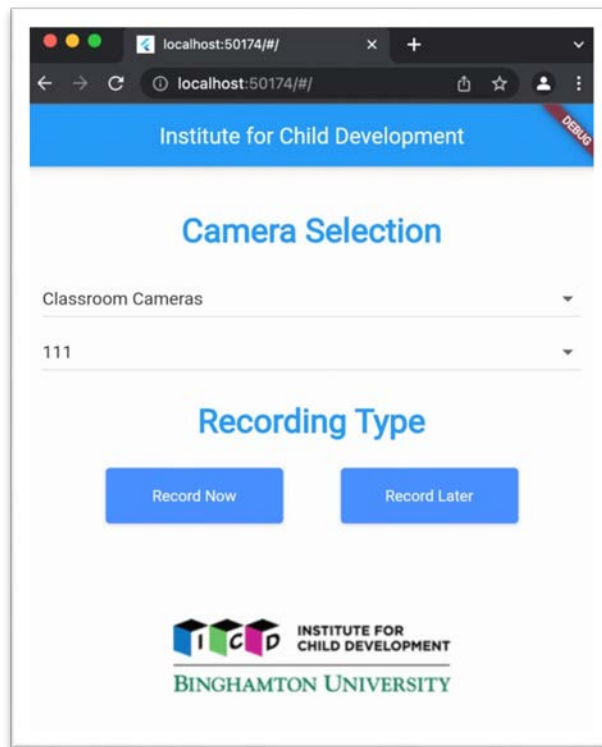


Figure 2. Recording Now User Interface Model

### 4.3 Record Now / Record Later

Depending on which recording option was selected, the user would then see one of two similar screens as Figure 3. First, for an immediate recording, there would have a large green “Start Recording” button on the top of the screen. When the button is pressed, it sends an API to call out the selected camera and begins the recording. A notification bar shows up at the bottom of the UI to notify the user that the recording has begun. Next to the “Start Recording” button, there is a large red “Stop Recording” button, which has the same function except it notifies the user when the recording has stopped. The user also has several data entry fields available to fill out information including Child Name, Recorder’s ID, Recording Details, and then a Recording Purpose section. Since the Recording Purpose tag is used as means of searching and differentiating between recordings and the client had specific purposes in mind, the team decided to code in three buttons with the options rather than having the recorder type them out and risk mistakes. Finally, at the bottom of the page lies a “Submit Notes” button, which when pressed will submit the notes to the ICD server for storing. The PHP script has an auto-cut-off function that ends the recording after 1 hour. If the staff needs to record for longer than an hour, which is unlikely according to the Administration, they can restart a new recording to capture more.

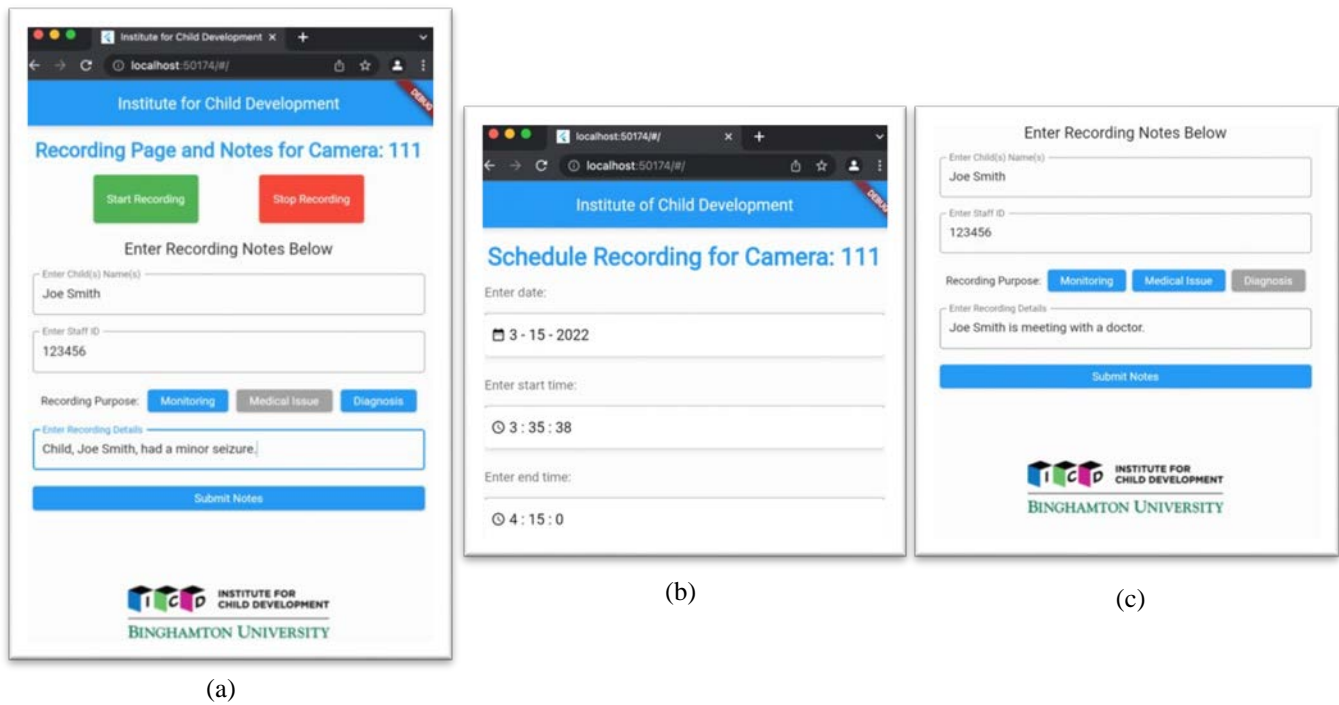


Figure 3. (a) Record Now and Notes UI, (b) & (c) Schedule Recording and Notes UI

If the user selects the Record Later option to schedule a recording, the screen shown will be similar to the record now option with a small change. The Schedule Recording UI includes a DateTime picker widget package, which allows the user to enter a date and then the start and end time for the recording on that date. These are located where the "Record" button would typically be. The rest of the page is the same, with all the same options for taking notes on the recording. If the user wishes to add more notes to the recording at the date it is captured, they will be able to access the database and add them then.

## 5. Model Validation

The designed UI holds up to all the security and privacy requirements, due to the work done by the existing FileMaker server. The team designed the pages to be intuitive, and with as little to distract or confuse the user as possible. The camera selection screen has been designed to limit the number of options the user faces and is organized in a way that will be simple to learn. The two recording pages are not cluttered, and any input needed by the user is clearly marked.

The functionality of the UI is verified as the Web Application is connected to the ICD's database. The PHP script embedded in the "Record Now" button ensures that this UI has been successfully linked to FileMaker and that recordings are saved into the ICD's database once the staff stops the recording. Since the team must comply with HIPAA regulations, privacy and security requirements were heavily stressed while constructing the UI. A connection to FileMaker also verifies these requirements by ensuring that users who log in are indeed the staff of the ICD and that no outside access to the database is permitted. By incorporating the ICD's metadata of staff member information and security level, the team was able to further emphasize the privacy requirements and regulate who has access to certain cameras.

The recommended UI allows the ICD staff to record instantaneously on a tablet, which saves a great amount of time from their preexisting recording process. The average time saved with the implementation of the new UI is visualized in Figure 1. Receiving comments from the ICD staff regarding the ease of use, convenience, and efficiency of the UI has been valuable for determining the overall effectiveness of the Web Application. During the planning stages of the project, the client expressed that they would be looking for several key validation methods to ensure the delivered product was satisfactory. These included the functionality and whether it met the core requirements, the cost associated, the speed of use, and the ease of use. The functionality is confirmed by running the Web Application and testing the different scenarios that can be encountered. The cost is minimized in the design by using all systems and cameras that are preexisting and currently in use, while other programs

similar to the team's design can cost tens of thousands in full. The speed of recording is significantly improved with the new design, by distributing recording directly to the ICD staff. The process has moved from a state where it might be impossible to record if the right people are not available to a state where the staff can always start recording immediately. Finally, the ease of use has been met through the team's design as mentioned above and confirmed by the client.

## 6. Project Impact and Conclusion

From the test run of the code, it is evident that the UI has decreased the processing time of initializing recordings for the ICD staff members. When providing services, capturing completely needed assessment information and spontaneous events is crucial for treatment decisions, documenting, and reviewing child status. The current system is inefficient and not reliable. To replace and improve this system, the team has implemented the Web Application within their preexisting servers and databases. Thus, the ICD already has the procedures, cameras, and servers needed for the new system and is a subscriber to the platforms that the team has utilized, therefore this project costs little to nothing.

Maintaining HIPAA compliance was heavily stressed throughout the project. Since the ICD already has multi-level PINs for each staff member as well as metadata of the security levels, integrating the new application into their existing system satisfies their privacy requirement of only the staff with appropriate credentials should have access to the Flutter Web Application. Having users log into the ICD's FileMaker program reinforces the privacy of the ICD for both accessing certain cameras and viewing recordings.

The UI is designed with simplicity and minimalist aesthetics to prevent any mishaps from staff members. The team worked on generating an elegant UI with buttons, text boxes, and notifications by using the Flutter Software Development Kit (SDK). The "Record Now" and "Stop Recording" buttons are green and red respectively to clearly label their functionalities and provide contrast from the rest of the widgets. Text boxes can prompt users to enter notes of the recording. Notifications are displayed at the bottom of the screen to inform users of when a recording has been started or stopped. Once recordings are stopped, they are saved directly into the FileMaker database. This new process alleviates the ICD staff from any delays in the recording process and ensures that they can focus on providing comprehensive and individualized services.

## 7. References

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