

Team Scrubs (#13): Improving Patient Identification

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How Might We:

How might we accurately and effectively identify children in pediatric healthcare using biometric identifiers?

Description/Background

Approximately 200,000 people die in the United States every year due to medical errors. Ten out of every 17 medical error deaths are due to patient misidentification[1]. Under the current situation, 7.4 percent of patients are misidentified. As a result, ninety-two percent of these patients are administered the incorrect medication[2]. Studies have shown that patient misidentification is one of the leading causes of medical error and medical malpractice[3]. By reducing error from patient identification, patients will receive a higher quality of care due to increased safety and accuracy of treatments delivered.

The systems currently in place to identify adult patients have limited effectiveness. Foremost, a number of factors put children at a higher risk of medication error, including their dependency on their parents or on other adults, development, demographics and a different epidemiology of medical conditions. A substantial amount of preventable medical errors in the pediatric population is the result of an error in prescribing, dispensing and administering medications[4]. Neonatal Intensive Care Units (NICUs) have an even higher rate of misidentification. A one year study period of identification and medication risk in a NICU discovered that *over 50% of the patients* on the average day were at risk for incorrect treatment due to misidentification, and some days as many as 72.9% of the patients were misidentified[5]. Ultimately, improving the safety and efficiency of the medical system through patient identification will lower the risk of receiving incorrect treatment on an individual basis, as well as reduce the cost of national health care.

The most widely used method of identification currently used in hospitals involves identifying a patient upon admission based on verbal and visual information. The patient is given a wristband with a unique barcode to identify him/her at the different checkpoints in the hospital. Barcodes confirm the patient's identity once they have been admitted because the barcodes are all unique. However there is a lot of room for error in giving the patient their wristband based on verbal and visual information. Also, once the barcode has been printed it is difficult to update necessary information in real time [6]. Additionally, this system is less efficient on infants and very young children since they all have very similar appearances[5]. It's also difficult to identify identical twins, even more-so when they are children [7]. Finally, when a child is too young to speak for themselves, they can't alert a nurse or doctor if their identification or wristband information is incorrect.

Biometric identifiers rely on something that is unique to each person and naturally a part of that person. They are very reliable, accurate, and efficient [7]. Iris scanners can even distinguish between identical twins, and the iris never changes throughout someone's lifetime [7]. Additionally, iris scanners are less expensive than competing methods of identification and are very easy to integrate into most Electronic Medical Record (EMR) systems [7, 8]. However, the healthcare industry has a huge web of complications including financial concerns, time, and resources. When considering solutions, especially around patient interaction and patient identification, hospitals must consider stigmas associated with biometric identification. Additionally, some hospitals, including Children's Hospital of Atlanta, have considered biometric identifiers, but are concerned that children won't be able to focus long enough on the camera to capture a clear image of their irises [9]. Other professionals in the pediatric medical technology development industry also express this concern [10]. With regard to funding the installation of biometric identifiers or other technology, hospital budgets are carefully divided and planned out, so often times hospitals feel as though they don't have enough confidence in the technology to warrant reworking their budget to purchase it [8].

Stakeholders in this problem space include the pediatric patients, doctors, and hospitals. A new identification system will decrease patient identity theft and increase the efficiency of identification, improving the ability of doctors to quickly access important information, therefore increasing the accuracy of the treatment and allowing doctors more time to treat other patients [11]. Since the doctors will have access to more correct information, medical errors will be reduced [12]. However, the implementation of new technology will cost the hospitals money upfront, and will require the staff to take the time to learn how to use it.

Project Goal:

The goal of our project is to improve the quality and safety of healthcare provided in pediatric hospitals by using biometric technology to increase the accuracy of patient identification. Because children are more sensitive to incorrect medication and current identification systems are less effective on children than on adults, our goal is to focus on technology designed specifically for children[4]. We will research the accuracy and practicality of iris recognition systems, and then develop and test an iris scanner and make system improvements that optimize biometric identification specifically for toddlers over 1 year old. By developing improvements for the system and performing the research to prove its effectiveness, we hope to increase hospital interest in implementing biometric identification systems. We anticipate an increase in biometric implementation to result in a long term decrease in hospital errors associated with patient identification, especially in the pediatric environment. Our first hospital we will engage with will be Children's Healthcare of Atlanta (CHOA), since Leanne West, one of our advisors, is in charge of Georgia Tech-CHOA relations.

External Advisors:

The three advisors that we hope to acquire are Leanne West, Chief Engineer of Pediatric Technologies; Gang Bao, a professor at Georgia Tech that has experience developing technologies for Children's Hospital of Atlanta; and Thad Starner, a CS professor that specializes in wearable computing at Georgia Tech. From Leanne West, we hope to gain connections with Children's Hospital so that we can develop a stronger relationship with the hospital. Additionally, we hope to gain insight in the process of implementing technologies in pediatric hospitals as well as insight in developing technology specific to children. We also hope to gain insight in developing and producing biometric technology specifically for children from Dr. Gang Bao. Additionally, from Dr. Gang Bao, we hope he can help us better understand the biometric aspects of our technology. Lastly, we hope to use Dr. Starner as a guide and reference for connecting the hardware and software aspects of our project.

Objectives

Perform Customer Discovery Research:

Our team's first objective is to conduct research in order to gain a more concrete understanding of why iris scanners don't work well on children, why hospitals do not want to implement them, and how to construct iris scanners. In order for us to develop and implement our own iris scanner, we need to know more about what aspects of eye scanners as they are currently designed need to be changed so that they will be more suitable for children of all ages. We will be researching possible modifications to current iris scanners that will help to capture the attention of children for enough time to get a clear picture of their irises. Because we can't feasibly perform a control experiment on children using pre-existing technology, we will perform the large majority of our research by talking to people who work in the field. Below, the tasks encompassed within this objective are outlined.

Tasks:

- Consult at least three different professionals that work with iris scanners and/or children patient identification to learn the existing limitations with current iris scanners.
- Speak to at least two professionals who work with patient identification on a daily basis about what factors limit hospitals from implementing iris scanners in general.
- Consult at least one professional who has experience making iris scanners to learn more about how we can go about modifying existing products for our specific needs.

Once we have completed this objective, we will understand exactly what about the current iris recognition system doesn't work for children.

Anticipated Issues: The main issue we anticipate with this part of the project will be contacting and finding enough sources to learn more about iris scanning children. At the very least, we anticipate it taking about 3 weeks to be able to coordinate and meet with enough professionals to accomplish all the tasks listed above. We are planning on starting to work with the devices as

soon as we feel we have enough research, even if we have not completed all of the above tasks. If we get more perspectives from meeting new people once we've started building a prototype, we will modify our device/application accordingly.

Construct the Biometric Application:

Our second objective will be to use the information that we gathered from our research and use it to create an application in iOS that will perform the iris scan in a way that is predicted to be more successful with children. Also, this objective includes the construction of necessary add-ons. This step is critical in our project because we will be synthesizing the information we gathered through our research to formulate a solution, and it will allow us to see the feasibility and the functionality of that solution in a hospital environment. Without the accomplishment of this step, we will not be able to test our application on adults which will then prevent us from testing on children. Below, the numerous different tasks encompassed within this objective are outlined.

Tasks:

- Formulate Improvements
 - Organize and combine all the information we gathered through interviews and personal visits
 - Identify all the areas in the current method that could be improved
 - Evaluate the success of the system as a whole, and whether it could be made more efficient aside from the interface (different types of data matching, more or less threading etc)
 - Ideate with team members and meet with advisors who have more expertise in children and pediatric technology to help determine ways that we can improve how children are able to act with the iris scanner to make it more effective
 - Meet with advisors who have more expertise in technology development and creation to present ideas about what we would like to accomplish with the technology and how to best design the application and the add-ons

We will have completed this section of the objective when we have a solid idea of what we need to incorporate into our application and have the design for any necessary add-ons.

- Product Development:
 - Obtain an iPhone and other necessary materials to build the application
 - Learn the appropriate computer language to code the iOS application and incorporate commands for the image capture and manipulation. We will attend GIT MAD (a mobile application development club) for assistance in writing and

learning the necessary code, as well as consult with Thad Starner, a Georgia Tech professor in the college of computing department.

- As we are learning the appropriate language, use it to write the application
- Use online open source libraries, such as projectiris.co.uk to write the algorithms necessary for the iris recognition
- Connect our application with a database to store the results from the utilization of our Iris Scanner
- Use sketchup, solidworks, inventor or another 3D modeling program to design the improvements so they will work with the board camera
- Construct and program the improvements
- Conduct a pilot study on adults comparing the effectiveness and accuracy of our iOS application to an iris scanner currently on the market. This study will be on ourselves and peers and less official than the study we will perform on Children since we only need to ensure that the application works to the general standard of a normal iris scanner.

Upon completion of this objective, we will have created a functional application and necessary additions for the exterior of the phone that is catered towards identifying pediatric patients.

Anticipated Issues: The issue that we will face most often will be our lack of experience in working with hardware and software. Due to our lack of experience, we will run into situations where we are uncertain on how we would connect various parts of our system to each other. Consequently, it is imperative that we contact as many experts that have experience in making electronic devices as we can so that we can ask the expert for help if needed. Another issue that we anticipate is that the Iris Scanner that we develop will not be effective. We can resolve this problem by consulting companies that have already made Iris Scanners and asking them questions specifically targeting the fabrication process.

Test Improvements for Children:

Our last objective will be to test the improvements on children. This step connects our research and development to our application and will determine how well our improvements actually perform in the real world. This is the final step for our project and represents the culmination of what we have been working towards – implementing an improved biometric identification system. Without this step we will not have the real world experience necessary to implement our design and will not know what we need to fix and redesign. Below, the numerous different tasks encompassed within this objective are outlined.

Tasks:

- Determine a set of parameters to determine effectiveness which could include (but are not limited to): Accuracy, speed, ease of use, ease of integration
- Develop an experimental procedure to test current identification systems in each set of parameters, which will include how we measure success and our statistical analysis plan
- Develop an experimental procedure to test our improved identification system in each set of parameters (must be similar enough to use the first experiment as a basis)
- Obtain IRB approval for our research
- Contact CHOA and set up appointment(s)
- Perform the study
- Collect data and compare our improved identification system to current systems
- Analyze data and formulate improvements where necessary

Upon completion of this step, we will have data to support whether or not the iris recognition system we developed increases the ability for hospital staff to use iris recognition technology for patient identification in a pediatric environment. Also, we will have data to support whether our technology is more accurate in identifying patients than the barcode system that is currently in place.

Anticipated Issues: The issues that will present the most work will be determining a set of parameters which encompasses the true effectiveness of our improved system. While accuracy and speed of the system can be quantitatively measured, other variables cannot. Ease of use, ease of integration and other points of testing will have to be evaluated quantitatively which will pose a challenge when analyzing the data as a set. We will overcome this by speaking with healthcare professionals in order to get a thorough understanding of what they look for in an identification system. Additionally, we will ask for their help to develop criteria for evaluation. Because they are experienced, they will have the greatest understanding of what we should and shouldn't take into account when redeveloping our solution.

Gantt Chart:

Task Name	Q4			Q1			Q2		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Need help? Learn how to use this template.									
[-] Patient Identification	Patient Identification								
[-] Research of Feasibility in a Pediatric Environment	Research of Feasibility in a Pediatric Environment								
Potential ways to capture attention of children									
Why are Iris Scanner not working for children									
[-] Learning APP Development	Learning APP Development								
Creating simple programs assigned									
Familiarizing with ProjectIris.co.uk									
[-] Acquiring Materials	Acquiring Materials								
Acquire Materials									
[-] Developing the Algorithm for Capturing the Iris	Developing the Algorithm for Capturing the Iris								
Working on capturing the iris from a photo									
[-] Make the Application Compatible with the Database	Make the Application Compatible with the Database								
Integrate Application with a Database									
[-] Add Add-Ons to the App that Capture the Attention of Children	Add Add-Ons to the App that Capture the Attention of Children								
Make External/Internal Improvements to the Camera									
[-] Debugging and Testing on Adults	Debugging and Testing on Adults								
Testing									

Budget:

We are proposing to write our own iOS application that correctly identifies patients based on their iris. To build this application, we will need modeling software programs like SolidWorks, access to 3-D printing, and algorithms that are freely available in open source libraries online. Additionally, we will need an iPhone to test and debug our application. Lastly, we will need to be given some travel reimbursements for trips to Children's Hospital of Atlanta and M2SYS. During these trips, every member of the team will join. It is imperative that we visit

these institutions to gain a better understanding of our problem space and witness the problems facing the current system.

Here is a brief overview of where we may be spending:

Item	Corresponding Objective(s)	Cost
iPhone/iPad	2 and 3	Already Owned
Iris Scanner	2 and 3	\$180-290
3-D Printer and Material	2	Already Owned
Travel	1 and 3	\$100
Open Source Libraries	2	Free
Coding Programs	2	Available through Georgia Tech
	Total	\$280-390

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