Wound Capture: Documenting Wound Care Assessment and Treatment

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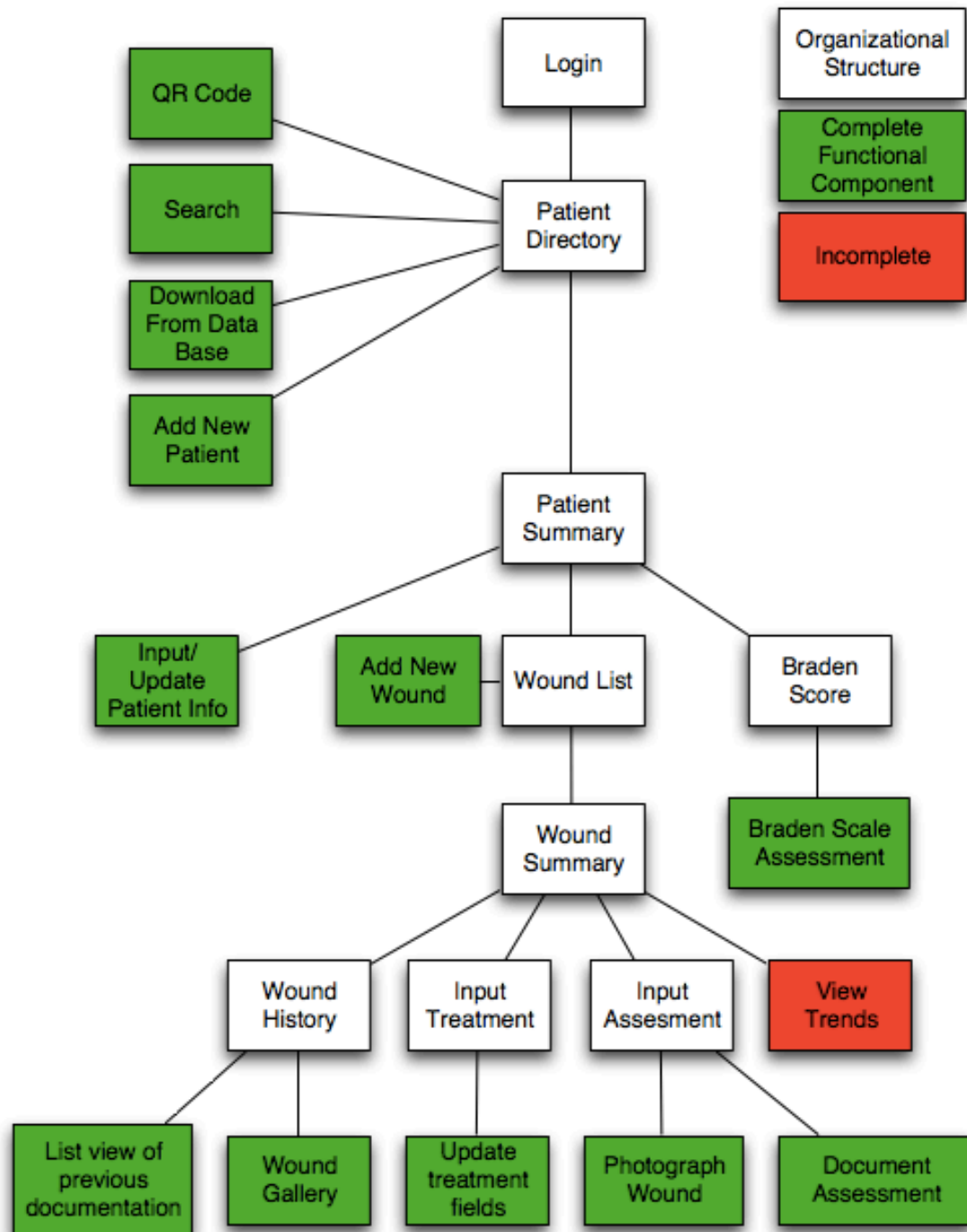Apper context total: 425
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What

Wound Capture is an application built on the Android platform that is designed to improve wound care documentation and assessment. The goal of the application is do allow users to update assessment and treatment information regarding a wound, as well as view previous instances using the mobile device.
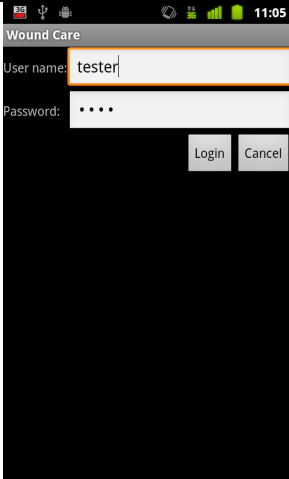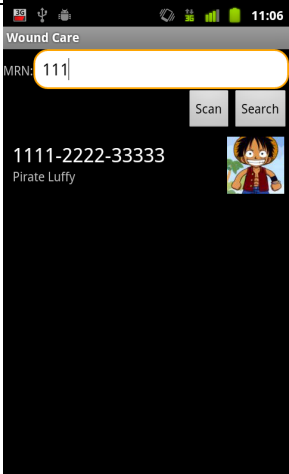
Why

Development of Wound Capture was inspired by possibilities created by capabilities of new smart phones and challenges of traditional methods of wound care assessment and documentation. Decrease in price of mobile phones that have a larger display area, built in camera, flash, wireless and network capabilities make it possible for these devices to retrieve and store data easily at a reasonable price. These capabilities mean it is possible to use one device while preparing for wound care, document at the time of providing care, and easily look back on previous assessments and changes in treatment plans. Current practices of assessment and documentation are fragmented, involve multiple people and often happen after significant time gaps after cleaning, treating, and re-dressing a wound. These barriers reduce the efficiency of wound care, which is why Wound Capture could has the potential to reduce spending on a large portion of cost to the healthcare system.
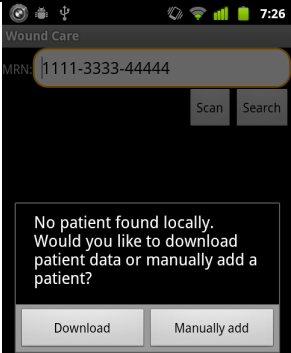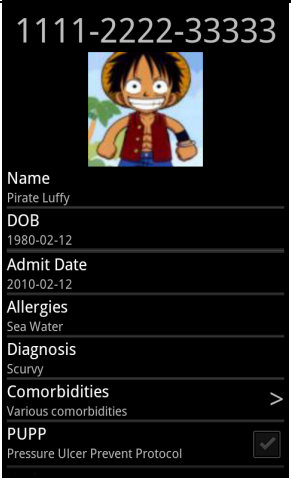
Block Diagram

QR Code		**Login**	**Organizational Structure**
Search	→ **Patient Directory**		**Complete Functional Component**
Download From Data Base			**Incomplete**
Add New Patient			

- QR Code
- Search
- Download From Data Base
- Add New Patient

→ Patient Directory → Patient Summary

Patient Summary:
- Input/Update Patient Info
- Add New Wound → Wound List
- Braden Score → Braden Scale Assessment

Wound List → Wound Summary

Wound Summary:
- Wound History
  - List view of previous documentation
  - Wound Gallery
- Input Treatment
  - Update treatment fields
- Input Assessment
  - Photograph Wound
  - Document Assessment
- View Trends
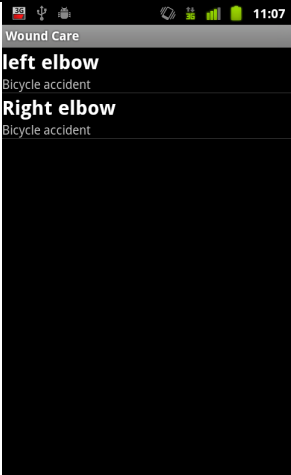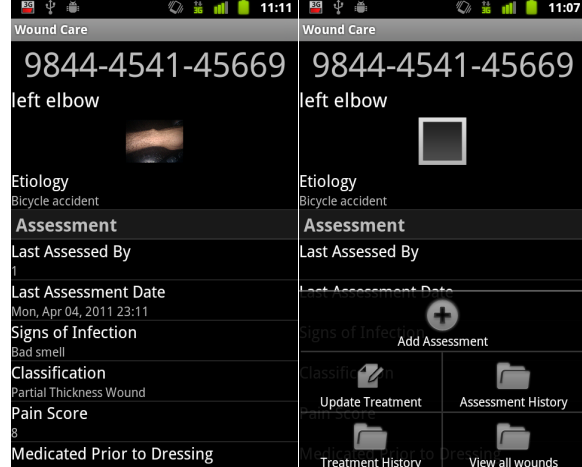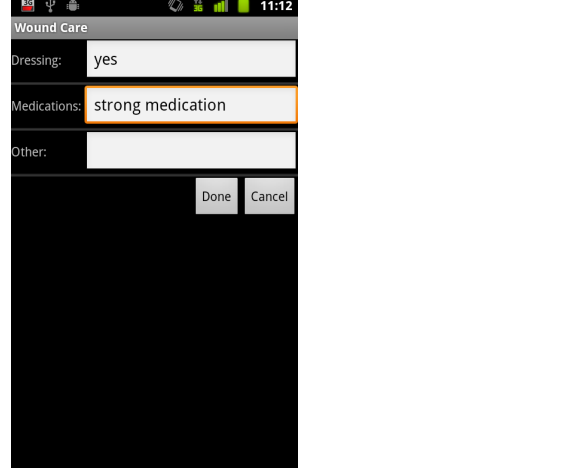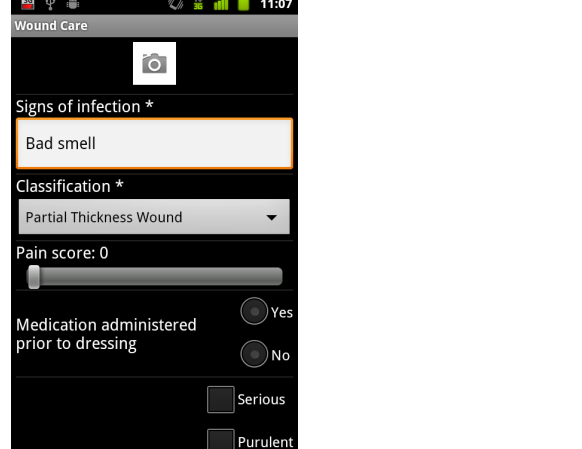
- **Login:** Patient confidentiality is extremely important so users are required to enter a username and password. This is meant to address regulations related to the protection of patient information and healthcare providers concerns about patient information being secure.
- **Patient Directory:** Managing multiple patients can be a challenge, so the patient directory allows a health care provider (HCP) to search for patient profiles. If a patient's information is not there the provider can download the patient's profile from a database or manually create a profile for a new patient.
- **Patient Summary:** When a patient profile is selected a summary of relevant information is displayed. This incorporates demographic information as well as significant information related to their health such as their any diagnosis or comorbidities, allergies and any reason for being admitted.
- **Braden Scale:** Although Wound Capture is meant to help document and assess wounds preventing wounds is also important. Therefore each patient profile displays the Braden Score, which is calculated by completing the Braden Assessment. This helps to identify patients that are at risk for developing pressure ulcers.
- **Wound List:** Within the patient profile new wounds can be added to the Wound List, which organizes wound based on physical location on the patient. The summary list shows all of the patients' wounds, allowing the provider to select the wound they are interested in.
- **Wound Summary:** If a wound is selected a summary which includes the latest image, assessment and treatment information is displayed. This allows a provider to easily see most recent state of the wound and makes preparing to provide wound care easy.
- **Input Treatment**: The treatment input fields allows a user to input information regarding dressings, medications and other requirements for the wound. This updates the wound summary to ensure current treatment protocols are provided for the patient.
- **Input Assessment:** From the wound summary a user can add a new assessment. This allows a user to take a picture and annotate it, and then enter key pieces of information for the assessment – signs of infection, state of the dressing, drainage, *et cetera*.
- **Wound History:** If the provider wants more information on the progress and history of the wound a list view of previous documentation is available. Alternatively a gallery view of the wound is available, which allows the user to slide between a pictorial timeline of the wound.

Functionality

Screenshot	Complete or Functional Components
	Login This is the first screen after launching the app. and is functional. It requires a username and password to match appropriately.
	Patient Directory The patient directory gives the user the option of manually searching, scanning a bar code or manually adding a patient, all of which are functional. Once the correct patient is retrieved the user can select it to view the profile.

7:26 Wound Care MRN: 1111-3333-44444 Scan Search No patient found locally. Would you like to download patient data or manually add a patient? Download Manually add		**Add Patient** When a patient's MRN is not found the option to download a profile, if available, is given or the option to create a profile for the new patient. Both of these features function, if connected to the patient databases.
1111-2222-33333 Name Pirate Luffy DOB 1980-02-12 Admit Date 2010-02-12 Allergies Sea Water Diagnosis Scurvy Comorbidities > Various comorbidities PUPP ✓ Pressure Ulcer Prevent Protocol		**Patient Profile** The patient profile displays a picture of the patient, as well as significant demographic information. From this screen it is possible to see why the patient was admitted, if they have comorbidities, and if a Braden Scale assessment has been done, and what the result is. Selecting the Braden Scale takes a user to a menu that allows them to complete the assessment, returning a score based on the test and inserting it in the profile. From the patient profile you can select the wound list, and using the menu button you can choose to add a new wound.
11:07 Wound Care **left elbow** Bicycle accident **Right elbow** Bicycle accident		**Wound List** When a wound is created the location is used to organize the Wound List. This allows a provider to easily see the various wounds a patient has and viewing information about each of them.

	Wound Summary & Options After a wound is selected a summary of the wound, which merges the view of the most recent Wound Treatment and Wound Assessment. This merged view allows a clinician to see an image of the wound, and an overview of its current state. The menu on this screen allows a user to navigate to the history view, add a new assessment or update the treatment information.
	Update Treatment Updating the treatment provides a user with the option to enter Free Text for different categorizes. The most recent treatment is displayed in the Wound Summary, and previous treatments can be accessed from the history view.
	Add Assessment The assessment option allows a user to complete a larger set of criteria, which need to be documented after providing patient care. This includes the ability to take a picture, complete Free Text fields, use Drop Down Lists, Radio Buttons, Sliders and Check Boxes. Similarly to the Treatment information is saved, displayed in the Wound Summary and older assessment data can be retrieved from the history view.
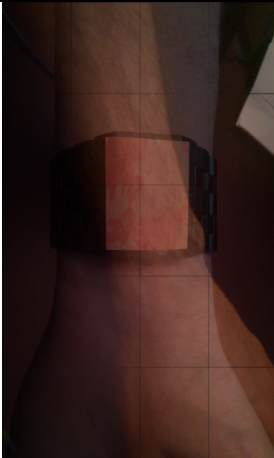
	Photographic Documentation When the image of the camera is selected in the assessment the camera is triggered and an overlay is displayed. This overlay would be replaced by the most recent image. Currently the app only has a hardcoded image in the overlay, because we only began to spiral on the camera form of documentation a week ago. Providing an overlay, allows similar size and scale of pictures, allowing for easier comparison of images.
	Wound Annotation After an image is taken a long tap of the screen brings up the option to annotate the image. To allow users to consistently measure length and width of the wound an arrow can be used to demark this. Tunneling, which is a wound that continues under intact skin and would not be visible from the surface, is also an annotation that can be added. This function ensures that providers properly clean and inspect the wound and do not miss wound tunneling.
	Wound History – Gallery View The image gallery allows the user to slide a timeline of images across the bottom of the screen to navigate a chronologically arranged set of images for a particular wound. This allows a user to navigate an image by its appearance, which is highly indicative of progress or regression, rather than by date.
Screenshot	**Non-functioning/Incomplete Functions**

Trends

Although various aspects of the application could use development, we did not get the opportunity to develop trend analysis functions for the application. This was due to time constraints and challenges encountered in the core functions of the application. Despite being useful this function was not essential was left until last to develop.

Further discussions of improvement and development opportunities are outlined in the final section: What Next.

Lessons Learned

Define Core Function

The group started by mapping out the entire application, which meant we took a very linear approach to development. Due to our approach we only integrated the camera, image overlay and annotation capabilities in the last spiral. So we did not have the opportunity to test and revise it, despite being key features of the app.

Realistic expectations

Wound Capture takes advantage of the camera and wireless capabilities of the phone, but does not use the accelerometer, microphone, and other sensors. This gave the group a false expectation of the simplicity of the application, and we did not account for the complexity of handling the data the application collects, stores and retrieves. This again impacted our timelines and causes an underestimation of the time we would need for certain functions.

Group Member Contributions

Mike Delorme

As one of the programmers, Mike's primary responsibilities were the wound assessment and treatment data. He implemented the backend database functions to create tables, input data, and retrieve data for wounds, wound assessments, and wound treatments. Mike developed the Add Wound and Add Wound Assessment screens in the app and was responsible for hooking them up to the database backend. He created the Wound Summary screen to view the wound data, wound

assessment data, and wound treatment data. He also implemented the history views for both wound assessments and wound treatments, and ensured that there was strict chronological consistency between the assessments and treatments. Mike and Bilal both spent a considerable amount of time developing the database schema and ensuring that the Database Helper worked properly.
Bilal

Bilal Durrani

Bilal created the login screen which identified who the app user is. He was also responsible for the patient directory view, which allowed doing patient lookup via 2D barcode scan and MRN number. Bilal created the views to allow adding new patients to the phone either by downloading existing data from a remote server or by manually adding a new patient record. The patient profile views, which let the user add a patient head shot was part of adding a new patient. Bilal created the custom picture taking view, along with the view that lets the user graphically annotate a wound with length, width and tunneling data. Bilal created the image gallery view, which lets the user see all the past wound image in a single view. Bilal also created the activity to enter Braden scale information for the patient. All these views were integrated with the local database.

Robert Fraser

As the Apper for the group Rob focused on the clinical application of the application. Outlining the clinical applications and required functionality was at the core of his contribution. This involved conducting research on documentation standards for wounds and how digital cameras and computers are being used for wound documentation in order to provide the programmers with necessary information for the application. Inclusion of scales and tools (i.e. Braden Scale) to be used was based on Rob's discretion. Designing the icon, developing the slides for presentations, and providing feedback and new ideas were also part of his responsibilities.

Apper Context

Wound care places a significant burden on the healthcare. This is due to the prevalence of chronic disease, the risk of nosocomial (hospital acquired) infection, and growing number of elderly patients. Diseases like diabetes - which affects 1.3 million Canadians - impairs wound healing and can cause a foot ulcer to ultimately require leg amputation [1]. Surgical wounds become infected at a rate of 4.5% [1], which leads to increase in inpatient length of stay and associated costs. Finally, as our population's age increases so does the risk for chronic wounds [1]. These trends are just some of the reason that increased efficiency of wound care documentation and assessment has the potential to positively impact patient care in Canada.

In addition to a systemic need for improvement in wound care, current assessment, documentation, and treatment practices have significant problems. Researchers found that even among wound care nurses there were inconsistence use of terminology, and clinicians can vary greatly in their assessment of wound tissue documentation [2]. This is partially caused by knowledge gaps, but compounded by the fact that documentation can happen up to 30 minutes and in some cases hours later. Creating a mobile device that can easily be used at the time of care, and capture an image along with standardized assessment information, it would reduce significant details from being lost due to poor documentation.

Documentation can also face the challenge of requiring multiple forms from different locations. Some long-term care facilities had as many as six different forms within their organization [3]. Interventions to centralize documentation not only saved clinician time it also improved patient care [3]. In an other study increased monitoring of wound care treatment and assessment enabled a community care organization to reduce healing times of wounds from 23 to 21 weeks and costs per patient from an average of $14,350 to $3,617, despite an increase in average dressing costs from $938 to $1,291 [1]. Both cases illustrate the potential to reduce cost and increase efficiency in wound care.

Wound Capture would allow clinicians to streamline and standardize documentation, and improve monitoring of wound care. Therefore similar reduction of cost and improvement of patient care is not an unrealistic expectation. The increasing cost of healthcare – almost half of every Canadian tax dollar is spent on healthcare – and opportunity for improvement in care for patients with chronic wounds make Wound Capture a viable application for clinicians. To quantify the impact of Wound Capture time studies on clinician documentation, patient outcomes, and cost analysis would be necessary.

What Next

Future Improvement

A key part of the improvement in our application would include improving the user interface (UI) as well as testing the application. Doing both would allow us to improve UI based on feedback of users as well as expose problems that emerge during test. Even in our limited testing problems arose, such as an inability to take pictures if the flash does not go off because it cannot focus. Therefore further testing of the basic capabilities currently working in the application would identify bugs before adding new features.

Even though basic functionality of the application was complete, some advanced features were not integrated that we had included in the original plans. For example, the trend analysis function would allow better viewing of changes in wound area or pain levels. Exporting data collected on the phone to a database or medical record that could be accessed from computer would also greatly improve the utility of the application. Finally, the ability to analyze the colour and scale of the wound based on a point of reference (ruler and colour card) in the picture would be interesting to investigate, but would require much larger time lines.

Application and Commercialization

The practical nature of Wound Capture provides interesting opportunities for using and commercializing the application. To move forward with the application further development would be necessary. Partnering with a healthcare organization could provide the opportunity to secure funding to customize the documentation and system integration to a specific organization's electronic records and documentation standards. Another opportunity might be grant funding to partner with a group of wound care specialists to further develop the application. Alternatively, working with a company that employees developers and provides mobile based systems to health care organization could provide necessary labor for the project and provide a potential channel for distribution through their clientele.

References

1] Hurd, T., Zuiliani, N., & Posnett, J. (2008). Evaluation of the impact of restructuring wound management practices in a community care provider in Niagara, Canada. *International wound journal*, *5*(2), 296-304.

[2] Beitz, J., & van Rijswijk, L. (2010). A Cross-sectional Study to Validate Wound Care Algorithms for Use by Registered Nurses. *Ostomy Wound Manage*, *56*(4), 46–59.

[3] Horn, S. D., Sharkey, S. S., Hudak, S., Gassaway, J., James, R., & Spector, W. (2010). Pressure ulcer prevention in long-term-care facilities: a pilot study implementing standardized nurse aide documentation and feedback reports. *Advances in skin & wound care*, *23*(3), 120-31.