Scan, Skin, Send

Theme:
Digital Health

Team Number: 03

Team Name: Scan, Skin Send

500 Char Summary

‘Scan, Skin, Send’ is a solution for a local problem that will lead into an effective tool for helping to diagnose skin problems.

It allows the secure, discreet transfer of photographs and potentially other media types to the doctor by using the patient’s smartphone. This process is not a replacement for face-to-face consultations but makes it easier for patients in isolated communities, working shifts or with long appointments wait times.

The application would be in an excellent place to begin machine learning and could be licensed or embedded as a standalone app.

Background Information:

In the UK, around 54% of the population are affected at some point in their lives with a skin disease. With over 2000 recognised disorders, £413 million is spent on skin care treatment making accurate diagnosis fundamental to managing these conditions. As a whole skin diseases represent 34% of diseases in children, with eczema affecting 20% of infants. Hand eczema is also one of the most common reasons for disablement benefit in the UK. Malignant melanoma is another common disorder with this form of skin cancer being most prevalent in the 4,000 deaths which occur as a result of skin disease.

While it can be assumed that GP’s are knowledgeable in all areas of dermatology, most training schemes have no dermatology attachments with those undertaking a dermatology undergrad receiving only an approximated 6 days of learning and teaching. Currently it is estimated only 650 consultant dermatologists work within the health care sector with Hospital-based services requiring at least one whole-time equivalent consultant dermatologist per 62,500 people. These consultants carry out over 13 million primary care consultations each year.
Royal College of Physicians 2013 - Specialities: Dermatology

Current Problem:

Patients with skin conditions currently take photographs of their problematic areas and email these to the generic email account of the GP. This practice started due to the Coronavirus pandemic and after speaking with 3 GPs, who are doing this, I suspect there is not a tool in place for alternative methods. Receptionists download the photos from the generic account and add them manually to patient records. This poses several problems:

Receptionists:

1. Receptionists spend around 10 minutes per patient email. A Highlands based GP estimated around 4 patients send photos per day. - **Waste of Time.**

2. The generic account is available to multiple members of staff who do not need to know about the specifics of the condition. - **Too much information / lack of privacy.**
3. Dealing with multiple patient emails at the same time could lead to mistakes being made when assigning photos to records. - **Human Error**

Patients:

4. From a patient's perspective, the method can be quite cumbersome. Patients need to take several photographs, log into their email client, attach photographs and send to the correct email address. - **Human Error**
5. Current method could potentially be insecure. Recent email exchange exploits have been found and the method is inappropriate for a patient's personal email account. **- Security Risk**

Doctors:

6. Patients may send too many / large image files which cannot be stored in the patient's record. This could lead to picking / choosing which images to keep. Again this seems to be an issue affecting Scotland, but there appears to be a limit on the storage size of patients data.
7. When patients transfer to a different GP, all images in the patient's record must be deleted first otherwise the records cannot be transferred. (This seems like an issue primarily affecting Scotland, and may be fixed in the future) This means the next GP is missing previous photographic history.

Proposed System:

The proposed system would simplify the process for patients, removing the administrative burden on receptionists and sending appropriate detail to Doctors.

Stage 1 - Photographs:

The first step would offer a secure way to transmit photos from a patient's phone using an application. After speaking with a patient, a Doctor would generate a one time use code allowing the patient to log into the application. On the doctors end, this could be achieved using a web client.

On the patients end, upon receiving the one time code from their GP, they would simply download the app from their device's app store (Google Play, Apple App Store) and open it. It would be advised that patients keep the system on their phone for future use, thus eliminating the need to download the app every time. Once opened, the patient will be prompted to log in using their one time code where they will be given instructions on how to use the system before

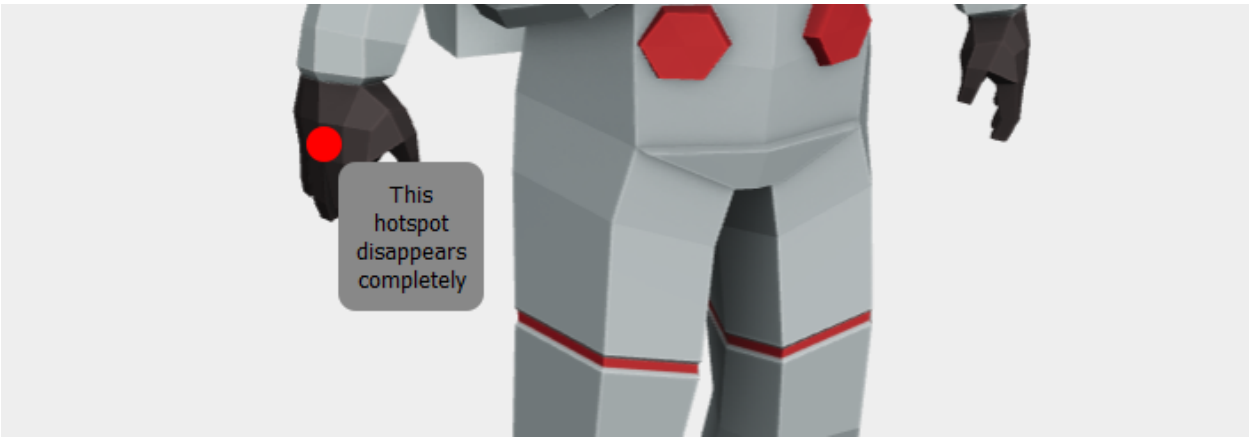
the camera opens. The patient can then take up to 5 photos of their affliction to be sent directly to their GP and patient records.

Stage 2 - Other Media:

Additional types of media could be recorded such as videos and 3D Scans.

For example, the iPhone 12 Pro comes with a Lidar scanner. This is used for AR functionality as a depth sensor. This depth sensor can be used to create a 3D Mesh of the affected part to be sent to the doctor. The mesh would allow doctors to view the affected areas from a number of directions. Currently this could be incorporated using the **`<model-viewer>`** html component. https://modelviewer.dev/ “Model viewer is currently support on the last 2 major versions of all evergreen and mobile browsers”. There is also the future potential for use in combination with a VR headset, but this is not planned.

The **`<Model-viewer>`** component also allows for adding hotspots to the 3D model which could be helpful If multiple departments were studying it.



https://modelviewer.dev/examples/annotations/index.html

Stage 3 - Machine Learning and Analysis:

The system both captures images and has doctors diagnose patients. Using this system, it would be fairly straightforward to create huge datasets of images with known skin conditions. By organising them into groups by ethnicity and skin condition, you could start machine learning to pick out common skin conditions such as eczema**,** psoriasis and rosacea. The more people using the application, the bigger the dataset and the more accurate the prediction.

This machine learning program would have large economic and health incentives. The program could be licensed and rented by 3rd party applications providing a long term source of income.

A standalone app could be developed and used as an initial checkup for patients without local health facilities.

Technical Implementation

Application

The application would be written for both Android and Apple devices using a shared code base.

Hardware Requirements

Currently a secure system for data transfer could be implemented at the time of writing. A budget level smart phone capable of taking photographs would be suitable. If Doctors required higher quality images this could pose a problem, for example in developing economies.

For 3D Scanning:
Mobile telephone with Lidar scanning capabilities. At the time of writing, the iPhone 12 Pro is capable of this and uses it for depth sensing when using AR. Some could argue that Apple leads the way with consumer mobile design. For example, the “notch” at the top of the device and removing the 3mm headphone jack were originally in Apples designs. Other manufactures were quick to follow. It is possible in the near future, the Lidar sensor will be more prevalent with the rise of Augmented Reality applications.

Target Market and Cost Structure

Scan, Skin, Send is primarily aimed at the public health sector, in the UK this is more commonly known as the NHS. The NHS would be encouraged to promote the system's benefits with patients and create a sustainable system to which the machine learning instrasture can grow. As the NHS is free to use across the whole of the UK, no charges will be applied to their patients with money received coming from the NHS itself.

Future markets for Scan, Skin, Send could include the private health care sector, where providers pay for the usage of the app and within the Business to Business market allowing businesses to purchase the full application for the information gathered from the machine learning capabilities. These markets will not be inclusive to those in the UK but globally allowing diagnosis of skin diseases to occur in the most remote of locations and locations where health care is not widely available at a low cost.