

FINAL ON STAGE



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Discover AI Challenge

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FINANCIAL SERVICES



HEALTHCARE



RETAIL



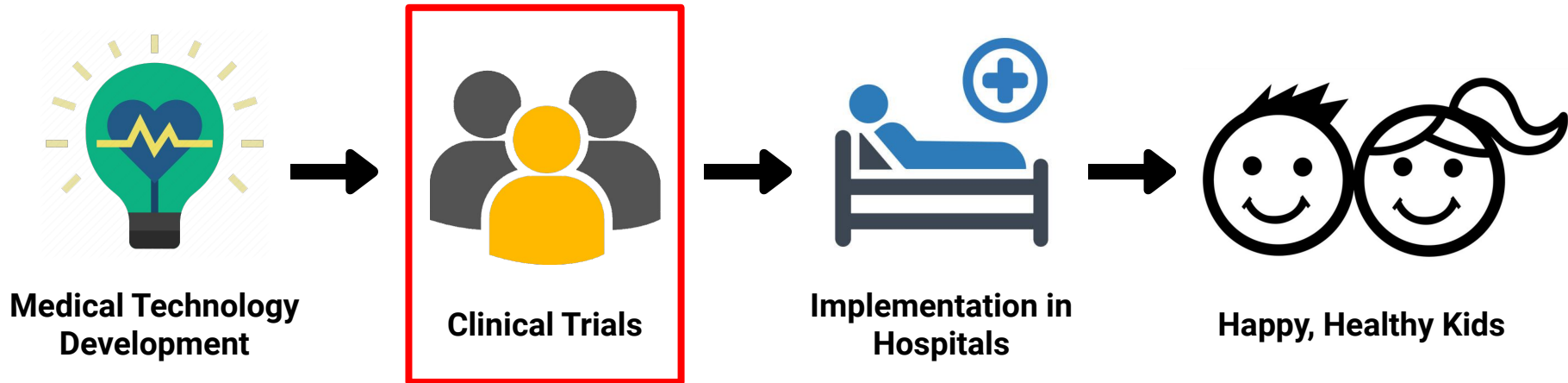
SMART CITIES

An NLP and ML-based tool to streamline clinical trials
and improve diagnosis in the BC Children's Hospital
Pediatric Emergency Department

Pediatric Pals

PROBLEM STATEMENT

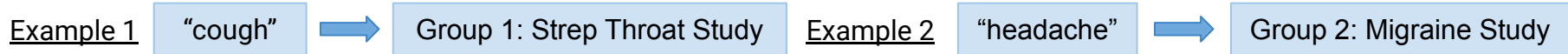
The current clinical research process at the BC Children's Hospital Pediatric Emergency Department (BCCH PED) is inefficient and unequipped to handle the rapid pace of cutting-edge medical technology development, resulting in a gap period of 10-15 years between when medical technologies are developed and when they reach patients. We want to streamline the clinical research process to more rapidly take these technologies from bench to bedside, ultimately helping sick kids feel better faster.



DESCRIPTION OF SOLUTION

An application that will:

A) Use natural language processing libraries hosted in Microsoft Azure to parse nurse's intake notes on general patient symptoms to sort patients into groups depending on which clinical research studies they are eligible for.



B) Send group-specific questionnaires to tablets located in patients' rooms for them to complete while they wait to see a doctor (usually 1-3 hours), to get more information about their condition and conclusively determine study eligibility.

C) Based on questionnaire results, generate final lists of patients who are eligible for each study that research assistants can then approach to obtain informed consent.

D) Collect final diagnoses from doctors and use this information in conjunction with nurses' notes and patient-entered data to train our machine learning model to accurately diagnose pediatric emergency conditions - an objective diagnostic tool to complement and validate doctors' diagnoses.

What makes our solution different?

Current interventions to improve patient care focus on the medical technology development phase, but no matter how fast new technologies are developed, they are not useful unless the clinical trial process is streamlined so that patients can benefit from these innovations more quickly. Our solution focuses on improving the efficiency of clinical trials to fill this gap, and in the process generates a large data set that can be used to train a built-in machine learning model to diagnose conditions.

SOLUTION SCHEMATIC

Patient arrives at
BCCH PED.



Nurse Assessment

Nurse's Intake Notes



Nurse-entered Data

NLP tool groups patients
based on symptoms.

Group 1



List of potentially eligible
patients for each study

Group 2



Group 3



Study-specific surveys sent
to patient tablets (1 per
room) with detailed
questions about symptoms.

Final list of eligible
patients for each study



Patient-entered Data



Approaches eligible patients
to obtain informed consent.

Clinical Research Assistant



Doctor's
Final
Diagnosis

Doctor-entered
Data



Machine
Learning
Model



Objective Tool
to Validate
Future
Diagnoses

TARGET

Primary Target Market



Provincial Health Services Authority (PHSA), British Columbia's publicly funded health authority that oversees BCCH.

PHSA to approve and fund the implementation of our application in the BCCH PED.

Secondary Target Market



Primary application users: Health care providers (nurses, doctors) and clinical research professionals in the BCCH PED.

Pediatric emergency clinicians serve patients aged 0-17.

Size of Target Market

Primary Target Market: PHSA provides services province-wide

Secondary Target Market: ~15 clinicians and 4 research assistants working each day in the BCCH PED

BUSINESS MODEL

Value Proposition

- Reduce time between development and implementation of medical technologies
- Improve efficiency of clinical trials
- Lead to faster and more accurate diagnoses
- Improve care for annual 43,000 patients
- Offer SQL database maintenance

Key Partners & Customers

- Machine learning tools:
 - Microsoft Azure
- Funder/customer:
 - PHSA
- Users:
 - Clinical researchers and clinicians at BC Children's Hospital Emergency Department

Customer Relationships

- CRM
 - Clinical research team & clinicians
 - Handling patient data for their studies
 - PHSA
 - Generate monthly usage reports to demonstrate app benefits

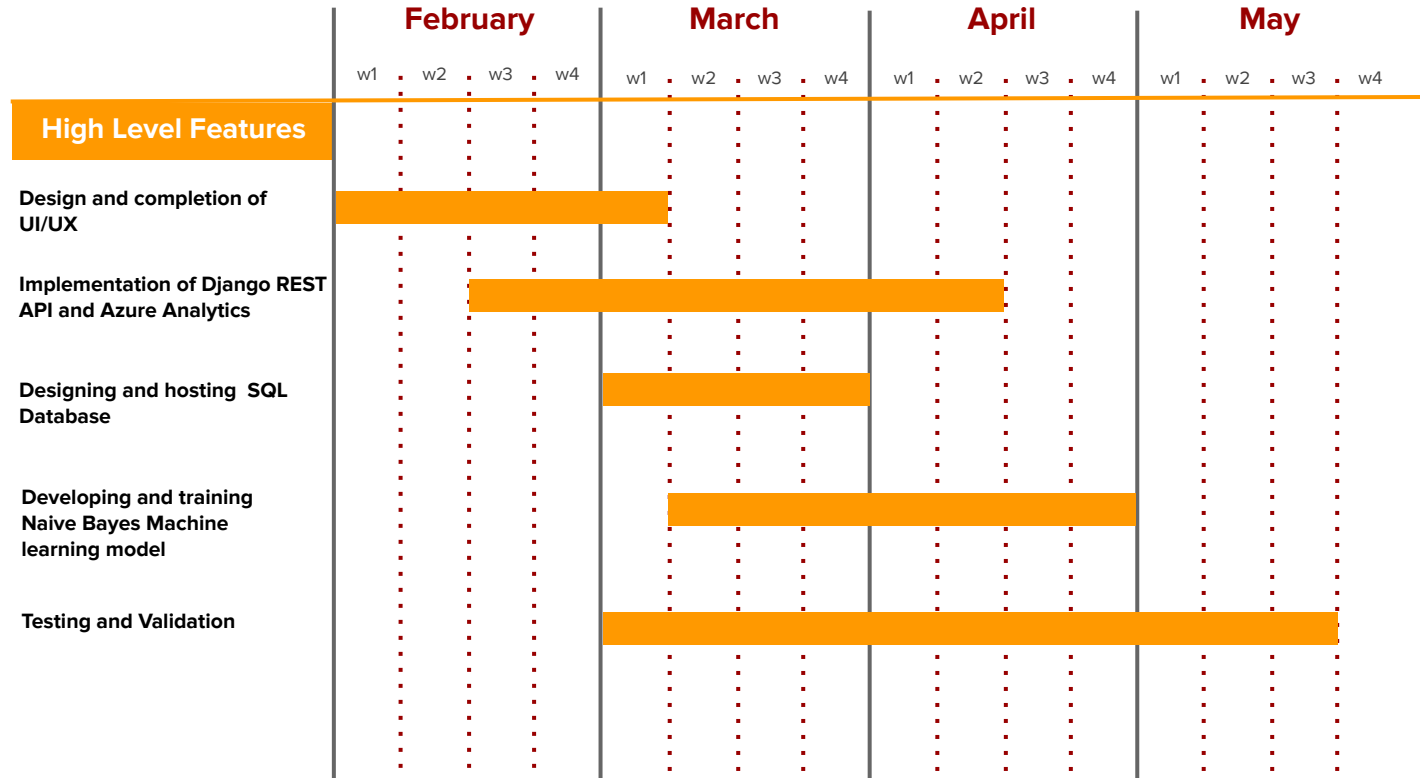
Key Activities

- Build webpage with two-factor authentication connected to Azure
- Build user interface in React.js
- Create REST API service with Django hosted by Azure
- Create dataset that will map symptoms to diagnoses
- Implement natural language processing to parse user input
- Acquire 55 tablets (1 per room) for app use

Cost Estimates & Funding

- 2 contracted software engineers maintaining app and database (annually): $\$66,000 \times 2 = \$132,000$
- Database hosting (annually): $\$10,000$
- 55 tablets: $\$70 \times 55 = \3850 (excl. tax)
- App development using open source tools: $\$0$
 - Total cost: $\$145,850$
- Funding: Provincial Health Services Authority (PHSA)

TECHNICAL ROADMAP TO MVP



SOLUTION ARCHITECTURE

Technical Roadmap Process

To build our solution, we will follow a sprint-based structure where we will deliver functionality early and often. We expect to deliver our MVP by mid-April, 2020 to ensure we have enough time for testing and validation.

Data Collection

We will obtain data sets to aid us in mapping symptoms to diagnosis with the use of Kaggle and other online resources. We will also reach out to health care professionals to ensure that the database we acquire and construct is correct. We are prepared to create our own dataset to train our model if there are few online resources.

Tools and Technology

All of our server side computation will be hosted in Microsoft Azure. Azure will host our back end services in the Django framework. We will also leverage Azure AI utilities to help build and train our Machine Learning model, as well as analyze and aggregate patient data. The User Interface will be built in React.js. There will also be an SQL based DB for storing datasets and patient information.

Our Machine learning model will be based on the Naive Bayes Classifier technique to map patients' symptoms to illnesses they may have. Our team also has experience using the SVM and Random forest classifier techniques - we will build models based on these techniques to see which provides the best results.

BENEFITS OF THE APPROACH

Our application will directly benefit patients, clinicians, clinical researchers, and health authorities (PHSA) in the following ways:

Patients & clinicians

- Maximizing the efficiency of clinical trials to take breakthrough medical technologies from bench to bedside more rapidly.
- Using the data from the application to train a machine learning model that will help doctors more accurately and efficiently diagnose pediatric emergency conditions.
- These outcomes will improve the standard of care for the 43,000 patients who visit BCCH annually.

Clinical researchers

- Streamlining the clinical research process will maximize clinical researchers and research assistants' efficiency, allowing them to spend more time and energy on meaningful work (i.e. patient interactions).

Provincial Health Services Authority (PHSA)

- The streamlining of the clinical research process will advance the PHSA's mandate of "better serving patients with a more integrated system of care" (PHSA, 2020).

TEAM PRESENTATION



BARMASH
ARIELLA
22

BA (Gender, Race, and
Social Justice) UBC
Student

I'm a graduating UBC
student interested in
building equitable
urban communities
and supportive social
services.



DISSANAYAKE
ASHINI
21

BSc (Biochemistry) UBC
Student

I'm a Research
Assistant in the BCCH
Emergency Department.
Passionate about
healthcare quality
improvement, clinical
research, and advocacy
on behalf of children &
youth!



OUYANG
JORDAN
22

BASc (Computer
Engineering) UBC
Student

Graduating UBC
student in Computer
Engineering.
Passionate to leverage
technological
advancements for
social benefit.



WONG
SAMANTHA
23

Business
Administration
(Marketing) Capilano
University Student

I'm a graduating
Capilano student with
a passion in digital
marketing, branding,
and market research.