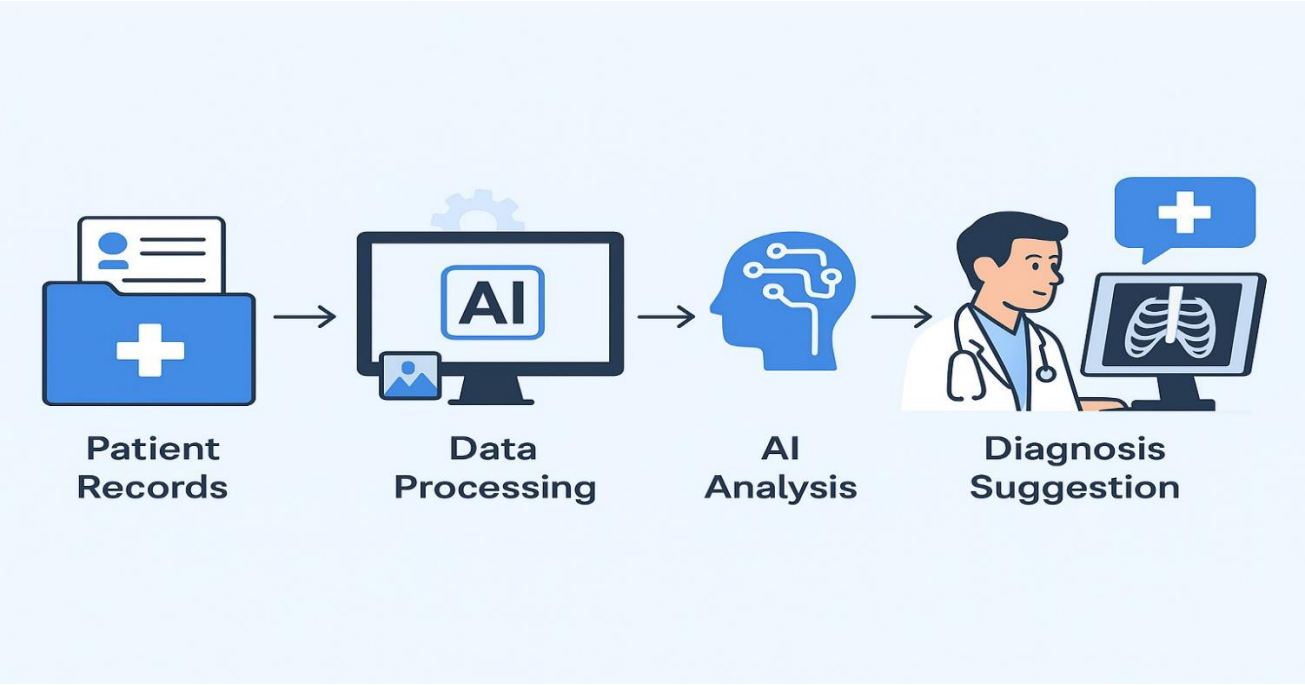
BUSINESS ANALYSIS 3.2 PROJECT

Healthcare industry (NOT ENOUGH DOCTORS)



Business Analysis Project Documentation

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1. AI Solution

MED-Access is an AI healthcare platform created to help with the shortage of doctors in South Africa. The system identifies diseases and monitors patients, supporting doctors by analyzing symptoms and suggesting possible diagnoses quickly. By looking at symptoms and medical history, it gives doctors or patients ideas about what might be wrong. This helps reduce the workload for doctors and lowers the number of patients each doctor needs to see every day.

2.Problem definition

What is the problem?

In healthcare, the biggest challenge is not having enough doctors, especially in public hospitals and rural clinics, which causes delays in treatment because they have to handle a high number of patients and have little time with each patient. A patient may have complicated symptoms or a medical history that can be difficult for doctors or nurses to figure out faster, which can cause other patients to wait in long queues for long hours. Currently, doctors overwork, leading to stress and less efficiency.

How Relevant is it to the theme?

This AI solution fits the theme because it uses artificial intelligence to help healthcare by making diagnoses faster. By using this AI, the project will help support doctors, improve the quality of health support, and also make healthcare more accessible to everyone. Analyzing symptoms, medical histories, or scans reduces doctors' workload and helps patients get treatment sooner.

How Beneficial will it be to solve the problem?

Solving this problem will improve healthcare by making diagnosis and treatment faster, which helps patients recover sooner. It will reduce waiting hours in hospitals and clinics, allowing services to run more smoothly. Doctors and nurses will get support with routine checks, giving them more time to focus on serious cases and reducing their stress and risk of burnout. The use of AI can also improve accuracy in diagnosis by comparing symptoms and medical histories with large databases, which lowers the chance of human errors.

3.Business objectives

Our main goal is to fill the gap caused by not having enough doctors, ensuring that patients are still attended to quickly and helping doctors to handle more patients easily by using AI for diagnosis and monitoring, and also freeing doctors to concentrate on urgent and complex cases. When there are not many doctors, AI can give an early check, so people can still get care. Use AI to give faster diagnoses and monitoring, so patients spend less time waiting in hospitals and clinics.

4. Success criteria

The AI project will be successful if at least waiting times for patients are cut by 40% and doctors' load is reduced by 30%, at least 70% of patients must be satisfied with the service, and also if they spend less time waiting in hospitals and clinics because AI helps give faster diagnoses and monitoring. The AI is successful if it helps reduce doctors' workload in hospitals where there are only a few doctors, and if patients spend less time waiting for diagnoses and treatment at clinics.

5.Business Background

The healthcare industry faces a challenge of not having enough doctors in hospitals and clinics to meet the needs of all patients, because there are not enough doctors, patients have to wait a long hours, diagnoses are slower, and both doctors and patients feel more stressed. Hospitals in rural areas often cannot provide care on time.

To help with this problem, our artificial intelligence can support healthcare. Our AI will prompt patients' symptoms, medical history, or scans and give a possible diagnosis, helping doctors make decisions faster. AI lowers doctors' workload, allows them to focus on urgent or complicated patients, and helps patients get care more quickly and easily.

6.Requirements

Medical datasets will be required as they will be used to train and test the AI System. Technology will be needed since our project will be developed in python using libraries such as scikit-learn, TensorFlow, and more for machine learning and natural language. The AI system must look at patient information, such as symptoms, scans, medical history, and lab results. It should give suggestions for possible conditions, and doctors and nurses must be trained to use it properly. The system must keep patient data safe, have a reliable internet connection, and use easy-to-operate software and hardware. It should also be updated and checked to make sure it works properly.

7.Constraints

Quality of Data – The AI can only provide reliable predictions if patient information is correct and complete. Missing or incorrect records may lead to wrong suggestions.

Training and Use – Doctors, nurses, and staff need proper training to use the system well. If they are not comfortable with new technology, system use may be slow.

Privacy and ethics: Our AI system will follow laws like POPIA to protect patient's data.

8.Risks

Incorrect Diagnosis: There is a risk that the AI system might return wrong results when checking symptoms or records. If that happens patient could receive wrong advice or delayed treatment.

System Downtime: Problems with the internet or hardware could stop the AI from working when needed.

Resistance from Healthcare staff: Doctors, nurses, or other staff around the healthcare sector may be worried that AI will replace them and take their jobs, so this can slow down the implementation of the AI system.

9.Tools and Techniques

Data collection and integration

The system will collect information from patient records, lab results, scans, and medical histories. It will combine data from hospitals, clinics, and electronic health records. The patient data may include symptoms, past illnesses, test results, and imaging scans. Historical medical information will also be used to help the AI make more correct predictions.

AI Tools

-Python with libraries like Scikit-learn, Tensorflow, PyTorch, Spacy, Pandas, Numpy, and Matplotlib will be used for machine learning, data analysis, and visualization.

-GitHub will help us with version control and managing tasks as a team

-Jupiter Notebook/VS Code, we will use them for coding environments

Techniques

-Classification models will help us with predictions

-Natural Language processing will be used to understand and analyse patient-reported symptoms

-Time-series analysis will study the patient's history

-Data pre-processing is a technique that will be used to clean and improve the data

Data Protection

Data will be kept safe and shared securely to protect privacy and follow rules.

10.Machine Learning Approach

Our project uses a classification approach because the goal is to predict a disease category based on given symptoms. The solution is relevant since classification algorithms are designed for problems where the output is a discrete label

We planned the workflow as follows:

- Encode symptoms using one-hot encoding
- Encode disease labels using label encoding or dummies
- Train and compare different classification algorithms.
- Select the best-performing model for deployment in the GUI.

The algorithms chosen:

- Decision Tree Classifier – Simple and provides clear decisions rules
- Naïve Bayes – Fast and effective with categorical features
- Logistic Regression (multiclass) – baseline model.
- Random Forest – ensemble method that improves accuracy.

11. Data

The MED-Access system needs good-quality medical data to work well. This data should give a clear and correct picture of patient health. It includes information such as patient details and medical history, descriptions of symptoms, results from tests like blood work and basic health measurements (such as heart rate, blood pressure, and temperature), and medical images such as X-rays, CT scans, and MRIs.

Records of past cases with confirmed diagnoses are also important because they help train the AI to make better predictions. The system will use this data to learn, test, and improve its accuracy, and it will keep updating as new information is added. Since all these data types are directly connected to patient care and diagnosis, they are reliable and useful for solving the problem of too few doctors in hospitals and clinics.

12.Model

The AI model will be evaluated through standard machine learning validation techniques:

Train/Test Split or Cross-Validation – Ensuring model generalizability.

Accuracy Metrics (depending on task):

Classification: Precision, Recall, F1-score, ROC-AUC.

Forecasting: RMSE (Root Mean Squared Error), MAE (Mean Absolute Error), MAPE (Mean Absolute Percentage Error).

Confusion Matrix Analysis – To measure true positives vs false negatives (important in medical diagnosis).

Domain Validation – Model outputs compared against expert clinician opinions to ensure medical reliability.

This ensures both statistical accuracy and clinical relevance.

13.Time Series Analysis on Data

Why Time Series? South African healthcare faces patterns over time (e.g., HIV testing rates, TB case trends, hospital admissions during flu season, medicine stockouts). AI time series analysis can forecast these and support better planning.

14.Techniques Used

ARIMA / SARIMA – For seasonality in disease outbreaks. LSTM / GRU (Deep Learning) – For long-term dependencies in healthcare trends.

Prophet (Facebook's model) – For interpretable forecasts of patient inflow and medicine demand.

Sample / Example Time Series Analysis

Use Case: Predicting monthly HIV viral load testing rates in Gauteng.

Data: Historical testing records, with variables like number of tests, clinic closures, electricity outages, and funding levels.

15.Analysis Process

Trend Detection – Identify overall growth/decline in testing rates.

Seasonality – Detect cyclical patterns.

Forecasting – Predict the next 12 months of testing demand.

16.Model Output

Predicted decline in testing during power outages.

17.Extras

Natural Language Processing ,Speech Recognition or Speech Synthesis

-Our project can integrate NLP to make the system more user-friendly and relevant to health care. Our dataset user's 0 and 1 values for symptoms, but in real life people describe their health in words. NLP CAM turn those words into structured symptoms our AI model understands

- Relevance to the Theme: -Health care can be improved if patients can explain their symptoms naturally. With NLP and speech tool, patients don't need to select from long lists, they can type or talk to the system.
- Relevance to the proposed solution: NLP - if someone types "I have chest pain and shortness of breath" the system will pick out the important symptoms and match them to the dataset. Speech recognition - as optional patients can say their symptoms, and the system will turn the speech into text to analyse. Speech Synthesis - as optional the system can speak the results and precautions , helping patients who can't read easily.
- Achievabilty -These features are achievable with existing Python libraries -NLP: NLTK, spacy -Speech Recognition: SpeechRecognition -Speech Synthesis - pyttsx3,gTTS

Deep learning

Deep learning is a type of machine learning that uses a network called neural networks with many layers to learn patterns from large amounts of data. It will help in healthcare by looking at medical images like X-rays, CT scans, and MRIs to find diseases such as pneumonia, tumors, or broken bones. It can also study patient histories and test results to predict health problems. For MED-Access, deep learning helps the AI give more accurate diagnoses by learning from many past cases and medical images, helping doctors make faster and better decisions.

Chatbot

A chatbot can serve as the main interface between patients and the system, making healthcare assistance more interactive and more accessible to both parties. Instead of navigating complex menus, patients can simply chat with the bot to describe their symptoms, ask health-related questions, or request guidance. The chatbot will use NLP to understand the patient's input, deep learning to make accurate predictions, and speech synthesis to provide spoken responses if needed. This creates a conversational experience where patients feel like they are speaking to a virtual health assistant, reducing barriers to care and making the system easier for everyone to use.