

Expert System utilising IoT & Artificial Intelligence

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Abstract

Artificial Neural Networks are computational models inspired by, and meant to simulate, the functionality of the human brain. The Convolutional Neural Network is an Artificial Neural Network that is most suited to image processing which requires pattern recognition.

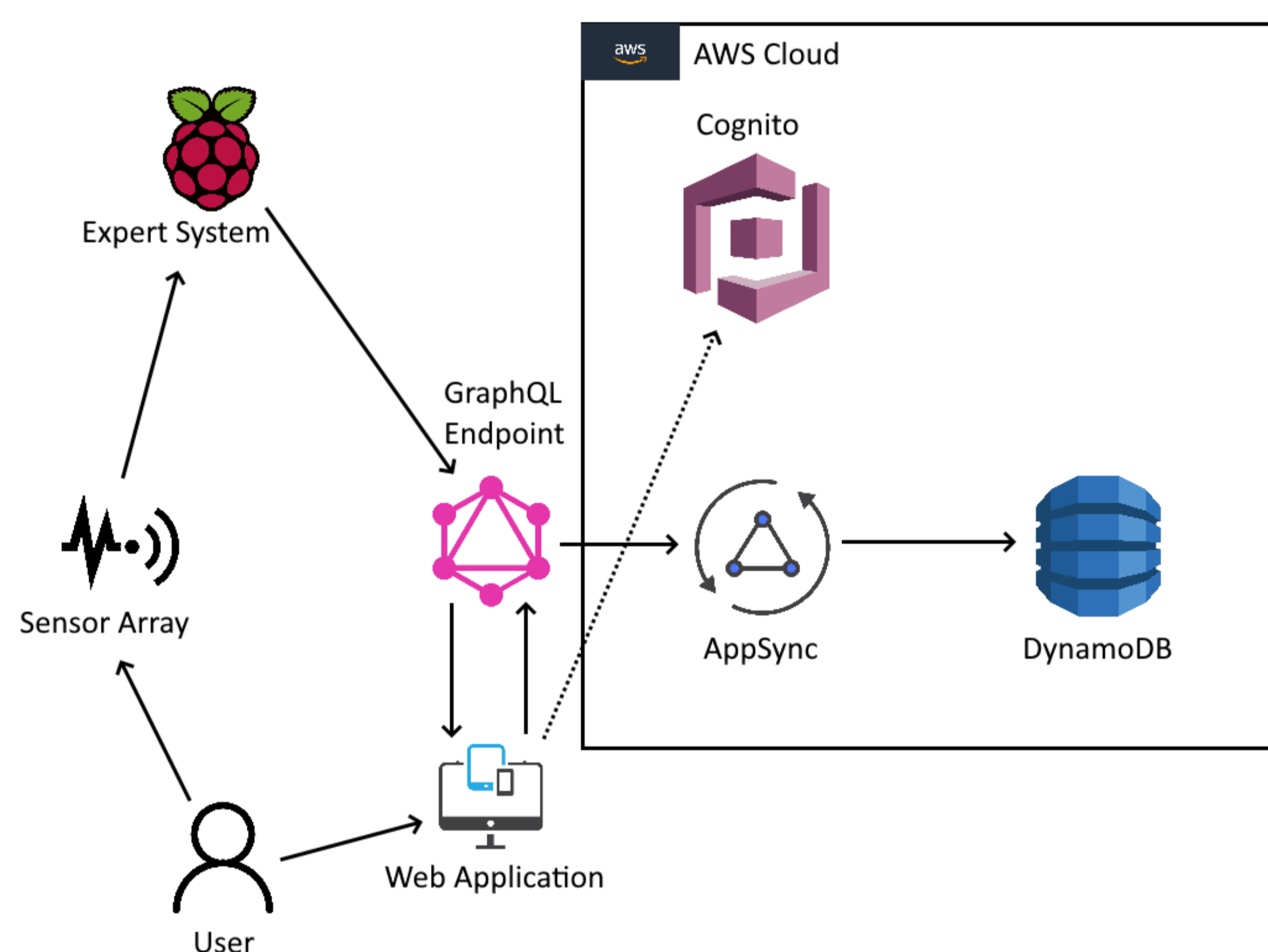
Objective

To investigate the effectiveness of developing an Expert System which would detect changes in a human's vital statistics using Internet of Things technology and Artificial Intelligence.

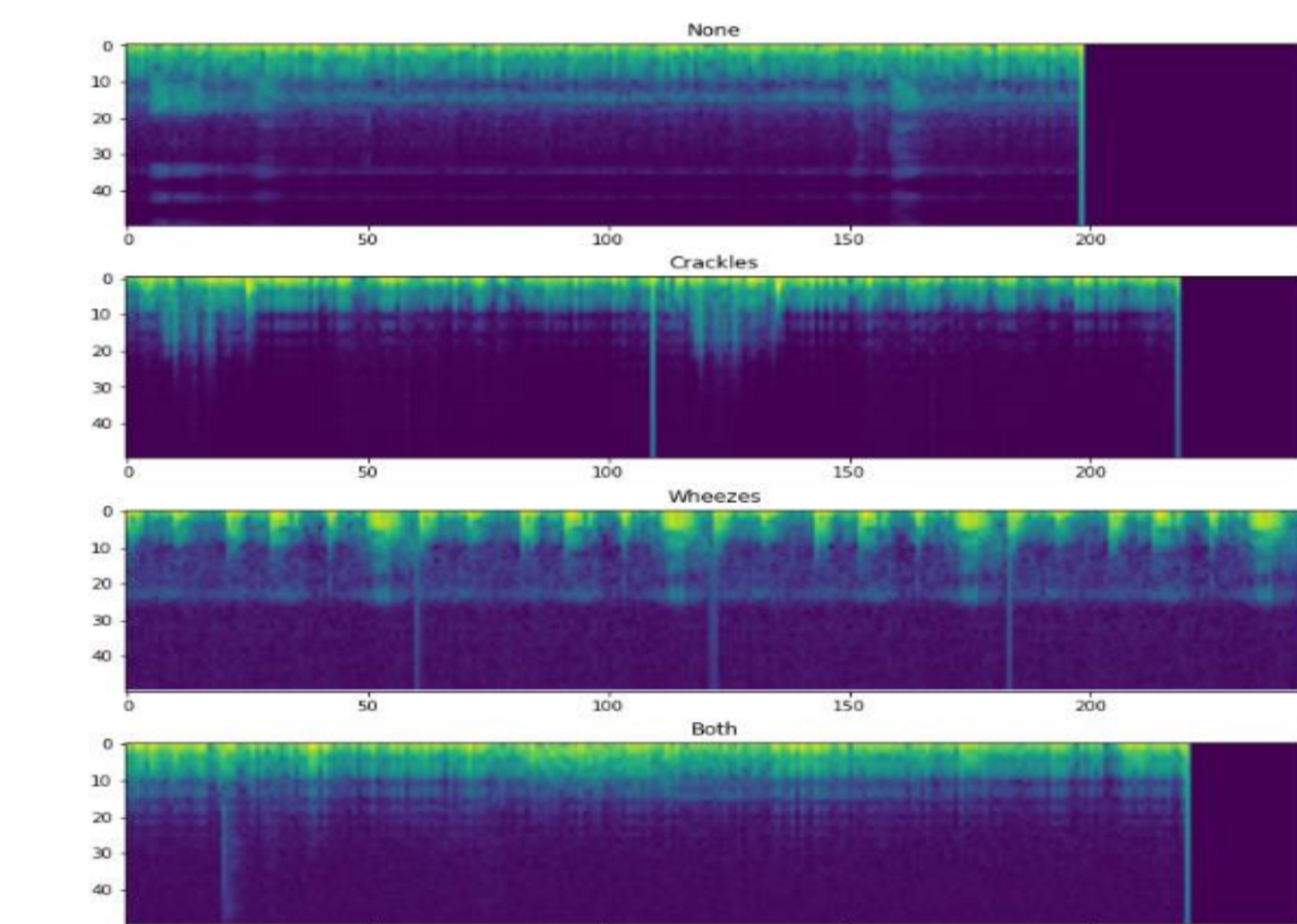
Methods

A prototype was built (as per Systems Architecture Diagram below) that collected data from a person in the form of photoplethysmography (PPG) signals from a finger and an audio clip of the person's breath. This data was deployed to a cloud database via the GraphQL API. A web application subsequently received the data via a Reverse API (Webhook) and processed this data through client-side inference methods. Results were then presented in a dashboard format to user.

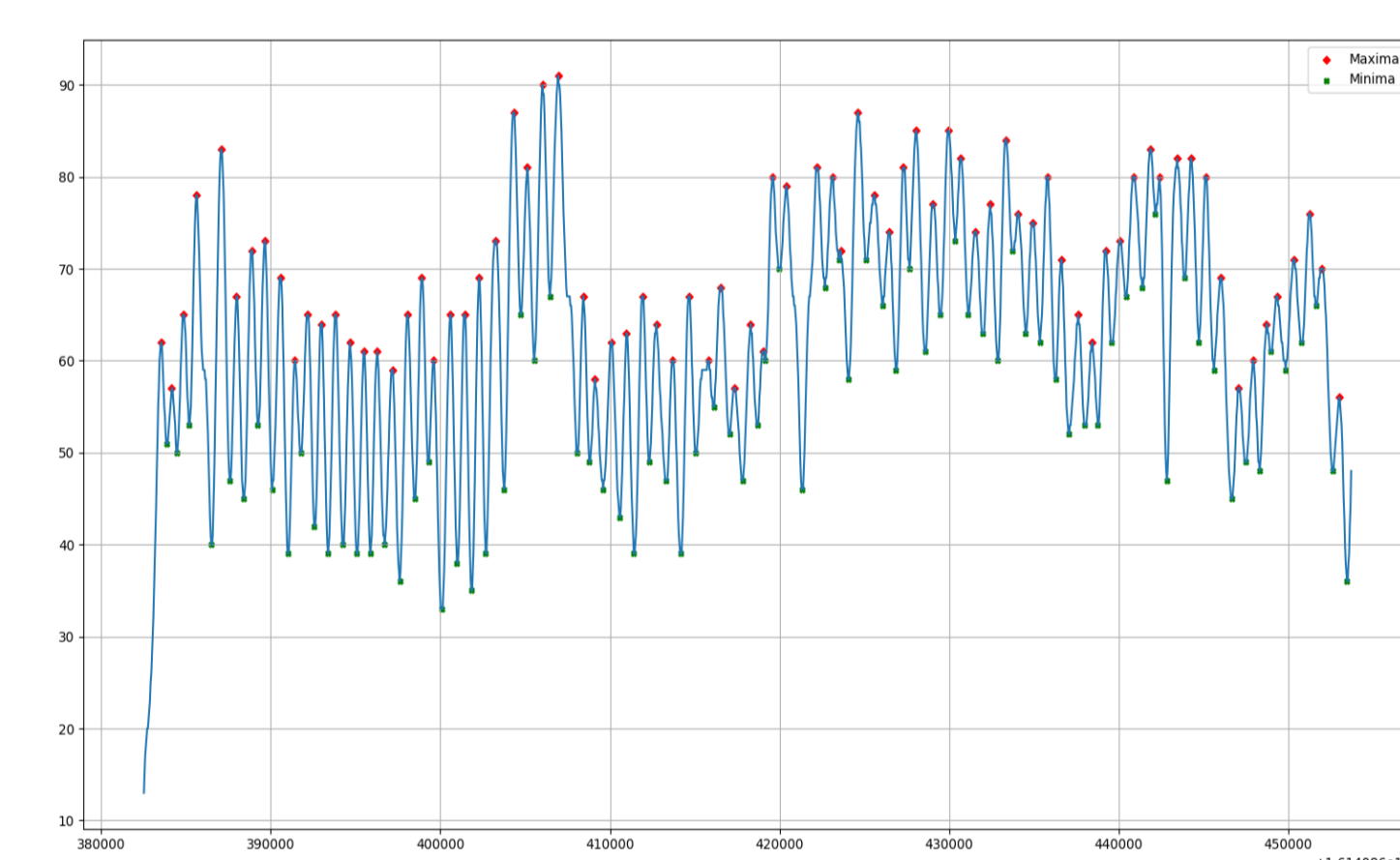
System Architecture Diagram



Spectrographs



Photoplethysmography Signals



Results

- Ultimately the project resulted in an application as presented in the architecture diagram above.
- The system collects user data in the form of photoplethysmography signals and in an audio clip of the system's user breathing.
- CNN then predicts lung health.
- RMSSD algorithm calculates Heart Rate Variability (HRV)
- Web application acts as a front-end inference engine to display a dashboard to the client.

Conclusions

- The methods used can produce an effective system to monitor a person's health and detect anomalies in vital signs
- PPG readings are sensitive to movement and light as they are calculated from reflected light through human flesh.
- For accurate readings, the user should remain still and attach the sensor to their finger using tape that has a strong adhesive and is non-transparent.