School of Electrical and Information Engineering
University of the Witwatersrand, Johannesburg
ELEN4002/4012: EIE Investigation (Capstone Project) 2022

Tender Bid for Project Number: 22P21

Project Title: App to scan pool water test strips

Group Number: 22G05

Project Overview:

In order to begin the design of the app to scan pool water strips, sufficient research will need to be done to understand the possible outcomes displayed by the pool water strips and their corresponding courses of action. Research on image processing and effective image capturing in different light conditions will also be important for this stage. The design of the image capturing techniques and separation and analysis of each testing strip segment will need to be planned and complex algorithms developed. After the design stage, a database will need to be developed with the use of the processed image data. This data will be used to train the artificial intelligence program to recognize the colors present on the testing strips and will be used to determine the appropriate course of action for each color. The database will need to consider different light conditions in the images. The actual implementation of the project will involve image capturing, processing and utilizing machine learning to analyze the pool water testing strips and advise on a plan of action. This project will be developed into an application. The final stage of the project will be testing the application against known values and making any necessary changes to the coding and image processing.

Preliminary Budget & Resources:

Since this is a machine learning project, the majority of the resources that will be required are software based.

The image capturing stage will require the use of a cellphone camera and will not require any resources to be provided by the university.

An image processing library will be required to analyze and manipulate images. This library will need to convert the images into a data format so as the machine learning database can be developed. OpenCV is a commonly used image processing tool for machine learning, it is open source and therefore free to use.

A database will need to be developed with the test strip image data; this will require databasing software. Open-source software such as MySQL and Cassandra are available and free to use.

Application development can be done with the use of Unity which is free for students. The application development will be done in Python as this is the most common language used for machine learning and comes with many supporting resources.

Weekly Milestones:

Week 1: Research on pool water test strip outcomes and possible solutions. A plan on image processing techniques and how the app development will take place.

Week 2: This week will focus on a general project design, highlighting the image processing section and determining the software required for each stage of development.

Week 3: Image processing design; this week should focus on capturing the image data and designing an image processing approach.

Week 4: This week will focus on implementing algorithms to capture and analyze the pool water test strip images, developing a dataset.

Week 5: This week will focus on the implantation of machine learning and application development.

Week 6: This week will focus on finalizing features and ensuring application covers requirements.

Week 7: Testing of application with the use of test strips in various lighting conditions.

Week 8: Making any necessary adjustments to project and finalizing project report.

Risks and Mitigation:

Several risks exist in the implementation of this application. Although these risks are not necessarily harmful, they could pose a risk to the success and usefulness of the application.

It is essential that the final application meets the project requirements and provides a correct course of action for the chemical ranges on the testing strip. If the image processing is performed incorrectly, the result determined by the machine learning program could suggest an incorrect course of action for the pool water correction. This could be avoided by thoroughly testing results against known values, ensuring the image processing and image analysis with the use of machine learning has been performed correctly and accuracy.

An important project requirement is that the application is able to work successfully to analyze images in all light conditions. If this requirement is not carefully considered, the program could mistake a specific color for another. In order to ensure that this does not take place, it will be necessary to thoroughly test the application with test strip images in different light conditions.

Software advancements could mean that the app becomes unusable in coming years. The solution to this is to ensure the software is adaptive.