Project: Traffic Camera Image Analysis

Client: CSIR, Department of Defence, Peace, Safety AND Security

Team: Quadcore Productions

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University of Pretoria, Department of Computer Science

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Contents

1 The Team

The members of our team, Quadcore Productions, are:

- Mpho Baloyi
- Hlengekile Jita
- Moses Mayimela
- Themba Mbhele

We are students at the University of Pretoria, all completing our third and final year in BSc Computer Science.

1.1 Mpho Baloyi

1.1.1 Interests

- Keeping abreast with new technologies

- Learning and using new technologies to solve problems
- Reading up and doing research on new and old concepts in computer science
- Solving riddles and puzzles
- Helping people through the use of ICT

1.1.2 Technical Skills

- Solid programming skills in Java, C++ and Python
- Fair amount of knowledge in assembly programming
- Web development with HTML, JAVASCRIPT, JQUERY, CSS, PHP ,AJAX, ANGULARJS
- Human Computer Interaction Design
- Database design with MySQL
- Understanding of process development
- Knowledge of unit testing, mocking and dependency injection

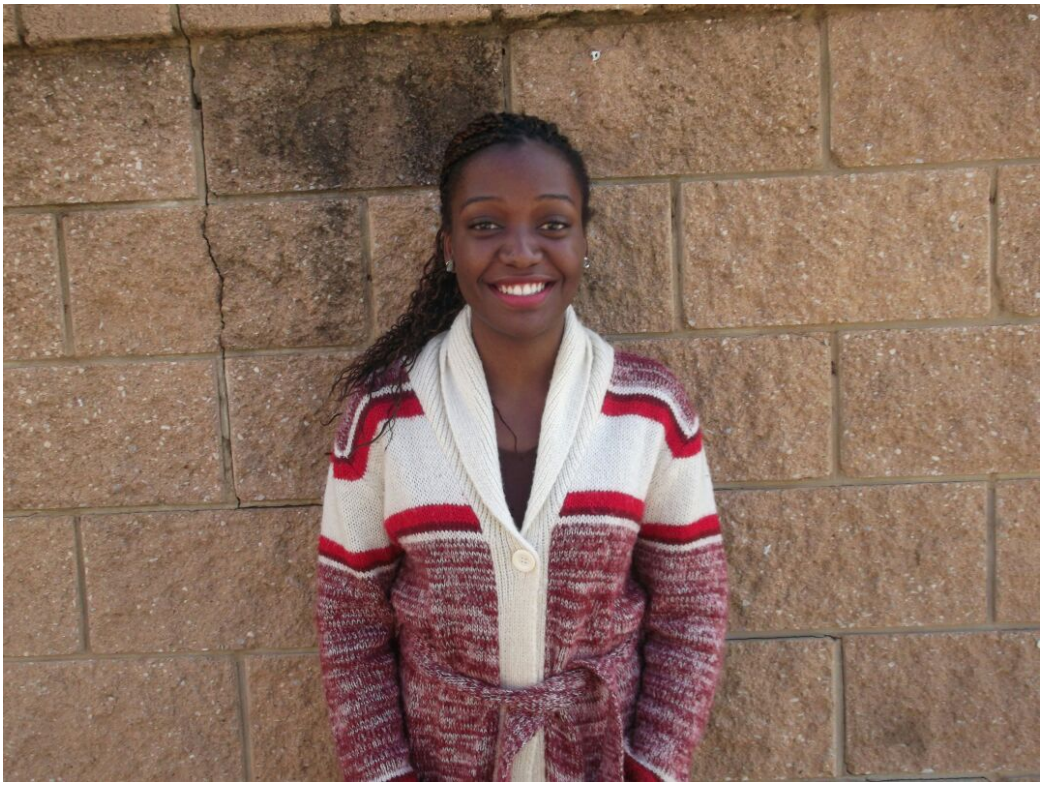
1.1.3 Non-Technical Strengths

- Excellent Communication skills
- Patient
- Creative approach to problem solving
- Pays attention to detail
- Excellent planning skills
- Ability to grasp concepts quickly
- Willingness to learn new things
- Ability to interpret and follow technical plans
- Ability to collaborate and work efficiently with other people
- Ability to work under pressure

1.1.4 Relevant Past Experiences

Work in the mini-project of the university of Pretoria taught me important skills in software engineering such as unit testing,dependency injection,mocking and working with different technologies. I believe that these skills will be valuable to the development of this project as they apply in every area of software development.

1.2 Hlengekile Jita



1.2.1 Interests

- Staying abreast with new gadgets and new technologies
- Reading up on the role of ICT in communities and the lives of others especially in education
- Finding out how IT can better business information systems
- The world of business, including business processes and organizational strategies

1.2.2 Technical Skills

- Microsoft Office - Word, Excel, Access, PowerPoint
- Programming - Java, C++, Python, Android
- Database Design - MySQL, PostgreSQL
- Web Development - XHTML, HTML5, CSS, JavaScript, PHP

1.2.3 Non-Technical Strengths

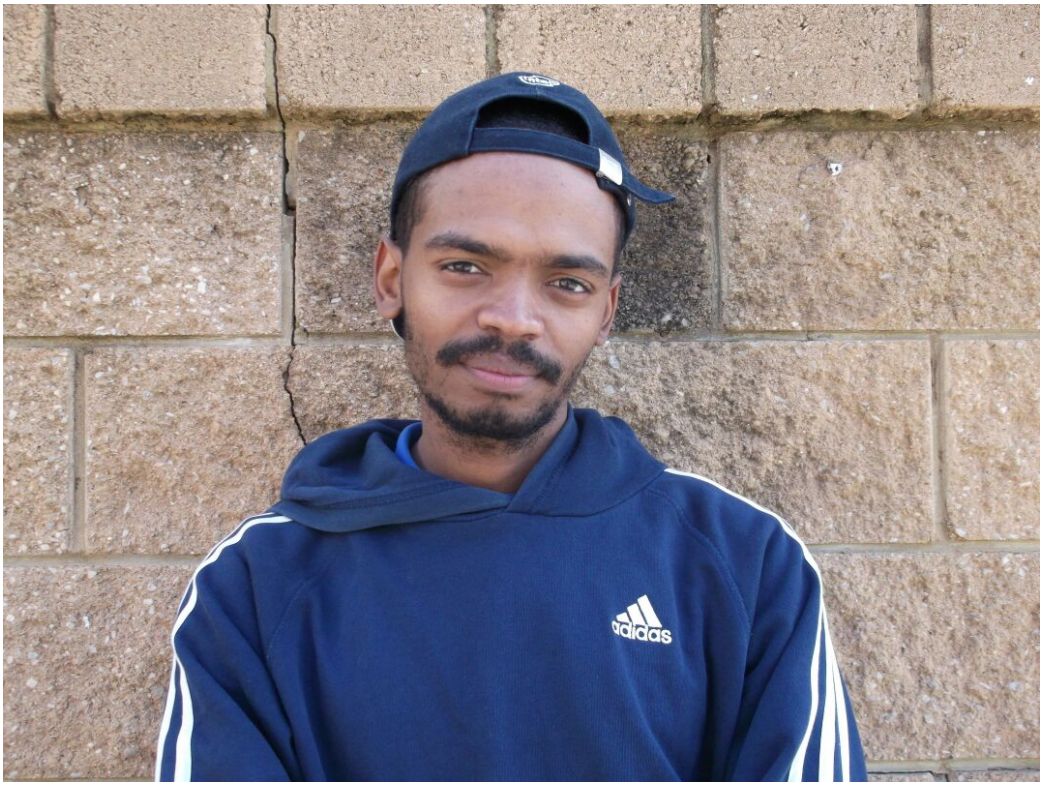
- Good leader
- Excellent communication skills both verbal and written
- Works well under pressure
- Great at teamwork
- Sociable character that gets along with people
- Organized individual with meticulous planning skills
- Determined

1.2.4 Relevant Past Experiences

Some of my past experiences which I believe will add value to the project is that I have worked on a data processing projects at the CSIR during vacation work periods. This includes the analysis of Twitter Data and Normalization of text for text processing in text-to-speech systems. This will be valuable experience because we will be doing image processing.

In addition to that, my recent experience working on the COS 301 Min-Project has also given me invaluable experience in terms of the software engineering process and working together with people towards the goal of a working software system.

1.3 Moses Mayimela



1.3.1 Interests

- Keeping up to date with the latest technologies e.g Raspberry pi and Intel Edison.
- Reading Tech reviews and comparisons on software and hardware systems such as BLE vs Classic Bluetooth.
- Taking part in Hackerthons e.g Hack4Water.

1.3.2 Technical Skills

- Programming skills in:
    1. Java.
    2. C for embedded Systems (8 bit and 32 bit) and PC applications.
    3. C++.
    4. C#.

5. Python.

- Knowledge in assembly programming for embedded (8 bit and 32 bit) and PC applications.
- Web development with:
  HTML,CSS, Javascript, NodeJS (Javascript framework),PHP and AJAX
- Database design with MySQL, MSSQL and PostgreSql.
- Unit testing,mocking and dependency Injection
- Familiar with GSM/3G Modules AT commands.
- Experience with Linux servers.

1.3.3 Non-Technical Strengths

- I like working with people who love what they do.
- I can lead a team and I also respect a leader.
- I am always willing to learn and expand my horizons.
- I am open minded to people's opinions.

1.3.4 Relevant Past Experiences

- Won, breakthrough developer award for 2015 in the MTN M2M (IoT) competition.
  http://www.mind2machine.co.za
  https://www.youtube.com/watch?v=HZlryrw1Ois.
- 2nd place at the Hack4Water Hackathon in April 2016.
  https://twitter.com/hashtag/hack4water

1.4 Themba Mbhele

1.4.1 Interests

- Gaming
- Artificial Intelligence
- Keeping up with the new developments in the Computer Science field
- Participating in IT challenges e.g Standard Bank IT Challenge

1.4.2 Technical Skills

- Strong programming skills in C++ and Java
- Linux 64-bit assembler knowledge
- Unit testing, mocking, and dependency injection
- Web Dev - HTML5, CSS, WebGL, JavaScript, PHP

1.4.3 Non-Technical Strengths

- Excellent time management skills
- I am a Dedicated student who will put in the necessary effort to make a success of any project that I am a part of.
- I am a Team player

2 Project Execution

2.1 Development Methodology

For this project, the development of the traffic camera image analysis system will require us to work on aspects of the system starting with the retrieval of the images from the SANRAL site, thereafter we will begin to apply intelligence and do analysis of the images, using the information our app will then need to produce the user with a report.

Based on the above, we have decided to adopt an Agile Development Methodology and more specifically, Extreme Programming. Using this methodology we are able to incrementally build the software system using sprints where specific functionality is completed. We would like to continuously deliver high quality software. This would mean work very closely with the client, CSIR. As we work together we will be able to identify numerous use cases that will become the focus of the sprints, the development team will complete.

Extreme Programming practices focus on having a continuous process, a shared understanding and giving feedback. These principles are important to our project because as previously mentioned, we would like our client to be satisfied hence we need to make sure that we have a proper understanding of their needs and provide them with working progress at regular intervals for their feedback. The practices that are key are:

- Planning
- Test-Driven Development
- Continuous Integration
- Small Releases

The system will thus have to demonstrate working functionality at the end of each sprint and incrementally grow to its best form as it gains aspects of functionality. We will follow a development process of planning, design, implementation and testing at every sprint. In this way, because as the project progresses, development processes are completed as a whole, we only have to revisit completed aspects of the system if we have ways to modify and improve on it and not to make corrections because of faults.

In addition to this development process, other aspects of Extreme Programming that will add great value to the development of this traffic camera image analysis system is:

- Pair programming, in this way code is continuously reviewed by the team.
- Simple Design, in this way every member of the team is able to learn as we go and develop a rounded understanding of the system enabling the production of better software.
- Sustainable pace, in this way we are able to produce our best work at all times, instead of trying to rapidly produce software that fails.

2.2 Communication With Client

To keep the clients informed we are going to use the following means of communication

2.2.1 Email

Email will be our standard form of communication, we will use emails to:

- Inform the client of our progress
- Address any issues or concerns that they client or we may have
- Acquire information from the client

2.2.2 Phone calls

Phone calls will be used to contact our client in order to address urgent matters that may need an immediate response from the client. We will respect the client and not call outside of business hours and this method of communication will only be used with their consent.

2.2.3 Regular Meetings

We will have regular meetings with the client, these meetings will take place twice a month. In these meetings we will discuss the progress of the project, demonstrate completed work, discuss problems we may be experiencing and address any concerns that the client may have.

2.2.4 GIT

Access to our Git repository will be provided to the client,so the client can be able to monitor the progress of the project. Git also allows the client to have access to any and all source code used in the project.

In addition, we are open to any other forms of communication that our client may prefer.

2.3 Technical Challenges

Some of the technical challenges we will experience on this project are as follows:

- Handling the influx of traffic data that is continuously updated.
- Analyzing the images in order to make conclusions about them.

  We will tackle these technical challenges by firstly for handling the influx of traffic data we will make use of a web server will then do the analysis thus the android application will only have to make requests to the server and accept responses in the form of the reports.

  Secondly, we will deal with the analysis of images, so that we can make relevant conclusions about traffic control, by using technologies such as OpenCV.

2.4 Technologies

For the front-end of the system, in the initial stages of the project, we will be looking at both a mobile application and web interface. The primary front end tool will be a mobile application as is specified will be the mobile application and because of the potential that some mobile devices will not be able to handle the traffic from the server, we will also be looking at a web interface. For the mobile application, we will provide an application for android devices and we will develop it using the following:

- Android Studios
- Java

The back-end of the system, which is primarily the web-server if necessary, it will be implemented using the following:

- Python will be used to grab images from `https://www.j-traffic.co.za/traffic/cameras.aspx` if a web server if needed
- Java
- OpenCV will be used to analyze the images.

2.5 Deliverables

At the end of this project we will deliver the following:

- Android Application
- Documentation
- Source Code
- Unit Tests
- Developers Guide
- Requirements Specification
- Architecture and Design Document