gis IN motion.

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| **CLIENT: UP MANAGEMENT** | **TEAM NAME:**  **GIS IN MOTION** | **DATE: 31 JULY**  **2023** |

MOVE@UP

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# **Executive Summary**

**Company Overview**

This company is made up of 4 diverse individuals that cover a broad range of GIS professions, after all obtaining an undergraduate degree in Geoinformatics at the university of Pretoria, and soon forming a Geospatial Company afterwards.

GIS in Motion team aims to formulate solutions based on the effective use of geographical information, and spatial and other data. The solutions maximise value for our customers by applying mathematical, and machine learning sciences to the unique spatial information.

**The Problem**

The problem identified by the University of Pretoria: The students (and staff) are struggling to navigate through the campus efficiently and effectively, in order to arrive at class on time. The students have a limited time of 10 minutes between each class to get to their next lecture. Many students have reported that the current maps provided are confusing and take too long to navigate with.

Mode of Transport: On foot, skateboards, golf carts and on bicycles

The target audience: The students at the University of Pretoria

The current solution that is being used, is a non-interactive map of the Campus, provided by the university.

**The Solution**

The proposed solution for this project is to create an interactive web-map that students can use to navigate the campus between each class.

* This allows students to find solutions specifically for their individual schedules and needs.
* This solution will allow students to select their next destination and their mode of transportation, and the web-map will provide the quickest route to get to that location.
* It will be easy to use, as not to exclude any individuals that may need to use it.

This will not only make it easier for students to get to class, but it can help reduce anxiety associated with navigating the large campus, and less students that are late to class means that there is less frustration for lecturers caused by the disruptions.

**Highlights**

The project will take place over 3 months, covering 5 phases of development

* Data collection
* Data organisation
* Data Visualization and Analysis
* Application Development
* Finalising the Product

**Financial**

****This project's budget is estimated to be approximately R30 000 in order to cover personnel, equipment, and travel expenses. The proposed budget only covers the current project – further requests will be completed at an additional cost.

# **Business/Client perspective**

## Background

The University of Pretoria, Hatfield Campus, has a lot of routes to get from one place to another. This includes lecture halls and buildings, libraries, shops, parking areas and places of residence. However, there are a number of issues that greatly affect the mobility of students. It is essential that student mobility is optimised, especially during the ten-minute time frame between lectures. Students often have to navigate from one place to another as swiftly as possible in order to reach their classes on times. Mobility issues are introduced through a number of factors. Firstly, there are a lack of bicycle, skateboard, and golf cart routes, which in turn causes the cyclists, skaters, and golf-cart drivers (staff) to use the same paths and routes as pedestrians. This puts students at risk, as it increases the chances of an accident occurring. Secondly, the paths and routes that are frequently used by students are quite narrow and bi-directional. This causes congestion, time delays and often drives students to use roads as their routes, where there are often cars and other vehicles. Thirdly, majority of communal areas used by students during their free time are clustered in one area, rather than dispersed around campus. This furthers the issue of congestion. Finally, although there are online maps of the campus available, there are fewer maps placed around campus which students can use whenever they want to use alternative routes, or do not have data or internet connection due to the WIFI connectivity being weak and, in some areas, non-existent.

## Overview of Proposed Solution

The solution to the issues that affect the mobility of students in the University of Pretoria, Hatfield campus is a tangible product. This product is an interactive web programming application called Move@UP. It uses data collected during the ten-minute time frame between lectures from student surveys which are distributed randomly to better understand student mobility. Secondly, from the quantitative measurement of the number of people passing a certain area/point at campus which indicates the specific points where foot traffic occurs. Followed by the physical observation of areas where bicycles, skateboards and golf carts intersect with walkways and routes used by pedestrians and these modes of transportation are tallied to determine whether their exclusive routes are needed. Lastly from the counting and finding of locations where physical maps are placed around campus. After data collection, the data undergoes data cleaning where it is saved, edited, and stored for analysis in order for Move@UP to perform at its optimum. The Move@UP application has a lot of functionalities, which include showing the students alternative paths around campus after they have selected their destinations and mode of transportation, it also facilitates the implementation of routes which can be used exclusively by cyclists, skaters, and golf cart drivers. In addition, it indicates to students which paths they have to keep left due to the paths being narrow and bi-directional. Finally, Move@UP has an offline map of campus for students to use whenever possible.

# **Scope and Limitations**

## Scope

The application will be released incrementally, in order to ensure the client is consistently satisfied with the level of output from our team. The scope is as follows:

**Version 1:**

Web map showing the data that has been collected throughout the data collection phase. This version is simply to ensure the client is satisfied with the rough layout of the application.

**Version 2:**

Added interactivity features, such as clicking on data points and changing the view from a 2D layout to a 3D layout.

**Version 3:**

Addition of the dashboard, that shows information that cannot be portrayed on a map in easy-to-understand tables or graphs.

**Version 4:**

This version involves all the necessary functionalities but includes errors and may require debugging.

**Version 5:**

The final version of the Move@UP Application, which involves all necessary features:

* Interactive Web Maps
* Dashboard
* Multiple ways to view the datasets

## Limitations

Limitations are aspects that are assumed to be included in the application but have explicitly been excluded. In the case of the Move@UP application, the main exclusion has been real-time data. The Move@UP application cannot show “live” data, for example, where there is currently heavy foot traffic. The Move@UP application can provide an estimate as to where there may be foot traffic, but it cannot access live data, that changes continually with time.

# **High-level non-functional requirements**

* Data collected must be reliable and accurate
* Data must be analysable, so that a solution can be proposed
* Enough data must be collected to conform to the central limit theorem
* Surveys must comply with the POPI act
* Open-source software must be used
* Software must not inhibit hardware constraints (i.e. crash the users’ computer)
* The web-application must be accessible to various operating systems
* The web-application must provide a feasible solution to the problem

# **Project phases and deliverables schedule**

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| Phase | Schedule |
| Data Collection | 3 August - 15 August |
| Data Organization | 15 August - 22 August |
| Data Visualization and Analysis | 22 August - 12 September |
| Application Development | 25 September - 23 October |
| Finalising Product | 23 October - 30 October |

## Data Collection

The data collection process entails gathering the raw data necessary for this project. The main datasets we will be collecting are as follows:

* Foot Traffic: Foot traffic at specific points around the University of Pretoria Hatfield Campus will be collected. This will be done through counting the number of people passing a specific point over a specified time period. This data will be used to visually represent high foot traffic areas at the University of Pretoria Hatfield Campus.
* Bicycles intersecting walkways: The number of bicycles that intersect with walkways will be tallied. This is necessary for determining whether bicycle routes are needed at the University of Pretoria Hatfield Campus.
* Surveys: Surveys will be distributed to students at random, in order to gain a better understanding of student mobility. The survey will address issues such as tardiness, routes taken between lecture halls, and forms of transportation while on Hatfield campus.
* Roads/Paths: This dataset involves the roads and different pathways on the University of Pretoria Hatfield Campus.
* Buildings: The Lecture Halls on University of Pretoria Hatfield Campus. This is necessary in order to determine routes and where students are most often traveling

Deliverables for this phase include raw data.

## Data Organization

Data Organization involves cleaning the data and putting it into a suitable format. The data collected from the previous step will be organized into spreadsheets, where they will be saved in the .csv file format. Data with a spatial aspect will include the latitude and longitude, and exported to a shapefile. Deliverables for this phase include organized information in spreadsheets and shapefiles.

## Data Visualization/Analysis

Data visualization involves portraying the gathered data in a way that encourages understanding. This will be done on an open-source GIS software, such as QGIS. Using the data, maps will be produced in order to show the gathered data in a digestible manner, as well as showing spatial relationships. Deliverables for this phase include maps.

## Application Development

This phase involves the production of the Move@UP Application. The application will be coded in python or javascript, and the deliverables include interactive web maps and a dashboard, showing necessary information.

## Finalizing the product

This phase includes fixing any errors and optimizing the Move@UP Application, where the final deliverable is an efficient, polished and effective application

# **Budget**

This Project will take place over 3 Months, covering 5 phases of development.

We understand that the university does not have a large budget, and thus, we have tried to be as considerate as possible, only charging for the necessities, and using open-source programs and data.

Assuming that the product launch is successful, the company requires a 7% share in the profits made by the university.

This budget proposal also, does not include maintenance or changes after the product launch - that will occur at additional costs.

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| PHASE 1: Data Collection | | | | |
| 3 - 15 August = 12 Days | | | | |
| Location: University of Pretoria | | | | |
|  | **Amount** | **Rate** | **Flat Fee** | **Total Cost** |
| **Personnal (x4)** | 15 Hours | R212/hr |  | R3 180.00 |
| **Equipment** |  |  | R2 000 | R2 000.00 |
| **Travel Expenses** | 120km | R4.25/km |  | R510.00 |
|  |  |  | **Total** | **R5 690.00** |
| Justification: | The personnel would include all the members of the team, over the course of the 12 days in order to get the most accurate and unbiased data. | | | |
|  | The Equipment includes the software and hardware maintenance used in the data collection as well as any physical equipment used. | | | |
|  | Travel expenses are covered with the standard South African rate, as stipulated by SARS | | | |

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| PHASE 2: Data Organisation | | | | |
| 15 - 22 August = 8 Days | | | | |
| Location: University of Pretoria | | | | |
|  | **Time** | **Rate** | **Flat Fee** | **Total Cost** |
| **Personnal (x4)** | 20 Hours | R212/hr |  | R424.00 |
| **Equipment** |  |  | R2 560 | R2 560.00 |
| **Travel Expenses** | 0 | R4.25/km |  | R0.00 |
|  |  |  | **Total** | **R2 984.00** |
| Justification: | The personnel would include all 4 the members of the team, over the course of the 8 days in order to get the most accurate and unbiased data. | | | |
|  | The data organisation will be done using open-source platforms, so equipment fees would mainly cover the maintenance costs of the hardware used - this was calculated using the company standard of 4% of Replacement Asset Value | | | |
|  | Travel expenses are covered with the standard South African rate, as stipulated by SARS | | | |

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| PHASE 3: Data Visualisation and Analysis | | | | |
| 22 August - 12 September = 22 Days | | | | |
| Location: University of Pretoria | | | | |
|  | **Amount** | **Rate** | **Flat Fee** | **Total Cost** |
| **Personnal (x4)** | 25 Hours | R212/hr |  | R5 300.00 |
| **Equipment** |  |  | R0 | R0.00 |
| **Travel Expenses** |  | R4.25/km |  |  |
|  |  |  | **Total** | **R5 300.00** |
| Justification: | The personal would include all the members of the team, over the course of the 22 days in order to get the broadest Geovisualisation as possible, in order to make the most accurate assessments | | | |
|  | The Equipment includes the software and hardware maintenance used in the data collection as well as any physical equipment used. This fee, was charged in the previous phase and will only be charge every 30 days that the project takes place over | | | |
|  | Travel expenses are covered with the standard South African rate, as stipulated by SARS | | | |

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| PHASE 4: Application Development | | | | |
| 25 September - 23 October = 29 Days | | | | |
| Location: University of Pretoria | | | | |
|  | **Amount** | **Rate** | **Flat Fee** | **Total Cost** |
| **Personnal (x4)** | 30 Hours | R212/hr |  | R6 360.00 |
| **Equipment** |  |  | R2 560 | R2 560.00 |
| **Travel Expenses** |  | R4.25/km |  |  |
|  |  |  | **Total** | **R8 920.00** |
| Justification: | The personal would include all the members of the team, over the course of the 29 days in order to get the broadest Geovisualisation as possible, in order to make the most accurate assessments | | | |
|  | The Equipment includes the software and hardware maintenance used in the data collection as well as any physical equipment used. This fee, was charged in the previous phase and will only be charge every 30 days that the project takes place over | | | |
|  | Travel expenses are covered with the standard South African rate, as stipulated by SARS | | | |

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| PHASE 5: Finalising Product | | | | |
| 23 October - 30 October = 8 Days | | | | |
| Location: University of Pretoria | | | | |
|  | **Amount** | **Rate** | **Flat Fee** | **Total Cost** |
| **Personnal (x4)** | 22 Hours | R212/hr |  | R4 664.00 |
| **Equipment** |  |  | R2 000 | R2 000.00 |
| **Travel Expenses** | 100km | R4.25/km |  | R425.00 |
|  |  |  | **Total** | **R7 089.00** |
| Justification: | The personal would include all the members of the team, over the course of the 8 days in order to get the broadest Geovisualisation as possible, in order to make the most accurate assessments | | | |
|  | The Equipment includes the software and hardware maintenance used in the data collection as well as any physical equipment used. This fee was charged in the previous phase and will only be charged every 30 days that the project takes place over. The equipment also includes the product testing that will occur on campus, with the participants | | | |
|  | Travel expenses are covered with the standard South African rate, as stipulated by SARS | | | |

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| Total Proposed Budget | | | |
| **Phase** | **Time Period** | **Location** | **Total** |
| Phase 1 | 12 Days | University of Pretoria | R5 690.00 |
| Phase 2 | 8 Days | University of Pretoria | R2 984.00 |
| Phase 3 | 22 Days | University of Pretoria | R5 300.00 |
| Phase 4 | 29 Days | University of Pretoria | R8 920.00 |
| Phase 5 | 8 Days | University of Pretoria | R7 089.00 |
|  |  | **Total** | R29 983.00 |

# **Project success factors**

1. Driver: Lack of mobility at the University of Pretoria Hatfield Campus. Poor route choices of pedestrians and bicycles results in congestion, which makes it difficult for students to get to class on time.
2. Constraint: There are limited route choices available and, where there are multiple route choices, many students stick to familiar paths. As a result, heavy volumes of pedestrians and bicycles are channelled along a select number of pathways that cannot handle the volume of foot- and bicycle-traffic.
3. Important: A web-application needs to be created which can show areas that are frequently congested.
4. Nice-to-have: The web-application should also show students the best route to take between two points on the campus.

# **Appendix**