Residence Free-Parking Disk & Charged Parking System Specification

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Executive Summary:

In the attempt to address the issue of traffic congestion in Observatory, a system has been proposed which entitles the implementation of a handheld parking meter system in the notorious restaurant and shopping area of Observatory. This system would then aim to create an incentive for the use of public transport by charging for parking, but Observatory residents will benefit from being able to apply for free-parking residence disks. When applying for free-parking residence disks, non-OCA-member residents would be required to apply to become an OCA member.

The report will provide a specification of how the proposed system should be implemented and operate. In addition, a residence disk design will also be provided with built-in security features. A community survey has also been conducted with respect to this system. Findings of this survey will also be discussed in the report to ensure an effective implementation of the system.

Introduction

Business Background

The Observatory Civic Association (OCA) is non-political organisation tasked with the responsibility of representing the community in higher authority discussions and decisions, as well as improving the Observatory neighbourhood.

The OCA operates within a specific region of Observatory (as can be seen in Figure 1) with the following boundaries:

- South boundary: N2
- North boundary: Malta and Rochester roads
- East boundary: Alexander Road
- West boundary: Devil's Peak

Figure 1: OCA Operation Region

Concerns of the OCA include construction, rezoning, Integrated Zoning Scheme and building regulations, safety, public spaces and events, rates, Cape Town Integrated Development Plan, as well as traffic and parking (which will be the focus of this project).

The OCA is known to being one of the largest civic bodies in the Cape Town area. However, the OCA is eager to expand their membership, since the effectiveness of a civic body is limited to its member size. Despite some challenges, the OCA have managed to make significant contributions in the past of which some include revamping Village Green, upgrading Pepper Tree Square Parking, while also helping in many community projects. Pepper Tree Square Parking is now under the management of the OCA. In addition, the OCA is eager in helping Observatory to obtain international heritage status.

Business Objectives

OCA have the following objectives:

- Improving Observatory neighbourhood
- Representing Observatory community in discussions with municipality and government authorities.
- Acting in the interests of the Observatory community
- Supporting developments that are “people-centred, environmentally sustainable, responsive to the local built environment, culture and traditions and is socially inclusive” (https://obs.org.za/).
- Increasing membership size of the OCA.
- Helping Observatory obtain international heritage status.

Problem Statement

The OCA wants a proposal and plan to address the problem of traffic congestion in Observatory, which they can advance further. This proposed plan should especially relate to traffic and parking management while focussing on the following area in Observatory:

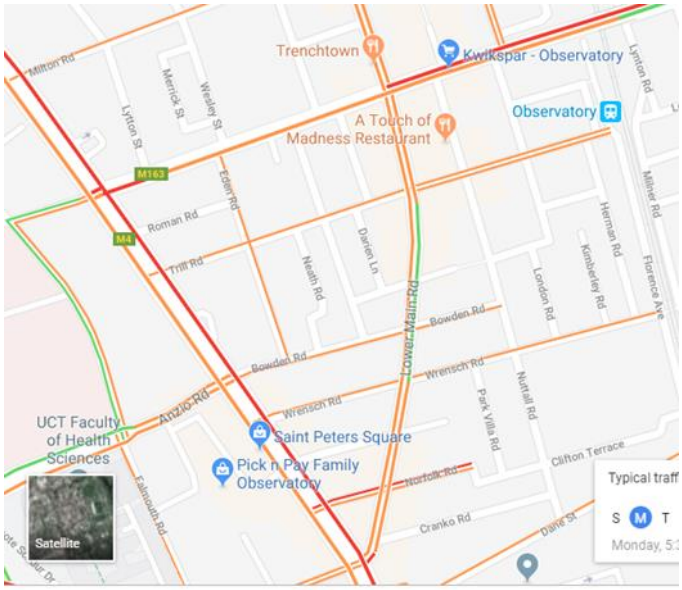

Figure 2: Scope Area

Moreover, the proposal should try to add some form of value to the OCA and Observatory community.

Traffic Congestion

When attempting to reduce traffic congestion, one follows a demand and supply notion, "Congestion can be reduced by either increasing road capacity (supply) or by reducing traffic (demand)" (Shamsher & Abdullah, 2012). As one is unable to "widen" roads or add additional roads, the supply-side approach is not possible. Hence, all three of the following provided options will focus on the demand-side approach to reducing traffic congestion.

General benefits that are associated with the reduced traffic congestion include the following:

- Mental-health benefits as drivers experience less anxiety and frustration.
- Environmental and health-related benefits from reduced air pollution, due to reduced carbon emissions.
- Economical and physical health benefits from reduced noise pollution. Reduced noise pollution could act as a contributing factor towards the increasing of businesses' customer base and profits.
- Expanding tourism sector as the trips become a better experience.
- Economic benefits arising from less frustrated drivers contributing to the increasing of businesses' customer base and profits.

General risks that are associated with reduced traffic congestion include:

- Future changes in traffic patterns and network infrastructure.
- Conflict with current or future traffic laws and regulations.
- Lack of support from government authorities.

- Increase in taxes and costs that are placed on community if government funds or invests in traffic.
- Exploitation by traffic congestion regulators and government authorities in order to gain additional income.

Project Objectives

The following were the objectives of the project:

- Develop an effective system for reducing traffic congestion by means of preventing illegal parking and incentivising the use of public transport.
- Creating a specification of residence disk and handheld parking meter system in order to provide the OCA with an implementation plan of reducing traffic congestion.
- Create a residence disk prototype with built-in security measures to minimise the probability of forgery and corruption.
- Conduct a comprehensive community survey to have a better understanding of how to implement the system such that it accommodates the community while also reducing traffic congestion.
- Propose an effective parking fee structure that will incentivise the use of public transport, but at same time account for the risk of experiencing significant resistance from non-disk holders due to being charged for parking.

System Overview

Description

The system attempts to reduce traffic congestion by incentivising the use of public transport and reducing illegal parking. The option proposes the issuing of free-parking disks and the charging of parking for non-disk-holders, in order to alleviate traffic congestion in Observatory.

Residents wishing to park freely, would then be able to apply for a parking disk from the OCA. The applicant will need to provide proof of residence as they will need to be an Observatory resident. Pepper Tree Square Parking could be used as a possible location for the issuing and application process of the residence disks. The applicant would also then be able to join the OCA, resulting in OCA membership size increasing.

Non-disk-holders will need to pay for parking per hour with the use of a handheld parking meter. When parking, the parking marshal will scan the vehicle's licence disk. Once non-disked holders are ready to leave, the parking marshal will scan the licence disk again with the handheld parking meter in order to calculate the fee that will be handed over to charged visitor. Non-disk-holders refusing to pay, will be fined for illegal parking.

The OCA have discussed such a system in the past, but still requires implementation plan and suggested pricing structure that will incentivise the use of public transport.

Operating Environment

The operating environment is chiefly within the OCA operating boundaries. The system is focussed around parking management for municipal and public parking spaces, under the control of the City of Cape Town.

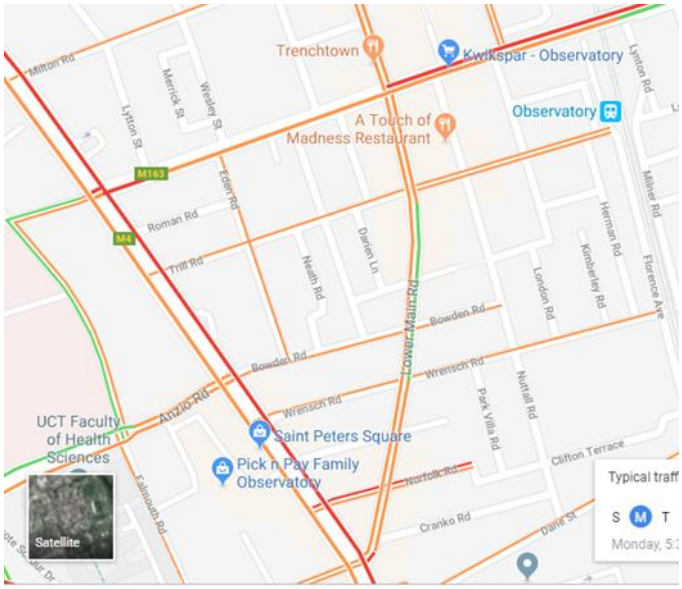

Figure 2: Scope Area

Past Implementation

City of Cape Town have handheld parking metres systems managed by private partners in the CBD area, as well as in areas of Claremont, Seapoint and Bellville. NumQue is the private partner responsible for Claremont, Seapoint and Bellville. In addition, NumQue tendered the CBD area between 2005 and 2009, after which the Street Parking Solutions have been responsible for parking management in CBD area with the use of handheld parking metre systems. While Street Parking Solution appear to be the first African parking management company, NumQue is known to be the pioneer in handheld parking metre system in South Africa with their system's first implementation in Middleburg. Handheld parking systems have also been implemented in Stellenbosch (since 2015), Pretoria CBD and many other parts of South Africa in order to apply better parking management practices

Benefits

Short-term benefits would include:

- Revenue generation from charging non-disk-holders for parking.
- Increasing OCA membership size by encouraging local Observatory residents to acquire parking disks while also becoming OCA members.
- Creating job opportunities with the need of parking marshals
- Increasing security and community safety: In an article by South Africa Car magazine, it is noted that a handheld parking meter have reduced vehicle theft in a number of South African towns, as well as with recovery of stolen vehicles, since vehicle

registration numbers are captured with the handheld parking meter device. Past implementation have also shown that such a system reduces vehicle vandalism.
- Improving transportation planning with the use of data captured by the handheld parking meter device. Such data include the frequency and duration of parking.

Long-term benefits will include income generation giving rise to further community benefits, and the reduction in Observatory traffic congestion along with is associated environment benefits. The OCA could use generated income to their discretion by either donations to local NGOs or other community projects and initiatives, which will in turn benefit the Observatory community.

Costs

Development costs include equipment costs of obtaining handheld-devices. Operational costs would include printing costs of residence disks, staffing costs concerning parking marshals, as well as administration costs.

Risks

An obvious risk would be residents not taking initiative in acquire parking disks, as well as having a negative attitude towards the application process. However, the OCA will still receive payment from charged parking in the event where a resident does not apply.

Observatory visitors might argue that it is unfair for them to be charged for parking. However, one could raise the same argument when visiting Claremont, where one needs to pay for parking at Cavendish. Furthermore, one might mitigate this by charging reasonable fees or giving South Africans discounts, since International tourists might not be so price sensitive.

Another high-impact risk would include the lack of available and affordable public transport, due to Ubers, taxis and other forms of public transport experiencing hostility.

One major risk would be theft of collected money by parking marshals. This could be mitigated with handheld parking-meter recording total of issued fees, which then can be compared against. Free-parking disks could also be forged. Unfortunately, fraud and corruption is inevitable. Nevertheless, one could reduce these situations with strict regulation and responses, such as the firing of parking marshals when caught.

Stakeholders

When considering how stakeholder will be impacted, it will be assumed that the City Council does not take over the project. The OCA would still need to obtain approval from government authorities. Whether OCA or government are responsible for initial capital will depend on the negotiated legal terms. Once given approval, the OCA will be responsible for the management of residence disks, but will also gain income from managing parking. These funds can then be used in community projects, benefiting the community.

The Observatory community can benefit from having the option of free-parking available to them, but will also be impacted by the application process. Unfortunately, Observatory visitors are negatively impacted as they are being charged, but they might not be price-sensitive to the fee. Parking marshals will be given job opportunities.

Business might negatively impacted with reduced customer base in the event of experiencing resistance from visitors towards charged parking. However, this balanced out with reduced traffic congestion attracting more visitors.

System Components

Residence Disk

Function

The residence disk will serve as a form of identification for vehicles being granted free parking. Thus, residents need to ensure the disk is clearly visible to a parking marshal. Hence, the disk should be fitting in left hand corner of the windscreen below the licence disk. These disks will only be issued to residents that have taken to initiative to apply for one by providing proof of residence to an OCA official. The Pepper Tree Square Parking could be a possible location for the issuing of residence disks.

Figure 3: Residence Disk

Properties

The parking disks will have the following features:

- Random-generated OCA membership ID
- Vehicle registration number
- QR Code which will be scanned by the parking marshal to assessing the legitimacy of the residence disk.

These various features of residence disk prototype can be explicit seen in Figure 4:

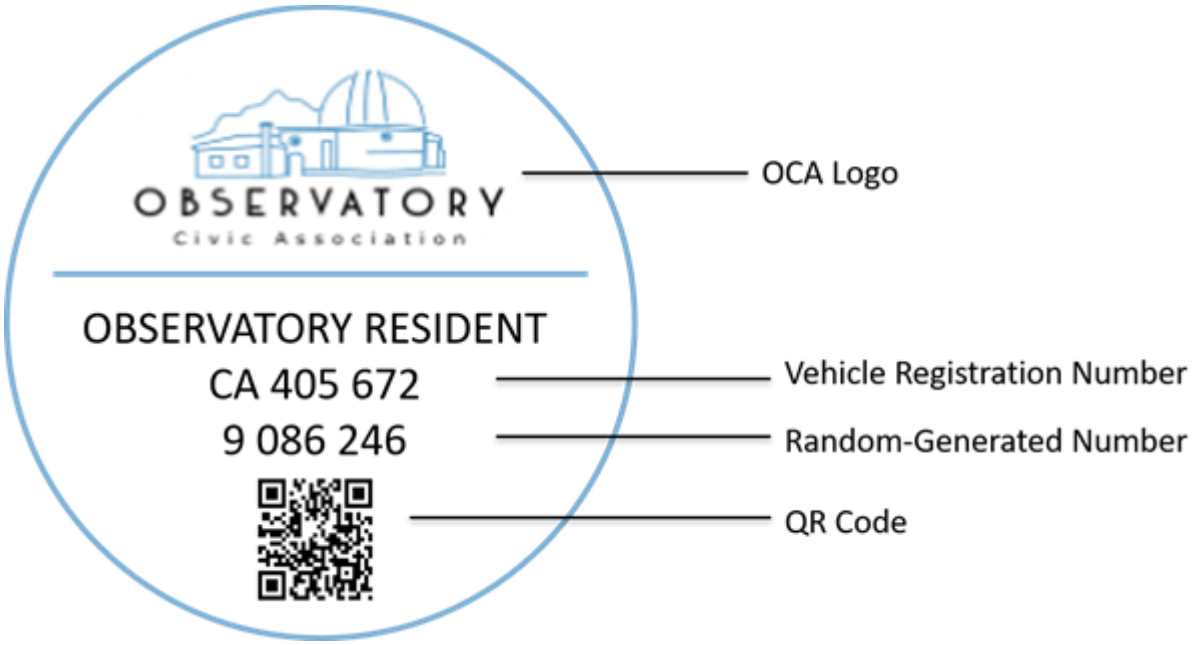

Figure 4: Components of Residence Disk

The random-generated number and QR code functions as built-in security measures for minimising the possibility of disk forgery. In addition, the random-generated number (which ranges between 0 and 9 999 999) will be unique to each resident, while the QR code will be unique to each issued residence disk. In the proposed system, these values would be stored in a secure database. Only the OCA would be able to directly access this database, while parking marshal would only be able to read from the database when scanning QR code to check for disk legitimacy.

Value Added to System

The issuing of residence disks enables the OCA to increase their membership size by having residents apply for membership when applying for a free-parking residence disk. This growth in membership size will also empower the OCA to becoming a more effective civic association. Furthermore, the OCA values its relationship with community and would not want to impose unnecessary costs upon them.

Related Concerns

A major concern of the implementation of the residence disk is the fact that the disks could be forged. This is an issue that the OCA will be faced with. However, the inclusion of the randomly generated number and the QR code are both features that will hopefully impede this action.

Handheld Parking Meters

Function

The purpose of these handheld parking meters is to keep track of occupied parking bays by a non-resident of Observatory so that they may be charged appropriately.

The parking marshal using the device will scan the registration number of a recently parked vehicle to log an entry. When the owner of the vehicle is leaving, the parking marshal will re-scan the registration number, in order for the handheld parking meter to calculate the parking fee. The transaction will be completed once the vehicle owner has paid the fee.

Properties

A cost of a single handheld parking meter is estimated to be R7000. This cost has been estimated with the use of online prices in other countries, due to the inability of accessing quotes for such a device.

The handheld parking meter is to be used by a parking marshal directed by the OCA. The meter will be connected to databases within the City of Cape Town in order to track vehicle number plates should the vehicle owners refuse to pay. These vehicle owners will then be fined by the traffic department of the City of Cape Town.

Value Added to System

The handheld parking meters will provide accurate, non-corruptible recordings. These recordings allow for accountability for those using the parking bays and can be shown to them should the transparency of the system be in question.

Related Concerns

Theft of parking meters can rarely occur, if at all. A stringent employee screening process conducted by the OCA will ensure that this risk is mitigated as much as possible.

Breaking and malfunctioning of the meters is possible and therefore parking marshals should use them with care. A backup pen-and-note system can be used to crudely achieve similar effects should a meter break during a parking marshal's service hours.

Database

Function

The purpose of the database is to keep record of Observatory residents who have received their parking discs. The database will store information concerning the name of the resident, the vehicle registration number, their random-generated membership ID number and an identification code embedded in the QR code on the disk. This information will be used for authentication purposes when the parking marshal scans the residence disk.

Properties

The database would be updated by the OCA as more residents obtain their discs.

The database would have to be created by the OCA or other entities should they choose to outsource it. This means that the cost of the database varies depending on the approach chosen by the OCA.

Parking marshals will only be given read-only access so as to ensure no unauthorised updates being made to the database.

Below is a table comparing two typical database implementations that are feasible for the OCA. The one implementation is that of SQL database, which requires expertise relating to databases and SQL languages. The other implementation is that of Google Sheet which only requires basic excel knowledge.

	SQL Database	**Google Sheet**
Performance	High-performance database, while the extension via a dedicated application	Sufficient performance for the implementation of this solution. Usability of accessing database can also

	could also improve the usability of the database access by means of GUI.	be improved in a similar way to that of SQL database with the use of scripts.
Scalability	Scalable	Limited in terms of scalability
Security	Security of local database depends on the quality of hardware and authentication permissions. Security of cloud-based database will depend on the host. SQL injection attacks can occur should the database not be protected from malicious inputs in the application. This could result in data loss.	Level of security is limited to the security offered by Google. Google sheets are only shared to those given permission but Google has faced data breaches before. Although the chances are slim, Google account information, therefore database access, can be hacked. Spreadsheet injections, similar to SQL injections, can occur as well.
Volume and Storage	Database will only be used to store information concerning Observatory residents. Thus storage should be such a concern, but the amount of provided storage would be subjected to related costs. If stored in the cloud, storage is not an issue provided they are within the host's limitations.	Up to 5 million cells are allowed per google sheet. This is more than enough; storage is not a problem. e.g. assuming 12 000 entries (residents) each containing 10 attributes, only 2.4% of the total space is used.
Reliability	Depends on access to the server hosting the database. Thus, this becomes an issue when using a local database in the context of frequent power outages.	According to Google in 2015, their services were running 99.97% of the time that year. Needless to say, reliability is not an issue and only dependant on one's own access to the service.
Backup/recovery	Can copy database onto a separate drive and update it regularly to avoid data loss due to unforeseen circumstances.	Spreadsheet can be copied and downloaded locally as a form of backup and recovery.

Value Added to System

The use of database enables the storing of valuable information and the detection of forged parking discs, providing security to the system. Additional data can be stored should the OCA require it for statistical analysis.

Related Concerns

The database is susceptible to being offline should it be hosted on a local device due to device being switched off either by human intervention or power outages. A reliable external cloud service could mitigate this.

Inaccurate recordings due to human error can occur leading to frustration in car owners and inaccurate conclusions drawn by parking marshals.

Functional Requirements

Acquirement of Residence Disks

Description

Observatory residents must provide proof of residence and vehicle ownership when applying for a residence disk that will enable them to park in Observatory at no cost. This information will be verified by an OCA employee. If documentation provided by a resident is valid, an OCA employee will issue the resident disk. In addition, if the resident applying for a disk is not an OCA member, they will need to apply to become an OCA member, otherwise the resident would just need to provide proof of being an OCA member.

Requirements

To ensure that only valid disks are issued, the applicant must provide the OCA with proof of residents as well as a proof of ownership of the vehicle. Additionally, the applicant must become an OCA member to receive a residence disk.

Sequence Diagram

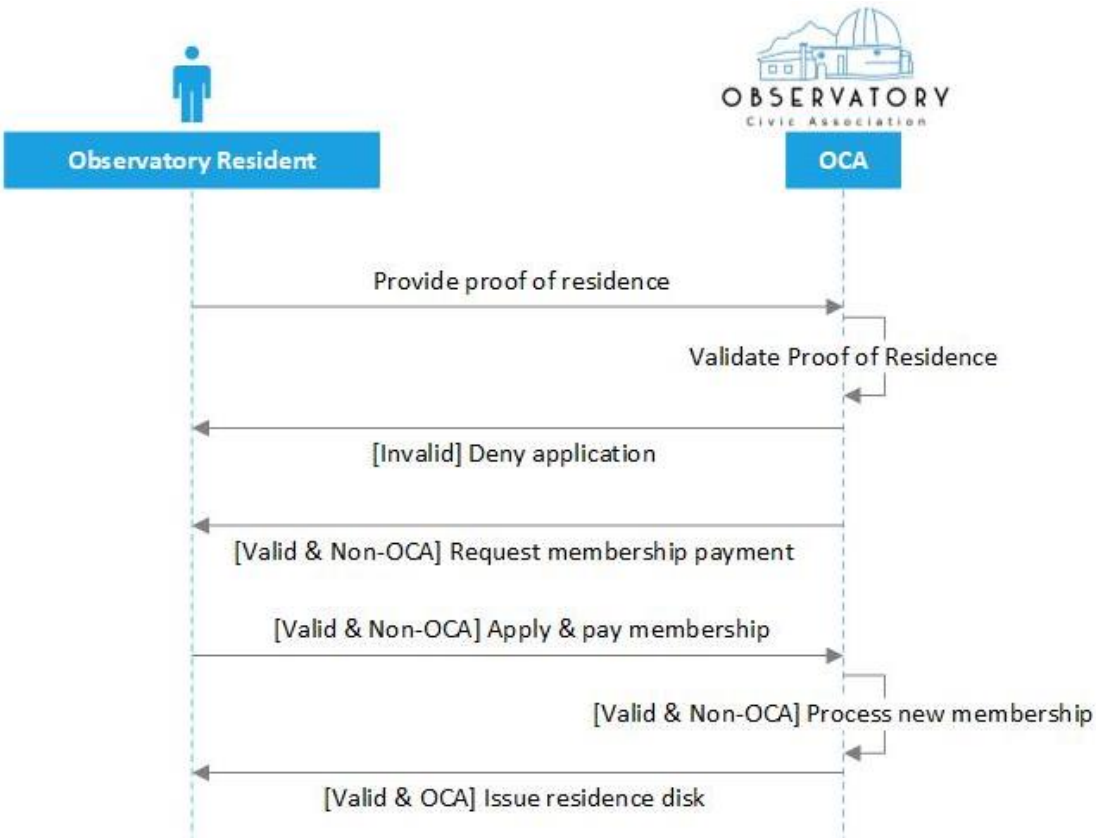

Figure 5: Acquiring Residence Disk

Charging of Parking

Description

The charging of parking to non-disk holders will be chiefly administered by parking marshals employed either by the OCA. Upon parking, should the resident not have a residence disk, the licence disks will be scanned by the parking marshal using a handheld device, then the owner of the vehicle is leaving, the parking marshal will re-scan the registration number, in order for the handheld parking meter to calculate the parking fee. Payment could proceed via cash, SnapScan or credit/debit card. The electronic payments will be processed using the handheld device whereas the cash payments will be processed manually with the payment recorded on the device.

Requirements

Both parking marshals and handheld parking meters are required in order to charge non-residence-disk-holders for parking. Information relating to the parking fee structure and supported payment methods should also be made available to the public beforehand.

In the event of illegal parking, the system needs to be able to track the license plate of the offender to allow government authorities to start parking offense legal action according to their by-laws.

Collection of Money from Parking Marshals

Description

Parking marshals would hand over the money generated at the end of their shift to the OCA. The OCA will have to commit to a set location to meet parking marshals and verify the amount given based on the records of the handheld parking meter.

Requirements

The OCA will have to check the recorded data on the handheld device to ensure no corruption has occurred.

Stringent screening of will be required to make sure parking marshals have the integrity to record every parking and parking transaction.

Sequence Diagram

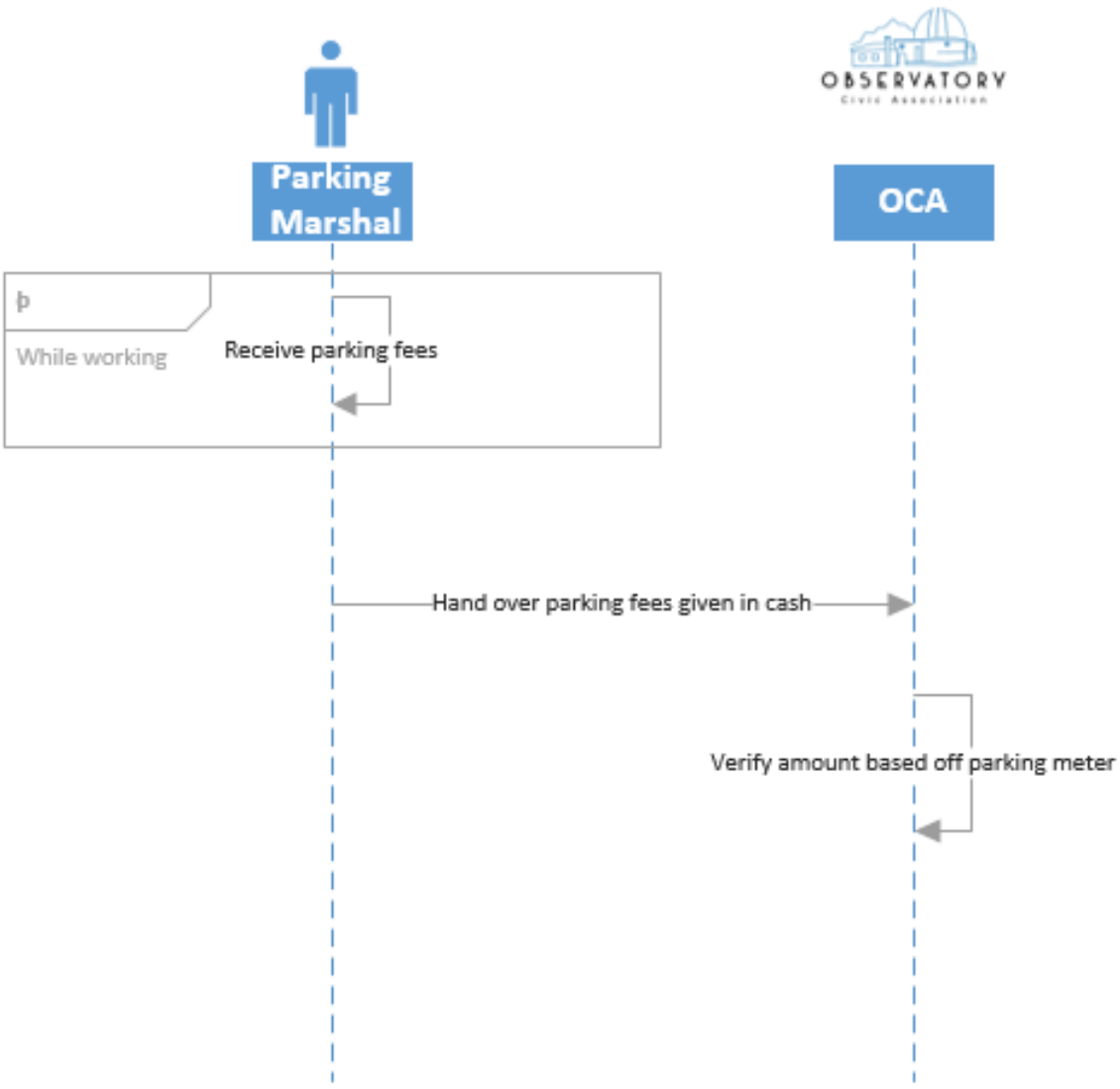

Figure 5: Collecting Money from Parking Assistant

Screening of Parking Marshals

Description

Proper screening of parking marshals is an important factor considering in order to minimise the probability of corruption, while also maximising the probability of having competent parking marshals. Work

During their work shift, parking marshals will have the following responsibilities of parking marshals would include the following:

- Scanning of vehicle registration number with the use of a handheld parking meter.
- Collecting payments from vehicle owners in the contexts of any of the supported payment methods.
- Issuing proof of payment in the case of paper slips, as well as electronic solutions (i.e. SMS / email).

The OCA would need to advertise the position of a parking marshal by means of their website, newspapers or notice board in community centres of Observatory. Prospective parking marshals would need to submit the CVs for reviewing by the OCA. The OCA would the schedule interviews with applicants that they deem fit for the role of a parking marshal. The physical interview should be focused on the context-related questions, i.e. potential real life situations should be presented to the candidates and their ability to resolve these problems would need to be assessed. After the conducting of an interview, the OCA would need to discuss and make comparisons in order to hire the best candidate for the position of a parking marshal.

Requirements

In order for the OCA to hire an applicant as a parking marshal, the applicant must satisfy the following requirements:

- Computer- or technology-literate
- Sufficient communication skills
- Time management skills
- High school degree
- OCA-member
- Integrity and honesty

Sequence Diagram

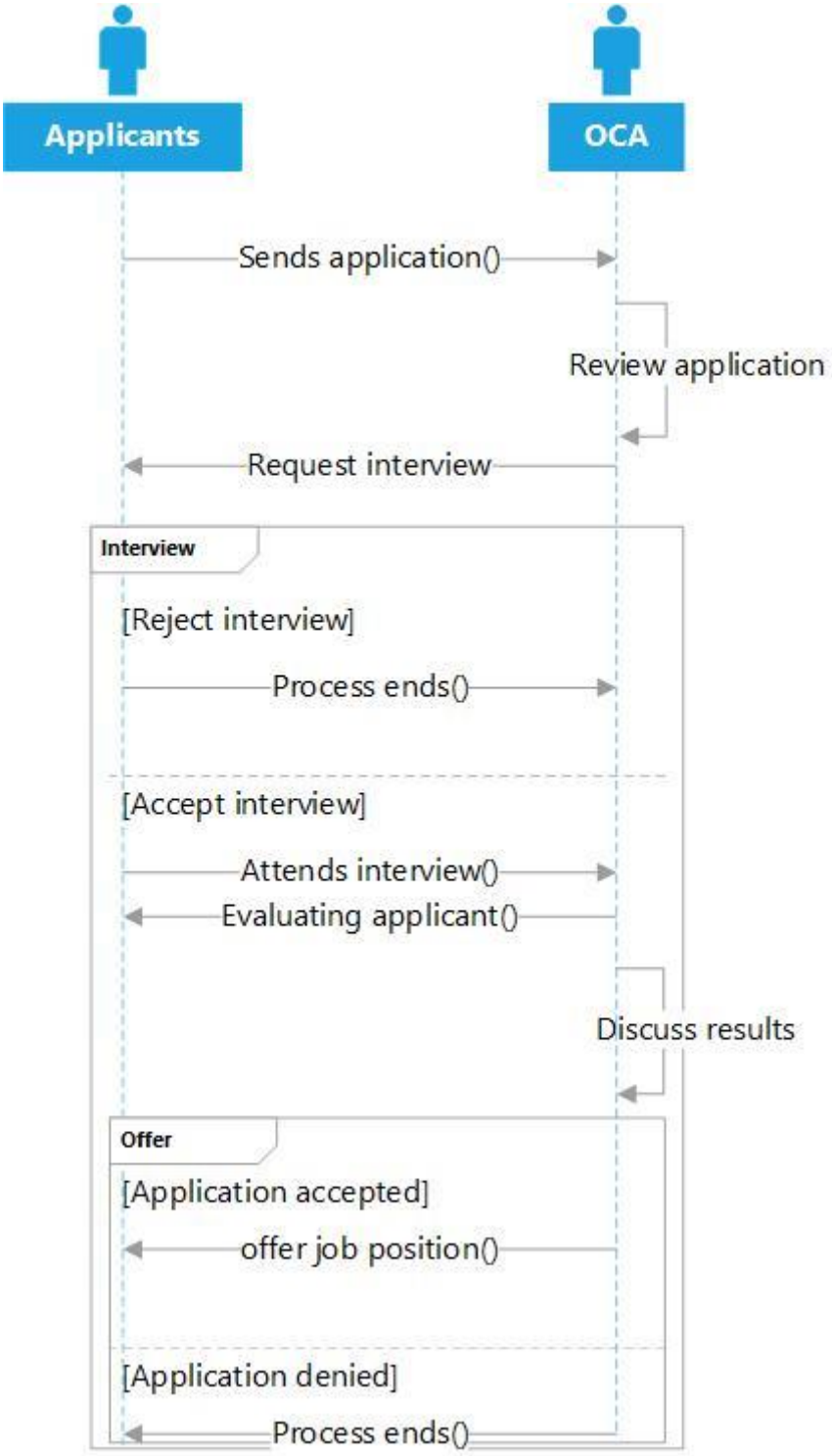

Figure 6: Screening Parking Marshals

Distribution of Profit

Description

Upon the generating of profit (i.e. generated revenue exceeding costs), the OCA could allocate profits to community projects in Observatory, such as with charity fundraisers, shelters for orphans and homeless adults, student health and awareness organisations, as well as the Rape Crisis Cape Town Trust, Cape Mental Health and the Kuyasa Fund -to name a few. The profits might also be used to provide more safety and better environment conditions. The community will benefit in many different dimensions from the spending by the OCA.

Requirements

In order for the OCA to distribute profits obtained from the proposed system to a local community project, service or charitable organisation, the following requirements should be in place:

- OCA should be sure that they are able to currently break-even as well as in the near future without the need of retaining these additional funds.
- OCA should prioritise and determine which community projects, services and charitable organisations are most in need and will benefit the most from the funds. The OCA will act in the greater good of the community.

Sequence Diagram

Figure 7: Screening Parking Marshals

Financial Requirements

Cost-Benefit Analysis

Development Costs	Year 0	Year 1	Year 2	Year 3
Handheld parking meters	-280000			
Residence disk production	-6000			
Database creation	-2000			
Parking marshal attire and equipment	3600			
Parking marshal screening	-6000			
Total	-290400			
Operational Costs	Year 0	Year 1	Year 2	Year 3
Parking marshal salary		-1095000	-1095000	-1095000
Administration wages		-10400	-5200	-2600
Equipment maintenance		-10000	-12000	-14400
Total	0	-1115400	-1112200	-1112000
Benefits	Year 0	Year 1	Year 2	Year 3
Parking fee revenue		1460000	1387000	1241000
OCA membership revenue		25000	45000	60000
Total	0	1485000	1432000	1301000
Cost Benefit Analysis	Year 0	Year 1	Year 2	Year 3
PV factor 2.5% [rate of return = 6.5(interest)-4(inflation)]	1	0.97561	0.951814	0.928599
Developmental Costs	-290400	0	0	0
Operational Costs	0	-1115400	-1112200	-1112000
Total Costs	-290400	-1115400	-1112200	-1112000
Benefits Derived	0	1485000	1432000	1301000
Net benefits	-290400	369600	319800	189000
Costs (time adjusted)	-290400	-1088195	-1058608	-1032603
Benefits Derived (time adjusted)	0	1448780	1362998	1208108
Net Present Value	-290400	360585	304390	175505
Cumulative Net Benefits (time adjusted)	-290400	70185	374576	550081
Return on Investment	15.85%			
Net present value	550080.9			
Internal Rate of Return	99.03%			
Payback Period	~9 months			

Parking Rate Structure

The suggested parking fees have been based off an analysis performed on popular Observatory restaurants and the average time spent there by consumers. The pricing model was also inspired by the parking structure used by the V&A Waterfront.

The following spreadsheet includes the supporting data:

Restaurant name	Peak period	Average time spent (hours)	Quiet days	Quiet days count	
A Touch of Madness	19:00-21:30	1.-3	mon, sun	Monday	12
Jerry's Burger Bar	20:00-22:00	0.75-2	mon	Tuesday	7
Cocoa Cha Chi	10:00-13:00	0.75-2	tues, wed	Wednesday	10
Mango Ginger	12:00-14:00	0.5-1.5	sat, closed on sun	Thursday	5
1890 House Sushi and Grill	19:00-21:00	0.75-1.5	closed on sun	Friday	1
Café Ganesh	21:00-00:00	1.-3	mon, tues, wed. closed on sun	Saturday	3
Sticky Fingers BBQ	19:00-21:00	1.-2	sun, mon, wed	Sunday	10
Pancho's	19:00-21:00	1.5-3	tues, wed, thurs, closed on sun and mon		
Linko Restaurant	Undefined	1.-2	wed, thurs		
Eagle Eye Spur Steak Ranch	19:00-21:00	1.-2	sun-thurs. fri		
Trenchtown	21:00-00:00	1.-3	tues		
Narona Pizza	Undefined	0.33-1.5	wed. mon, tues		
Big Momma's	19:00-21:00	0.33-1	mon, thurs		
Timbuktu	19:00-21:00	1.-2	sun, mon		
Obz Café	18:00-21:00	1-2.5	sat, sun. closed on mon		
Ground Zero Marley Coffee	11:00-13:00	1.-2	closed on sat		
Mr Lin's Sushi & Thai	19:00-21:00	1.-2	mon, wed		
Hello Sailor	Undefined	1.-2	tues, wed, closed on sun		
Edo Sushi Restaurant	19:00-21:00	1.-2	mon, wed. thurs		
KFC	Undefined	0.33-0.5	always popular		

The deduced daily rates are as follows:

Parking time	**Fee**
0 - 30 minutes	R5
30 minutes - 1 hour	R10
1 - 2 hours	R20
2 - 3 hours	R30
3 - 4 hours	R40
4- 5 hours	R60
5 - 6 hours	R80
6+ hours	R120

The fee structure is undoubtedly expensive considering most systems charge in the range of R2-R10. The fees, however, must be high enough to encourage public transport but low enough for people to still consider parking. Based off the analysis, we expect most people to only park for 1 to 3 hours, therefore we expect to receive R20 or R30 most of the time. The structure follows an exponential rate to further discourage longer parking times.

Interestingly, the higher the fee, the more likely that Observatory residents are to become an OCA member in order to avoid paying parking fees. This can help subsidise the costs involved although it would be recommended that the OCA increase the annual membership fee as extra value of being a member has been added.

It is understood that a fine balance must be struck as rates too high lead to underutilisation of parking space and encouragement of illegal parking, leading to further traffic congestion with the OCA struggling to cover costs. Rates too low will lead to excess demand which won't solve the issue of congestion.

The OCA can consider to make parking free on Sundays, Mondays and Wednesdays as those days are generally quiet and experience less congestion.

Legal Requirements

In order to implement this system, the OCA will need to request for a tender process for a handheld parking meter system, after which they would need to apply as a private partner. Once the Cape Town City Council has approved the tender process request and initiated the process, the Parking by-law concerning Observatory will be promulgated and the OCA will be able to apply as a private partner. The Cape Town City Council will then accept or reject the application based on pricing offered by the potential private partner, as well as other circumstantial factors.

Request for Tender Process

The OCA would need to convince Cape Town City Council that there is a need for the handheld parking meter system in Observatory. For this to be done, the OCA would need facilitate public participation, as well as present the traffic congestion issue to the Cape Town City Council, by addressing the contributing factors and negative consequences concerning the traffic congestion in Observatory. The OCA might also find it useful in their favour to involve a traffic engineer in order to prepare a traffic assessment, which will act as strong evidence for their argument that there is need to address traffic congestion in Observatory.

Apply as Private Partner

As a private partner for handheld parking system in South Africa, the OCA will be held responsible for:

- Appointing parking marshals
- Regulating parking marshals
- Material and maintenance costs (where an example of material cost will be that of the handheld parking meters; while maintenance costs will include maintaining)

Law enforcement will be responsible for taking legal action in the case of illegal activity concerning

When applying as a private partner, the OCA would need to present their terms of resident-disk-holders being given free-parking, request for data access concerning vehicle registration numbers, and state their fee for their service. The OCA would also be expected to present how the system will operate and the pricing structure that they will apply for parking by non-disk-holders. This pricing structure will also entail the issuing of resident disks.

Community Survey Results

A community survey has been conducted with Observatory residents in order to test the response of residents towards the residence disk and handheld parking meter system. The results have also provided a better understanding of the Observatory community with respect to their living environment, transport needs, experiences of traffic congestion and preferred payment methods. This has enabled improvements to be done to the solution and its prototypes such as to ensure a well-designed system. Unfortunately, the number of participants (18) is not statistically significant. Thus, no strong conclusions can be draw from the results. However, the results still provide a broad understanding. A sample size of 20% has a 22.4% margin of error, i.e. actual results can vary by 22.4% from conclusions drawn from findings, and thus one can still gain a broad understanding from the findings (https://www.sciencebuddies.org/). The survey also tested the usability of the proposed system. According to Nielsen, usability testing requires no more than 5 users (https://www.nngroup.com). In addition, a significant proportion of the population consists of students. The survey questions can be found in Appendix A, while the results will be discussed below.

Participants have been asked to rate the safety of the neighbourhood on a scale of 1 to 5, where 1 represented dangerous. Findings shows that only that 39% of the participants feel unsafe in the neighbourhood (see Figure 8). The presence of parking marshals and the security benefits associated with handheld parking meters. By introducing parking marshals to the streets, the majority (83%) of respondents would feel safer travelling in Observatory (see Figure 9).

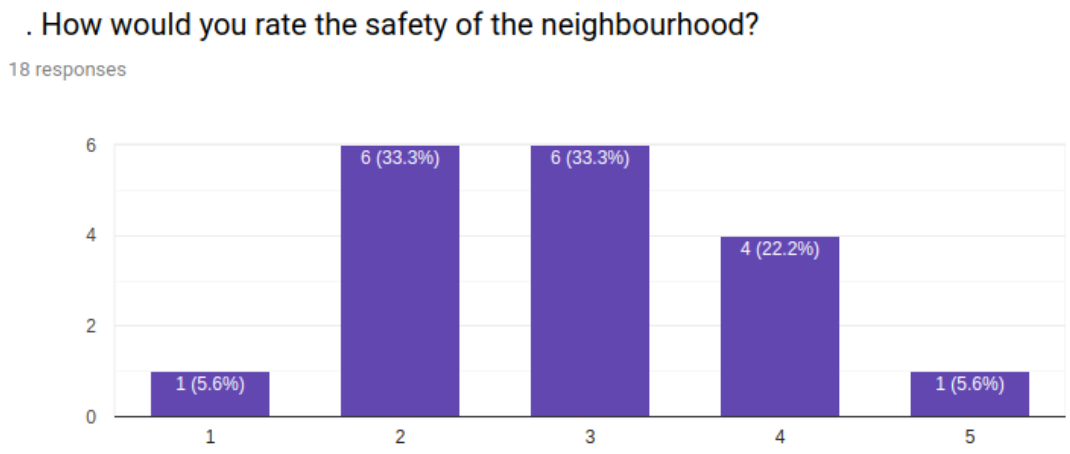

Figure 8

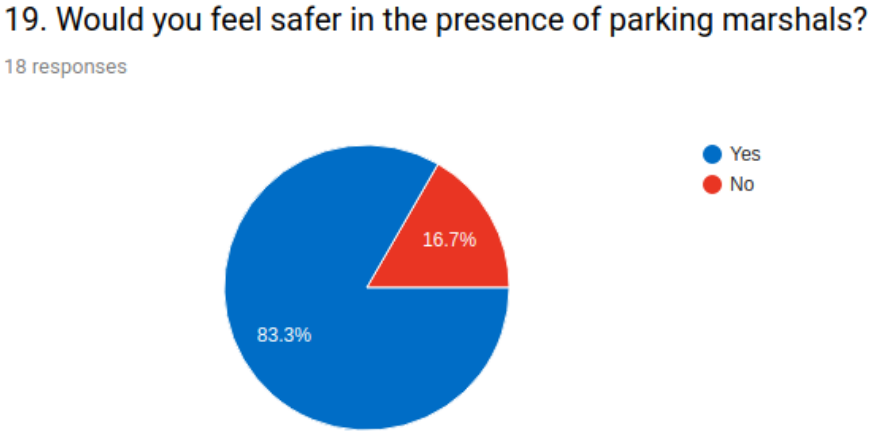

Figure 9

In order to gain a better understanding of vehicle ownership, participants have been asked indicate the number of vehicles they own. Findings shows a relative fair split among participants, with some having 1 vehicle, while others have not a single one (see Figure 10). This is not consistent with the fact that Observatory has traffic congestion problem. However, one needs to acknowledge that majority of participants are students. Thus, vehicle ownership is expected to be low among the group. In that light, the proportion owning a single vehicle can be considered quite high. The findings also call on further research with respect to the significance of the impact that public transport has on traffic congestion. Furthermore, this suggests network infrastructure as a significant contribute to the issue of traffic congestion. The majority (83%) of the respondents the main cause of the congestion is caused by road structures (see Figure 11). Moreover, given the fact that 39.8% of the respondents almost never use public, it is suggests a need to encourage the use of public transport among vehicle owners (see Figure 12).

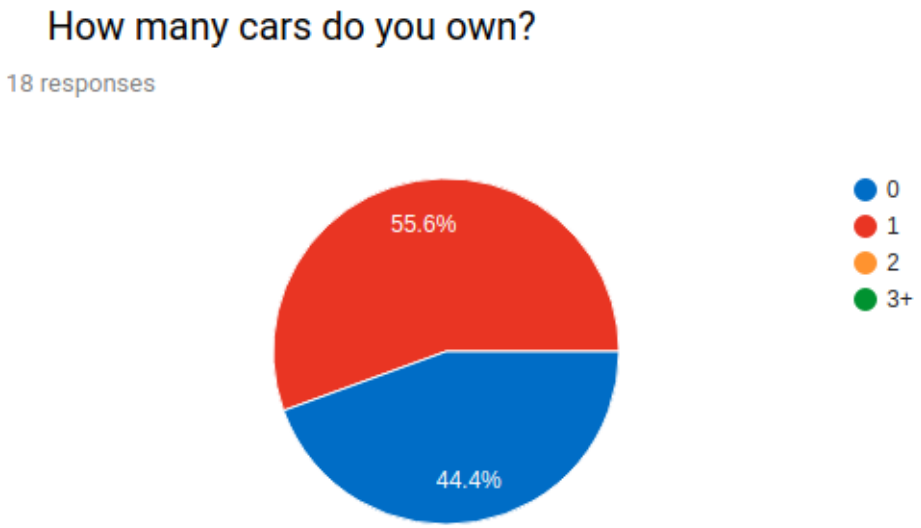

Figure 10

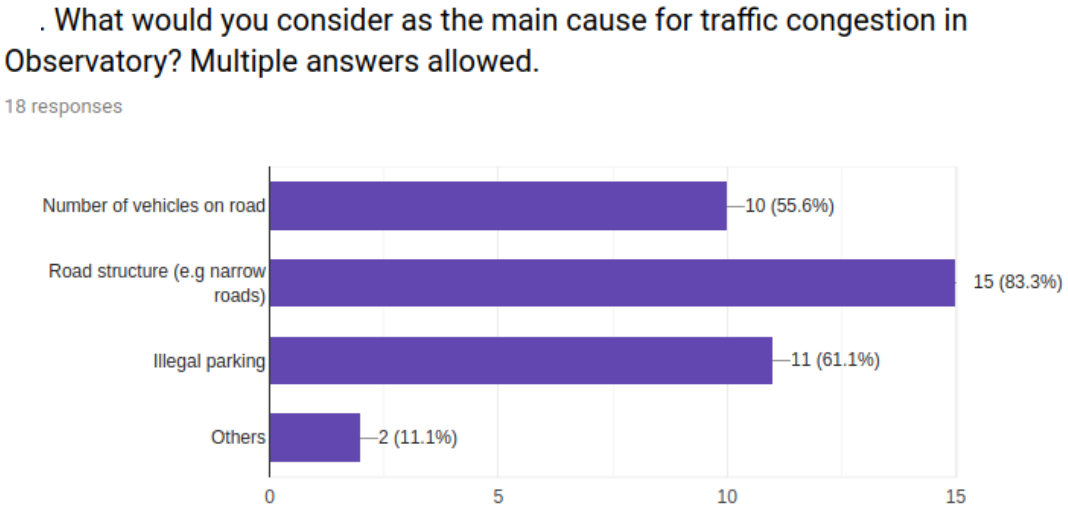

Figure 11

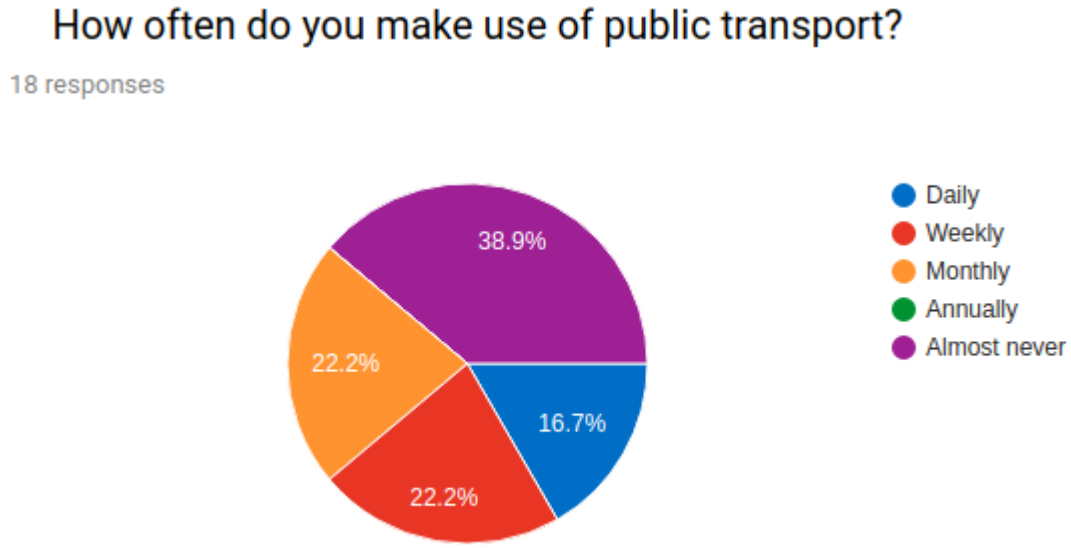

Figure 12

Findings from the survey shows that 88.1% of the respondents are willing to walk to places if the distance is less than 2 kilometres (see Figure 13). This can be considered as a positive indicator of the success of proposed system which relies on lowering the demand for roads (i.e. the number of vehicles) in order to incentivise the use of public transport.

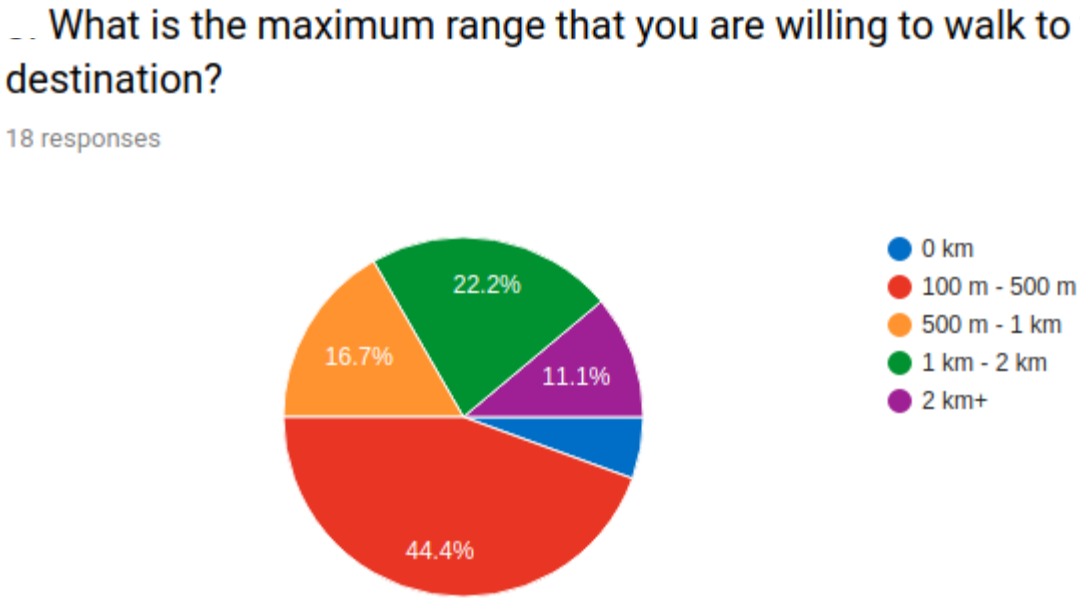

Figure 13

More than half of the respondents believe that the tourism sector will grow in the future (see Figure 14). This suggests an increase in the number of vehicles. This findings are in favour of the proposed system, since the charging non-residents for parking can help lower this number and rather incentivise the use of public transport.

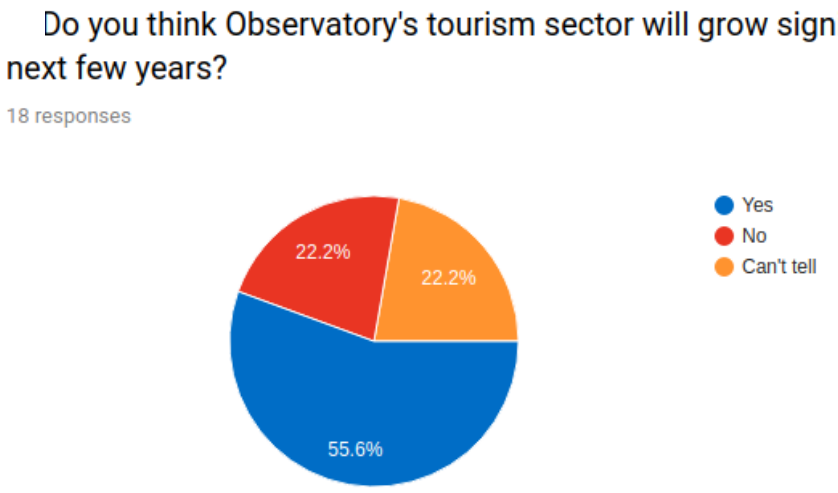

Figure 14

Only three of the participants are OCA members (see Figure 15). One needs to acknowledge the fact that the majority of the participant population are students. Nevertheless, this shows a further need for the implementation of the proposed system where residents are encourage to become an OCA member when applying for a free-parking residence disk, thus having great potential to increase OCA membership size.

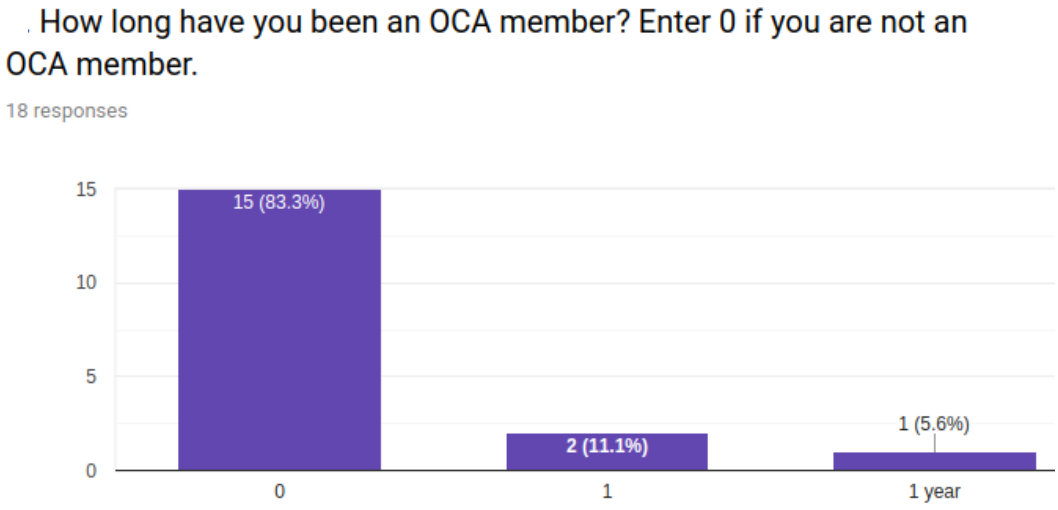

Figure 15

In order to assess whether Pepper Tree Square Parking would be an ideal location for the issuing of residence disks, participants have been asked to how often they park at or near Pepper Tree Square Parking. The majority response is “Almost Never”, thus not in favour of it being the location for the issuing of residence disks (see Figure 16). However, in retrospect, the survey question is poorly phrased as most participant might not even be aware where Pepper Tree Square Parking is. Therefore, the findings of this question should not be used as indicator of whether Pepper Tree Square Parking would be an ideal location.

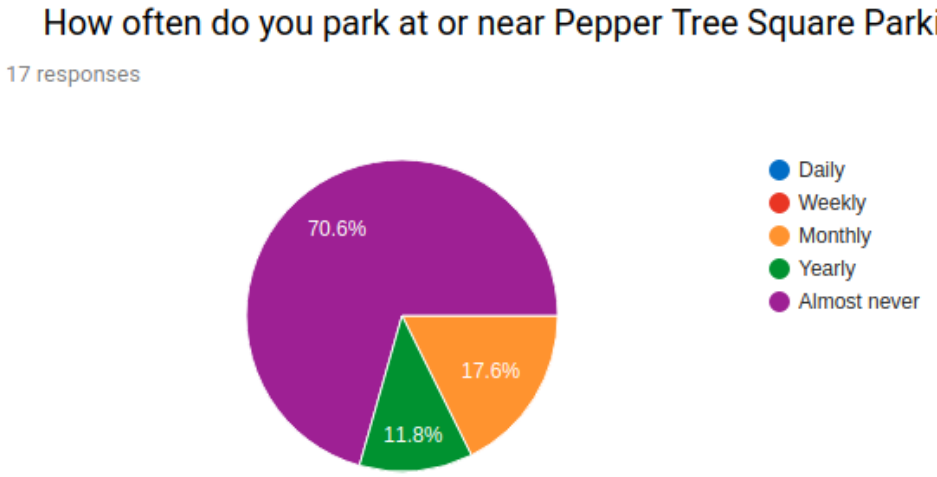

Figure 16

Responses shows 72.2% of the participants experiencing traffic congestion in Observatory on a daily bases, supporting the significance of the problem of traffic congestion in Observatory (see Figure 17). Majority also feels a need to address this issue (see Figure 18). Findings also shows that participant experience traffic congestion at its worst between 15:00 to 19:00. This is consistent with a Traffic Predictions Report (that is based on Google's traffic forecast for the area of focus) which can be seen in Figure 19. Majority of respondents also experienced traffic at its worst in the area of scope (see Figure 2 for area).

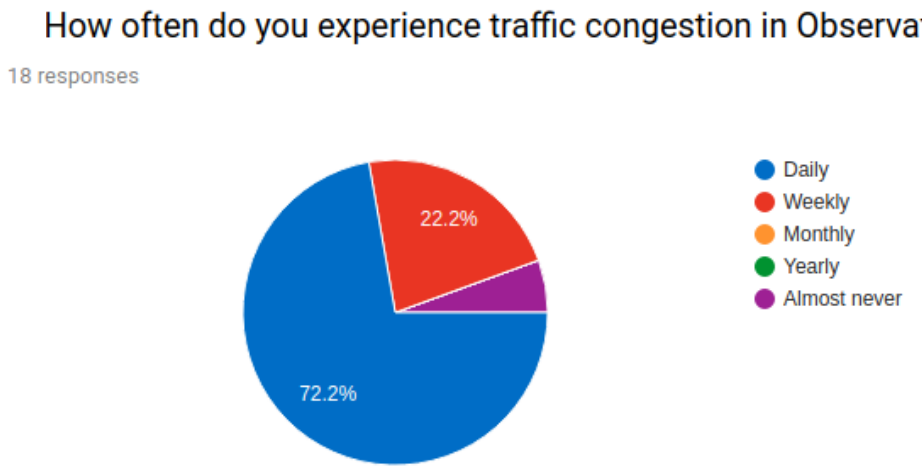

Figure 17

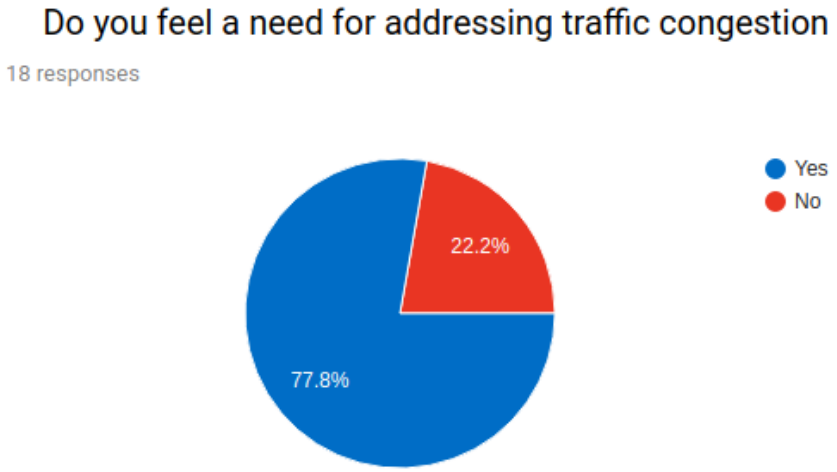

Figure 18

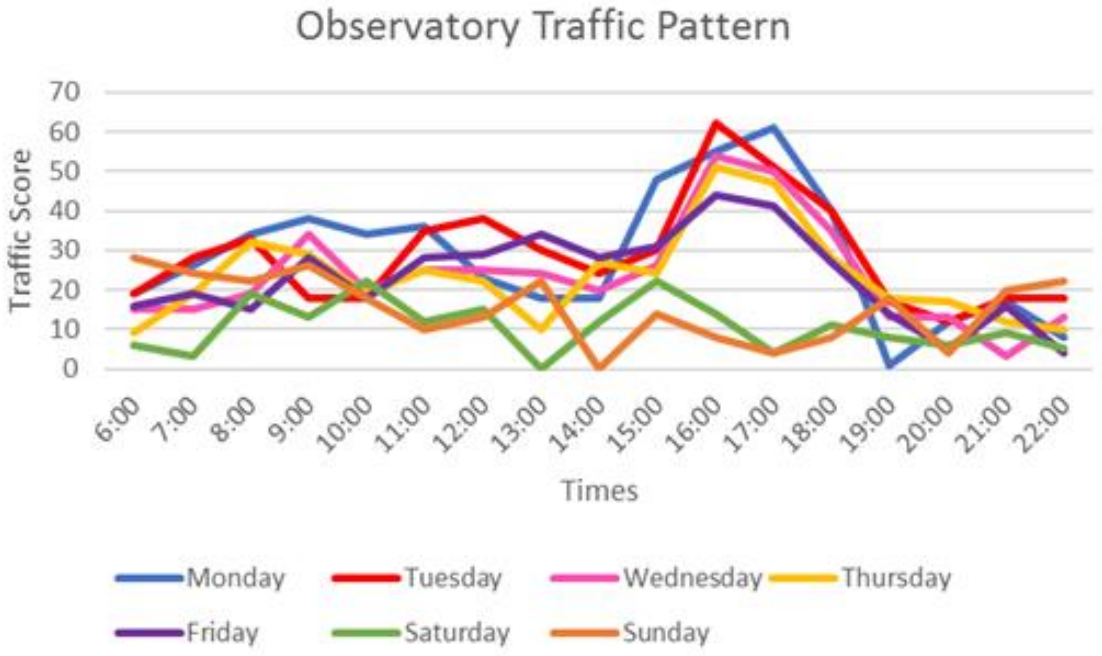

Figure 29: Current Observatory Traffic Pattern for different times of the week where Traffic Score = 33 + Orange Pixels + (2 x Red Pixels) – Green Pixels

Findings indicate a need to support most types of payment methods (cash, mobile, card, prepaid parking credits) for parking, but especially mobile payment (see Figure 20), when implementing the proposed system when non-residents are charged for parking. This is also supported by the findings showing that only 61.1% of the participants still carry cash on hand (see Figure 21).

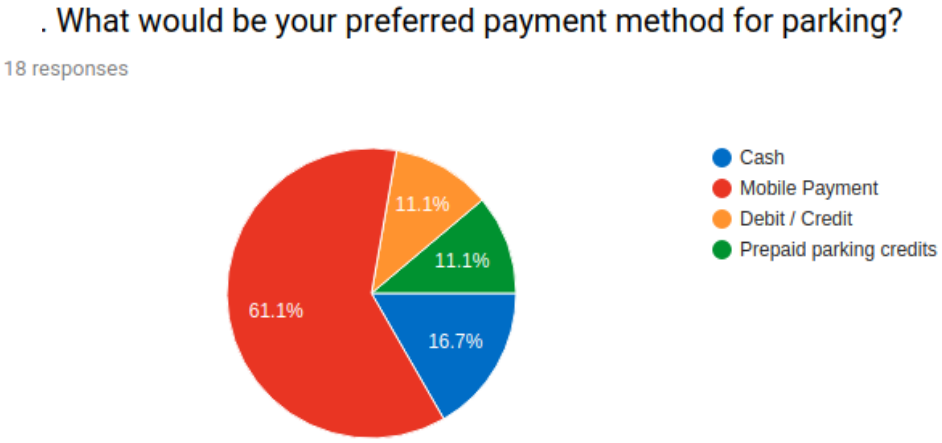

Figure 20

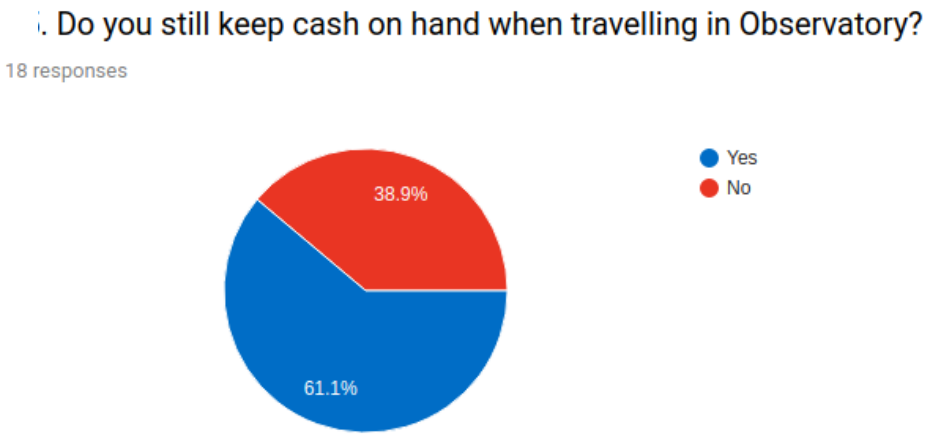

Figure 21

Vast majority (77.8%) of the respondents would want a proof of payment for parking in an electronic form (i.e. SMS or email), thus this needs to be taken into account when implementing the system (see Figure 22).

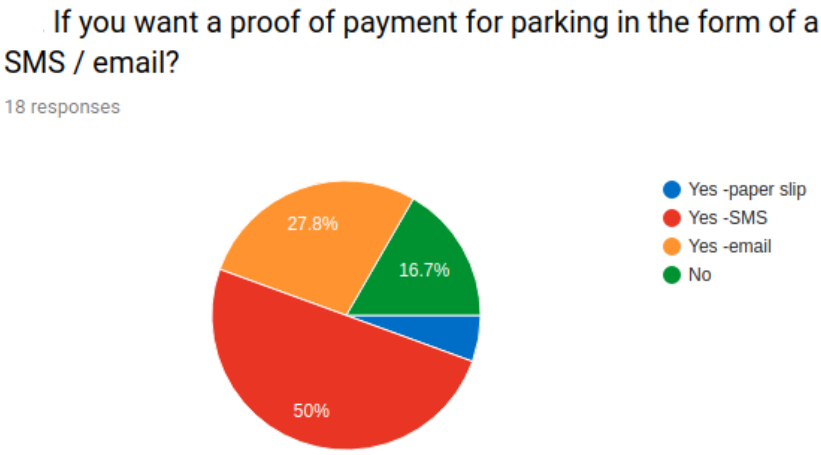

Figure 22

Additional finding in favour of the success of the proposed system is that of 83% of respondents indicating that they would take the initiative to acquire a free-parking residence disk (see Figure 23).

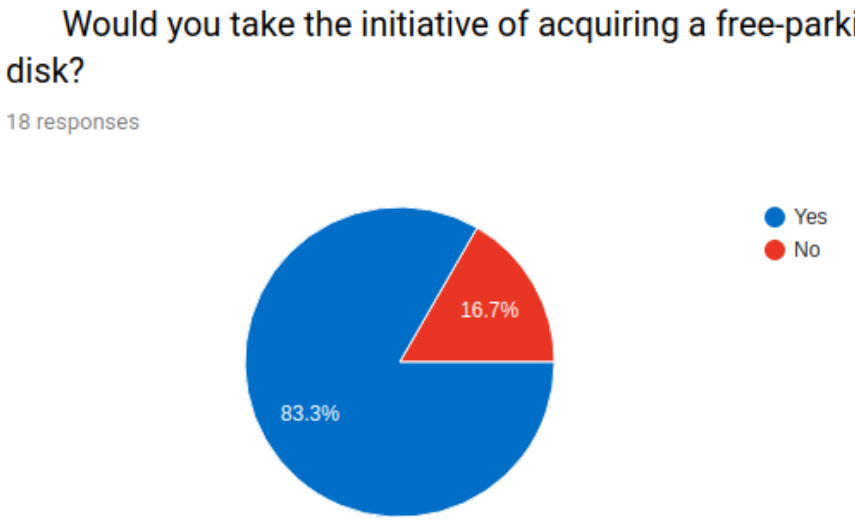

Figure 23

Majority (83.3%) of participants supports charging non-residents for parking if funds are used for local community projects, suggesting there is a need to invest in community project (see Figure 24). One also needs to account for the fact the entire participant population is that of Observatory residents.

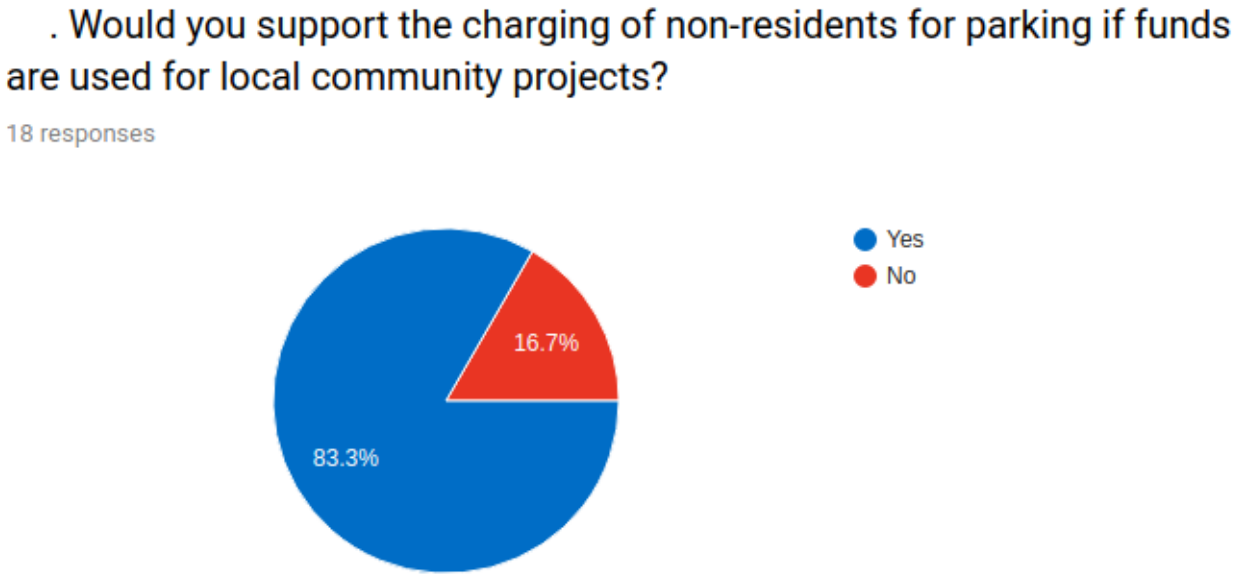

Figure 24

Lastly, findings shows that 88.9% of the participants would feel comfortable with their information being stored when being aware of the associated safety and security benefits (see Figure 25). This shows it is important that the vehicle owners understand these benefits. This also indicates a positive response towards the implementation of the proposed system.

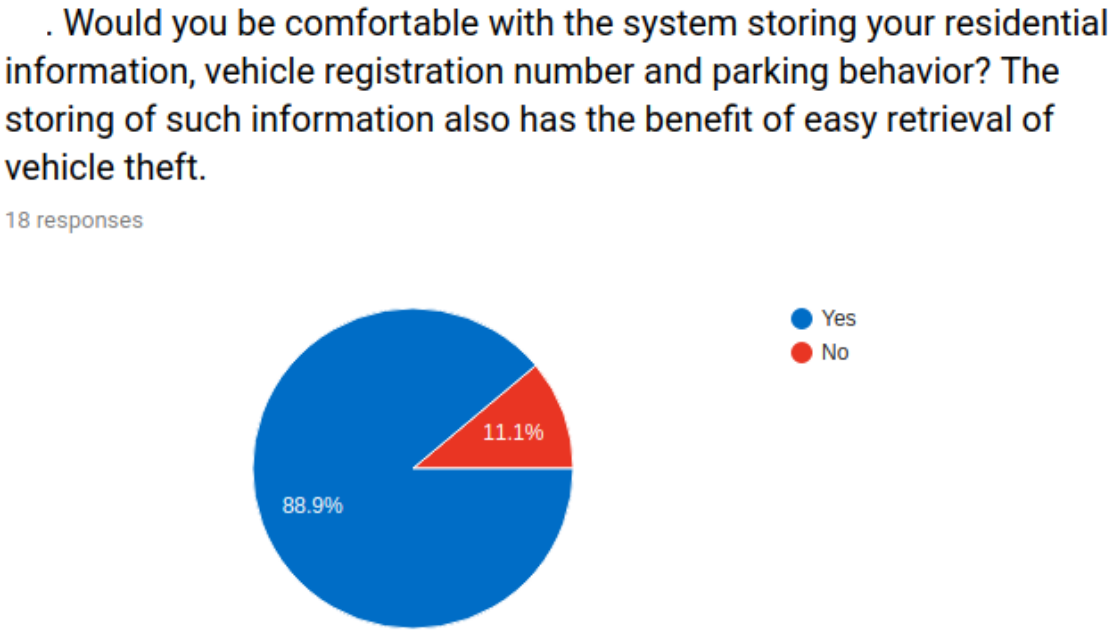

Figure 25

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Image References:

Cover Page: http://www.capetown.travel/wp-content/uploads/2017/12/Neighbourhoods-Observatory-Observatory-Street-Neighborhood-by-Hillary-Fox.jpg.jpg

Observatory Survey

Good day

This survey is being conducted by a group of students at the University of Cape Town (UCT) for an Information System project. The project focuses on traffic congestion in Observatory and assessing the viability of implementing a handheld parking meter system in the notorious restaurant and shopping area. This system would then aim to create an incentive for the use of public transport by charging for parking, but in this proposed system by university students, Observatory residents will benefit from being able to apply for free-parking residence disks.

This survey aims to gain a better understanding of the Observatory community especially with regard to their living environment, transport needs, experiences of traffic congestion, preferred payment methods and their thoughts regarding this system. Your contribution by completing the survey would be of great value and very much appreciated.

Please note that this survey is only conducted for university process.

* Required

1. **How would you rate the safety of the neighbourhood?** *

Mark only one oval.

	1	2	3	4	5	
Dangerous	◯	◯	◯	◯	◯	Safe

2. **How many cars do you own?** *

Mark only one oval.

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3+

3. **What is the maximum range that you are willing to walk to your destination?** *

Mark only one oval.

- ◯ 0 km
- ◯ 100 m - 500 m
- ◯ 500 m - 1 km
- ◯ 1 km - 2 km
- ◯ 2 km+

4. 4. **How often do you make use of public transport?** *

Mark only one oval.

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Annually

4. **Do you think Observatory's tourism sector will grow significantly in the next few years?** *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Can't tell

5. **How long have you been an OCA member?**
Enter 0 if you are not an OCA member.

_____

6. **How often do you park at or near Pepper Tree Square Parking**

Mark only one oval.

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Yearly
- ◯ Almost never

7. **How often do you experience traffic congestion in Observatory?** *

Mark only one oval.

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Yearly
- ◯ Almost never

8. **Do you feel a need for addressing traffic congestion in Observatory?** *

Mark only one oval.

- ◯ Yes
- ◯ No

9. **Where do you experience traffic congestion at its worst?**

_____

10. **When do you experience traffic congestion at its worst?**

_____

11. What would you consider as the main cause for traffic congestion in Observatory? Multiple answers allowed. *

Check all that apply.

- [ ] Number of vehicles on road
- [ ] Road structure (e.g narrow roads)
- [ ] Illegal parking
- [ ] Others

12. What would be your preferred payment method for parking? *

Mark only one oval.

- ◯ Cash
- ◯ Mobile Payment
- ◯ Debit / Credit
- ◯ Prepaid parking credits
- ◯ Other: _____

13. Do you want a proof of payment for parking in the form of a slip / SMS / email? *

Mark only one oval.

- ◯ Yes -paper slip
- ◯ Yes -SMS
- ◯ Yes -email
- ◯ No

14. Do you still keep cash on hand when travelling in Observatory? *

Mark only one oval.

- ◯ Yes
- ◯ No

15. Would you take the initiative of acquiring a free-parking residence disk? *

Mark only one oval.

- ◯ Yes
- ◯ No

16. Would you support the charging of non-residents for parking if funds are used for local community projects? *

Mark only one oval.

- ◯ Yes
- ◯ No

17. Would you be comfortable with the system storing your residential information, vehicle registration number and parking behavior? The storing of such information also has the benefit of easy retrieval of vehicle theft. *

Mark only one oval.

- ◯ Yes
- ◯ No

18. Would you feel safer in the presence of parking marshals? *

Mark only one oval.

- Yes
- No