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Final Year Project Report

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‘Penalty Charge Notice Semi-automated Payment System’ Desktop Application Integrating UI Path for Automation Called ‘PCN-Payer’.

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# Abstract

With data showing that over 100,000 Parking Charge Notices being issued in Redbridge council a year. And with these coming with deadlines where if paid in the first 14 days of issue the registered owner could save 50% of the charge. If paid after 28 days the registered owner will pay 50% more and this charge going higher and higher until it is paid off. The aim of this project was to design and develop a system in which would make this process quicker and easier so that people who receive these tickets could save more money. The aim was to create an automation that would complete the online payment form quicker than the user. The automation was developed using UI Path and was designed to have a login system where users could save their payment and personal data so that they wouldn’t have to enter it during the process and could use the system repeatedly.

This Report will outline the design and development of this application going into details of the methods used for the entirety of this project and any changes that were made to the design with justification. Any online resource used and any literature used will have also been mentioned below. This report will conclude with the final product and outcome of this project.

# 1 Introduction

Most people who drive a car in London understand the pain when one sees a parking charge notice pop out when checking their posts. Londoners live a busy life if were not at school or at work were out with friends and family. We are all on a grind living life to the fullest. All that momentum and joy shoots down when we get ready to pay the fines we have. Some fines increase in price because were too busy to pay them and forget. What if there was an application that would automate this task. An application where all you needed to do was login and submit 1 or 2 details rather then filling in the whole form over and over again . In the Parking Annual Report published by Redbridge Council 2017/2018 the number of PCNs issued across London had increased by 9.43% to around 5,616,402. In just Redbridge alone the number of PCNs rose from 131,422 to 164,126 in 2017/2018. There may have been a reduction of tickets issued during the pandemic however now that nearly everything is back to normal the trend me continue. Having a simpler way of paying for these tickets fast would benefit the residents and visitors of Redbridge council roughly around 150,000 times a year.

For the purposes of this report the application will be referred to as PCN Payer.

The contents of all headings labelled with a 1… have been copied from the Project Definition Document (PDD) and have been modified slightly. (Appendix A)

## 1.1 Problem to be solved

For the purpose of this project, the implementation will be limited to only The Redbridge Council and only a few options for each payment method, however this will serve as a proof of concept, and may be scaled to larger establishments and entirely different domains.

As people who are busy with our daily lives, we use social media as a form to keep us all connected, but this distracts us from focusing on the task that we have time limits on. As Londoners who drive we understand how frustrating it has become to avoid paying for charges like the Dartford charge, ULEZ daily charge and the congestion charge in central London. Caught up in the busy Londoner life we sometimes park in places where we shouldn’t and end up getting PCN (Penalty Charge Notice) tickets in the post.

A few of us are great at quickly paying it and reap the benefits of paying only half price of the charge but there are many of us who miss the 14-day window and end up having to pay the full price and in some cases 50% or more on top of the original fine. The tiresome task of paying a fine could be avoided if there was an application to do it all for us. Its purpose would be to simplify paying a parking fine so that we could save money by not paying our tickets late. It will also allow us to see where we are getting the tickets and what we can do to avoid them. There are no current Applications that I had found on the market to help users pay for there tickets quicker than to directly pay on the council website. This gap in the market which could benefit from over 100,000 potential use-cases alone in the recipients of Redbridge issued PCNs

### 1.1.1 Problems

|  |  |
| --- | --- |
| Problem | Solution |
| Some people don’t have the time to pay for the ticket | The app will reduce the time needed to pay for the ticket drastically making it easier and simple to pay the fines |
| Paying the fine late ends up costing more | The app can use just a photo to pay for the fine so no need to keep the paper with you and as it is simple and easy as soon as you see it you could pay it under 2 minutes |
| The task is boring and sometimes people just want to put off paying it | The app will allow for quick payment so it would be perfect for people who are very busy |
| No one website for all different boroughs | The app will simplify this through either image recognition of with a simple drop-down tab so all websites in one place. |

To achieve these solutions external / third party technologies maybe needed. An online Information storage system / online database may also be needed.

1. Python’s newest version or same version as the programme must be installed on the user’s Computer / Laptop.
2. Using PIP or manual download, install the following:
   1. Tkinter
   2. MySQL. Connector
   3. Selenium
   4. Chromedriver\_autoinstaller
   5. Re
3. Have the latest version of Google Chrome downloaded and set up.
4. Have MySQL downloaded and setup :
   1. MySQL Workbench 8.0 CE
   2. MySQL Shell
   3. MySQL Installer – Community
   4. Set up the MySQL Database used by the application by running the provided SQL file with all structural setup code on MySQL Workbench 8.0 CE.
5. Have The PCN Payer Setup application downloaded; used to download the PCN Payer desktop application.

## 1.3 Objectives

### 1.3.1 Primary Objective

1. To provide a quick and easy to use application to allow people to pay for their parking fines/ penalty charge notices all in one place.
2. To simplify the process of paying these fines and provide a way for users to see all previously paid for tickets.
3. Remove the need for users to repeatedly input their personal and payment details
4. Email the users a copy of their receipts to confirm the payment.
5. Allow the user to view the automation so they can see the process so that they are certain of the completion of the process and any errors along the way.

### 1.3.2 Secondary Objectives

To provide the functionality of other tasks that could be done on the payment websites through the app. For example:

1. Be able to send an appeal for the penalty charge
2. Be able to see the images of the vehicle in question through the application.

## 1.4 Project Beneficiaries

2 beneficiaries have been highlighted below:

Users will be able to pay their parking fines quicker which would save them their hard-earned money by paying before the 14-day period, so they only have to pay 50% of the fine. Users will be introduced with an application that allows them to pay for any London based penalty charge without needing to look through the documents sent in the post for a website.

The Councils will benefit from this as they will receive their payments quicker. The intended use of this application is to simplify the payment process for users so if they use it during the first 14 days of the issue of the ticket the council will revive this money quicker and may serve as a partial-deterrent to users to reduce the number of times they commit PCN ticket worthy acts.

## 1.5 Work Performed

Throughout the planning, design and development of PCN Payer, the agile methodology was adopted. There were 3 workstreams in which I developed the separate sections needed for the application to work. The first workstream focused on the User Interface (UI) Path which was mainly the back-end part of this application. This was the section that took the longest duration to work on as I had to do a lot of research to make sure that I understood the ‘selenium’ library, I already knew how to code in python but I was very new to the syntax and functions of this and other libraries used. The second workstream focused on the other back-end section of the programme, the database. I had past experience in SQL however setting up the server at data storage tables to work with the UI Path code was fairly tricky. I had started to merge these workstreams towards the end however I decided it would be easier to start the third workstream first as it would be easier and would require less changes. The third workstream was the Graphical User Interface (GUI) which also took time to learn as I wanted most of the code to be in python I chose to use the Tkinter library as this is the standard GUI library for python. Messing around with the GUI code so the correct pages would appear at the correct time and that they were all structured correctly was difficult to manage as the library doesn’t have the same flexibility as working with website design.

## 1.6 Assumptions

I had a different structure in mind for the application as I thought that it would be better to use automation through mobile devices. This was backed up by the fact that there were a plethora of articles and videos on the internet to explain each stage step by step. I had decided to change the platform on which my application was based on from an android application to a desktop/windows application as I realised it would be better if the user could see the automation in front of them as they could see that it was working and correct any errors as it went on. This approach meant that the application would not need any online based servers at the time.

I had also assumed that merging the MySQL database on the local MySQL Server written in SQL with the UI Path written in Python would be hard to merge as I didn’t have any prior knowledge of this and how it was done. The hours spent on research opened my mind to how easy this was and all it required was to install a new python library called ‘MySQL. Connector’ which enabled the python programme to connect to the server and to then send and receive data used to create new users and store user data.

## 1.7 Substantial Changes to Project Definition Document (PDD)

The most substantial change made in comparison to the PDD was that I changed the platform in which the application would run. Initially I had the idea to design it in a way that my laptop would work as a server where a mobile application would send and receive data through the internet but this was tricky as there was less security in this method as users would be sending personal data to an unsecure server through the internet. This was the integrity of data security would not be maintained and for this reason I decided to create a local version of my application where users could download and set up the application in under 5 minutes and use at home their selves. Although this system may seem less useable the idea was that most people would receive the PCN’s at home or would be driving to or from work/home where once they reached they could go on to their laptops/computers and quickly pay for their tickets most people have access to a laptop or computer at home or work. The functionality where users could see the photos taken by the ‘Ticket Enforcement Agents’ would still be maintained as users have a few seconds to have a quick glance at them during the automation where I have coded a very brief pause for the benefit of the user.

Another change made was the amount of functionalities the application provided as my main aim would not have been to the best standard if I was focused on the other smaller parts of the application. Functionalities like an option for users to appeal their PCN’s and or for users to be able to change their details that were stored on the database. I decided that this would all be added If I chose to update the current version and make a version 2.0. I believed that limiting the scope of this project allowed me to focus on the smaller things important for the main functions of the programme like selective data validity checking so that users would not add incorrect data when creating a new account. I had started on some back end functionalities which would mean that only a small update to the python code would be needed to introduce new functionalities; I have added a PCN-ticket table in the database already so that users would only need to update the application and not the local MySQL servers in their laptops.

I also decided not to introduce the feature for users to receive emails quarterly/annually as most people receive less than 12 tickets a year and most of them know where they got their tickets. Instead using the already provided functionality of the council website I decided to add the functionality where once the user paid for the ticket the confirmation would be sent via email to the user provided email when creating an account.

# 2 Output Summary

## 2.1 Computer/Windows Application

|  |  |
| --- | --- |
| Description | The Output of this project source code which could be compiled by most computer/ laptop text editors if python is installed on the computer however I compiled it in IntelliJ Idea Community Edition. Is an computer/Laptop based application which can be downloaded using a provided installer that I have set up for recipients to download and install PCN Payer through but will require the database to be set up for use. The application is an .exe executable file which once clicked opens up the application without the need of any text editor. Only the mentioned libraries and python is required for it to run. This will allow users |
| Output Type | This is the Application consisting of around 660 lines of Python code using 5 libraries (not counting comments and a few spaces in between). The 660 lines includes 11 interconnected functions needed for function of the application. Of the 660 lines of python code around 640 lines of code were written by me and around 20 lines copied using online sources. Research was used to write the remaining 640 lines which have influence from some research sources such as YouTube tutorials. The research / external sources are mentioned in the results section below. The complete version will be submitted via Moodle with all external sources mention here and all files needed to set up and run the Application. |
| Intended recipient | Currently any internal testers who own a windows laptop/computer with the installed application and are willing to set up the MySQL Server using provided SQL set up file. In the future after some tweaks any person who lives in , works at or drives through the Redbridge council. They will benefit from this if they get tickets often as this is a faster and easier way to pay for PCN’s once set up. |
| Results Link | More details can be found : |
| Appendix Link | More details can be found: |

## 2.2 Database

|  |  |
| --- | --- |
| Description | A Database used to save user data for running the automation. The database is altered through the application where the application reads and writes data to authenticate existing users and or create new ones. |
| Output Type | SQL Code; 94 lines of code which was auto-generated by MySQL Workbench 8.0 CE from the existing database I created in sections using the help of a tool in Visual Paradigm 16.3. Which I then altered to fit my needs. No code was copied from any online/external source. |
| Intended recipient | Will be used as part of the data store for the complete windows laptop application. This is needed for the application to run |
| Results Link | More details can be found : |
| Appendix Link | More details can be found: |

## 2.2 PCN Payer executable file (.exe)

|  |  |
| --- | --- |
| Description | An executable file which will after downloading allow the user to set up part of the application. This is so that users will interact with the application as like any other application; just open it and go from there no need to set up again on anything else. |
| Output Type | An executable file that is used to install and set up part of the application. This was generated using a third party application called Inno setup complier. |
| Intended recipient | Will be used as the set up executable file to download the application and partially set up its necessary files on the computer/laptop |
| Results Link | More details can be found : |
| Appendix Link | More details can be found: |

# 3 Literature Review

## 3.1 Methodology

Not having the best experience in using software development methodologies I initially spent time researching the different types of methodologies to see which one would work the best for me and for what I had intended my application to be capable of. I had some knowledge about the waterfall methodology as this was the easiest to understand and followed a step by step process. The methodology has a simple structure and understandable but creates a rigid framework for development and causes some resistance to make any changes during the development of the project.

The Agile development methodology provides more flexibility to change parts of the project that don’t fit in well with what I have intended for the project and also allows me to change and or remove some parts of the project which create difficulties when developing and testing. This cyclical methodology was the one I chose because of its flexibility. The development of this project relied on no tester/user feedback and therefore was mainly focused on improving the application through numerous test to make sure there were no major errors and or problems with the back end.

With the advantages of agile methodology with changes to fit my project needs the methodology allowed me to make numerous changes in the project with every development and test cycle.

## 3.2 Similar products

From my research I could not find any products that had similar functionality to the functionality I had envisioned for my project. I searched for numerous application on the apple store and on the play store and could not find any. I tried looking for web apps as well but they also did not have any similarity in my proposed functionality. Most applications I did find were about paying for parking where the companies either owned or managed the parking spaces. My idea was to create an application which allowed users to pay for parking fines as the councils were still stuck on the old fashioned way of paying by phone or website both requiring users to take a lot more time out of their day to do so. The market was nowhere near saturated with similar products and my product would be one of one.

## 3.3 Programming languages

When developing an application developers have to decide which programming language to use. Mainly Java or kotlin is used for android applications however for desktop applications java is most commonly used. Previous use of java for developing games led me to believe this was the best choice but when researching UI path the modules available in python seemed much more easier to use. Python was much more easier to learn and code in as there was a plethora of YouTube videos and online articles explaining how to use UI Path which was the backbone of my project.

Python has many benefits as it is dynamically typed which means variables don’t have to be assigned, it is automatically assigned a data type during execution and has improved productivity as users don’t have to spend too much time on learning syntax and rather work on the problem at hand. Its vast library support and ease to download and import libraries means that it is almost certain that you could find functions to fit your task. Using pip (Python Package Manager) is really easy and simplifies the exhausting tasks of downloading libraries and changing system variable like java requires users to do.

## 3.4 Solution Architecture

### 3.4.1 IDE

UI Paths can be created using various IDEs and they all work very similarly but as I had past experience with IntelliJ community edition. I chose it to be the one that I would use to develop my code. The coding assistance with its easy to navigate menu feature really stands out but the game changer is where its error analysis comes to play. With just one search with the clear in-depth error analysis the user could find a web article or YouTube video explaining the cause of the problem and how to fix it. Having used this IDE before meant that this was my go to for this project. The internet is mostly unanimous with agreeing that PyCharm is a better IDE to use when programming in Python however ‘stackshare.io’(updated May 2022) also agrees that the ‘on-the-fly Code analysis’ of IntelliJ IDEA and its ‘advanced refactoring’ is reason why some people chose it over PyCharm. I had the past experience and really liked the way my IntelliJ IDEA was set up and therefore it was a simple choice at the end.

### 3.4.2 Database/ Database Management System

With the plethora of options available both for online and offline use the choice wasn’t easy at the start. I had some past experience with using MySQL Workbench last year which made me lean slightly in that direction. The main functionality that I required from my database choice was that I could connect my Python code to it and or receive or send data from my python code fairly easily and fast. When researching I saw that MySQL community edition came with its own server application and a few extras which made me think that it was a well rounded software. Upon Further investigation I realised I was looking for a database management system rather than the database its self and the large number of options out there was making it harder for me to choose one. I started researching through YouTube tutorials and saw that there were many using MySQL Workbench. For that reason I decided to stick with it and started using it for the creation and management of my database.

# 4 Method

## 4.1 Development Methodology

Continuing on from section 3.1 the Agile methodology was beneficial for the project as ‘the agile development methodology minimises risks’(Synopsis.com 2017). As the software was developed in iterations adding new features step by step this meant that I could easily pin point any new errors as I would not move onto the next functionality without completing the previous one. My approach was somewhat different to this methodology as I had started the development of the software with very loose plans as I knew that there were going to be complications where it would be easier to change the requirement rather than to keep working on the complications and thus wasting valuable time.

This is where parts of the Rapid Application Development (RAD) methodology where starting to show. ‘This RAD process allows our developers to quickly adjust to shifting requirements in a fast-paced and constantly changing market’(Synopsis.com 2017). The constantly changing of requirements was needed to be able to produce a high quality application in a short period of time. This was easily done as I was working on this by myself; I would do this differently if working in a group as a clearer set of requirements would be needed. The application has always been end user focused however as their was no user feedback I had to manage with the resources I had and therefore depended on thoroughly testing and re-testing every section of the application to provide a robust application.

Using Agile Scrum Methodology meant that the workload was manageable as the development of the project was broken down into sprints. ‘Scrum is one of the many types of agile methodology, known for breaking projects down into sizable chunks called “sprints.” Agile scrum methodology is good for businesses that need to finish specific projects quickly’(Businessnewsdaily.com, 2021). Here I was able to develop the application incrementally as I had broken the workload down into 3 separate yet interdependent workflows. The first being the UI Path used for the back end of the application where all the automation would be done. When this was possible incrementally developing the second workflow, the database to accommodate for the information that would be needed to be stored for the automation to work fast. Then when both were working fine and at a stage where no changes were necessary I started to work on the GUI workflow. This was where Increments had to be broken down into smaller increments as small changes could make or break the application. After the application was working I was able to start the fourth sprint where I could add additional features like adding a new account so that the application could be well rounded overall. Each Development sprint lasted an average of around 20-30 days and the last sprint to make final stage tweaks took around 10 days.

These sprints saved me a lot of time as I did not have to waste as much time finding bugs and fixing them as every time I found an error I would simply revert to my last save and work back up from there. When a sprint was completed I was rigorously tested to make sure no errors/bugs were transferred over to the next development sprint.

## 4.2 Implementation

## 4.2.1 Software Used for Design and Development

|  |  |
| --- | --- |
| Software | Why and how it was used during the project |
| GitHub Desktop | GitHub allowed me to keep online versions of my application. During the iteration when I made changes if the application found bugs and I couldn’t fix it I would have an online save which I could retrieve. This also allowed me to see my progress and keep track by giving a title and description to every GitHub push. The ease of use from this application allowed for simple uploads to my private online GitHub account. |
| Microsoft Word | Used to write up this report and document any questions I may have had for my supervisor. Allowing me to keep track of a application to do list where I could amend the list as I went on developing the application. |
| Inno Setup Compiler | Used to create a executable set up programme that would set up the application onto a user’s computer. This would simplify the storage of the application when another person would try to use it. |
| MySQL Workbench 8.0 CE | This was used to create and monitor the database created for the application. I would be able to read and write to the database using this tool and was able to keep track of any writes the application would make to the database. This software allowed me to create and manage the database stored on my local drive and was the only thing I used for database related work. |
| Visual Paradigm 16.3 | This software was used to design the database in the early stages of development where I was making numerous tweaks to the database. This software also was used to generate SQL code used in MySQL Workbench 8.0 CE to create the database as only the structure and dependencies were needed to be made on this software. |
| IntelliJ IDEA Community Edition 2021.3.3 | This software was used to write the python programme needed to create the application . The UI Path was written in python using this software and so was the GUI. The access to the database from the Python script was also made using this application. |
| Google Chrome | This software was used to access pdf’s related to the project like the project brief. This was also used to carry out hours of research into methodologies, design tools, YouTube tutorials and etcetera. |
| Proto.io | An online tool was used to create design prototypes to use as a guid to how that application should look like. This was dependant on how customizable the python library was |

## 4.3 Design

## 4.4 Evaluation

# Work Plan

Chart 1.1 Illustrates a truncated view Gantt Chart outlining core project deliverables and objectives.

Timeline

Description automatically generatedChart 1.1

**Further Information**

<http://www.city.ac.uk/department-computer-science/research-ethics>

https://www.city.ac.uk/research/ethics/how-to-apply/participant-recruitment

https://www.city.ac.uk/research/ethics

# Participation Information Sheet

N/A

# Appendix A. PDD

# Appendix B. Requirements

# Appendix C.

# Appendix D. UI Design

# Appendix E. Project Timeline

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