KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

AUTOMATED TOLL COLLECTION

USING RFID

By

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Submitted to the department of Computer Engineering, in partial fulfillment of the requirements for the award of Bachelor of Science Degree in Computer Engineering

Supervised by:

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DECLARATION

We the undersigned, hereby declare that this project report entitled "**AUTOMATED TOLL COLLECTION USING RFID"** is the result of our own research under the supervision of Mr. Benjamin Kommey, except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature for any other degree.

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We offer our appreciation to all who helped make this project a success our parents, siblings, friends and supervisor, Mr. Benjamin Kommey.

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ABSTRACT

The traditional way of collecting toll in Ghana is fairly simple; the motorist parks by a toll booth and makes payment to the teller at the booth who in turn gives the motorist a receipt and change for the amount in situations where it is necessary. As simple as it seems it come with a great deal of inconveniences taking into account the amount of time motorist have to queue before it gets to their turn, the unnecessary time spent when the motorist have to wait for their receipt and change, fuel wastage due to long queue and even worst it causes air pollution due to high emission of carbon from the exhaust of the queuing cars.

A technological approach of curbing these situations is what we as a Computer Engineering students have taken to design a two way system that communicates with a web server to take toll from motorist; A passive RFID tag on the windscreen of vehicles bundled with all of the drivers information and a docking station with an RFID reader which will scan the vehicles tag and send the read information to a web server which will manipulate the data and make deductions with regards to the amount to be paid.

The payment has been streamlined to be taken from the data bundled on the RFID tag that will be placed on the windscreen. There is a transient communication that will be done between the RFID tag and the System at the docking station to make deduction on the amount to be paid and take the information of the owner of the vehicle.

The docking station sends the details of all transactions to a central server that is only accessible to the administrator and those he authorizes to look at these data. A camera has been added to the system an additional feature that will be used to track motorist who refuse to pay tolls and those without RFID tags and those with expired tags also.

CHAPTER ONE

INTRODUCTION

1.1 Background

A toll road, also known as a turnpike or tollway, is a public or private roadway for which a fee (or toll) is assessed for passage. It is a form of road pricing typically implemented to help recoup the cost of road construction and maintenance [1].

Toll collection has been in existence for a very long time. In the antiquated form travelers on horseback or wagons and even those on foot had to pay a levy before accessing a road facility. With the introduction of automobile transport this same principle was modified to take money from road users depending on the type of vehicle, weight of the vehicle, number of axles and the freight of the truck.

Collection of tolls is also varied in different countries, some use stations or booths which are supervised by a teller, others too have an unmanned station where motorist voluntarily pay any amount into at the station. Some countries too have evolved to develop automated means of taking toll where there is a setup at the station which electronically communicates with a transponder in the driver's vehicle.

The money generated from the accumulation of this fund is used to pay the workers at the station, maintain roads and bridges also in some instances they are used to repay the cost building the facility (since government sometimes take loans to construct these facilities) or enhance the project with additions that will make transport safer and faster.

But the main problems associated with the local means of toll collection here in Ghana is the cost of operation; payment of workers and the cost of printing receipt. Other related issues

concerned with the manual system of toll collection is the formation of long queues at station which in turn cause traffic jams and hence slows trade.

In summary the criticism of the manual system are:

Toll roads have been criticized as being inefficient in various ways:

1. They require vehicles to stop or slow down (except open road tolling); manual toll collection wastes time and raises vehicle operating costs.
2. Collection costs can absorb up to one-third of revenues, and revenue theft is considered to be comparatively easy.
3. Where the tolled roads are less congested than the parallel "free" roads, the traffic diversion resulting from the tolls increases congestion on the road system and reduces its usefulness [2].

1.2 Problem Statement

In spite of the recent development in the country in areas such as biometric verification of voters, issuing of driver's licenses and national identification schemes, we still use the manual way of toll collection where the driver of the vehicle has to park by a toll to make payment to the teller who will in turn issue a receipt and give out change in cases where that is necessary.

This manual methods comes with so many flaws that we only disadvantaged ourselves if we do not find measures that prevent long queuing at toll booth, cost of printing toll receipts, reduce the rate of air pollution due to the constant combustion of fuel at toll booth, eliminate the over reliance on unreliable humans who cannot be entrusted with the collection of state fund. With all the drawbacks of the manual method well illustrated, the demand for an improved and reliable form of collecting toll is urgent solution that has to be implemented.

1.3 Project Objectives

To develop a fast electronic method of toll collection.

1.3.1 Specific Objectives

- To design a passive RFID tag bundled with information of the motorist and vehicle.
- To design a docking station with an RFID tag reader that can send information to a web server.
- To develop a centralized web server containing the database of all motorist and vehicle that manipulate data by making deductions.

1.4 Scope

In full perspective this project is aimed at a national deployment for the collection of toll. However, with regards to cost easy sampling of data KNUST is used as a test state for the collection of data. And finally, the measure of how feasible this project can be on a large scale of traffic and commercialization.

CHAPTER TWO

LITERATURE REVIEW

2.1 Using Camera (Transcore)

Transcore Company (October 10, 2010) has also done a brilliant work in (ATC) Automated Toll Collector using camera and image processing schemes [3],but the short comings of this work caught up with them since ;

1. The camera needs high optimization for low light environment in order to take good picture that can clearly capture all the characters of the number plate for effective processing and identification of the vehicle and the driver's details.
2. This project also requires a camera with a high number of pixels in order not to compromise on the on image to be taken.
3. Defaced number plate due to mud on the plate or foggy weather, any of such conditions can make it very difficult for the camera to capture all the characters on the number.
4. Another annoying factor associated with this process high memory demand for storing the images of the number plates.
5. Proximity is another burden since quality pictures can only be taken when the car is close enough.

2.2 Secure toll collection system for moving vehicles

A secure toll payment system is realized by transmitting a changeable encryption code from roadside equipment at a toll plaza to a moving vehicle [4]. Thereafter, the moving vehicle uses it to encrypt payment information according to the Data Encryption Standard algorithm. The moving vehicle transmits the encrypted payment information to the roadside equipment which performs a credit or debit transaction. Because the encryption code changes from time to time, so too does the nature of the signal which is transmitted by the vehicle; and fraud,

based on electronic eavesdropping, is substantially eliminated. The encryption code comprises an 8-bit random number and a time/date number. Vehicle-mounted apparatus includes a transponder unit and a *portable smart card* which inserts therein. The roadside equipment includes a pair of spaced-apart antennas that are sequentially located along an express payment lane at a toll plaza and a computer (Plaza Server) which controls them.

2.2.1 Using SMART CARD (SWIPE)

This also employs similar schemes operation like that of the transponder unit it is just that in this system the motorist have to swipe across a machine at the docking station in order to get permit.

Problems

i. Time wasting due to swiping.
ii. Misplaced cards brings a lot of uneasiness to users.
iii. Traffic may increase if a faulty card user try to gain access and system keeps preventing it.
iv. The encryption algorithm takes time comparatively.

2.3 Method and system for two-way packet radio-based electronic toll collection

A two-way packet radio-based electronic toll collection system is to be installed on a highway and includes a main communication tower for transmitting continuously downlink communication packets that contain information regarding available uplink communication channels, and an in-vehicle unit installed in each vehicle passing along the highway to receive the downlink communication packets [5]. The in-vehicle unit is capable of selecting one of the available uplink communication channels. The in-vehicle unit and the main communication tower exchange toll collecting and payment information wirelessly via the available uplink communication channel selected by the in-vehicle unit and a downlink

communication channel corresponding thereto. When collision occurs along the packets transmitted by a number of in-vehicle units, a retransmission scheme is applied for each in-vehicle unit to guarantee successful communication between the tower and the in-vehicle unit. The problems associated with this system are as follows:

- Vulnerable to electrostatic discharge which can affect the communication between sender (smart card) and receiver.
- Affected by metals and magnet which can distort the reading of the smart card.
- Troubleshooting is very difficult.
- The RF signal can be jammed.

2.4 Universally applicable, in-motion and automatic toll paying system using microwaves

Toll collection facilities for tunnels, bridges and turnpikes slow traffic, waste time and fuel, and increase air pollution [6]. Eliminating the need for a toll payment stop would avoid this waste and reduce toll facility operating costs. A single, universally applicable system and apparatus is described that can eliminate most toll stops and simplify funds transfers. The system starts with a lump sum paid in advance to a permanently assigned collection agency's representative. This sum is inserted, electronically, into the memory of a *microwave* transponder-data-processor, normally kept in the vehicle. As the vehicle passes suitably equipped toll collection facilities, a toll transponder receives billing information from the vehicle transponder, calculates the toll, transmit it back to the vehicle transponder where the toll is electronically subtracted from a stored balance. If the resulting balance is not negative, a pass signal is flashed. The information stored in the vehicle transponder's permanent memory includes a vehicle-owner code, a collection agent's code and a vehicle-class code. The availability of this information and the toll, plus the procedure for increasing the pre-paid balance makes possible a computerized and automated double entry bookkeeping and funds

transfer system. Security is achieved by crypto insertion codes. The stored current balance in the vehicle transponder is always indicated by a liquid crystal display.

Disadvantages

- Can exchange data only when there is a clear line of site and there are no obstacles.
- Signal absorption by the atmosphere and weather interference.
- It’s expensive.

CHAPTER THREE

METHODOLOGY OF STUDY

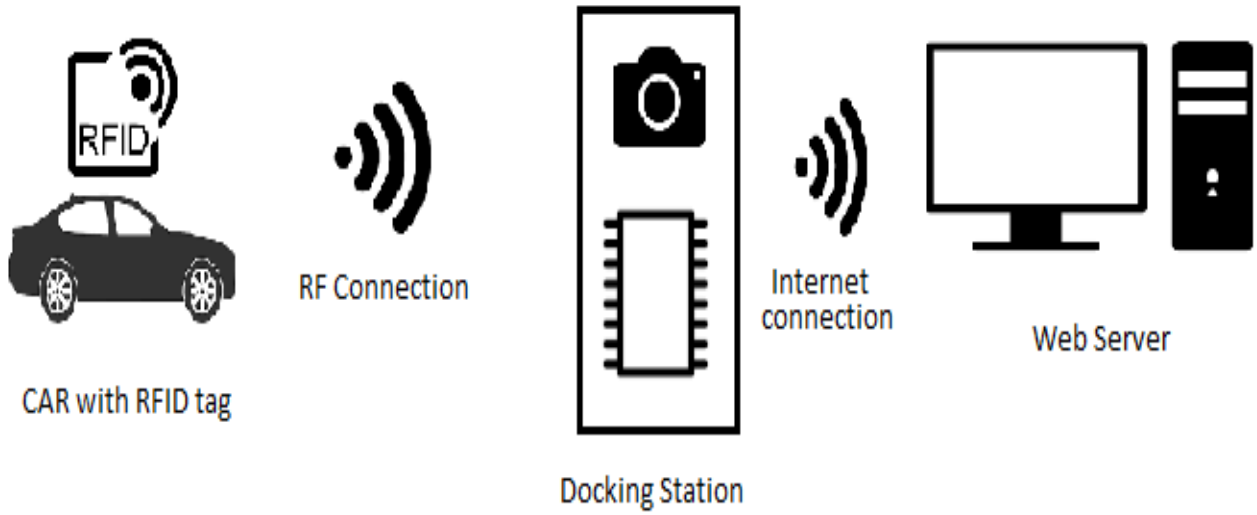


Figure 3.1 System Architecture

Our problem solving scheme is simple, instead of queuing and waiting to be attended to as in the traditional system, we have designed a docking station with a microcontroller board with Wifi capability and an RFID reader placed on a tall stretched bar on the road. We used a remote web server used as a database and storage for the microcontroller's processes and transactions. An RFID tag upon distribution is placed on the windscreen of the vehicle containing details of the car and the owner (car registration number and owner's contact). The RFID reader at the docking station will be setup in such a way that as soon as the vehicle gets within our defined area it will read the details of the vehicle from the RFID tag and send it to the microcontroller which will use these details to fetch information from the remote server to make payment deductions from the driver's account. Considering the scope of the work we recognize that it will be wise to incorporate a camera into this system, its main functionality is to take pictures of incoming vehicles. Capacitors will attached beneath a ramp on across to road a few meters before the docking station, the capacitors have been placed there to send

response to the microprocessor after it has been triggered by the movement of an automobile, the microprocessor will then issues an command within fractions of a second for the camera which have been indented to face the passing car's number plate to take an image of the cars number plate to be sent to the remote server. The usefulness of the incorporation of the camera is to make sure that all cars pay their due toll, road users with expired RFID tags can be easily tracked and foreign user who have not yet acquired RFID tags will be given access to the road but can be effectively tracked and accounted for usage of the road using the captured number plate. Figure 3.1 in the previous page gives a clear picture of how the system works.

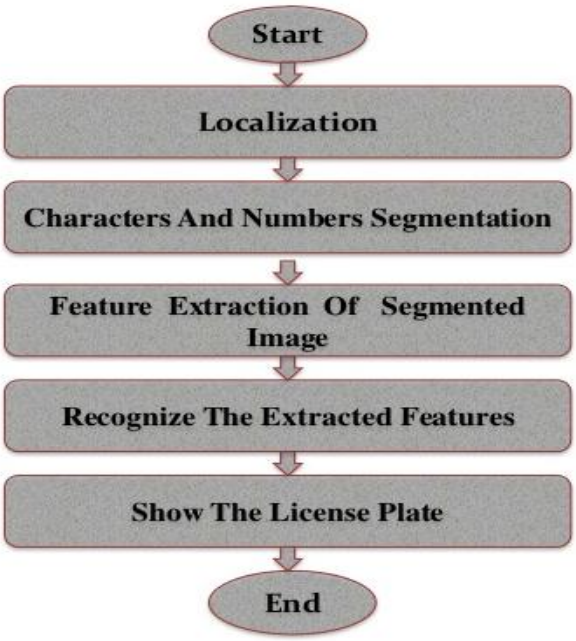


Figure 3.2 (License plate recognition Flow chart.)

After the image has been taken by the camera, there are several processes it has to go through before the details on the number plate can be digitally extracted [7]. The first step after capturing the image is that the camera sends this image back to the microcontroller which will process the original scene of the image into a grayscale image and based on an algorithm given to it, it will extract all the possible characters on the image. With these extracted

characters from the image the microprocessor will compare these characters with the details in the central server to find the details (owner and vehicle type) of the car. It stores this to show the vehicle used that particular but should it happen that after the comparison it realizes that the details do not match any of the vehicle data given to the central, it will store it in a different field to make it easier to track vehicles who are not registered on the DVLA and those who do not have RFID tags and those who have expired tags too. This is a new feature which was not present in the projects of S. Asenso, 2015 and S. Baaba, 2016 from KNUST. This is the main mechanism used to ensure that all road users pay tolls and that those who do not pay can be easily identified and brought to book.

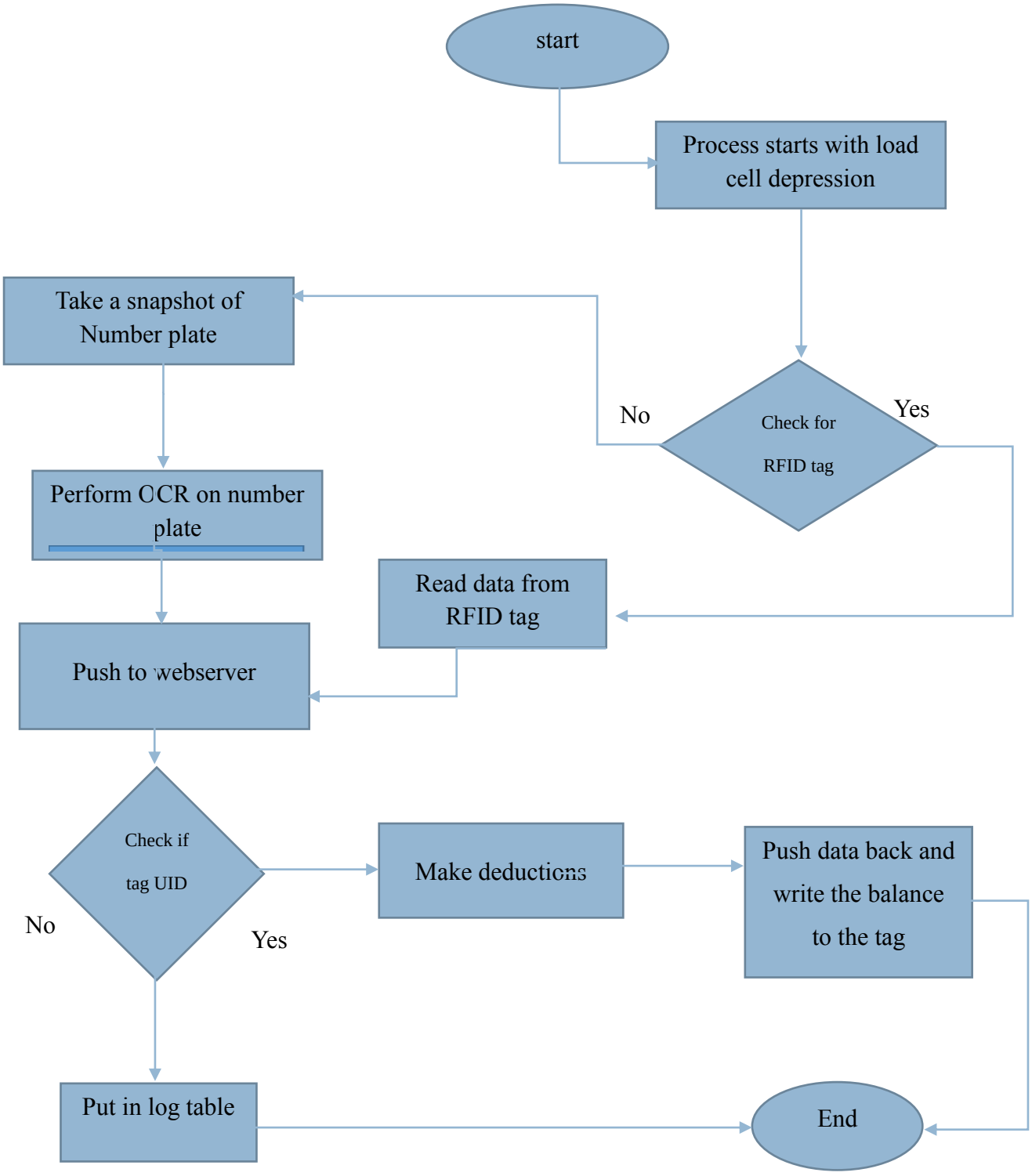


Figure 3.3 (Flow chart for the Automated Toll Collection System.)

The system is constantly checking to see if there is a car on the road and one it gets the input that shows that there is a car on the road and the car passes over the ramp the camera takes a snapshot of the car's number plate. The capacitors beneath the ramp act as load cells that triggers the microcontroller to make the camera take the picture. The microcontroller takes the output image from the camera and performs OCR (Optical Character Recognition) on the number plate to extract the details on the number plate. This detail is pushed to the webserver which will make comparisons of the data to find the exact vehicle using the road. It make deduction from the owner's account, stores the result in a log table.

3.3 Design Overview

This subsection highlights the summary of the design of the device in question.

3.3.1 System Design

For our proposed design, there is a need to interface these four components; an RFID reader, a Microcontroller, a Wi-Fi Module and a web server to produce the desired effect.

3.3.1 (a) RFID Reader

This component is coupled to Microcontroller to take details from an oncoming vehicle and write it to the microcontroller. The microcontroller will send the data from the tag to a web server to make the data manipulations or deductions.

3.3.1 (b) Microcontroller Board

The primary component of the design is the microcontroller. It is here that all the OCR algorithm occurs and all other processing from the input hardware components occurs. The microcontroller receive data input from the RFID reader, the microcontroller pushes it to database on a webserver for deduction and the board also has a Wi-Fi component which makes this transmission possible.

3.3.1 (c) Web Server

A remote web server with a structured database of the details of the vehicle and its owner. This web server will also be used to as a storage for transactions or a toll log and a back-up for the system's software.

3.3.1 (d) Wi-Fi Module

Communication between the microcontroller board and the remote webserver will be made using Wi-Fi communication standard hence a Wi-Fi unit has been installed on the board to make this seamless communication possible.

3.3.1 (e) Camera

The prior focus for the need of a camera in our system is for tracking and accurate data keeping. It has been programmed to take response from the microcontroller which is also triggered by the capacitors beneath the speed ramp a few meters before the docking station.

3.3.1 (f) Capacitors

The capacitors have been arrange to form a load cell beneath a speed ramp a few meters before the docking station. They trigger the microcontroller to make the camera take a picture of the car's number plate when the car drives on the speed ramp and Optical Character Recognition (OCR) would be performed on the picture, we used a push button instead in the prototyping.

3.3.1 (g) LEDs

The light emitting diodes (LEDs) are the indicators on the system placed on the docking station. It shows Red to signify a fault and Green when the system is active and in full functionality.

3.4 Database Schema

The webserver's database was designed with these tables:

- **Location:** This keeps the location of all the docking stations where they have been placed; the Region and City.
- **Owners:** This will be bundled on the RFID tag placed in front of the car's windscreen, it will contains theses details; the Driver's Name, Residential Address, Phone Number and Email Address.
- **Vehicles:** Each type of vehicle pay a specified amount to be paid so there would be allotment to group the vehicles into different types so that the system can easily know the amount to be taken from a particular vehicle. It also stores the car's registration number, one owner can have many vehicles.
- **Users:** This keeps the administrator's username and the hashed password, and also contains the credentials of the Automated Toll Collection system vendors.
- **Tolls:** This table keeps track of the balance after transactions, time of transaction and the details of the vehicle it transacted with using a foreign key from vehicle table.
- **Log:** Contains the details of unregistered road users (or users not on the ATC system).

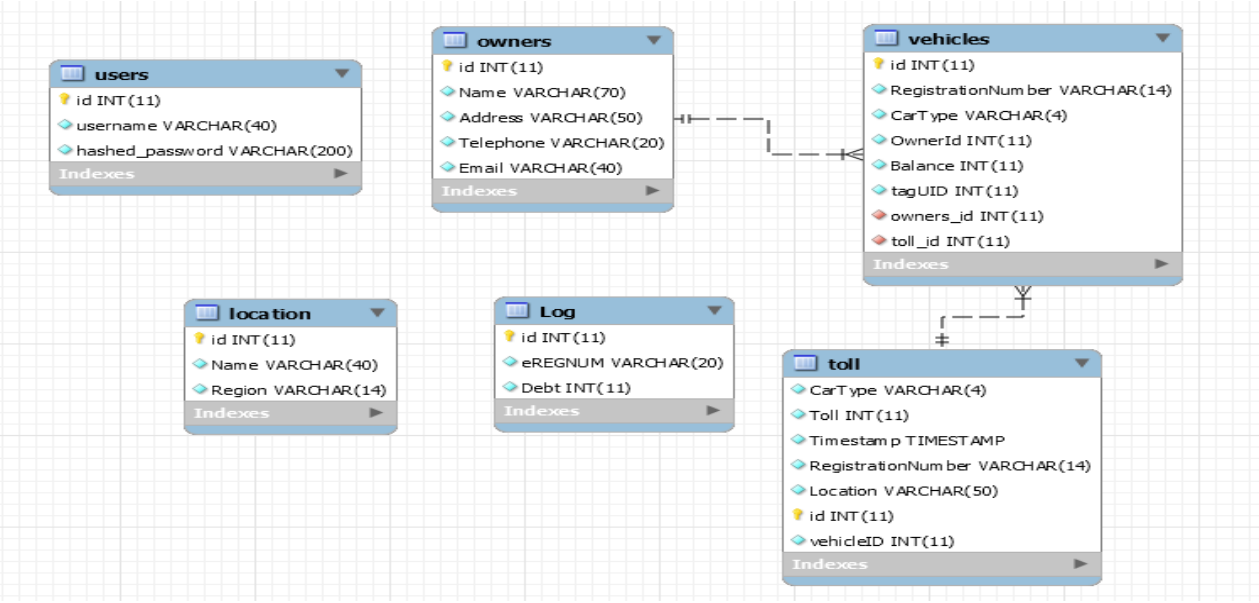


Figure 3.4 (Entity Relationship diagram)

The entity relationship diagram of the database was made using MySQL workbench.

3.5 Packaging

The end product of the system will be kept in a glossy miniature container like this. It has a transparent glass covering the front in order to aid the exchange of data between the RFID tag and the microcontroller. Here are several views of the container.

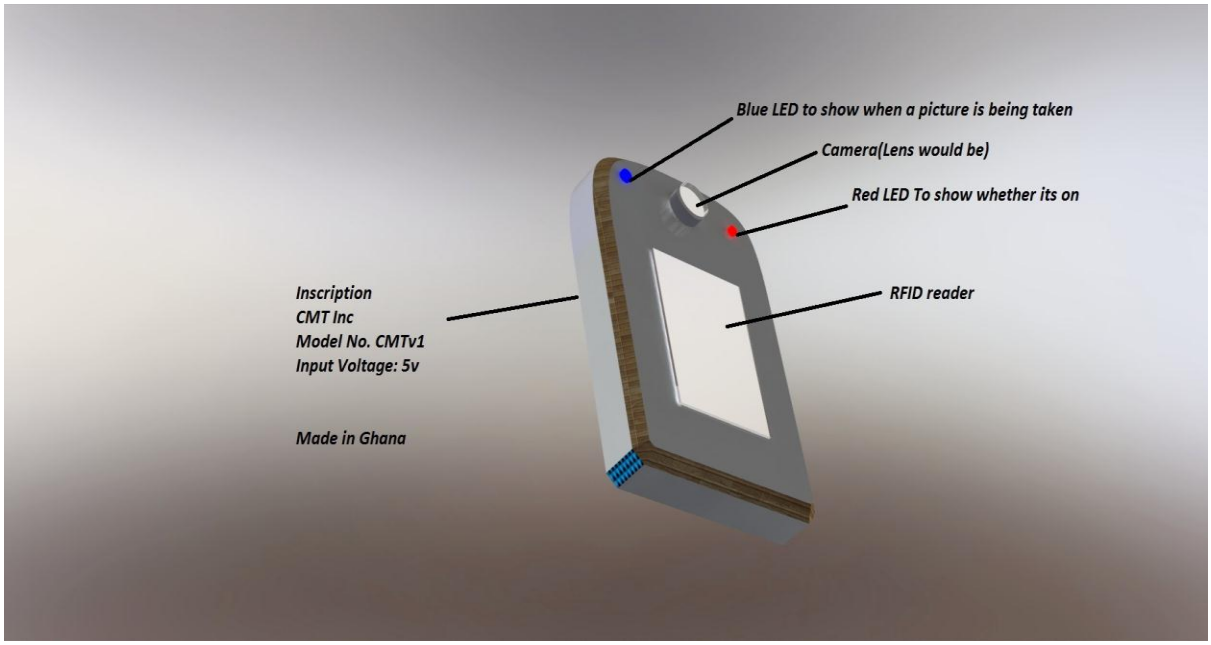
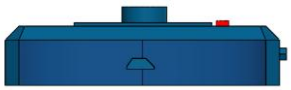
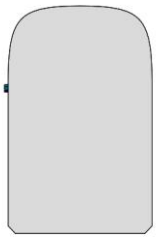


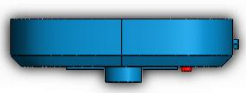
Figure 3.5 (Packaged Product) Solid Works software was used for the packaging.



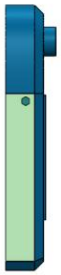
BASE VIEW



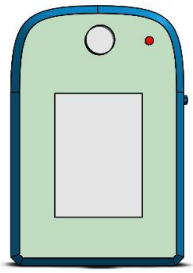
BACK VIEW



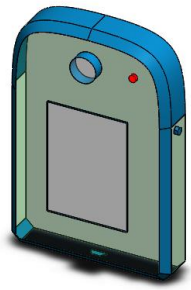
TOP VIEW



SIDE VIEW



FRONT VIEW



TRIMETRIC VIEW

3.6 Block diagram for the docking station

An RFID is connected to the central system of the unit (which is the microprocessor) to take and feed the vehicle's information to the microprocessor for data manipulation. This same microprocessor has been configured to have a two way communication channel with a webserver to push data unto it for storage and take data from it for manipulation. This communication is made possible because of a WIFI module connected to the microprocessor board.

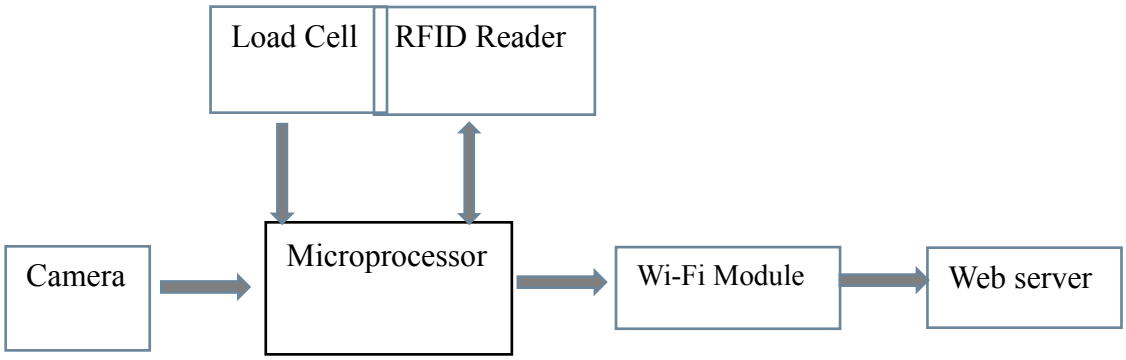


Figure 3.6 (Block Diagram for the docking station)

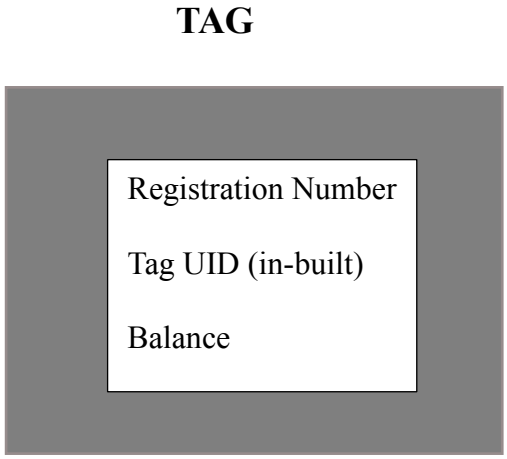


Figure 3.7 (the data bundled unto the RFID tag)

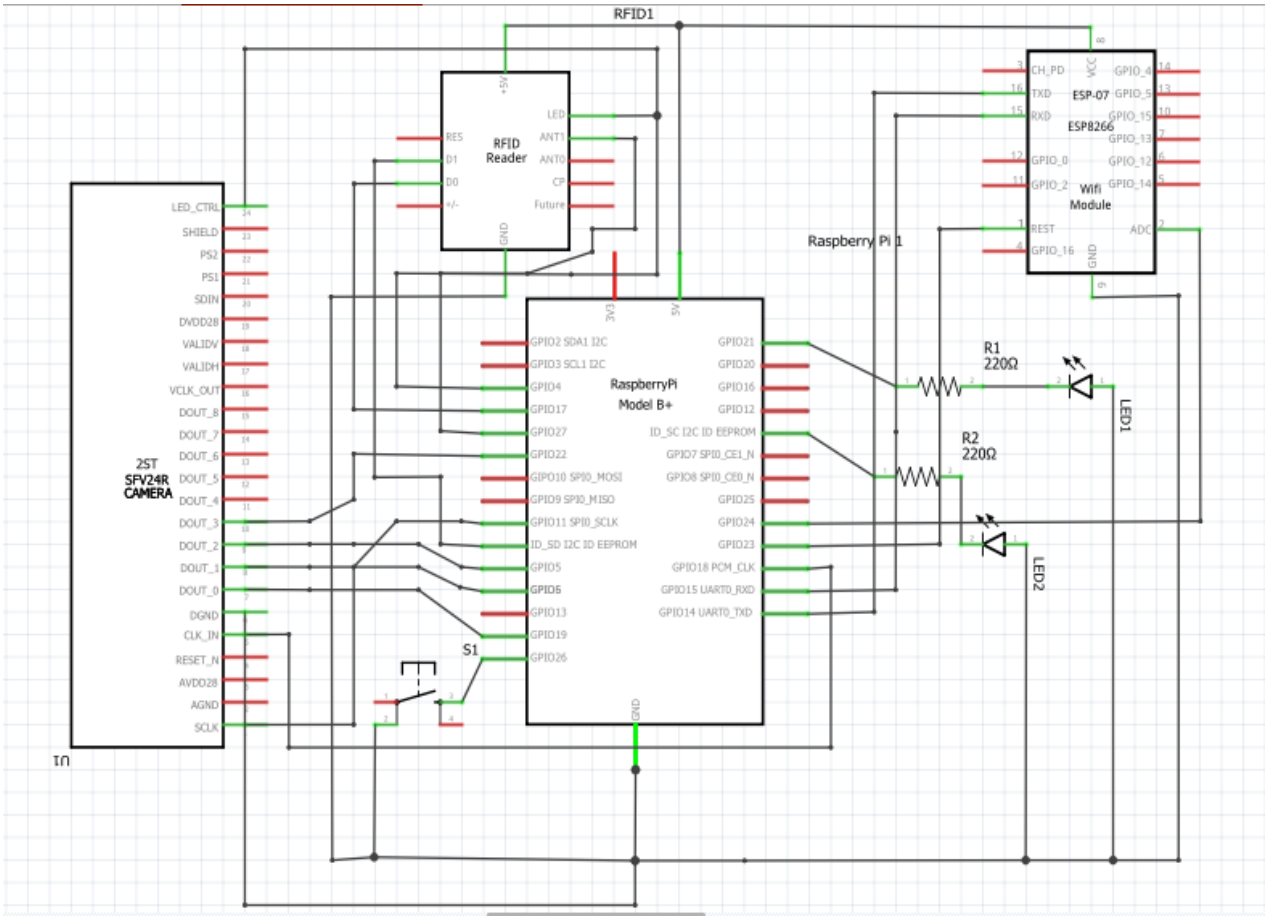


Figure 3.8 (Schematic of the final circuit Board)

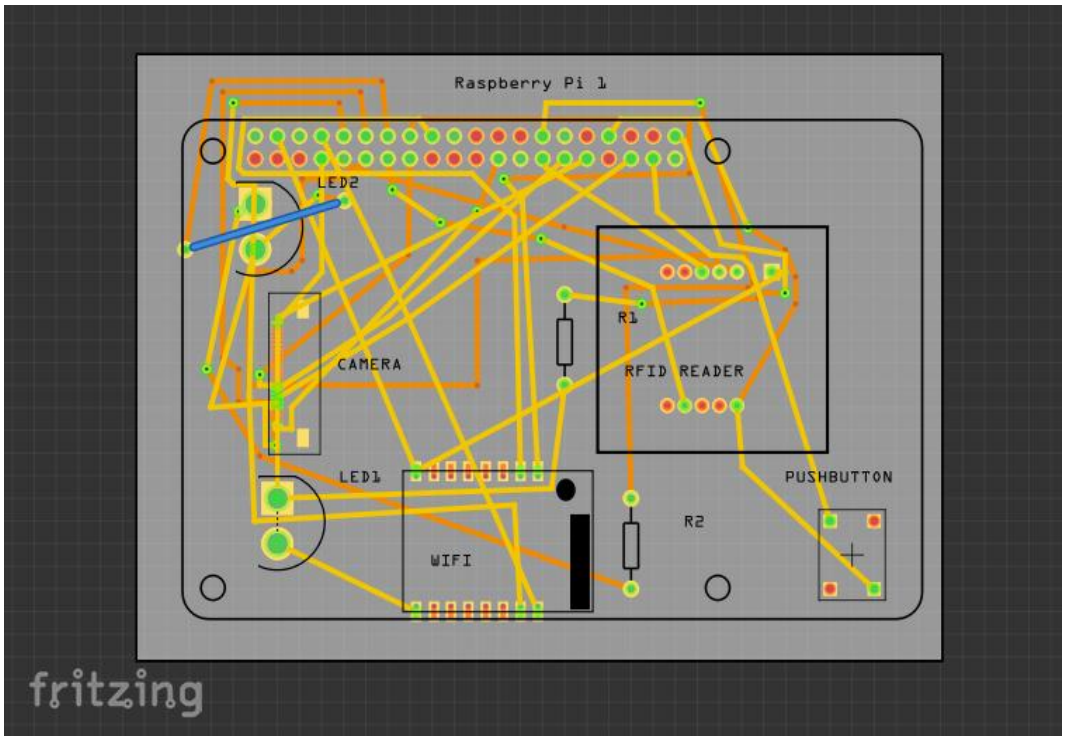


Figure 3.9 (Routed Board Layout)

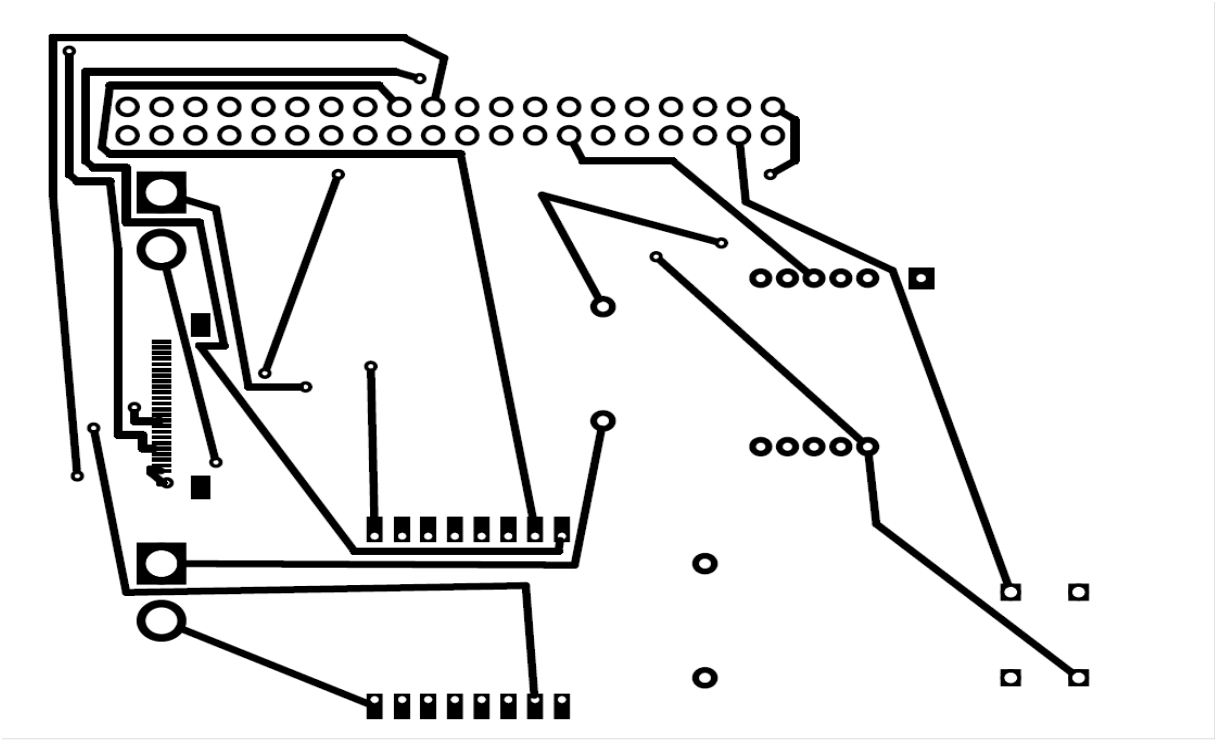


Figure 3.10 (Printed Circuit Board Copper top etching)

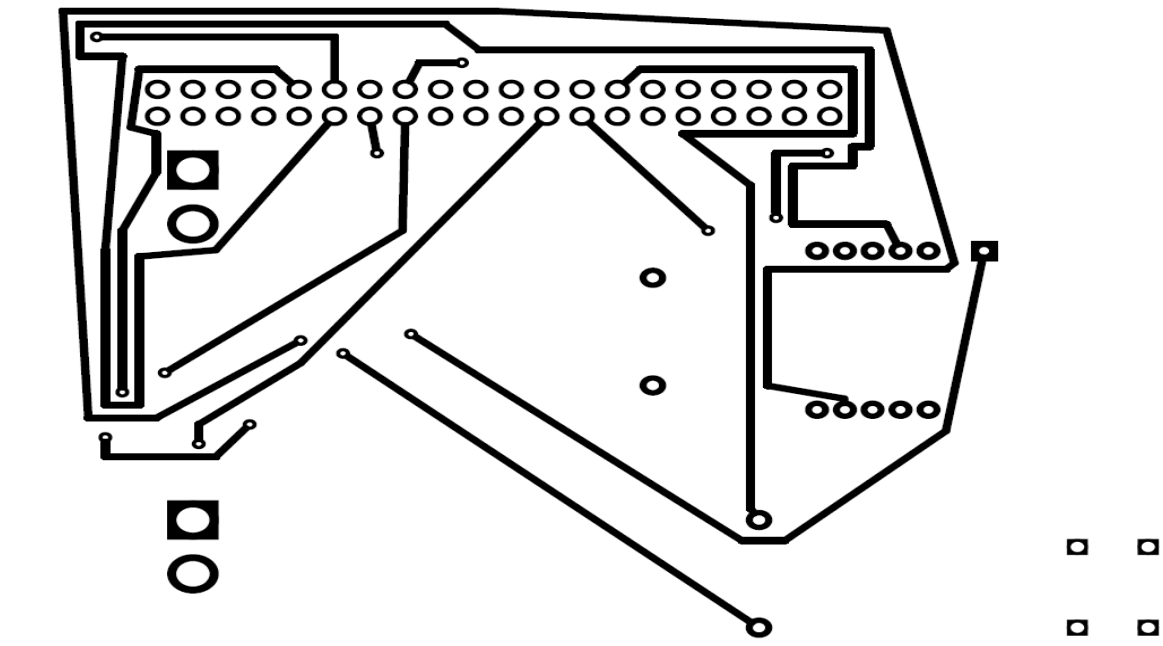


Figure 3.11 (PCB Copper bottom etching)

The above PCB etching diagrams are two because it is a multilayer board. All of which was made by *fritzing software* since *Eagle* was component insufficient. All though the fritzing software does not have all the components but it was able to get the PCB job done.

3.7 Testing and Discussion

Multiple experiments were performed on the proposed system to test its performance with respect to speed and accuracy.

For the docking station the language used for programming the *raspberry pi board* was **python**. The editor used was **NANO** in Linux. We made use of the **OpenCV** library for the OCR to make the camera extract text from the number plates and **MFRC522** for the reading and writing of the Radio Frequency Identification (RFID) tags.

While on the web server, ***wampserver*** was used to emulate a localhost server on our laptop running a *php* as the scripting language and API, to access and insert the data into the *MySQL* database. The editor we utilized for the *php* was **sublime text** and **phpmyadmin** for the MySQL database.

This *python* code snippet below shows how the road users data from the RFID tag is pushed to the web server in the form of an HTTP GET request:

```
# If we have the UID, continue
if status == MIFAREReader.MI_OK:

    # Print UID
    print "Card read UID: "+str(uid[0])+","+str(uid[1])+","+str(uid[2])+","+str(uid[3])
    urllib2.urlopen("http://192.168.137.1/atc/twig2/getRfid.php?Loc=Paris&tagUID="+str(uid[0])).read()
```

An application programming interface (API) was design in *php* to receive the data from the RFID tag, the code snippet is shown below:

```php
<?php
//include the codes to send EMAIL to Road USER
    include("sendmail1.php");

//

$getUID = $_GET["tagUID"];
$getUID =  trim($getUID);
$getLoc = $_GET["Loc"];
//the location should be preloaded onto microcontroller

// $getTime currentTimestamp

//get the registration number from the OCR
$getRegNum = $_GET["rnum"];
```

An already built API was used to alert registered users via SMS on the ATC system, the *php* API used is from http://api.txtlocal.com/docs/sendsms . The code demonstrates how it was used:

```php
// Textlocal account details
$username = urlencode('computereng33@gmail.com');

$hash = urlencode('298f5dabcd7c7c0dff3af6c83cd7974a30097cc4e039d8c251c1b0ab6b9c9839');

//computereng33 298f5dabcd7c7c0dff3af6c83cd7974a30097cc4e039d8c251c1b0ab6b9c9839

// Message details
$getnum;
$numbers = urlencode($phne);
$sender = urlencode('TOLL SERVER');
$msg = "Dear registered user, CMT Toll collection new balance is GHC ".$bal;
$message = rawurlencode($msg);

// Prepare data for POST request
$data = 'username=' . $username . '&hash=' . $hash . '&numbers=' . $numbers . "&sender=" . $sender . "
  &message=" . $message;

// Send the GET request with cURL
$ch = curl_init('http://api.txtlocal.com/send/?' . $data);
curl_setopt($ch, CURLOPT_RETURNTRANSFER, true);
$response = curl_exec($ch);
curl_close($ch);

// Process your response here
echo $response;
```

The administrator can view and manage the database of the toll from registered and unregistered user, the picture shows some of the toll log the administrator sees.

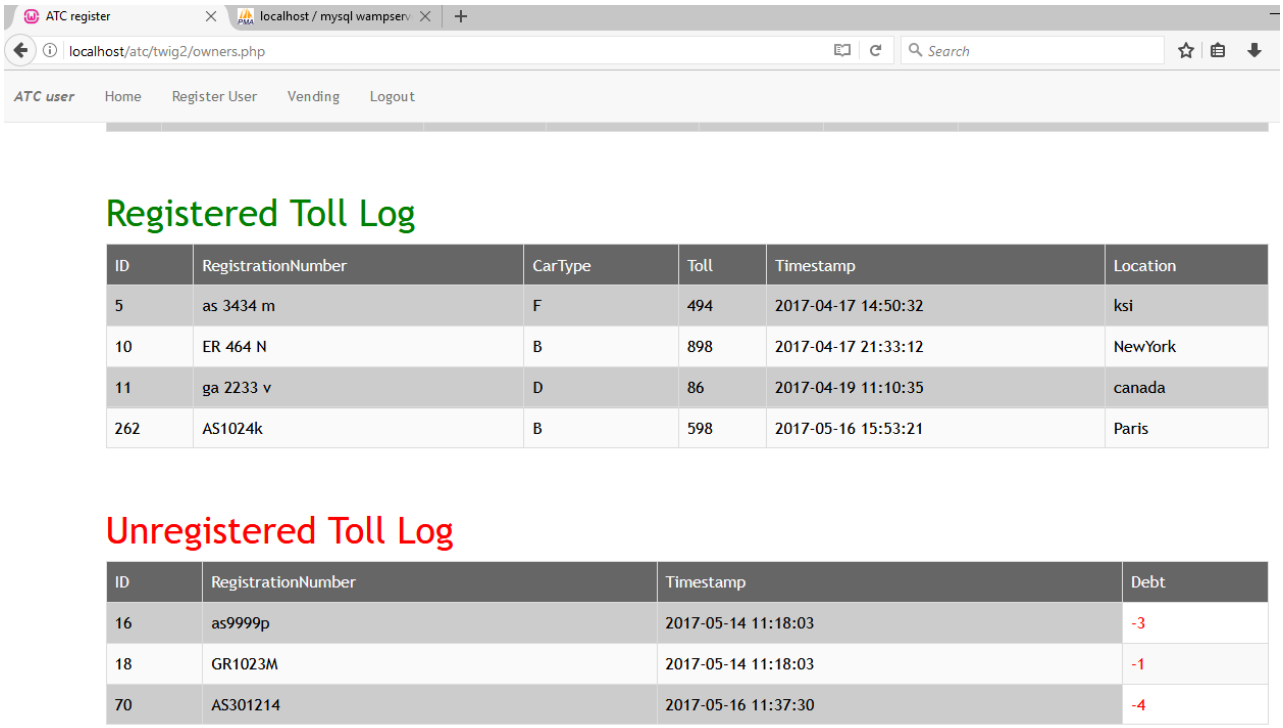


Figure 3.12 (image of web portal)

For the unregistered users a search is made through the DVLA database to find the car type in order to issue the appropriate charge, thus it is shown in red and a negative value since it is a debt. If no information is found the registration number is still recorded with the debt column having a value of zero (0).

The camera is activated when the car passes over the load cell (we used a button instead in the prototype). The *python* code snippet shows the function used capture an image and programmatically saves it as *imagetest.png* and the OCR algorithm starts to work on it:

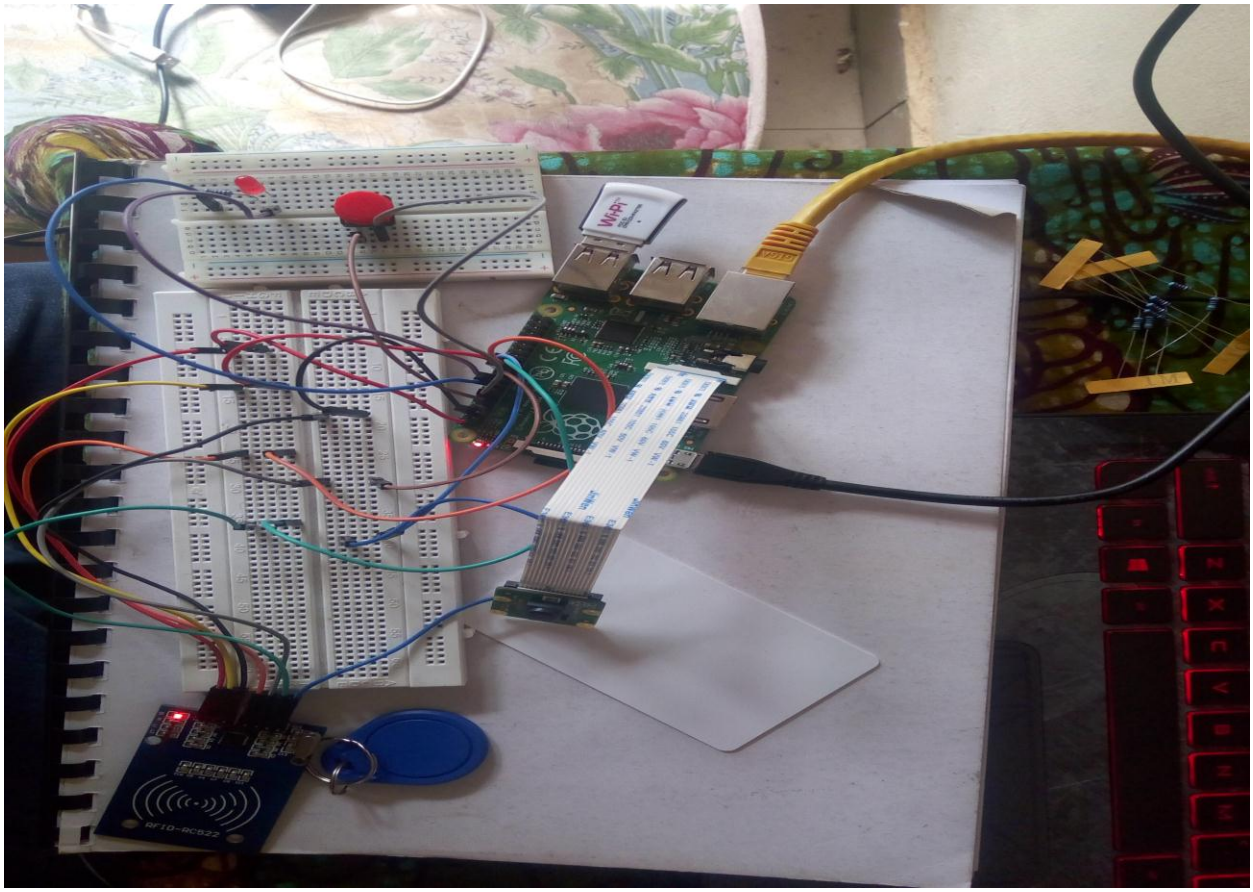
```
camera=picamera.PiCamera()
camera.capture('/home/pi/LPRmaka/LicPlateImages/imagetest.png')
imgOriginalScene  = cv2.imread("/home/pi/LPRmaka/LicPlateImages/imagetest.png")          # open

if imgOriginalScene is None:                            # if image was not read successfully
    print ("\nerror: image not read from file \n\n")    # print error message to std out
    os.system("pause")                                  # pause so user can see error message
    return                                              # and exit program
# end if

listOfPossiblePlates = DetectPlates.detectPlatesInScene(imgOriginalScene)           # detect plates

listOfPossiblePlates = DetectChars.detectCharsInPlates(listOfPossiblePlates)        # detect chars in
```

Figure 3.13 (Picture of the final circuitry of the Docking Station)


RFID-RC522

CHAPTER FOUR

CONCLUSION AND RECOMMNEDATIONS

4.1 Conclusion

This project was birthed out after seeing the hurt people go through at toll station; the time spent on queuing, the money spent on fuel and even the harm it causes to the environment due to combustion. All these were stated in our problem statement and we tackled them by providing an efficient, convenient and fast way of taking tolls and even provided an extra help in tracking vehicles especially those who do not pay tolls using a camera.

ATC (Automated Toll Collection) solved the stated problem using proper coordination between its 3 (three) sub-components:

- **RFID tag**

We successfully bundled the owners information onto the RFID tag.

- **Docking Station or Detection Station**

The docking station consists of the microprocessor board (raspberry pi) interfaced with an RFID reader, Wi-Fi module and a camera. The camera forms an integral part of the system it, the camera is placed at the docking station to take pictures of all the passing vehicle in order that vehicles who use the road without paying tolls can be easily tracked, although it is an added feature or not part of the main project idea. The transmission of the users information too was successful.

- **Web Management Portal**

The Web Management Portal is a web application built for administrators to be able to access data obtained from road users and the toll that were taken using the RFID Reader. A secure portal was built using modern web development technologies.

All in all the project met the objectives that were set out for:

1. Providing a system that will reduce the cost in printing receipts, time and energy spent queuing at toll booth and even the environmental hazard it seems to pose.
2. Providing a platform to view records of road user taken at the docking station.

4.2 Recommendations

We did our best to make sure that the project met the objectives that were set out for it but while we worked on it we got to understand there were some improvements that could made on this work, some of which is:

- CMOS camera to capture fast moving cars or vehicles.
- A faster processor which will increase the OCR performance.
- The web portal for the administrator should be improved to show daily, weekly and other statistics of the accumulated tolls.
- Detection scheme to alert the administrator if a docking station is down.
- To push the whole idea to be implemented nation-wide by the Ghana roads and transport sector or DVLA.

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[4] Grant by D. M. Claus, K. D. Murphy, M. E. Taylor "Secure toll collection system for moving vehicles, Smart Card", May 1994. from:https://www.google.com.gh/patents/US5310999

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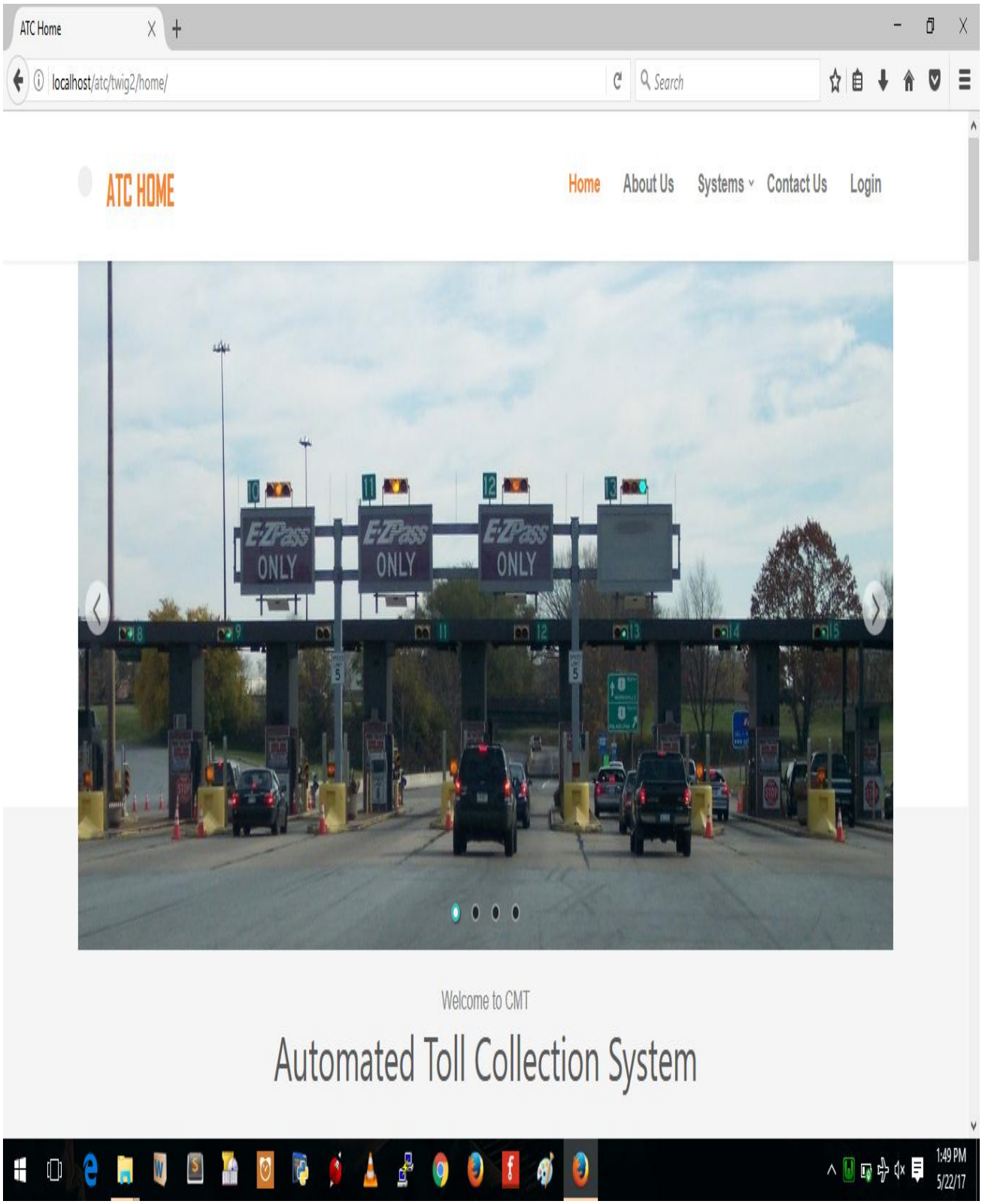
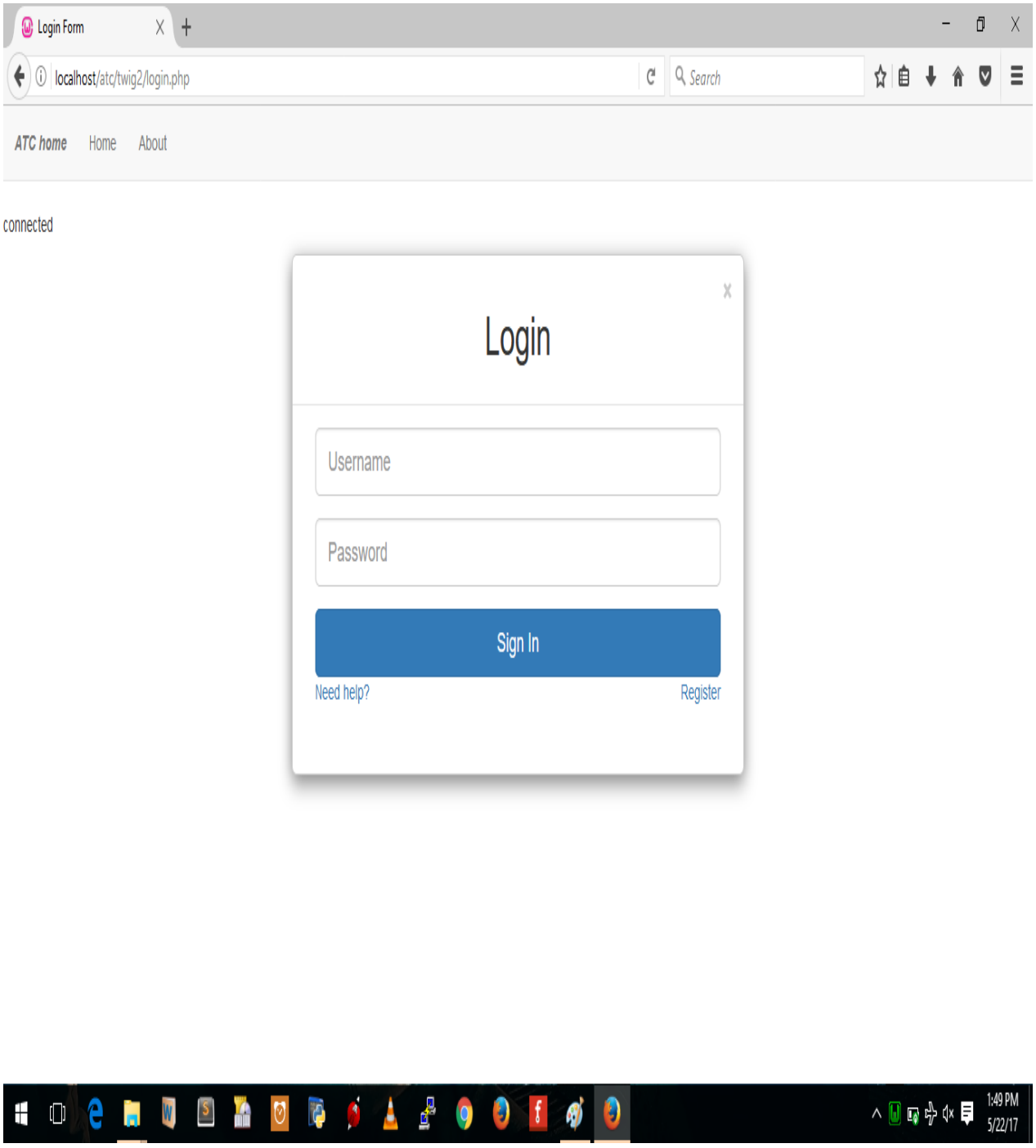
APPENDIX

Interface Design of Web Portal

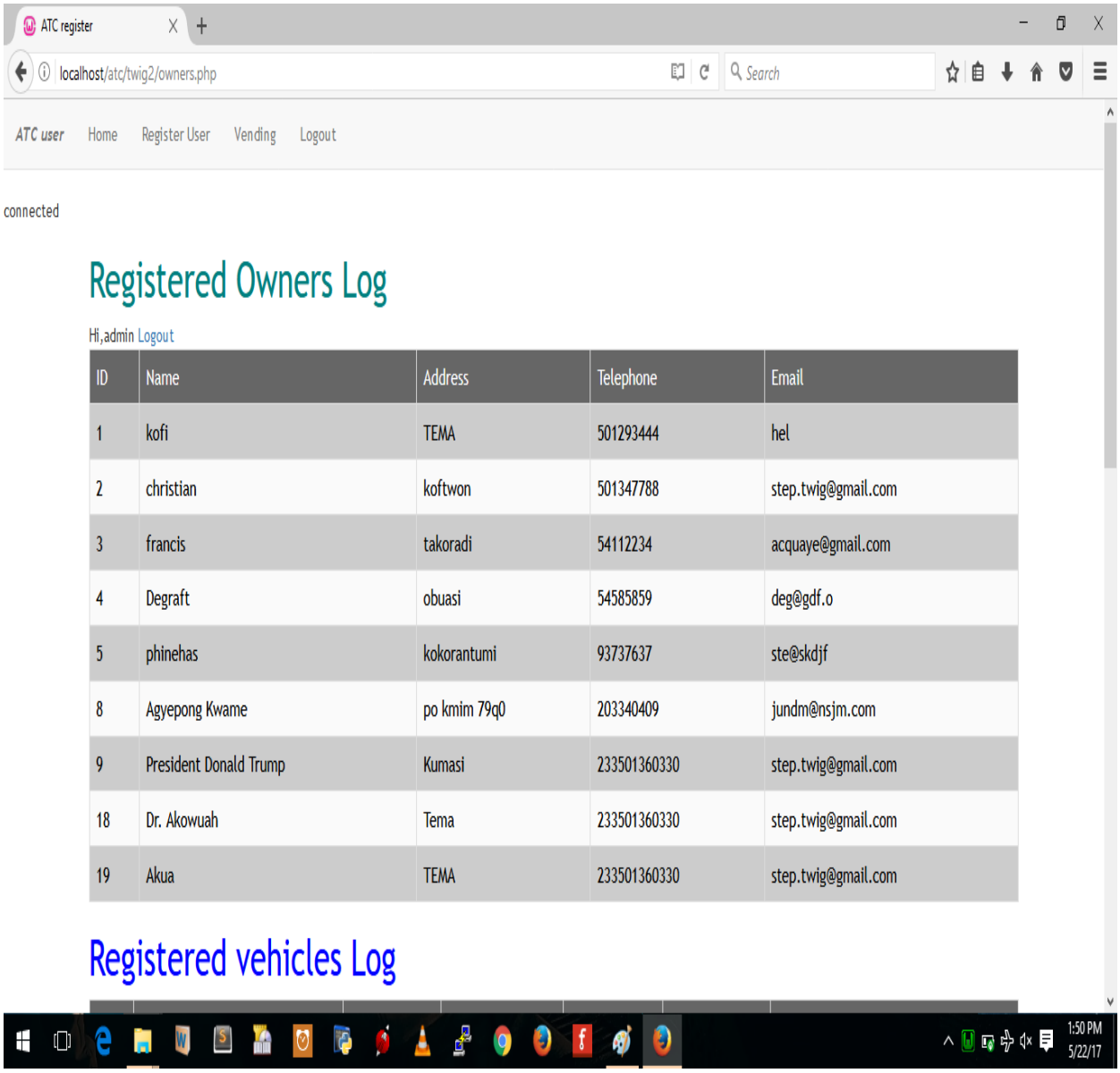
Home page



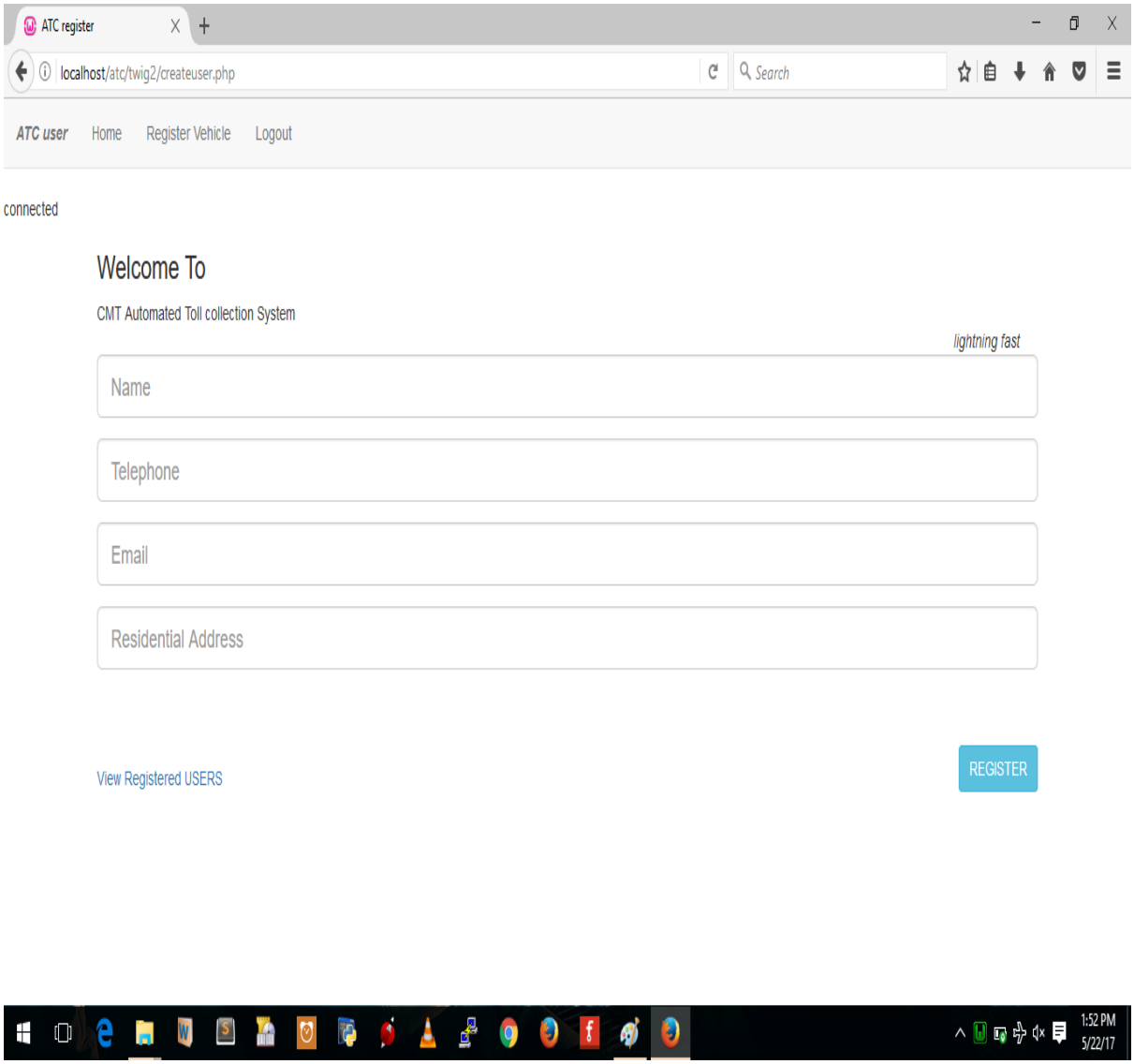
Login Page


Login Form
localhost/atc/twig2/login.php
Search
ATC home
Home
About
connected
Login
Username
Password
Sign In
Need help?
Register
1:49 PM
5/22/17

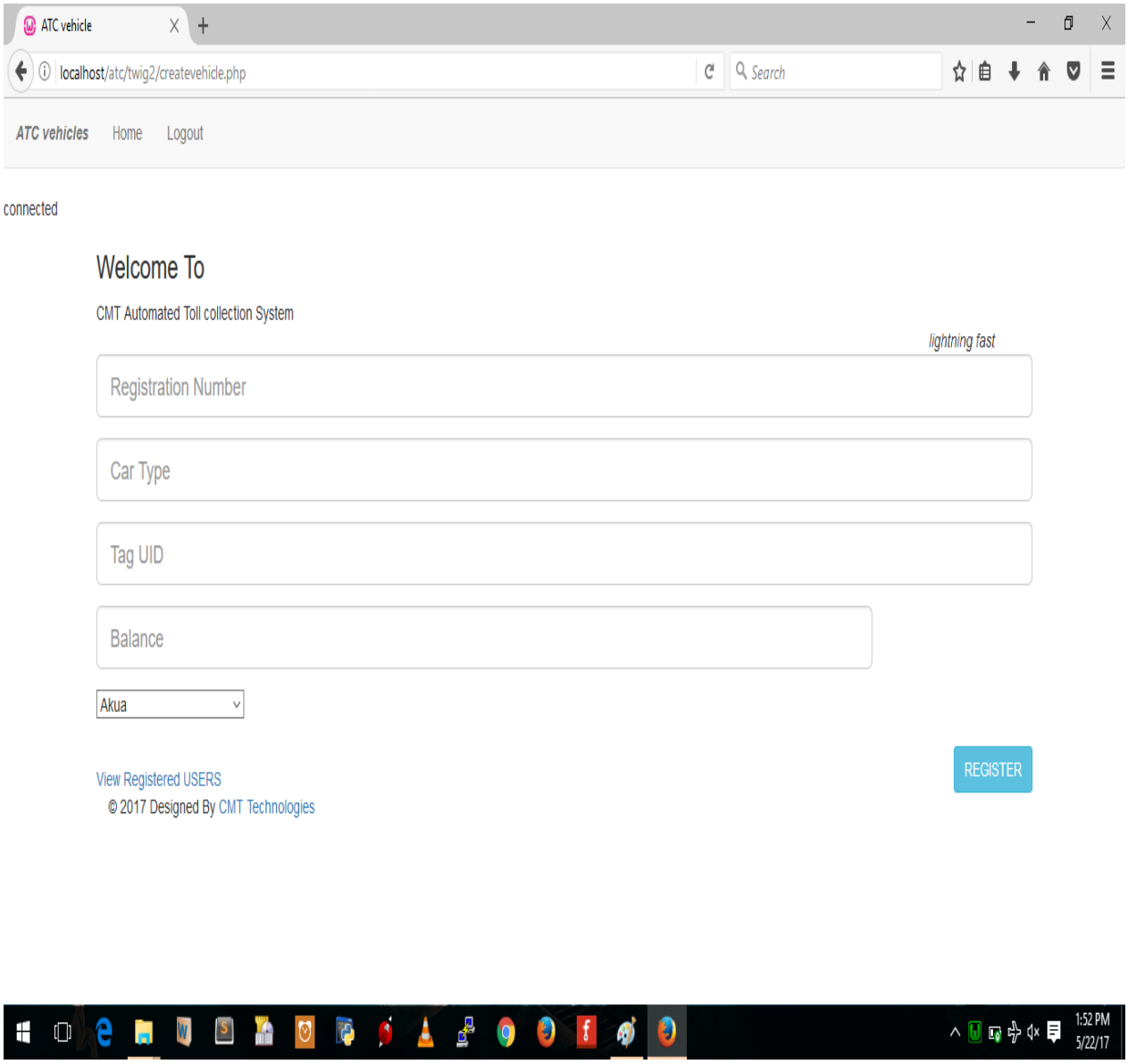
Administrator Dashboard



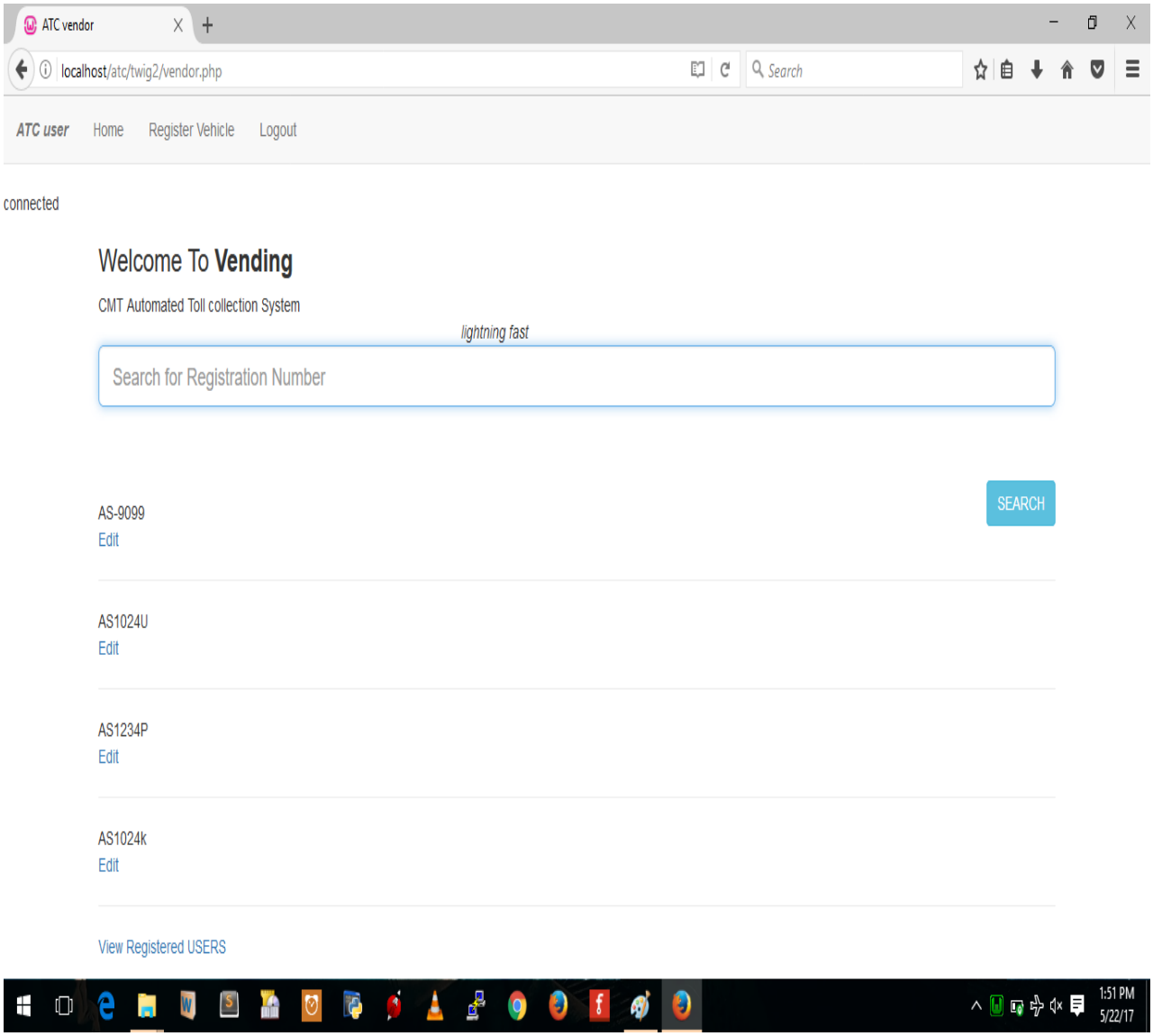
Owner Details Registration Page



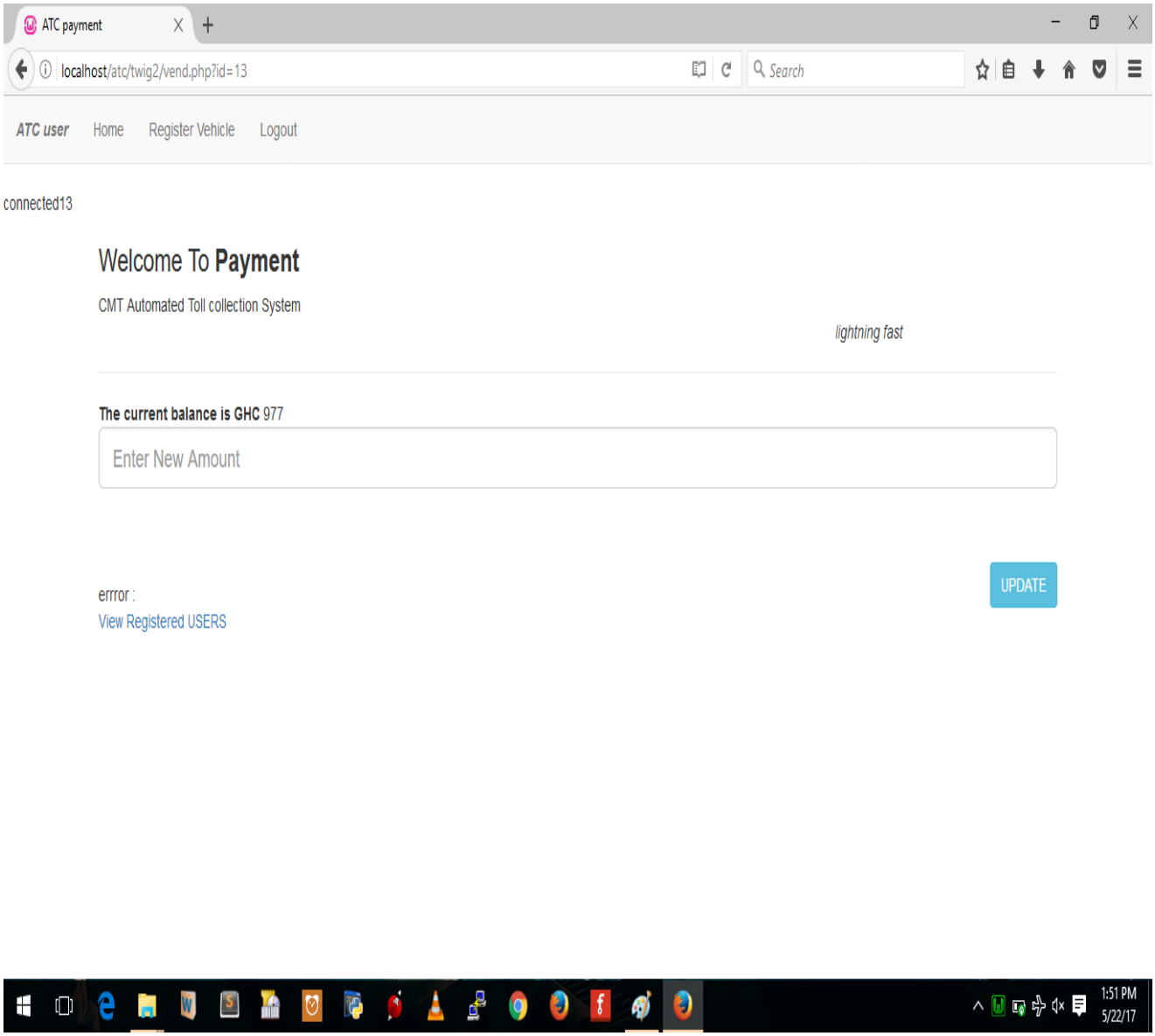
Vehicle Details Registration Page



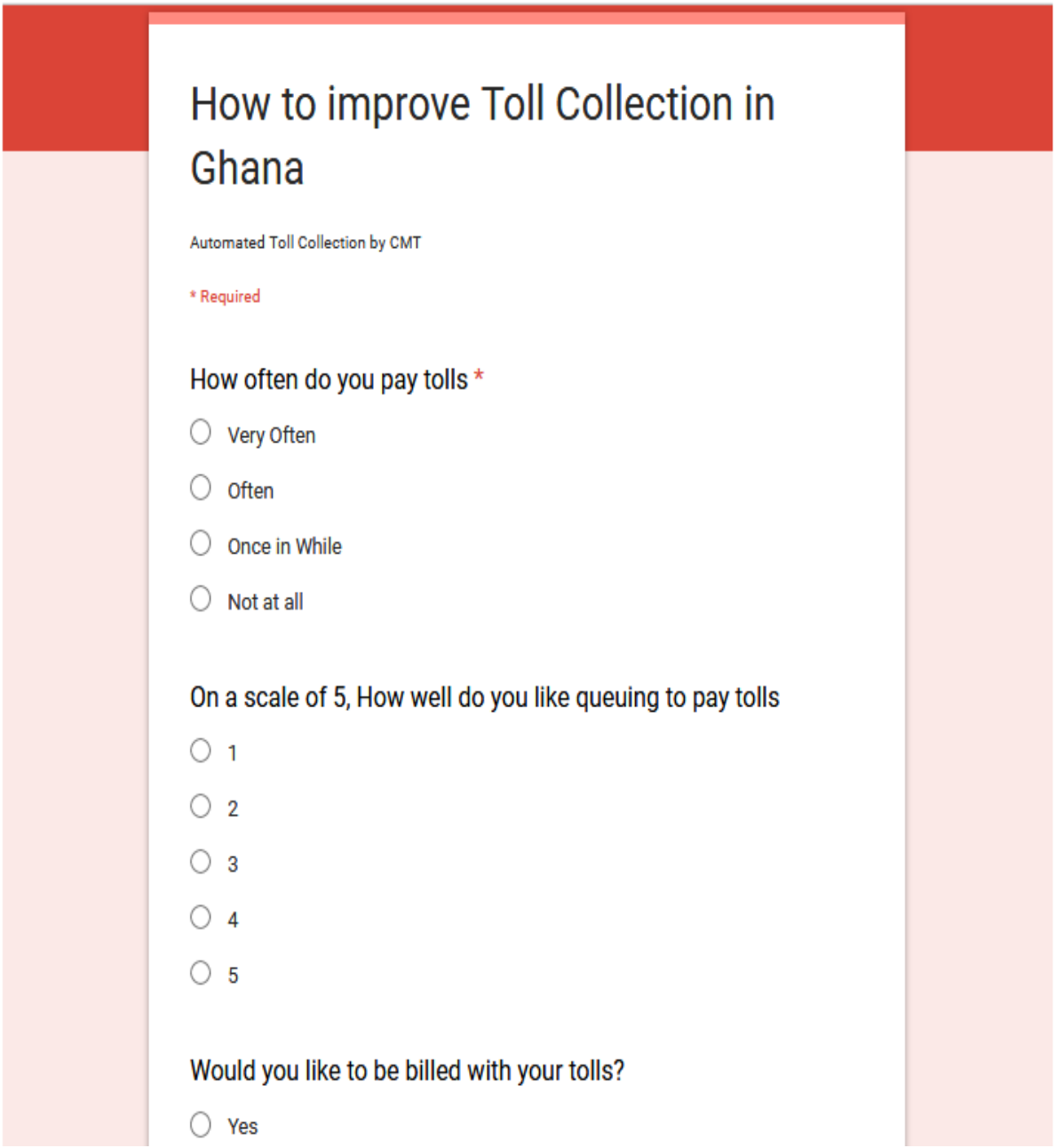
Vending Page



Payment Page



Questionnaire to access the toll collection, page 1



How to improve Toll Collection in Ghana

Automated Toll Collection by CMT

* Required

How often do you pay tolls *

- Very Often
- Often
- Once in While
- Not at all

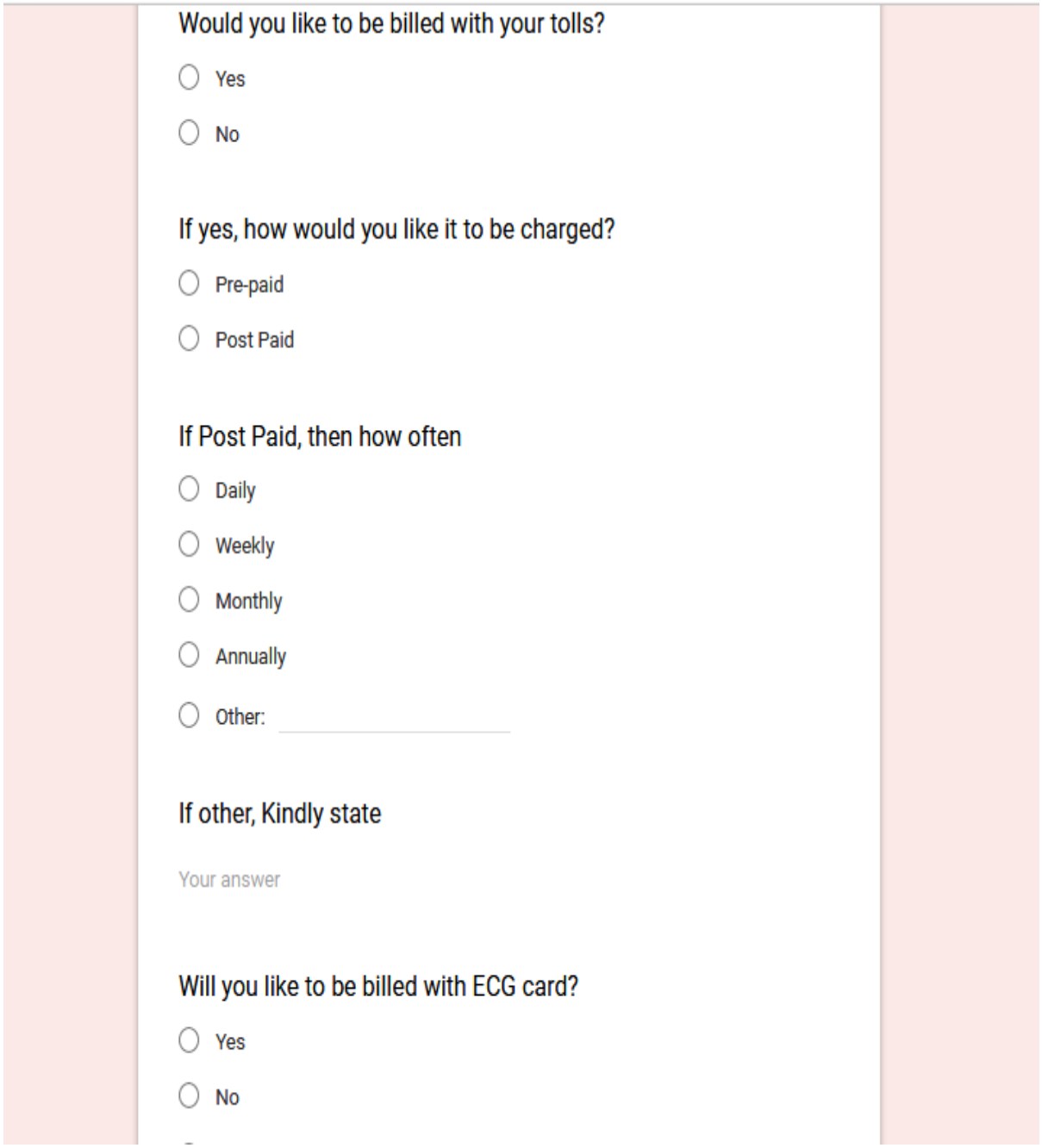
On a scale of 5, How well do you like queuing to pay tolls

- 1
- 2
- 3
- 4
- 5

Would you like to be billed with your tolls?

- Yes

Questionnaire to access the toll collection, page 2



Would you like to be billed with your tolls?

- ○ Yes
- ○ No

If yes, how would you like it to be charged?

- ○ Pre-paid
- ○ Post Paid

If Post Paid, then how often

- ○ Daily
- ○ Weekly
- ○ Monthly
- ○ Annually
- ○ Other: _____

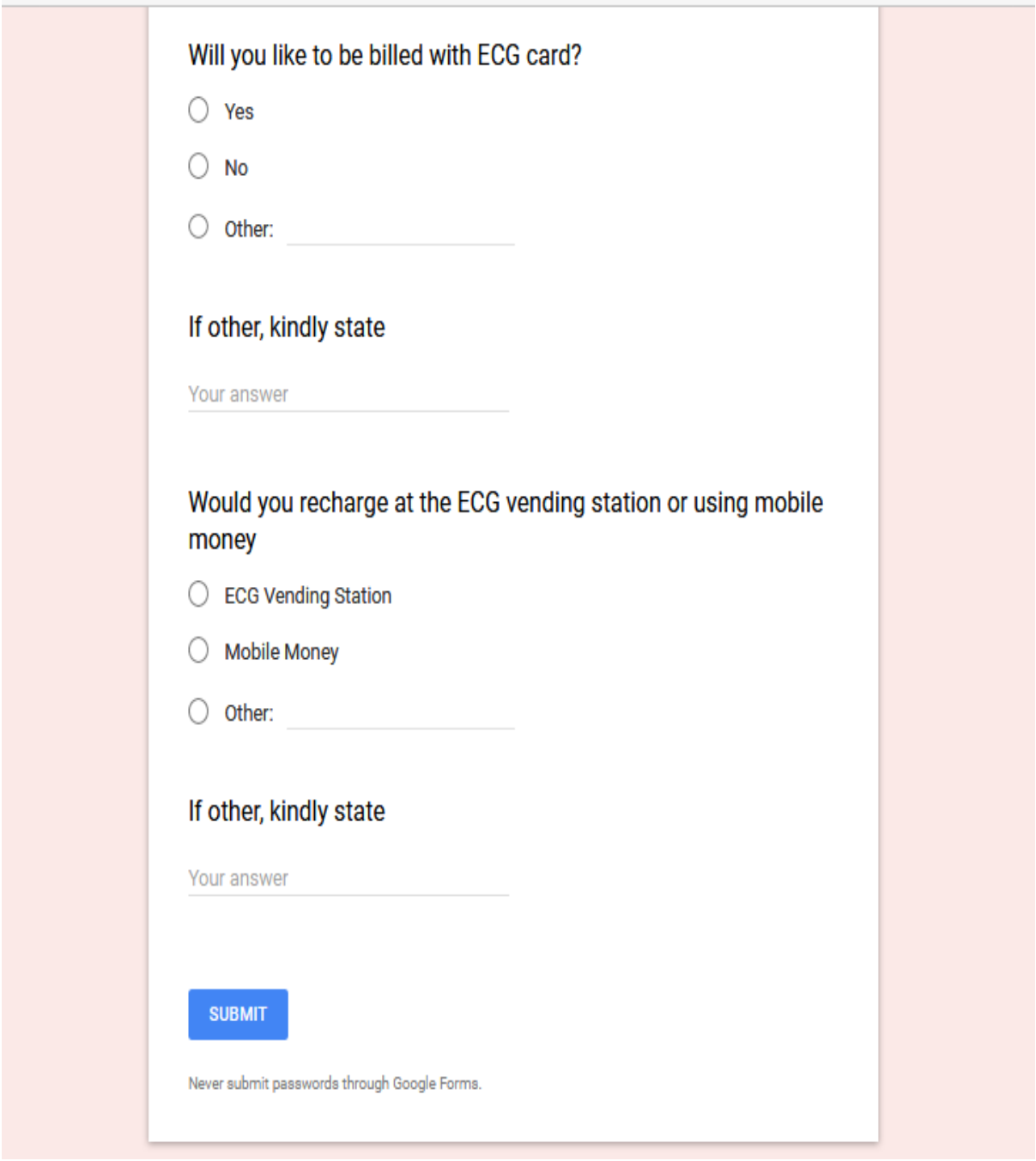
If other, Kindly state

Your answer

Will you like to be billed with ECG card?

- ○ Yes
- ○ No

Questionnaire to access the toll collection, page 3



Will you like to be billed with ECG card?

- Yes
- No
- Other:

If other, kindly state

Your answer

Would you recharge at the ECG vending station or using mobile money

- ECG Vending Station
- Mobile Money
- Other:

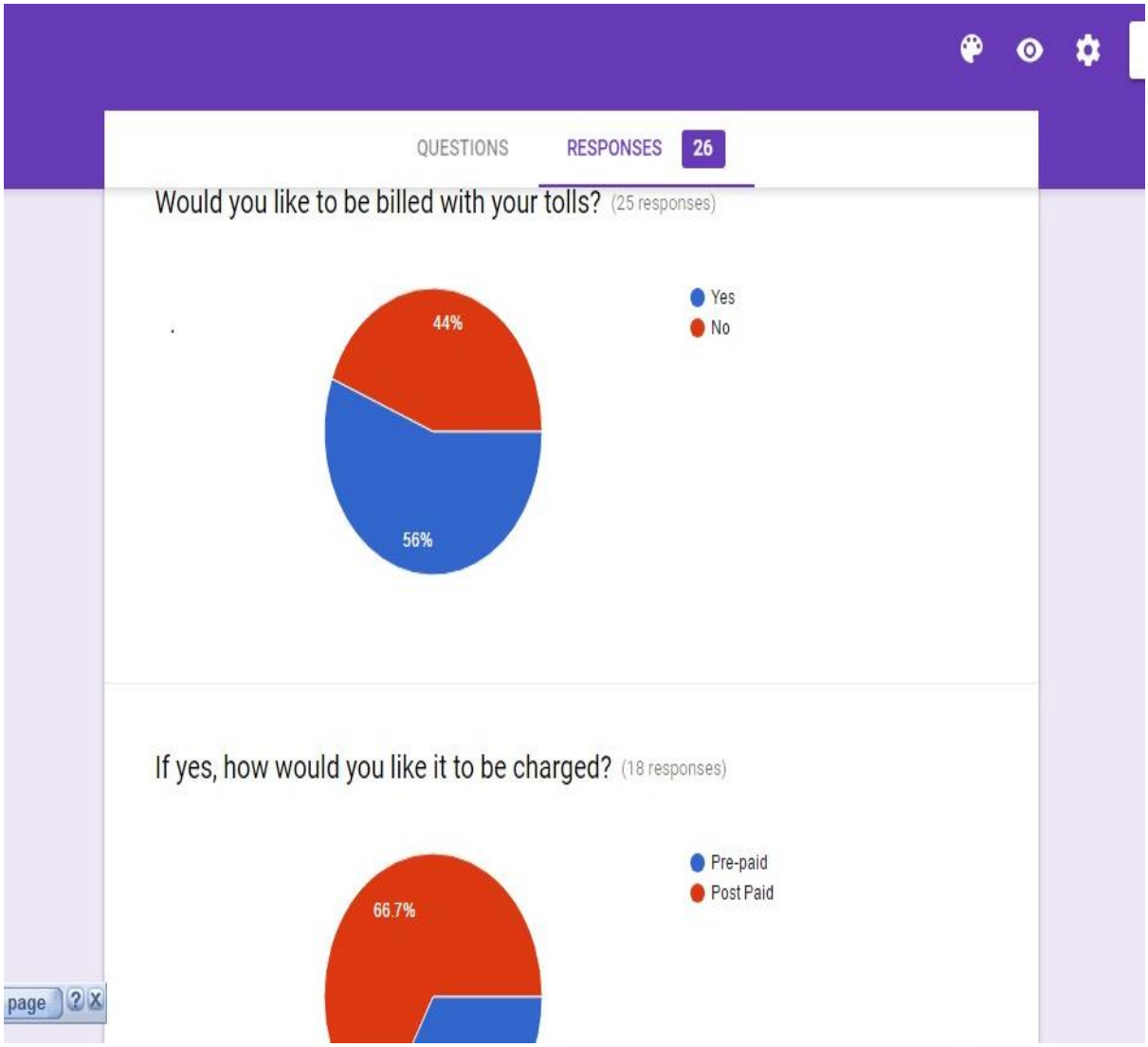
If other, kindly state

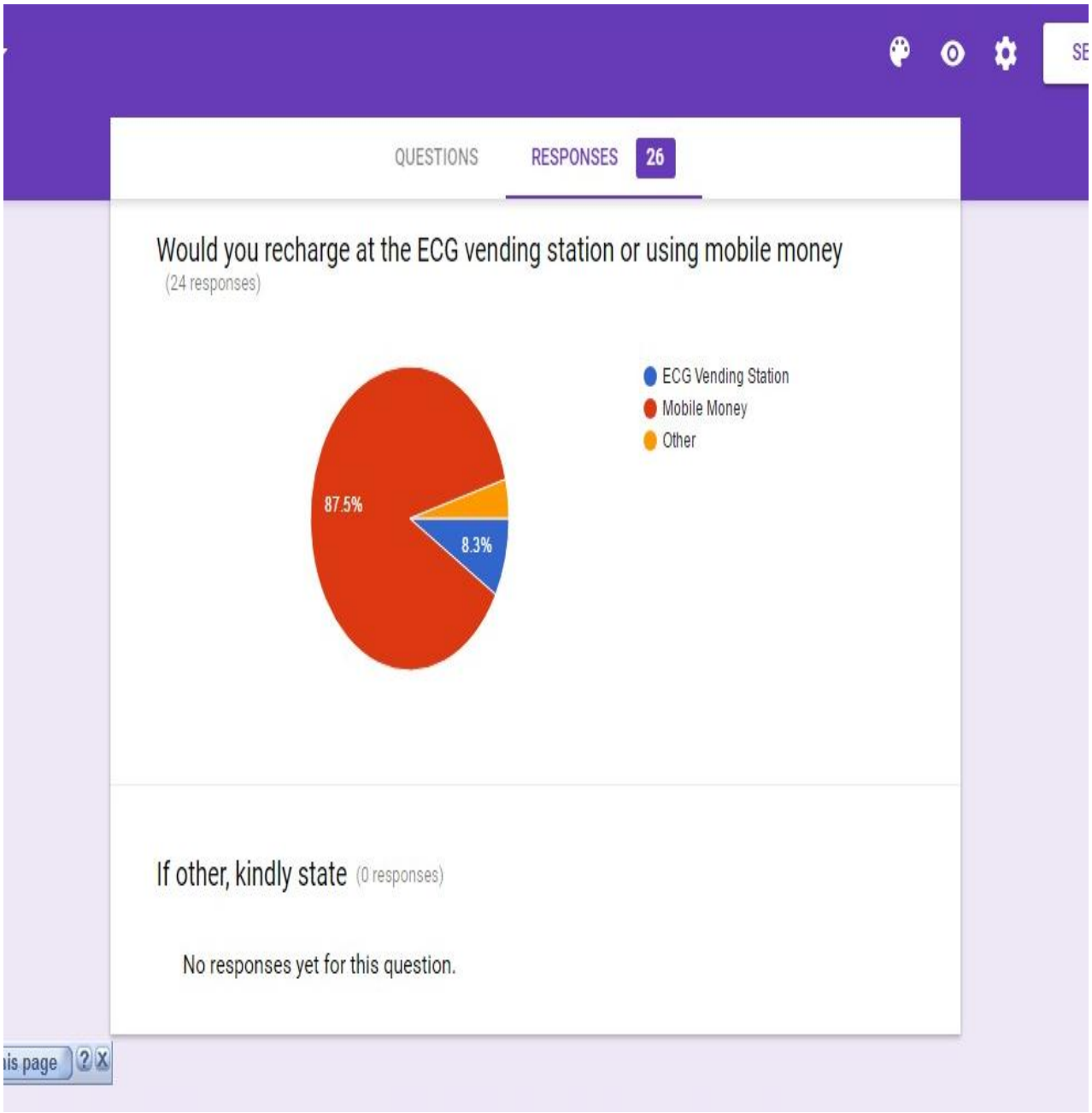
Your answer

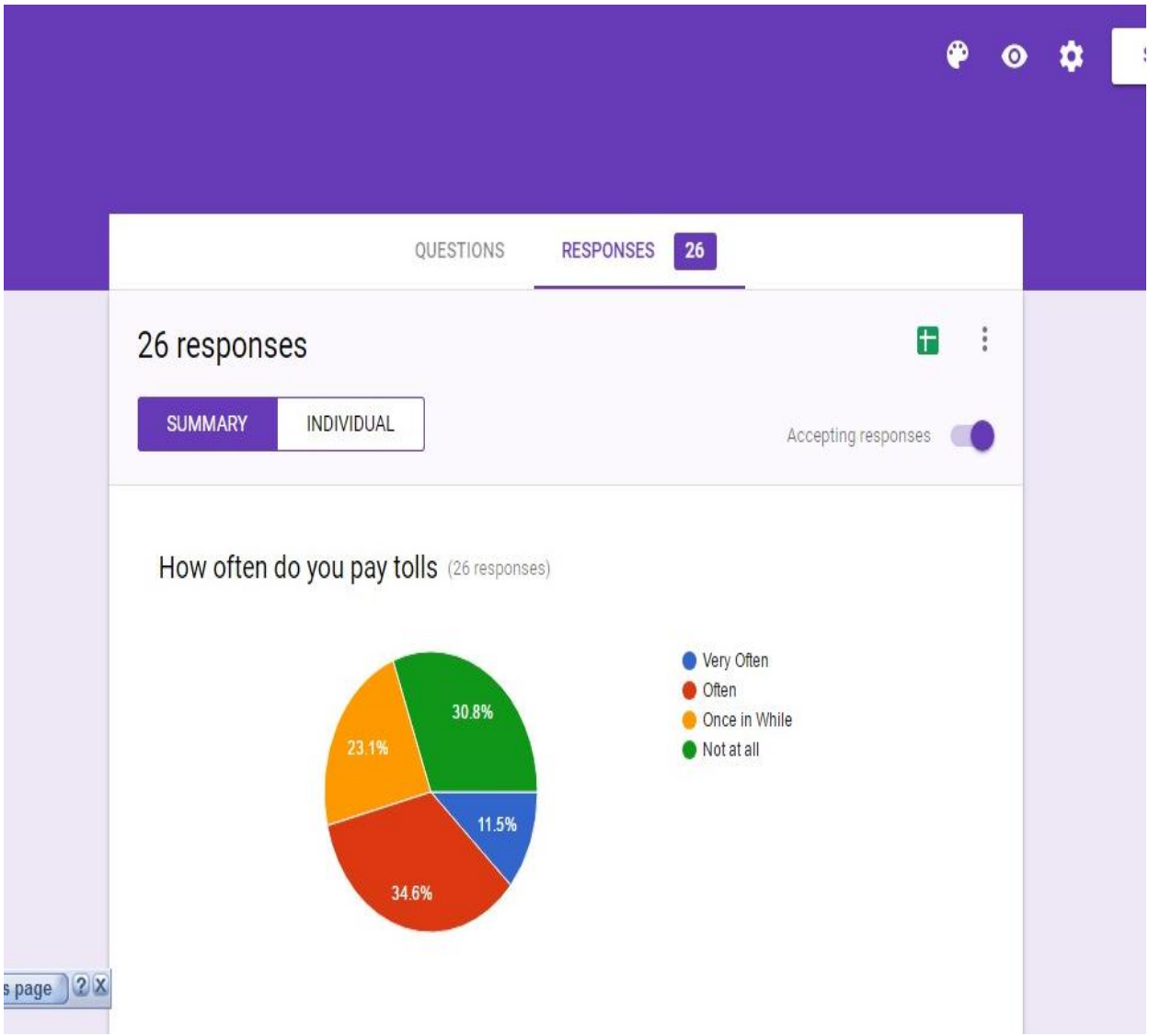
SUBMIT

Never submit passwords through Google Forms.

Reponse to the questionnaire:




QUESTIONS
RESPONSES 26
Would you recharge at the ECG vending station or using mobile money
(24 responses)
ECG Vending Station
Mobile Money
Other
87.5%
8.3%
If other, kindly state (0 responses)
No responses yet for this question.


QUESTIONS
RESPONSES 26
26 responses
SUMMARY
INDIVIDUAL
Accepting responses
How often do you pay tolls (26 responses)
30.8%
23.1%
11.5%
34.6%
Very Often
Often
Once in While
Not at all

Project Timeline:

-