Smart Fare System for CNG

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Declaration

We, hereby declare that this thesis is based on results we have found ourselves. Materials of work from researchers conducted by others are mentioned in references.

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ABSTRACT

The fare system of CNGs of our country is very unfair most of the times. Drivers do not follow the proper way and harass the customers. As a solution we came up with an idea which will help the customers to travel as they always have, but will not pay the fare in cash. Instead of paying in cash they will use a smart card to pay the fare. The smart card is mainly a RFID card which works based on Radio Frequency. Moreover, to avoid unpleasantness for the driver, he can also use his very own smart card (RFID) to pay his bill at the gas station. We are using a database to store all the information of our drivers and customers. Database saves the information and updates all of them according to every trip that vehicle makes. Every single driver and customer will have their own specific smart RFID card. While traveling we will measure the distance and set a fare for the customers to pay using the fare calculation system. The customer pays the fare by swiping the RFID card. It will be automatically updated in their database. To measure the distance we are taking the help of Google Map API. Start location and end location will be verified by a GPS tracker. RFID card is not very popular in our country though it is being used by the different people of the country to ensure some security services.

Index Term: RFID card, Google map API, CNG, fare calculation system.

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We are deeply thankful to our thesis supervisor Dr. Amitabha Chakrabarty, Assistant Professor, Department of Computer Science and Engineering (CSE), BRAC University for his guidance and continuous support throughout the work and giving us feedbacks. He was very thoughtful and his insights and unfathomable knowledge pushes us to complete this valuable journey of our life. Each and every member of this group are blessed to have an honored supervisor like him. We are also thankful to our family, friends for their support and encouragement. Moreover, we thank BRAC University along with all the respective faculty members for giving us the opportunity to complete our BSc. Engineering degree in Computer Science and Engineering. Finally we are thankful to Allah for giving us the determination, courage, patience and giving us strength to complete our project.

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Chapter 1
Introduction

At first, here, we are going to give the reader a complete overview of our project briefly. It contains some major portion of our thought to begin this very project, their merits and limitations in a nut shell.

Public transportation was never a strong side in our country for the people who move frequently for living or for their need. Those who can bear a little more usually takes taxi cabs or CNGs. Taxi cabs are more expensive than CNGs. The drivers of the CNGs take the advantage of it. They ask for more than they should and which is not authorized by the proper authority. It pushes us the regular customers in the back foot. The smart fare system for the CNGs will help the passenger to reach their destination by using the help of the vehicle without giving the driver more money than the driver deserves.

This system gives us the opportunity to use our own RFID card to pay our fares. RFID card is not very popular in our country but others use it for the sake of their security [1]. RFID card will be needed to start our journey and to finish it. After swipe the RFID card to its reader, it will start counting the distance, and by swiping it second time we are going to stop that counting. It will give us the distance between the starting point and ending point. Based on that distance and our fare rate we are going to charge the passenger the fare and will be automatically deducted from the account of them. The account is actually a virtual banking system connecting with a database management system which contains all the information needed to fill up the system requirement. GPS tracker is going to provide the longitude and latitude of the location and Google map API is going to receive it and show us our exact location [2]. GSM900A module transfers the data to the server from where we get all the information we need [3]. All the drivers will have their own machines for this system and the money is going to be in his account which would be already updated by his account number by the provider.

We mainly are focusing to do that even without having a smart phone. The users only have to register for their RFID card by giving proper information. After registering and saving money in their account they can use this system for good.

1.1 Motivation

People of our country are very much helpless when it comes to transportations system along with other things. They cannot let go or hold tight the situation when it comes to get a public transportation. Our local bus services are very time killing and over populated. In pick hours we are unable to get in a bus unless we are physically quiet fit or lucky. Not everyone can afford a car or bike. Eventually we avoid taking the help of a CNG to reach our home or destination. Fighting all for others or our family we cannot keep going on continuing the fight to get in a bus. Then there comes the hard part to find a CNG. Convince it to go somewhere with our limited resource.

The CNG drivers take this opportunity to earn more than an "extra little" money for themselves. They ask for some prices we cannot bear. Then convincing the driver is basically impossible. This is where it comes in our mind to do something. The system does not require any cash. It actually is a virtual banking system, where you keep your money and send to other person whenever you like. No need to transact hard cash with anyone. The driver even does not need hard cash to buy gas for his CNG. His RFID card will help to pay the bill without the cash. This is the main reason for doing our thesis work, to prevent the harassments and giving the passenger and drivers an easier way to travel. Both the parties will be happy if they agree on proper terms.

1.2 Thesis Contribution

Our society is going to get benefits from our thesis work. This project is one of the solutions which give us the opportunity to overcome our transportation problems. It may save lots of time, energy and money which can be used as resources to other fields. We do not have to waste our time to looking for CNGs within our budget limit. We will use more CNGs thus it is very common and available vehicle in our country.

We have done some analysis basis of functional and non-functional requirements. We considered some pros and cons of this system. We tried to find our loopholes in the system, found some and overcame them. We are hoping that in future it will work just fine, as we are working now in limited resources. This society will be benefited by this system, we feel strongly hopeful about that.

1.3 Problem Statement

Mainly we faced the difficulties when we tried to collect the data from the CNG drivers. We collected almost 200 driver's opinion about the data we need. We had to face some technical issues while working with hardware part. The GSM and GPS were not easy to use. GPS modules cannot track locations if we don't give it some time. GSM are difficult to handle if we are not using the right one, because of its frequencies.

We also had to cope up with new environment when we are out at the field for our project work. We worked very hard and study a lot to learn about our hardware and software parts. To work with Arduino it is a new experience. It gave us some trouble too.

We also faced problems while using GPS. The functions of GPS we used are not good enough. It became difficult to operate the functions as it required more efficiency. It was also cheap and difficult to use inside. Another challenge was it only works outside or near the window.

We also faced issues with the RFID card. RFID card has different frequencies and it has variations. So it was difficult to decide which will work better. We had to find the right RFID card so that it can work properly.

The fare rate was another problem. How we should set the rate, which one will be helpful for both the passengers and drivers. A lot of other options can be added here. We tried very hard to prioritize our requirements.

1.4 Solutions

There are four kinds of RFID cards in the market and for each type there are specific RFID readers in. For each type of RFID cards it was compulsory to use the compatible RFID reader but there are only one kind of RFID reader in Bangladesh. So, it was a challenge to find out the right combination as in the right RFID card.

In case of GSM there are different buad rates for each country. Buad rate for Bangladesh is 900A. So, finding out the correct buad rate was a challenge. We have used GPS in our system to get longitude and latitude of the CNG auto rickshaws. While using GPS we needed an open space unless the GPS was almost unable to show the longitude and latitude.

We overcame the problem of GSM [4] and GPS [5] and took a dataset model to overcome the fare problem. This fare rate can be added later as it may change time to time. We averaged our collected data.

1.5 Methodology

The work here basically is to measure the distance. To measure the distance we will be using Google map API, which will help us to show us our locations if they are required. After getting into a CNG we are going to swipe our own RFID card, which will have a personal number for each of the members of the system. When we swipe it for the first time, GPS tracker will start tracking our location.

GPS tracker will collect the longitude and latitude value of our position. After that GSM module will transfer the data into our server. Google map API will collect the longitude and latitude value and will ping the location of us in our smart phone. Here is to note that, this traveling can be done without having a smart phone, just by having only one RFID card.

After finishing travel, we have to swipe the card for the second time. It will stop sending the position values. After a while when the server is not getting any value, it will collect the distance using Google map. By multiplying it with the fare rate per kilo it will charge the passenger a certain amount and will be deducted from his account automatically.

1.6 Objective and Goals

The objective of the smart fare system for CNGs is to reduce the level of harassment for the passengers. Finding a CNG auto rickshaw with a proper fare is a very difficult one nowadays. Drivers do not cooperate with the passengers, they always ask very unfair fares from the passengers. Sometimes passengers have to hire the auto rickshaw with a higher fare in the pick hours. The drivers take that advantage to earn more money. Here, in this project we are using RFID cards and Google map API to reduce the level of harassments so that passengers can travel without worrying for an unpleasant fare. We also show how much distance they traveled. Meter tempering has also been a problem in many cases. This entire system is going to end this

problem forever. As the system is very simple and straight it is also going to be easier for people to understand and adopt. The effort was to find out a solution to the problem of a long lasting CNG fare system. . CNG auto rickshaw drivers had a tendency to seek more fare than the meter shows. In which most of the cases passengers have been the victim. After the introduction of transportation services like "uber" and "pathao" in Bangladesh people have started ignoring CNG auto rickshaws as transport because they were having a better service and security at a same cost with other app based transportation system. As a result CNG auto rickshaw drivers are also being harmed financially. In this system this problem was tried to be solved. And it has been made very simple so that people of all ages and walks of life can easily adopt this.

1.7 Thesis Outline

Chapter 1 is the INTRODUCTION of the thesis. The Motivation and Objectives & Goals of the thesis are described here.

Chapter 2 is LITERATURE REVIEW. This chapter consists of related works and research which indicates to the real life works and researches done by others, which are related to our thesis work in many ways.

Chapter 3 is RESEARCH ANALYSIS where two algorithms of data analysis are described and have been shown their implementation for comparing them with our proposed model.

Chapter 4 is SYSTEM IMPLEMENTATION. This chapter consists of Implementation of our system. It introduces our developed model, its works, and its features, its workflows, hard wares and software.

Chapter 5 is DATASET AND RESULT ANALYSIS**.** Where we have shown the data we collected through our whole research process and results we had from the algorithms that we have used.

Chapter 6 is CONCLUSION AND FUTURE PLAN which consists of conclusion remarks and future works

Chapter 2

Literature Review

CNGs are used by almost all classes of people even if they are paying more than the fare price. Passengers sometime have to bargain or indulge in quarrel with drivers against their wish. CNG has always played an important role in the transportation system of Bangladesh. In comparison to other transportation systems, it is more available in our country. These CNGs use taximeter to calculate the fare. Generally taximeter is an electro-mechanical device installed in taxicabs and auto rickshaws that calculates passenger fares based on a combination of distance travelled and waiting time. It does it by calculating distance through an electro-mechanical cable known as sensor cable. The electrical circuit on taxi meter calculates total distance and time of the travel period. The sensor cable is connected through a long cable directly to the taxi meter. There is a ring inside the sensor cable which turns as the wheel rotates. For every rotation it produces electric pulse, this is sensed by the taxi meter motherboard and calculates the distance.

Uber[1] app which gives similar services. But in those apps they take cash in our country and also do not have enough vehicles for our people. We can consider another app as our inspiration of work which is Pathao[2]. Pathao also provides similar services providing apps but they take cash too. We are using our system in the most common vehicle of our country 'CNG', which is more available in our country. Our system does not require extra time or money. Uber and pathao has been very popular among these days in our country and the main concept of uber is creating a connection among passengers and drivers using their own private vehicles by means of internet. Firstly the system transmits the pickup location of the driver. The passenger can see the details of the approaching vehicle and the information of the vehicle and driver and the estimated time of arrival. The driver sets the official start of the ride. After reaching to the destination, the system computes the fare as a function of time and distance. In our system, Using Google map[3] to measure distance and reaching a destination is not a new thing in this modern era.

1. https://www.uber.com/en-BD/
2. https://pathao.com/
3. https://www.google.com/maps

There exists some apps which helps us to make our travel easier. In our app we are using Google's API to measure the distance and will set the fare rate. After reaching the specific destination our smart card will help them to pay their fare. A thesis paper titled 'Efficiency Analysis of Public Transit systems in Bangladesh [6] has highlighted the status of Dhaka as a global mega city with serious concerns over the current status and future prospects for its transit systems. A thesis paper was published to find the differences between the two public transport namely Battery Powered Easy Bike and CNG powered Auto Rickshaw in terms of cost (operating cost, manufacturing cost, maintenance cost), user friendly and environmental issue[7]. Another study in detail urban transport systems in Asian cities as they share the same characteristics like high population density, traffic problems, deteriorating public transport service and a lack of investment funds [8]. After a long-term comparative analysis of the issues author provides insights to the key public policy choices in these cities and reveals potential opportunities for public transport in high density urban areas. According to him high densities results in high traffic intensities, pollution, traffic injuries, congestion and make low availability of road space but also give opportunities to have public transportation with high service levels and these are highly accessible and profitable as long as have huge number of potential customers. Another research paper was published in 2009 [9]. The goal of the research in this paper was to develop a compact, robust and affordable hybrid system in order to significantly reduce the fuel consumption and emissions of auto-rickshaws. In another article shows nearly 86 percent CNG-run auto-rickshaws do not follow fare charts prepared by the government. A police officer said they usually take action against the auto drivers who do not use meters. Police sergeants will be brought to justice if they are found guilty. BRTA said passengers of auto-rickshaws have to pay Tk 40 for the first two kilometers and then Tk 12 for next each km while waiting charge is Tk 2 per minute. According to the State-run BRTA, there are over 12,320 CNG-run auto-rickshaws plying streets in the capital. Another paper by Ronald Jarret, under Dr. Nigel Clark, Professor of Mechanical and Aerospace department, in West Virginia University was published in December 2000. They wanted to test the emission level from heavy duty vehicles and their environmental impacts [10]. Another article discusses single drive systems and multi-drive systems. With multi-drive systems the motor controllers must additionally be configured to provide an electronic differential effect [11]. An Entrepreneurial projects program

at Illinois Institute of Technology under title “Solar/battery hybrid three-wheel auto rickshaw for India” was done by Mulhall, P., M. Naviwala, S. M. Lukic, J. Baraband, and A. Emadi, at Vehicle Power and Propulsion Conference, University of Texas, Arlington, USA was published in 2007. This project includes research on the conventional auto rickshaw, future conceptual infrastructure designs for electric rickshaws, and the recent design research and simulations of the next auto rickshaw. According an article. New CNG auto-rickshaw fare from today on The Daily Star, November 01, 2015 [12]; At least six mobile courts have been set up at different key points in the capital to monitor whether the drivers are charging extra fare. The mobile courts of Bangladesh Road Transport Authority (BRTA) will also monitor the fitness of the three-wheelers and check the valid documents of the vehicles, said an official of the BRTA. It also says, the auto-rickshaws must have a meter system to ply on the roads according to the government instruction. In September, the government hiked the minimum fare to Tk 40 from Tk 25.According to the hiked fare, commuters will have to pay Tk 12 for each kilometer and Tk 2 per minute as the waiting charge. Previously, the rate was Tk 25 for the first two kilometers and Tk 7.64 for the next. Waiting charge was Tk 1.40 per minute. The drivers will have to pay Tk 900 on daily basis to the owners as deposit money where the rate was Tk 600.

Chapter 3
Research Analysis

3.1 Linear Regression

Linear regression [13] is a form to estimate the real values based on continuous variables. We establish here a relationship between dependent and independent variables by fitting a best line. This line is called regression line. It is represented by a linear equation.

The earliest form of regression was the method of least squares, which was published by Legendre in 1805 and by Gauss in 1809.The term "regression" was coined by Francis Galton in the nineteenth century to describe a biological phenomenon.

Equation: Y = aX + b

Here,

Y = Dependent variable

a = Slope

X = Independent variable

b = Intercepts

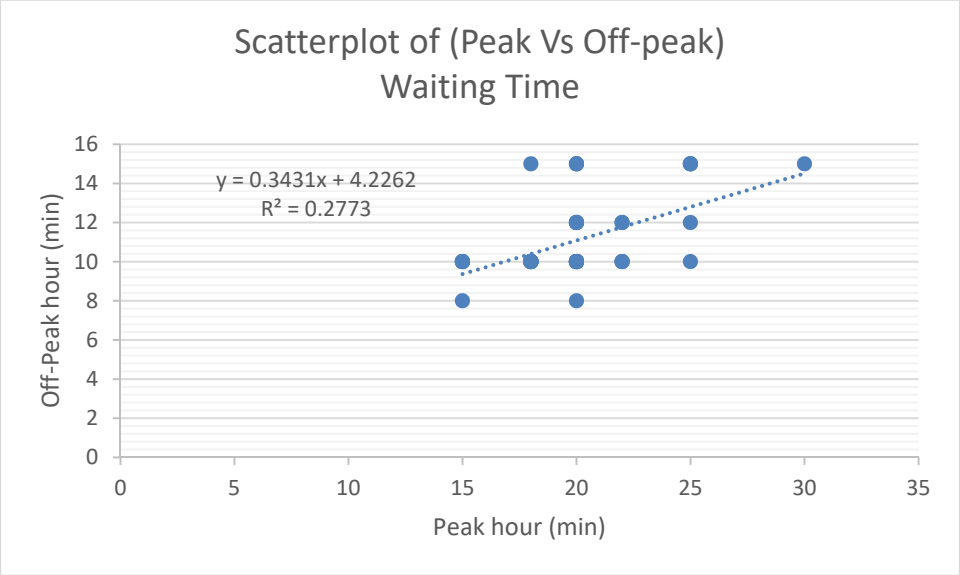

Figure 3.1a: A linear regression

There are different types of linear regression. This one is a simple linear regression. It is simple because it has only one independent variable. By finding its best fit line we can fit a polynomial or curvilinear regression. Here, Y is the dependent variable, a is the slope, X is the independent variable and b is the intercepts. We placed the values of peak hour on X axis and the values of off peak hour on Y axis. After plotting all the values and doing all the linear regression we get the average waiting time on off peak hour is 10-12 minutes and the average waiting time on peak hour is 20-22 minutes per hour.

3.2 Cluster analysis

Cluster analysis [14] or clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar (in some sense) to each other than to those in other groups (clusters).Cluster analysis itself is not one specific algorithm, but the general task to be solved.

Cluster analysis was originated in anthropology by Driver and Kroeber in 1932 and introduced to psychology by Zubin in 1938 and Robert Tryon in 1939 and famously used by Cattell beginning in 1943 for trait theory classification in personality psychology.

STEP ONE- Start with data Set	
Per day travel kilo	per day fare(income)
235	3000
240	3500
250	4000
230	2500
234	2900
238	3300
250	4100
231	2600
255	6500
233	2700
239	3500
235	3200
240	3500
245	5400
240	2000
235	1500
230	3540
237	2560
230	3000
235	2900

Figure 3.2a: Data set of cluster analysis

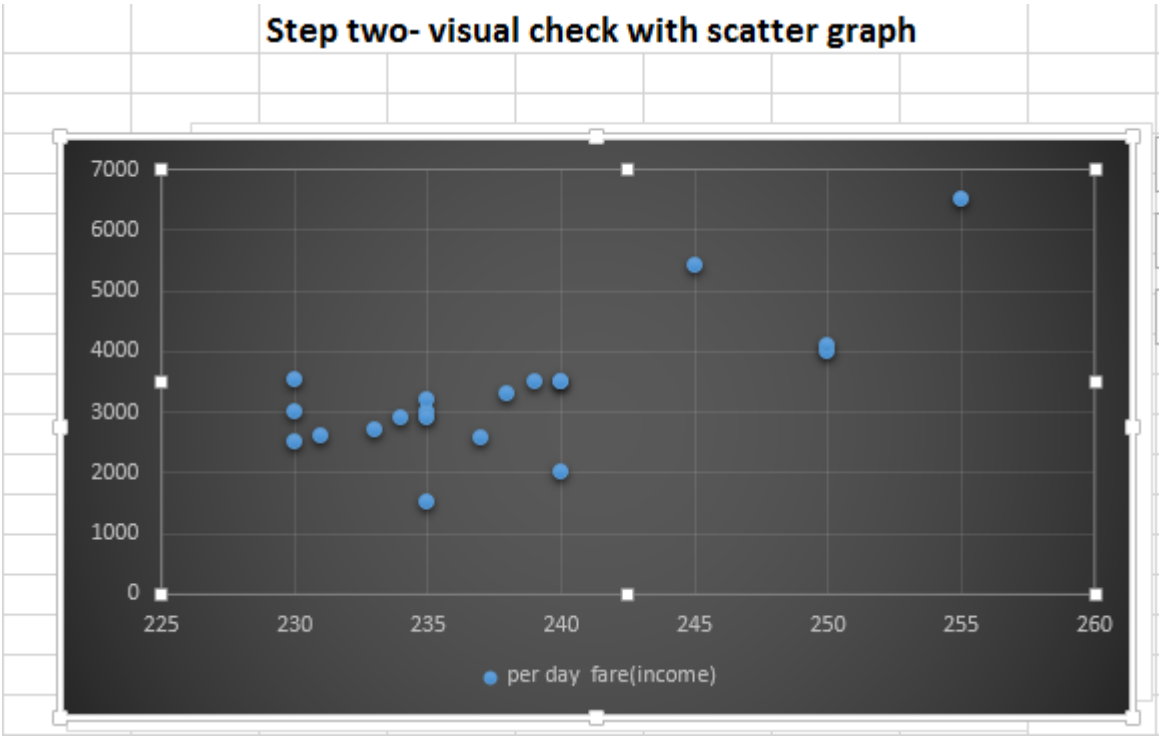

Figure 3.2b: Graph of cluster analysis

Here we do cluster analysis to find out the cluster or group of data for average travel kilo per day and average fare (income) per day.

Chapter 4

System Implementation

In our project, we are measuring the time and distance between two points-source and destination. To measure the distance and time we are using Google map API, it shows and helps us to determine the distance between our source and destination. We are using a smart device and card to set our source and destination. Our smart card actually is a RFID card, which works using RFID card reader connected to Arduino. This reader starts measuring data, calculates the data and set a fare for the customer, which is transacted in their bank accounts.

4.1 Workflow:

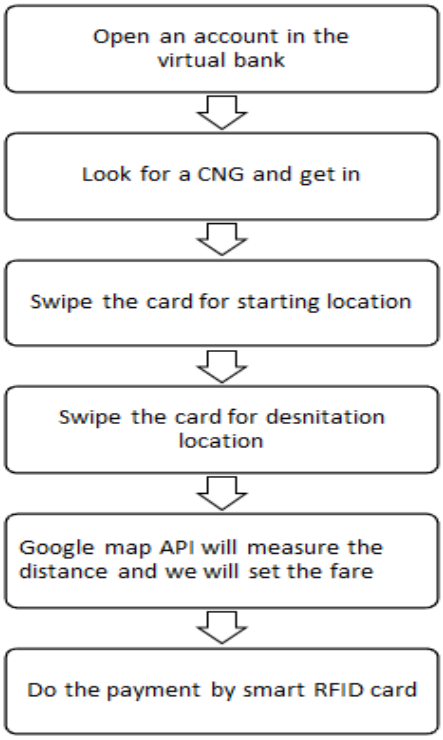

Figure 4.1a: System implementation

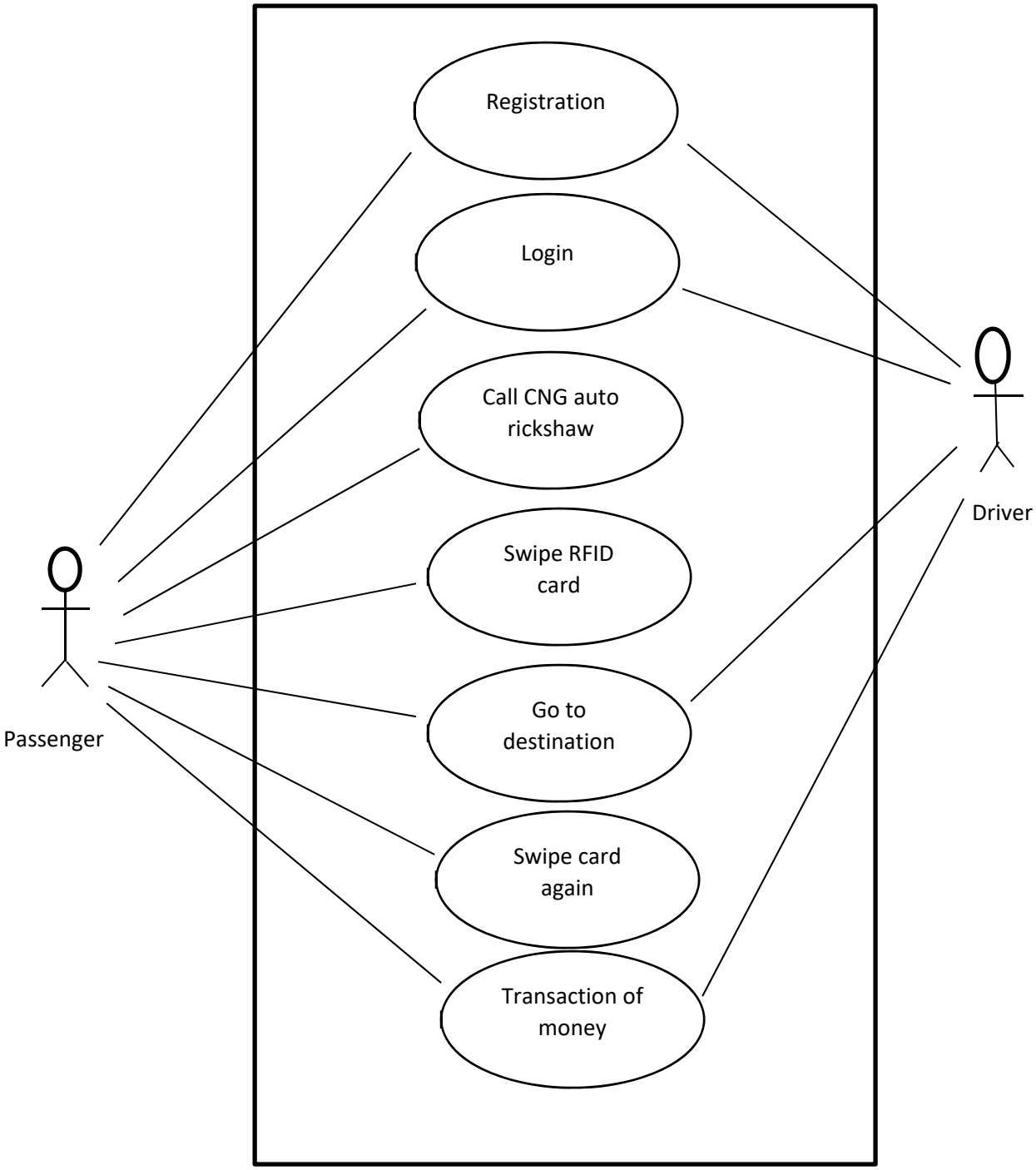

Figure 4.1b: A use case diagram of smart fare system for CNGs

4.2 Software components

4.2.1 XAMPP

XAMPP is a completely free, easy to install Apache distribution containing Maria DB, PHP, and Perl. The XAMPP open source package has been set up to be incredibly easy to install and to use. XAMPP helps us to create and develop our own applications using Web server technologies. Many people know from their own experience that it's not easy to install an Apache web server and it gets harder if we want to add MySQL, PHP and Perl. XAMPP is an easy to install Apache distribution containing MySQL, PHP and Perl. XAMPP is really very easy to install and to use just download, extract, and start. XAMPP stands for Cross-Platform (X), Apache (A), Maria DB (M), PHP (P) and Perl (P). It is a simple, lightweight Apache distribution that makes it extremely easy for developers to create a local web server for testing and deployment purposes.

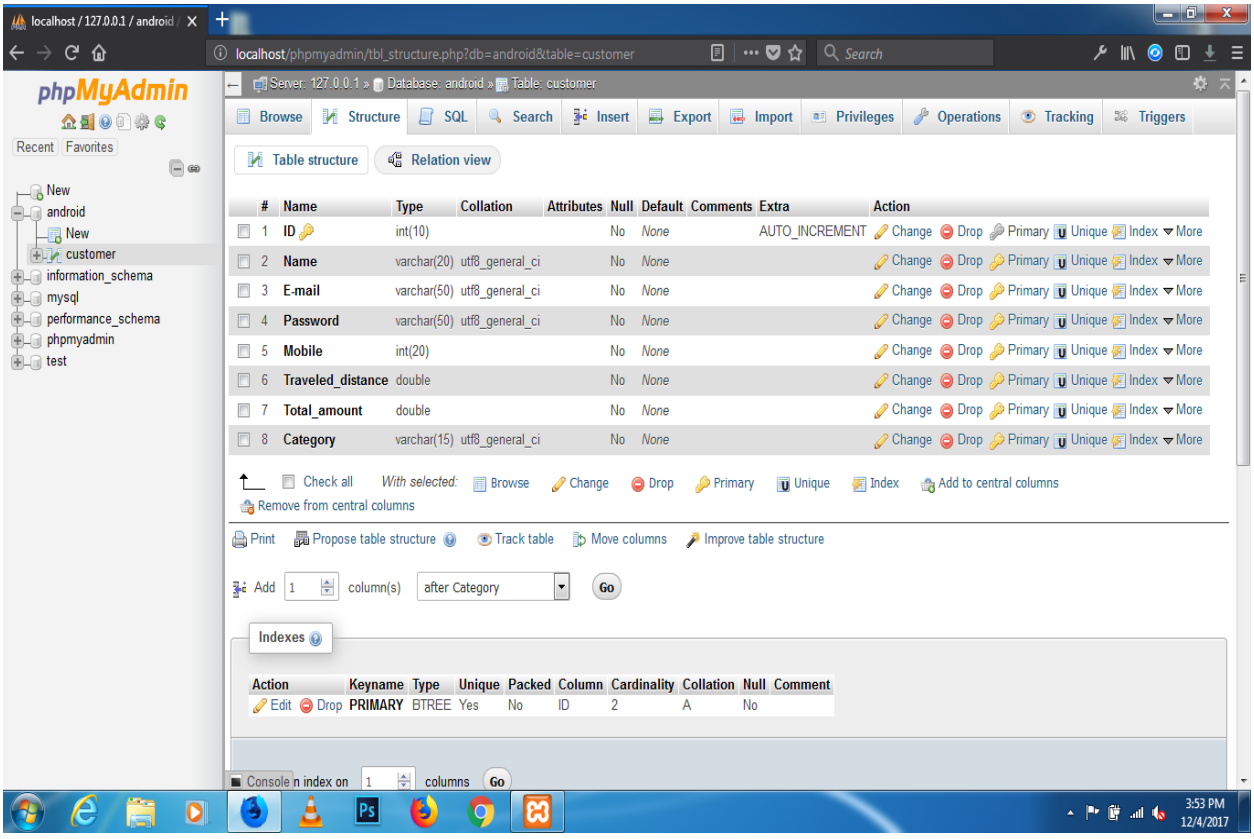

Figure 4.2.1: Database

Everything needed to set up a web server – server application (Apache), database (Maria DB), and scripting language (PHP) – is included in an extractable file. XAMPP is also cross-platform,

which means it works equally well on Linux, Mac and Windows. Since most actual web server deployments use the same components as XAMPP, it makes transitioning from a local test server to a live server extremely easy as well. XAMPP is regularly updated to the latest releases of Apache, Maria DB, PHP and Perl. It also comes with a number of other modules including OpenSSL, phpMyAdmin, MediaWiki, Joomla, Word Press and more. Self-contained, multiple instances of XAMPP can exist on a single computer, and any given instance can be copied from one computer to another. XAMPP is offered in both a full and a standard version[15].

4.2.2 Google Map API

API (Application Programming Interface)

APIs are like user interfaces-"Just with different users in mind" introduced the idea that an application user interface, or API, is an interface for software. APIs are used by software applications in much the same way that interfaces for apps and other software are used by humans. What Are APIs and How Do They Work? The standard electrical socket found in most walls as a metaphor for explaining the principles of an API.

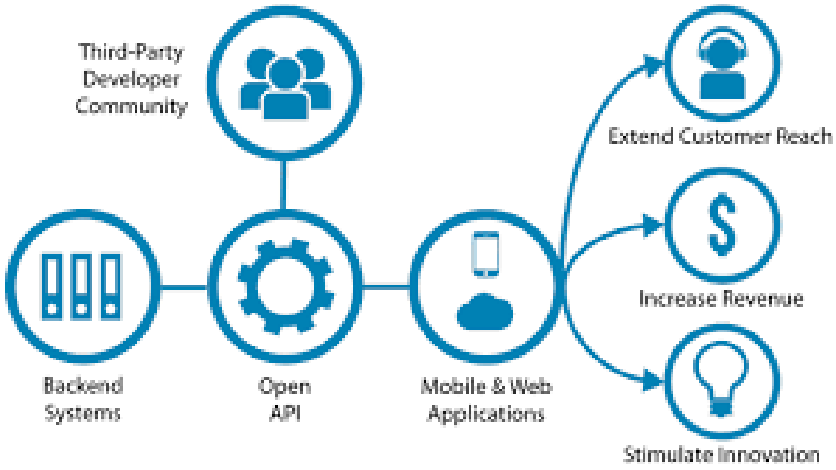

Figure 4.2.2: API

API matters the most to Programmable Web, the ones that are enabled for consumption from across a network or fuel the development of Web applications. In this part, we will examine how the concept of abstraction is a major contributor to flexibility for API providers. The API economy now spans thousands of API-providing companies across hundreds of categories.

Within each category there are multiple offerings, all competing for the affections and money of third-party developers--any one of which could unleash the next API.

4.2.3 Android Studio

Android studio provides the fastest tools for building apps on every type of Android device. It allows to focus on building unique and high quality apps. Android studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains IntelliJ idea software and designed especially for Android Development [17]. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development. We have used the current android studio version v3.0.1.

Android studio was announced on May 16, 2013 at the Google I\O conference. It was in early stage preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014[16].

4.2.4 Android SDK

The Android software development kit (SDK) includes an exhaustive arrangement of advancement devices. These unite a debugger, libraries and a handset emulator in view of QEMU, documentation, test code, and instructional exercises. Presently upheld improvement stages incorporate PCs running Linux (any cutting edge work area Linux appropriation), Mac OS X 10.5.8 or later, and Windows 7 or later. For this undertaking we have utilized SDK variant v2.9.0. It provides a selection of tools required to build Android apps or to ensure the process goes as smoothly as possible [16].

4.3 Hardware components

4.3.1 Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

Figure 4.3.1: Arduino Uno

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Arduino is the popular open-source electronics prototyping platform based on easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments and is designed to be as flexible as possible to fit your project's needs[17].

4.3.2 GSM module

GSM (Global System for Mobile Communications, originally Group Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI).It was created to describe the protocols for second-generation (2G) digital cellular networks used mobile phones and is now the default global standard for mobile communications.

Figure 4.3.2: GSM 900a module

General Packet Radio Service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM). GPRS was originally standardized by European Telecommunications Standards Institute (ETSI) in response to the earlier CDPD and i-mode packet-switched cellular technologies. It is now maintained by the 3rd Generation Partnership Project (3GPP). GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB) for computer. The MODEM is the soul of such modules [18].

4.3.3 GPS module

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, we can monitor the status of the module. The module can save the data when the main power is shut down accidentally.

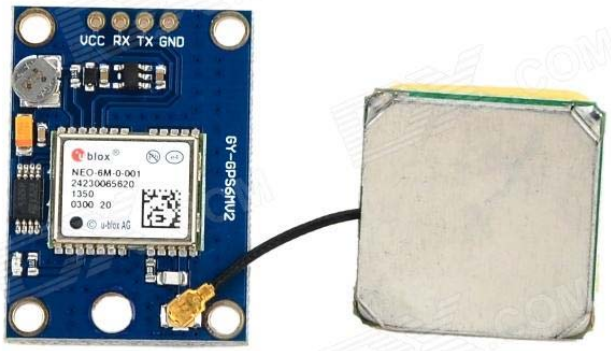

Figure 4.3.3: GPS Module

4.3.4 RFID card and reader

RFID stands for Radio-Frequency Identification. The acronym refers to small electronic devices that consist of a small chip and an antenna. The chip typically is capable of carrying 2,000 bytes of data or less.

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

Figure 4.3.4a: RFID card

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader [19].

Figure 4.3.4b: RFID card reader

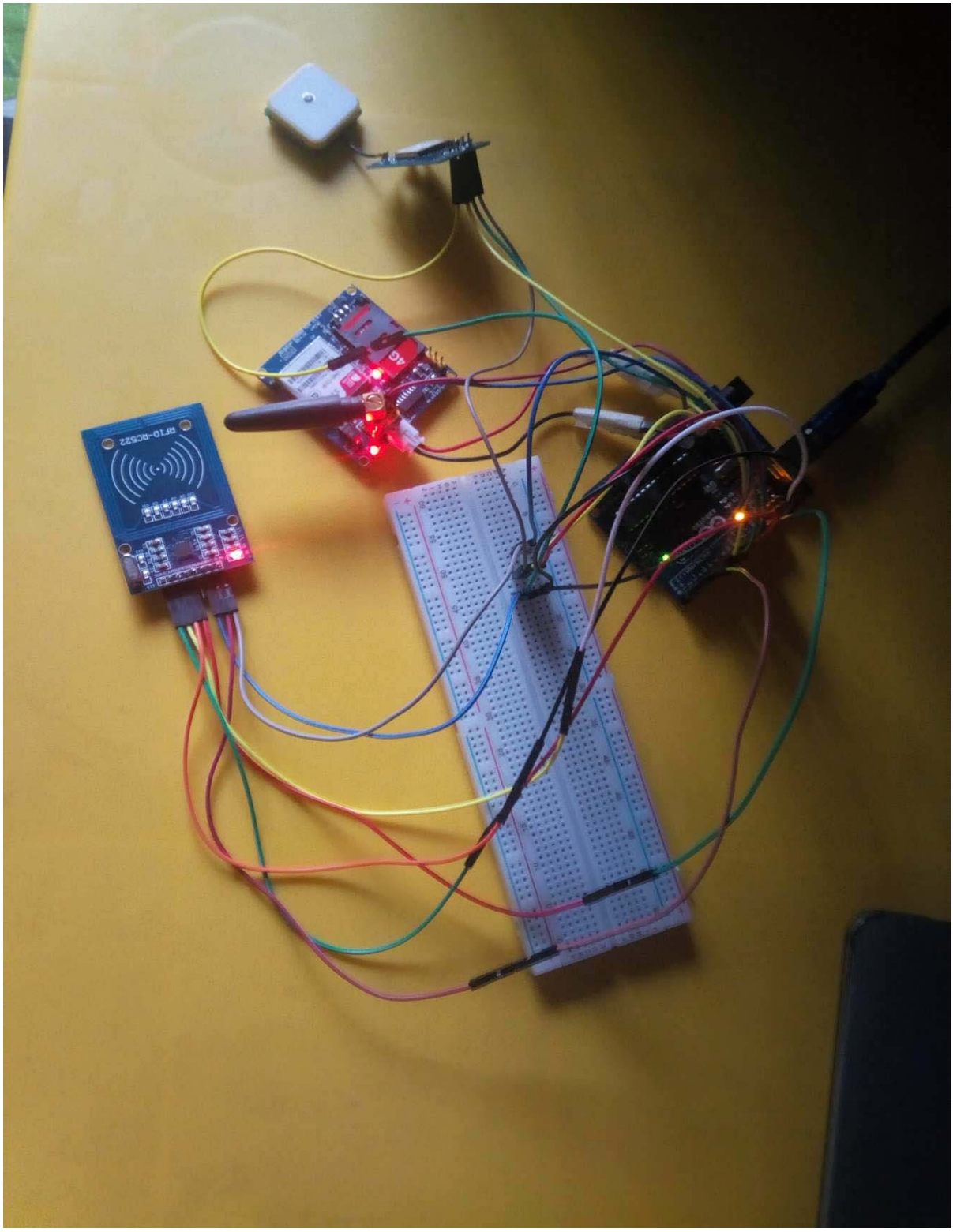

Figure 4.3.5: Smart fare System

Chapter 5

Dataset and Result Analysis

5.1 Dataset of CNG fare and travel time

Numbers	per hour	per day	passeners per day	monthly traveled kilo
1	18	200	15	6000
2	17	180	16	5400
3	18	200	16	6000
4	16	170	18	5100
5	16	170	18	5100
6	18	200	17	6000
7	18	200	17	6000
8	18	200	18	6000
9	15	160	17	4800
10	15	160	16	4800
11	18	200	16	6000
12	18	200	15	6000
13	17	180	15	5400
14	16	170	15	5100
15	17	180	15	5100
16	17	180	15	5400
17	17	180	17	5400
18	17	170	17	5100
19	17	170	18	5100
20	18	200	17	6000
21	18	200	18	6000
22	18	180	18	5400
23	18	180	18	5400
24	15	170	18	5100
25	16	170	15	5100
26	15	160	15	4800
27	15	160	15	4800
28	16	180	16	5400
29	17	180	17	5400
30	18	200	18	6000

Figure 5.1: Collected data from the drivers

5.2 Result analysis

According to the data we have collected, there are many reasons of high expense and maintenance that are found through primary data collections. Those problems are mostly solved in the new smart fare meter. The extra payment and bargaining for fare charge instead of offering the meter charge is researched. What makes the meters expensive, unreliable and prone to failures are found through primary data collection. The data analysis shows all the needed answers.

The research and data analysis says the fare charge price per kilometer selected by the authority was sufficient and satisfactory. However, many taxi cab drivers are not honest enough to accept the fare price. They manipulate the taxi meter or bargain to get more money. After talking to many drivers and taxi meter mechanics, it was found that meter forgery is common and not a very difficult work to do. As a result many taxi cab drivers use meter forgery to earn more money. The easiest way to do that is to manipulate the wire that connects wheel sensor to the meter. This results in voltage variation in the input of the taximeter and causes the meter to count more distance then the practical value. There is no way to stop it as long as the present meters are in use because this method is easy for the mechanics to follow. For the passengers they can't detect or do anything about it.

From the table above and from figure 3.1a, we notice the time we usually spend on the road waiting according to our CNG drivers. Regression analysis helps us to find out a suitable solution to set a fare for both the sakes of passengers and drivers. The average time we spent on waiting in a traffic jam is nearly 10-12 minutes in off peak hour and 20-22 minutes in peak hour for per hour in a day. The average number of passengers get on a CNG is 15-16 per day. The average of monthly traveled kilo for a CNG driver is 5500 kilometers. According to the CNG drivers these are the values of their daily and monthly variables.

From the figure 3.2a, we notice the dataset of per day travel distance in kilometer of CNG vehicles and per day income of CNG drivers. Then we get the average of those values by doing clustering of those dataset. Average value of per day travel distance found by our analysis is 230-235 kilometers. The estimated value of per day income is about 2500-3000 taka.

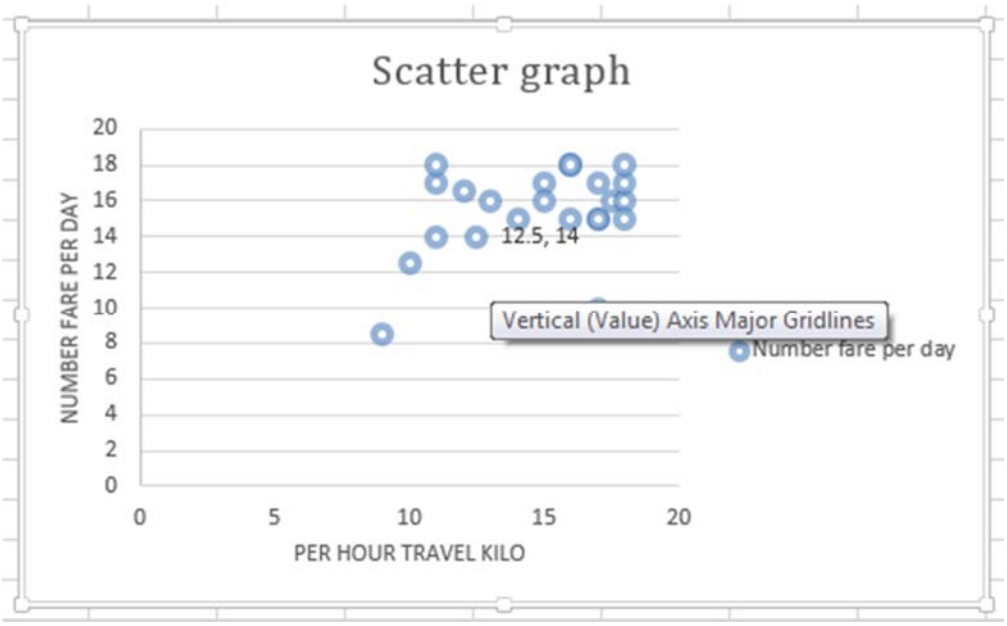

Figure 5.2a: Graph of result analysis

From the figure 5.2a, we find the cluster values of per hour travel distance and cluster values of the number of fare per day based on the above table of dataset. We get 12.5 hours as the value of per hour travel distance and 14 as the number of fare per day.

Above all, it will become an expensive and unreliable fare rate according to our collected analytical data and most of the problems and difficulties like extra payment and bargaining faced by both passengers and drivers are solved in the new smart fare meter.

Chapter 6

Conclusion and Future Plan

6.1 Conclusion

In the end we can say that, our project is very strong to introduce as a new methodology in the current framework. Our project will overcome the current problems that we passengers face every single day of our lives. We tried our best to ensure the maximum facilities in minimum budget. We tried to keep in a low limit while trying to make the machine. It is going to be very effective and reasonable; we ensured that. Now Uber and Pathao are doing really well in the Dhaka area. We can use our project wherever we want as long as there are public transportations to ride. The anywhere service and the availability of CNG will help the system to grow more and more. Though we tried to make our system flawless and we did it, still we are looking for other problems and trying to think out all the problems we may face in the future.

6.2 Future Plan

The smart fare system we currently established is kind of a prototype. We used some limited and small features here. The sector can be very big, though it will need lots of resources. We are trying this one for the CNGs for now. We are thinking about putting the system in every public transportation system.

Currently we are showing some limited data; just the fares are collected by the smart RFID card. In near future we are going to make it more secure by creating different types of security system.

People will not be only using the CNGs but the local public vehicles as soon as we try putting the system in there. The GPS module we are currently using its performance is good but not up to the mark. We will look into it to make its performance better.

Though we are using a Google app to measure the fare of CNG, but our system is completely useful even for those who does not have any smart phone but has the RFID card. Google app is just to show us the distance of our traveling path not the fare. In near future we are thinking to make the app in Bangla so that some people may find it effective for them.

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