

# A Proposal for IOT Based Smart Transportation Payment and Monitoring

COMPUTER SCIENCE AND ENGINEERING DEPARTMENT  
GRADUATING PROJECT

## Contents

Chapter One: Introduction.....	2
1. Background of the project .....	2
2. Statement of the problem .....	2
3. Justification of the project .....	3
4. Objective of the project .....	3
a) General Objective .....	3
b) Specific Objective .....	3
5. Scope and Limitation.....	3
a) Scope of the study .....	3
6. Assumptions made in the project .....	3
7. Limitation of the project .....	4
8. Feasibility Study .....	4
a) Technical Feasibility .....	4
b) Operational Feasibility .....	5
c) Economic Feasibility.....	5
9. Significance of the project .....	5
10. Beneficiaries of the project.....	5
11. Methodology.....	5
a) Data collection methodology .....	5
b) Development tools.....	6
12. Required resource with cost .....	6
13. Task and Schedule.....	6
14. Team composition .....	7

## Chapter One: Introduction

### 1. Background of the project

Transport has evolved in history, following a wide range of drivers, which changed how, how much, when, and why people moved and transported goods between places. Mobility demand has always been driven by the need to access opportunities, related to work, services, shopping or leisure, depending on the specific historical and cultural context.

Transportation has been a country's scale of civilization for centuries and will continue to be one for the years to come. People have moved from the simple cattle transportation to the sophisticated airplane and jets.

Digitizing the interaction of the passengers with the transportation system they chose is becoming the new norm. However, As Africans we are far behind and will need to work on our digitizing speed to catch up with the rest of the world.

The progress of global urbanization, especially in developing countries, is leading to an increased need in digitized and urban-metro transport solutions. As a result, automatic payment system for transportation has become a priority for public transport in large and medium-sized cities and generated large demand in other developed countries.

### 2. Statement of the problem

This outstanding capacity of the project aims to address various problems such as physical payment, tariff control, route allocation difficulties and mainly, it improves the traditional payment systems used in the public transport context.

Another outstanding property consists of the reduction of the operation costs thanks to two factors: the use of local communication infrastructures and the use of general purpose devices, avoiding devices based on proprietary technology. Finally, we have based our model on the ubiquitous paradigm, to achieve the initial objectives of the system; specifically, regarding flexibility and scalability. As a final consequence we can affirm that this paradigm provides techniques and ideas which can improve the traditional payment systems.

### 3. Justification of the project

Transportation is one part to build smart city. Among industry sectors that are rapidly adopting IoT technology, public transportation is one that can benefit the most from gains in operational efficiencies, cost savings, safety and security. for efficient tariff control, balance vehicle distribution,

These days COVID-19 is the big issue in all countries, so our system is working on combating this nationwide crisis by trying to minimize personal contact through money exchange etc.

Until now there is no launched IOT based transportation payments system in our country. So, our system will overcome problems that we have in transportation area.

The side effects are our country stuck on the old transport payment system. That affects the stockholders.

### 4. Objective of the project

#### a) General Objective

The general objective of the project is to address the transportation problem of inefficiency. This will be achieved with a semi-automated system consisting of web, android and IOT technology.

#### b) Specific Objective

The main objectives of this project are to prototype an automatic payment system through rechargeable cards or QR code, real-time route measurement with user trend analysis, and lastly, tariff and tax enforcement mechanism.

### 5. Scope and Limitation

#### a) Scope of the study

The scope of this project is the deployment of a payment and monitoring system for public transport providers like busses with in the geographic area of Addis Ababa. The project will consist of the backend implementation of a backend system to manage the database, a mobile application and a web app for user interaction and IOT based smart card payment system for the payment. Although the payment method is as stated above, it is also possible to integrate other payment systems if the need arises or the primary one becomes compromised for any reason.

### 6. Assumptions made in the project

1. All team members have or can acquire easily the skills necessary to build the system.
2. We have all the necessary hardware and software tools
3. The working space is available 24/7

4. Policies and regulation of the Ethiopian government allows such system to be implemented
5. Guidance and supervision are provided from Computer Science and Engineering department of ASTU research lab
6. The system will only be executed inside the scope

## 7. Limitation of the project

### **Resistance from transport service providers**

It is to be expected that this project will be met with a significant level of resistance from the transport service providers. There are various established norms and ways of working with in the community. In some ways this might appear to pose a threat and therefor be met with resistance stemming from self-preservation. For this resistance to subside, the system needs to take account for the wants and needs of the transport service providers.

### **Users' hesitation to adopt new payment system**

Since the start of the public transportation system people have always paid with cash. This is both convenient and ubiquitous. Even in the age we live in, cash is the default for most if not all users of public transportation. As such, for the conversion to this system there needs to be a convincing value proposition for the users and an increase of the ubiquity of the system.

### **Device theft**

As this system requires some kind of computing device onboard the transportation vehicles, it is highly vulnerable to theft. This needs to be taken into account in the physical design of the device and the development of the software. The installation point also has a factor to play to the susceptibility of the device for theft.

## 8. Feasibility Study

### a) Technical Feasibility

From a technical point of view, the feasibility of this project is high because of the following reasons.

1. The underlying tech is reasonably within the expertise of this team and therefor within the expertise of the Ethiopian tech community.
2. No unreasonably expensive or rare tools and equipment are used in this project. All of the tools and equipment are readily available within the Ethiopian and the international market.

#### b) Operational Feasibility

From an operational point of view, the feasibility of this project is high because of the following reasons.

1. The technology that is required to operate the product is easily learnable and easy to deploy.
2. The utility services that the product might need to connect to are readily available within the intended deployment area and the system also has redundancies to continue functioning even if that is not the case.
- 3.

#### c) Economic Feasibility

From an operational point of view, the feasibility of this project is high because of the following reasons.

1. The equipment needed to deploy said product is within the affordability range when assembled with off the shelf electronic components. This indicates if the product was ever to be mass produced on custom circuit boards, domestic or overseas, it will be significantly cheaper to produce, deploy and run the operations for all users and stakeholders alike.
2. The ROI (return on investment) for both the government and transportation providers is reasonable by current estimates. This opens the door for a whole host of deployment strategies. For example, the government can help with the purchase of the devices with a long-term repayment arrangement.

### 9. Significance of the project

### 10. Beneficiaries of the project

- 1, Transport service providers
- 2, Passengers
- 3, Ethiopian Revenue and Customs Agency

### 11. Methodology

#### a) Data collection methodology

The Data Collection for this project will be conducted by way of **interviews, questionnaires and requests for data from governmental and non-governmental organizations**. These can be, for all intensive purposes, called stakeholders of the project.

- Transport Ministry

- Passengers
- Addis Ababa City Administration
- Sheger Bus
- Ambesa Bus
- Traffic Police

#### b) Development tools

The development tools to be used in the execution of this project are as follows.

- **Laravel:** backend development
- **Flutter:** frontend development
- **Raspberry pi:** for IOT testing and deployment
- **Vue JS:** Frontend development
- **Trello:** Task management

### 12. Required resource with cost

Item	Cost
Raspberry pi 3 B+	3000 birr
RFID scanner and reader (RFID-RC522)	500 birr
RFID card	250 birr
GPRS Module	1000 birr
Gps Module	2000 birr
16x2 LED display	700 birr
4x3 keypad	600 birr
<b>Total</b>	<b>8050 birr</b>

### 13. Task and Schedule

Task	Due	Activities	Person in charge of overseeing operation
<b>Documentation</b>			
<b>Chapter 1</b>	March 18	Requirement gathering, Market research, Literature review	Yohanes and Tihitena
<b>Chapter 2 &amp; 3</b>	April 9		Tigist
<b>Chapter 4 &amp; 5</b>	April 30		Bemnet and Nebiyu
<b>Final Documentation</b>	May 5	Revision	Yohanes and Tihitena
<b>Prototype</b>			
<b>Architecture Design</b>			Bemnet and Nebiyu

<b>Front-End Design and development</b>			Tihitena
<b>Back-End development</b>			Nebiyu
<b>IOT design and development</b>			Bemnet
<b>API development</b>			Yohanes
<b>Integration</b>			Tigist
<b>Deployment</b>			Yohanes
<b>Defence</b>			
<b>Rehearsal</b>			
<b>Defence</b>			

#### 14. Team composition

Name	Role
<b>Yohanes Fikru</b>	Team Leader
<b>Tihitina Mesfin</b>	Frontend developer
<b>Bemnet Nikodimos</b>	Mobile development and IOT develomernt
<b>Nebiyu Adem</b>	Backend developer
<b>Tigist</b>	System Integrator