

Decision Support for solving Traffic Jams Problem in Yangon

Poe Shweli Win, Yin Mon Nyein Aye, Ei Shwe Sin, Koichiro Ochimizu
University of Information Technology (UIT), Myanmar
poeshweliwin@uit.edu.mm, yinmonnyeinaye@uit.edu.mm, eishwe@uit.edu.mm, ochimizu@jaist.ac.jp

Abstract - Nowadays, traffic jams problem is one of the headache problems in modern in cities including (Yangon, Myanmar). It still remains a major societal concern across the world. In fact, traffic congestion problems can be solved by many ways such as upgrading the road infrastructure, promoting public transport, using advanced traffic information systems, and so on. As a result, many approaches especially semantic web technologies, intelligent transport systems (ITS), queuing, forecasting algorithms and data mining techniques have been done to predict the congestion and to reduce. However, it is still needed to pay more many attentions to cope with the problem. Therefore, by using advanced process mining techniques, this research aims to provide useful information for the decision making to solve traffic control management problem in Yangon. In this research we intend to conduct conformance checking and bottleneck analysis to guess the measures against congestion problem by regarding the network of roads of Yangon as the prescribed process models and analyzing the hourly/daily/seasonal/yearly Traffic event data from cars data, results of performance analysis.

Keywords—*process mining, conformance checking, traffic control*

I. INTRODUCTION

Process mining is all about exploiting event data in a meaningful way in order to provide insights, identify bottlenecks, anticipate problems, record policy violations, recommend countermeasures, and streamline processes. In fact, the process mining spectrum is quite broad and includes techniques like process discovery, conformance checking, model repair, and role discovery, bottleneck analysis, predicting the remaining flow time, and recommending next steps [1].

Beneficial insights typically obtained from process mining include [4]:

- the uncovering of new opportunities with regards to the way processes are executed,
- the identification of root causes explaining why certain process variants have better performance than others,
- the discovery of key indicators that can predict the behavior of process instances in the near future,
- the confirmation/refutation of long-held beliefs about the behavior of one's processes, and

- the identification of problem areas in existing business processes (e.g. process anomalies)

According to our literature review, many researchers developed and investigated new process mining algorithms by using various case studies in various sectors such as the financial sector, telecom sector, industrial sector and public transport sectors, such as road fine management process and train describer system. Indeed, it is one of the big advantages that process mining does not depend on specific automation technology or specific systems. And, most of the work in process mining has focused on the operational (workflow-like) process. Therefore, this research focuses on considering road network as process model to check the traffic congestion problem.

Among the urban major cities, traffic congestion problem is one of the headache problems and a challenging task for our society. Most researchers from various fields have been paid attentions to solve it with various ways. Therefore, this research also aims to supports useful information for reducing traffic congestions in Yangon City. Next section discusses our proposed framework for our current research. The conclusion and future plan are discussed in the last section.

I. PROPOSED SYSTEM

In this section, the proposed framework with preliminaries tasks: logging of event data and describing road network of Yangon as the process model for the process mining of traffic congestion is discussed. Then we discuss how to use conformance analysis and performance analysis. Finally we plan to discuss decision support of process mining for the problem domain.

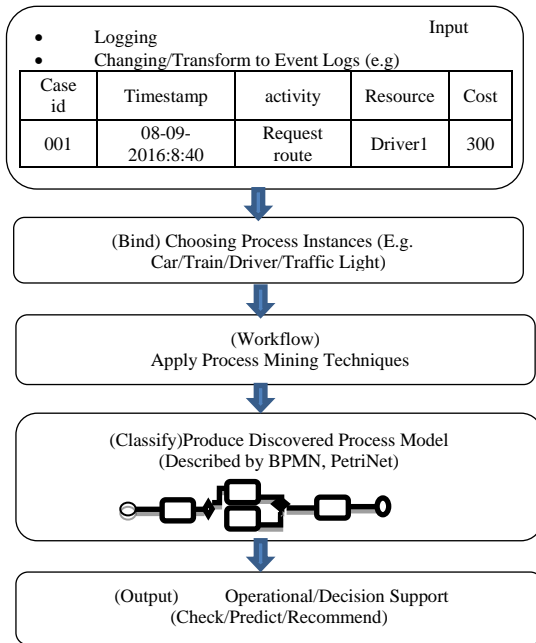


Figure (1) Proposed System

A. Logging of Event Data

Typically, event log, information on things that happen in organizations, machines, systems, and people’s lives, is the starting point for process mining. Today, process mining has exploits Internet of Event (IoE) to learn the things of information systems, organization and people. In process mining, an event log can be considered with not only at least three attributes have to be present: case id, timestamp and activity but also many attributes (columns). Therefore, here, we consider using GPS data as the event log for process mining of our case study by assuming as below:

- Car, Bus with GPS device (e.g mobile smart phone) → process instance (case)
- Car Driver and Bus Driver → process performers
- Each Traffic light on Road → well-defined steps/activities of process model for Car Case
- Each Bus Stop → Steps/activities of process model for Bus Case

The example of GPS data: {Device_ id, Latitude, Longitude, Time} of car set with GPS device as shown in the figure (2). As we mention, it is said that we can make logging event data, shown in table (1) for process mining.

{7f456898-f2ba-41a5-8ec0-a9581570e62e};	16.879327;
96.190997; 27/11/0014 05:20:33 pm; 2.05; Recording...;	

Figure (2) Example of GPS Data Captured by Car set with GPS device

Table (1) Example of Event Log Data

Car-id	Device_id	Time stamp	Lati tude	Longi tude	Speed
Car1	7f456898-f2ba-41a5-8ec0-a9581570e62e	27/11/0014 05:20:33 pm	16.879410	96.190983	1.2

B. Describe Road Network Process Model

For our case study, however, let us consider the road network of Yangon, Myanmar as an existing process model. Firstly, we are going to start our research with simple scenario described in below:

Scenario: Roads to School

Let us consider “the road ways reach to the school “as a process, the one who lives in Okkala Township goes to school (University of Information Technology) located in Bahan Township by car. There will be many routes to reach the destination shown in the below figure (2) getting Google map. Among them, the shortest way (31min without traffic congestion) needed to pass 13 traffics is selected for this scenario.

Therefore, to consider the “roads to school” as a prescribed process, there are some ingredients for that anticipated process as shown in the figure, which is mapped with business process. The figure (3) describes the following scenario:

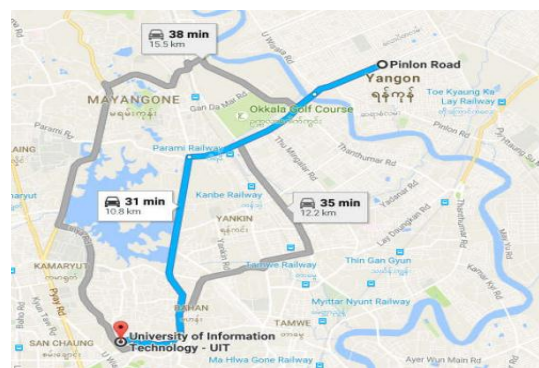


Figure (2): Ingredient of Roads to School Process

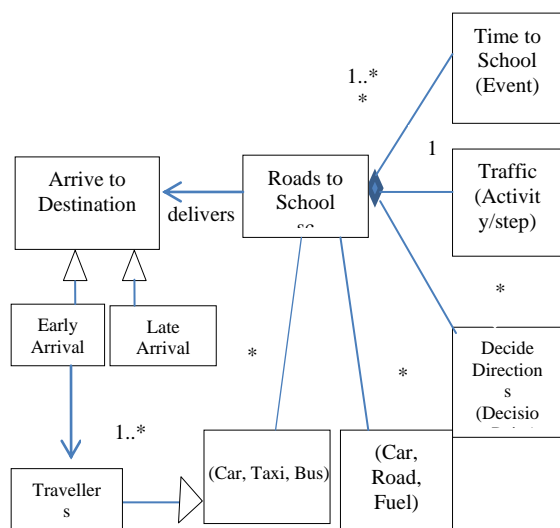


Figure (3): Ingredient of Roads to School Process

C. Conformance Checking

Most of the work done in process mining in the literature focuses on discovering a process from the log data. When it is mature in this field, most researchers have been noticed that models often deviate from the reality and the importance of conformance checking is increasing. Conformance checking allows us to compare model and log are considered with four dimensions:

- fitness,
- simplicity,
- precision, and
- generalization.

Basically, there are three approaches to conformance checking: *footprint*, *replay* and *alignment*. Moreover, conformance checking can be applied with the following various aims:

- to identify deviating cases and understand what they have in common,
- to identify process fragments where most deviations occur, for auditing purposes,
- to judge the quality of a discovered process model

This research aims to use conformance checking to check the deviation of cases and to suggest some additional behavior of process.

D. Decision Supports

Nowadays, the researchers in process mining field have studied to link it with supporting decisions in workflow-like process. Typically, There are four types of decisions when it comes to operational (i.e workflow-like) processes:

- Design-time decisions
- Configuration-time decisions
- Control-time decision
- Run-time decision

Though this research does not focus on workflow-like process, we plan to support additional behavior models and useful information to make better decision like control-time decision and run-time decision in traffic jams problem. Furthermore, it is also first step of studying about traffic control management process to be able to develop advanced transportation systems.

III. CONCLUSION

This paper proposed process mining techniques especially conformance checking of road network to detect deviations and diagnosis of the traffic congestion problem. The useful information for the decision making to solve traffic jams problem in Yangon are expect as the outcome of this research. By taking the advantages of process mining approach, we can plan the measures based on the real situation. Simulation technologies will be necessary to confirm the effectiveness of measures in future, may be at the next project.

REFERENCES

- [1] W.M.P. van der Aalst, H.A. Reijers, A.J.M.M. Weijters, B.F. van Dongen, A.K.Alves de Medeiros, M. Song, and H.M.W. Verbeek. Business Process Mining:An Industrial Application. Information Systems, 32(5):713–732, 2007.
- [2] W.M.P. van der Aalst, A.J.M.M. Weijters, and L. Maruster. Workflow Mining:Discovering Process Models from Event Logs. IEEE Transactions on Knowledge and Data Engineering, 16(9):1128–1142, 2004.
- [3] Freddy Lecue, Rober Tucker, Veli Bicer, Pierpaolo Tommasi, Simone Tallevi-Diotallevi, Marco Sbodio, “Predicting Severity of Road Traffic Congestion using Semantic Web Technologies”
- [4] Suriadi Suriadi, Moe Wynn, Petia Wohed, Arthur ter Hofstede, and Jan ReckerWil M.P. , “A Process Mining Analysis of Woolworth’s GPS Data”
- [5] Van der Aalst, “Extracting Event Data From Databases to Unleash Process Mining”
- [6] Wil M.P. van der Aalst , “No Knowledge Without Processes, Process Mining as a Tool to Find Out What People and Organizations Really “