Chapter 5
Availability Estimation of Demand Buses as Human Transportation System, Using Self-Organizing Map

Toyohide Watanabe
Nagoya University, Japan

Kentaro Uesugi
Nagoya University, Japan

ABSTRACT
The demand bus is a new transportation means, which is timely planned and runs order by order in accordance with independent requests of individual customers. Demand buses are alternative transportation vehicles, replacing traditional routing-oriented buses. In this paper, the authors address the characteristic issues, attend to the practical operations, and estimate and evaluate the trade-off strategies between usage convenience and cost management. The main idea, which is established from the features among parameters interpretatively, is to make use of visualization techniques and apply a self-organizing map (SOM) to this visualization. The authors display the co-related classification results computed individually from several selected parameters to keep their meaningful correspondence.

1. INTRODUCTION
The demand bus is a new transportation means, which is timely planned and runs order by order in accordance with independent requests of individual customers, and may be looked upon as alternative transportation vehicles in place of the traditional routing-oriented bus systems. So, the demand bus is a hybrid-type of transportation vehicle, combined well with taxes on demand-oriented driving and buses on scheduled-specific routing. The convenience may be particularly
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requested in provinces because the public or semi-
public transportation means are desirable moving
vehicles for oldsters and children though the resi-
dents are distributed here and there, and the number
of potential customers is not so many. While, the
cost-management is not yet sufficiently evalu-
ated with respect to the enterprise or commerce
viewpoint. Namely, the practical strategies for
scheduling, planning, routing, etc. are not always
sufficiently investigated from a point of trade-off
view between usage-convenience and manage-
ment cost though the demand bus is conveniently
regarded as one of new transportation systems.
This is partly because the estimation method is
development on many co-occurred parameters, and
partly because the operation situations are different
case-by-case, at time or at place. At least, in order
to apply the new transportation system to our real
world effectively there are many problems to be
heuristically or analytically resolved. In this paper,
we address the characteristic issues, attended to
the practical operations in this demand bus sys-
tem, with a view to estimating and evaluating the
trade-off strategies between usage convenience
and cost management.

In our research viewpoint, we do not analyze
directly the relationship among related parameters
but compute various cases one by one, derived
definitely from the selectively combined param-
eters. From various results necessary features
are coordinately arranged based on the synthesis
viewpoint. This is because we cannot choose truly
the important parameters for our consideration in
advance, but our investigation process becomes
generally heuristic-dependent steps. Namely, it
is very difficult to find out certainly optimal or
best-fit effort from the mutually followed results,
using various kinds of parameters. Thus, the main
idea, which should be established from the features
among parameters interpretatively in our approach,
makes use of visualization techniques, and also
applies self-organizing map (i.e., Kohonen, 2000)
to this visualization. Our important key-point is to
display the co-related classification results gener-
ated individually from the computation among
several selected parameters at once so as to keep
their meaningful correspondence commonly. This
process is very strictly dependent on individual
analysis abilities, and is too strongly superior to the
traditional approaches, which illustrate business
charts based on the properties between predefined
parameters, in points of the understandability,
multi-usability, flexibility and so on.

2. RELATED WORK

Until today, several researches about this demand
bus system have been reported with respect to
the convenience-specific proposal of operation
methods, comparative estimation evaluation
between traditionally scheduled/routed bus and
this demand-type bus, and so on. Tsubouchi et
al. (2007) summarized the current situation and
the adaptability of demand bus. In particular,
they reported the successful case in Japan that the
demand bus system can provide the convenience
for daily activities of residents. However, it is
one question whether the demand bus system
can supply cost-effective performance or not: in
many cases, it is not always sure to be profitable.
Concerning to the trade-off problem between
profitability and convenience, many research-
ers have also been reported: Maeda et al. (2002)
showed by computer simulation that the trade-off
relationship between convenience and profitability
is improved by means of making the service area
of operation comparatively narrow. Also, Noda
et al. (2003) pointed out that the convenience in
the demand bus system is better than that in the
traditional bus system when the profitability is
kept so as to be constant if the service area and
operation scale become large. Torii (2004) made
it clear that the demand bus system is superior to
the traditional bus system in case that they were
planned with the number of bus vehicles (Oha,
Shinoda, Noda, Kurumatsni, & Nakashima,
2002). Also, Yamato et al. (2008) investigated