**Contract Agreement:**

This contract agreement is made and effective on 5th October, 2020.

Between Dr. Muhammad Naiman Jalil

College of Business and Economics,

United Arab Emirates University.

Al Ain, United Arab Emirates.

And Mr. Muhammad Umar Salman

Lahore,

Pakistan.

**Terms of the contract:**

As per this contact agreement, Mr. Muhammad Umar Salman agrees to perform following research activities to conduct a research study as described in Appendix 1: Description of Research Project. The activities include:

Task 1. Develop simulation framework (including developing software codes) of selection algorithm for On-demand Mass Transport that Dr. Muhammad Naiman Jalil has developed.

Task 2. Perform simulation analysis of selection algorithm for On-demand Mass Transport (and by using software codes developed in task 1).

Task 3. Write results and conclusions sections in the form of potential journal article.

Mr. Muhammad Umar Salman agrees that Dr. Muhammad Naiman Jalil shall have a right to publish or present the results of work performed under this contract.

**Duration of the Contract:**

The start date of the research study project under this contract is 5th October, 2020. The total duration of research study project is four (4) months. End Date is 5th February, 2021.

**Payment Details:**

For services describes in Terms of the Contract, Mr. Muhammad Umar Salman shall be paid AED 1,800 (eighteen hundred AED) per month for the duration of the project (i.e. four month).

**Payment Dates:**

1st Payment shall be made on Date: 05th November, 2020 – amount to be paid AED 1,800 (eighteen hundred AED)[[1]](#footnote-1).

2nd Payment shall be made on Date: 05th December, 2020 – amount to be paid AED 1,800 (eighteen hundred)1.

3rd Payment shall be made on Date: 05th January, 2021 – amount to be paid AED 1,800 (eighteen hundred)1.

4th Payment shall be made on Date: 05th February, 2021 – amount to be paid AED 1,800 (eighteen hundred)1.

**Deliverables:**

1. Software Codes for Simulation

2. Simulation Results

3. Manuscript of the Paper

**Bank Details for Mr. Muhammad Umar Salman:**

Payment shall be made by bank transfer at the following bank account:

Beneficiary Name:

Bank name:

Bank Address:

Swift Code:

IBAN Number:

Account Number:

Sort Code:

**Fund Name (UAEU Internal Use Information):**

The payments for this contract agreement shall be made by using the following fund, grant code.

Fund: 31B122-UPAR (3) 2019

Grant Code: G00003340

**Signatures:**

|  |  |
| --- | --- |
| **Dr. Muhammad Naiman Jalil**  **United Arab Emirates University**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  [Signature]  Date: 05-October-2020 | **Mr. Muhammad Umar Salman**  **Lahore, Pakistan**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  [Signature]  Date:05-October-2020 |

\_\_\_\_\_\_\_\_\_\_ End of Agreement \_\_\_\_\_\_\_\_\_\_

**Attachments:**

Appendix 1: Description of Research Project

Appendix 2: Passport Copy of Mr. Muhammad Umar Salman

Appendix 3: Resume of Mr. Muhammad Umar Salman

**Appendix 1: Description of Research project**

On-Demand Mass Transport – Service Design Choices

Synopsis

In academic literature, on-demand bus service concept, where a bus route can be adjusted based on customer request was earlier explored by Archetti et al. (2018) for public transportation context. The authors noted significant improvements in customer journey times (i.e. door to door journey times) and capacity utilization of transportation infrastructure in their simulation study.

More recently, Koh et al., (2018) explored on-demand mass transport service (at Singapore Land Transport Authority) where authors provide design architecture for such service. As per this architecture, in case of passenger demand realization, out of the entire operational bus fleet in the network, the particular bus that incurs minimum additional transport cost to reroute is selected to serve the passenger. It is intuitive to note that a particular bus that has the minimum travel distance between its current route path and pick up / drop off point of the incoming customer shall be selected.

One may argue that such an approach may not be optimal since each bus has a future demand potential on its current route. Simultaneously, the rerouted bus path also has some future demand potential on its new route. The greedy approach adopted by Koh et al., (2018) fails to account for currently available bus capacities and future demand potential in the network.

The pilot study by Singapore Land Authority also focus on segregating high demand density neighborhoods from low demand density neighborhoods and offering on-demand bus services for the latter neighborhoods only. While the former neighborhoods were proposed to be continually served using fixed line routes.

In this research, we focus on the above two aspects of on-demand bus services. In relation to first aspect, we assess benefits of accounting for future passenger demand information and current network capacity information while making a bus selection decision. We also aim to develop efficient algorithms to that can be applied in practical settings.

In relation to the second aspect, we aim to challenge the prevailing assumption that on-demand bus services are suitable for low demand density neighborhood only. Here, our objective shall be to compare segregated on-demand and fixed line networks with networks where on-demand and fixed line network are jointly operated in low demand density and higher demand density neighborhoods.

Current Status:

The above description relates to a project that is already ongoing at College of Business and Economics, United Arab Emirates University. Researchers have already identified exact problem formulation and modelling choices for the problem. Next steps are to establish a simulation model to analyze the models for their results.

References:

Archetti C, Speranza MG, Weyland D, 2018 A simulation study of an on-demand transportation system. International Transactions in Operational Research 25(4):1137-1161.

Koh K, Ng C, Pan D, Mak KS, 2018 Dynamic bus routing: A study on the viability of on-demand high-capacity ridesharing as an alternative to fixed-route buses in Singapore. 2018 21st International Conference on Intelligent Transportation Systems (ITSC), 34-40.

**Appendix 2: Passport Copy of Mr. Muhammad Umar Salman**



**Appendix 3: Resume of Mr. Muhammad Umar Salman**

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1. Payment is dependent on timely progress and completion of tasks identified above. [↑](#footnote-ref-1)