Software Impacts 22 (2024) 100722

Contents lists available at ScienceDirect

Software Impacts

journal homepage: www.journals.elsevier.com/software-impacts

Original software publication

IpyDisp v2 alias *DuduTracker:* A web-based version

Komi Mensah Agboka [a,*], Elfatih M. Abdel-Rahman [a,b], Samira A. Mohamed [a], Sunday Ekesi [a]

[a] *International Centre of Insect Physiology and Ecology (icipe), P.O. Box 30772 00100, Nairobi, Kenya*
[b] *University of KwaZulu-Natal, School of Agricultural, Earth, and Environmental Sciences, Pietermaritzburg 3209, South Africa*

ARTICLE INFO

Keywords:
Software
Spatiotemporal
Entomology
Cellular automata
Spatially explicit
Ipydisp

ABSTRACT

This study presents the updated *version v2* of IpyDisp named *DuduTracker* which improves on the window-only-requirement of *IpyDisp*. The updated version is web-based that can be used in alternative operating systems like Ubuntu, Mac, Linux, and others. The update's effectiveness was also evaluated using a survey involving a diverse range of users including students, data analysts, and academic researchers from different age groups, geographical locations, and computer literacy levels. Areas for future enhancement were identified, primarily focused on making the software responsive to various screen types and improving certain interface aspects.

Code metadata

Current code version	V2.0
Permanent link to code/repository used for this code version	https://github.com/SoftwareImpacts/SIMPAC-2024-259
Permanent link to reproducible capsule	
Legal code license	MIT License
Code versioning system used	git
Software code languages, tools and services used	Python
Compilation requirements, operating environments and dependencies	All necessary requirements are listed in https://github.com/Vansnoden/dudu_tracker?tab=readme-ov-file
If available, link to developer documentation/manual	https://dudutracker.monadeware.com/help/
Support email for questions	

1. Background

A recent study introduced *iPydisp* [1] a Python-based framework for visual analytics that tracks biological control agents (parasitoids) at the landscape scale. This tool uses cellular automata to enhance interactive visualization, providing valuable insights into parasitoid dispersal.

However, *iPydisp* is currently limited to Windows users, restricting its broader application across various operating systems like Ubuntu, Mac, and Linux. To address this, we have developed *Dudutracker*, a web-based version of *iPydisp* that eliminates this limitation. *DuduTracker* retains the cellular automata-based algorithm to generate dynamic visualizations of insect dispersal patterns, tailored to their specific bioecological characteristics. It is accessible across different platforms, making it more versatile and user-friendly.

2. Architectural blueprint, user interface, and functionality of the software

Fig. 1 below illustrates the comprehensive schematic of software architecture. The schematic accentuates the interconnected components of the software, portraying the seamless fusion of data ingestion, analysis, and simulation in a singular dynamic system designed for scientific exploration and decision-making support. The functionality is mainly the same as the former version.

* Corresponding author.
E-mail address: kagboka@icipe.org (K.M. Agboka).

https://doi.org/10.1016/j.simpa.2024.100722
Received 20 October 2024; Received in revised form 7 November 2024; Accepted 10 November 2024

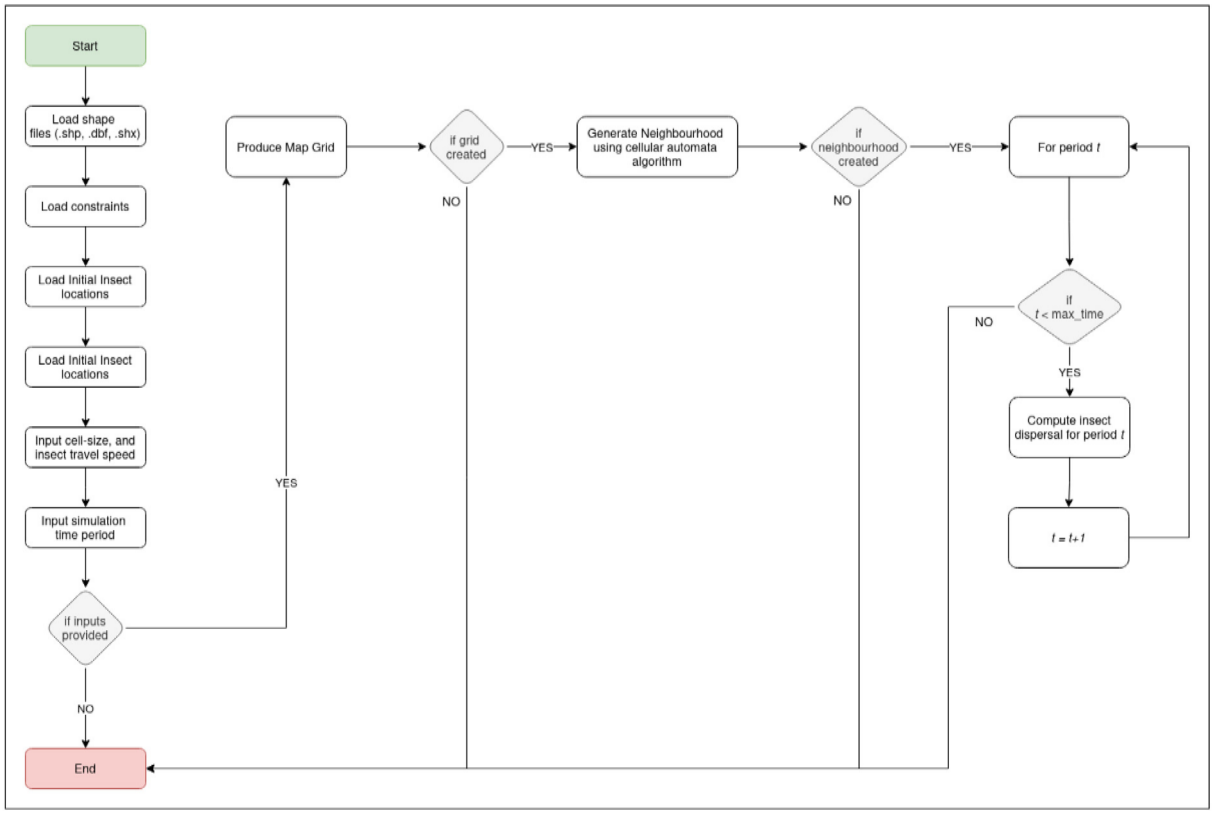

Fig. 1. Comprehensive schematic of software architecture - A detailed representation of the software architecture, elucidating the intricate network of data inputs, model configuration interfaces, and output visualization panels.

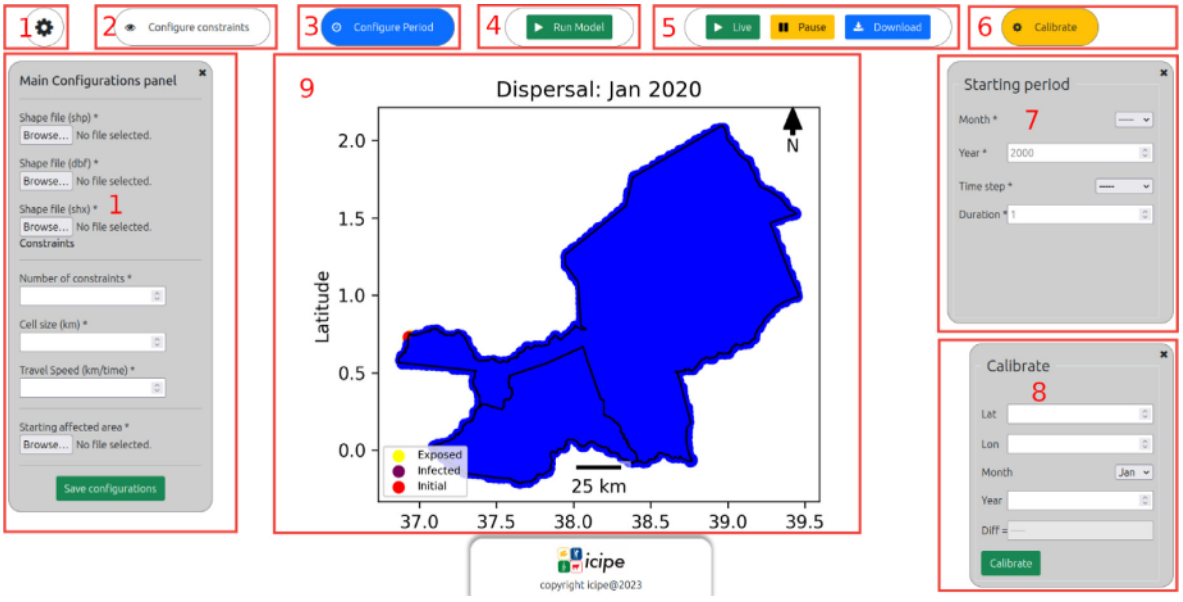

Fig. 2. Schematic representation of the *DuduTracker* user interface.

Fig. 2 presents the schematic representation of the *DuduTracker* interface. The different panels and features are the same as the previous version *Ipydisp*.

3. Evaluating the user experience: intuitiveness and user-friendliness assessment

The primary objective of this survey-based analysis was to critically evaluate the intuitiveness and user-friendliness of the web-based version using a structured questionnaire, for a total of 100 test users incorporating both demographic questions (age, profession, computer literacy level, and prior experience with analogous software) and usability scale questions. Participants rated various aspects of the software's usability on a Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These statements covered ease of navigation, clarity of instructions, aesthetic appeal, and the utility of help or tutorial features. Furthermore, specific scenarios were laid out for

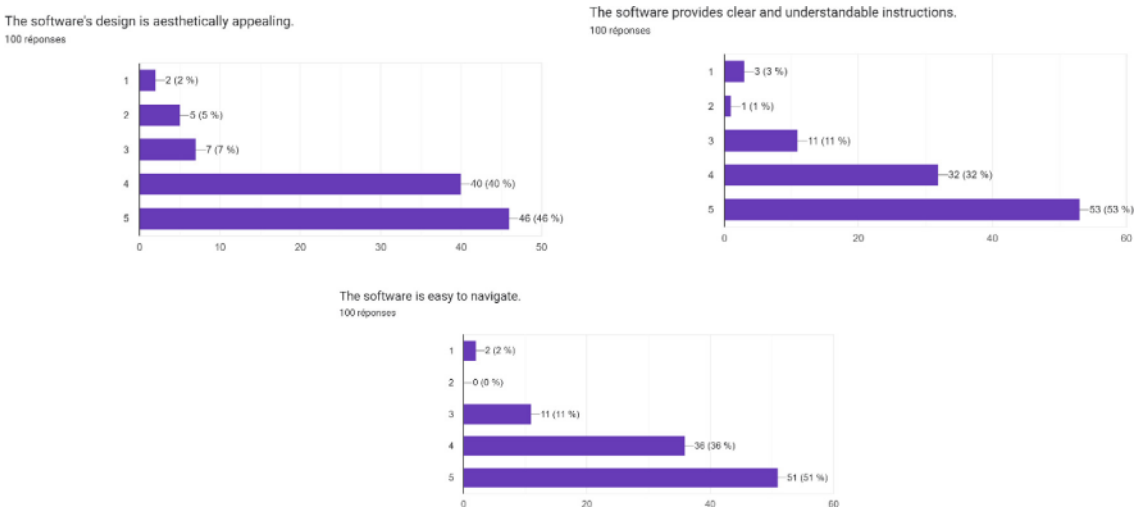

Fig. 3. Survey analysis shows an overwhelmingly positive feedback for the software across an array of users.

the participants to interact with the software, which they provided feedback on their experiences. Open-ended questions were also posed to gather insights into specific areas of improvement or appreciation. In our survey analysis, we noted overwhelmingly positive feedback for the software across an array of users, differing in professions, age groups, and computer literacy levels. The users' diversity reinforces the software's broad applicability and user-friendliness. Key aspects such as ease of navigation, clarity of instructions, aesthetic appeal, and helpful tutorial features received high appreciation. Most respondents experienced no issues, highlighting the software's user-friendly design. Suggestions for improvements were minimal and largely related to screen responsiveness and interface enhancements. The majority did not encounter unexpected errors, attesting to the software's robustness. Standout features included the user-friendly interface and tools such as the 'Live' and 'Run' buttons. Fig. 3 below presents some of the key results regarding the software's intuitivity and ease of navigation.

4. Impact

In addition to the successful impact of the previous version, as reported by Agboka et al. [1,2], the improved version of *DuduTracker* has had a significant impact on agricultural pest management. Its transition to a web-based platform has made it compatible across multiple operating systems, greatly enhancing accessibility for researchers and agricultural professionals alike. This increased accessibility contributed to *DuduTracker*'s selection for presentation at the 2024 Agricultural Innovation and Technology Marketplace (MITA), organized by the West and Central African Council for Agricultural Research and Development (CORAF) in Lomé, Togo, under the theme "Management of Bio-aggressors" [3].

At MITA, *DuduTracker* was showcased as a promising technological solution for pest surveillance and management, aligning with CORAF's objectives to integrate climate-smart, nutrition-sensitive, and gender-sensitive technologies in pest and disease management across West and Central African agricultural value chains. Additionally, the software was nominated for the Abdoulaye Touré Agricultural Innovation Prize, an award honoring innovations that positively impact farmers' livelihoods. These acknowledgments highlight *DuduTracker*'s role as an essential tool for researchers and agricultural experts, contributing to more precise and effective pest control interventions and reinforcing food security in Africa.

CRediT authorship contribution statement

Komi Mensah Agboka: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Formal analysis, Data curation, Conceptualization. **Elfatih M. Abdel-Rahman:** Supervision. **Samira A. Mohamed:** Funding acquisition. **Sunday Ekesi:** Funding acquisition.

Funding

The authors gratefully acknowledge the financial support for this research by the following organizations and agencies: Swedish International Development Cooperation Agency (Sida); the Swiss Agency for Development and Cooperation (SDC); the Australian Centre for International Agricultural Research (ACIAR); the Norwegian Agency for Development Cooperation (Norad); the German Federal Ministry for Economic Cooperation and Development (BMZ); and the Government of the Republic of Kenya. The views expressed herein do not necessarily reflect the official opinion of the donors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors extend their heartfelt gratitude to Salvador Atagong for his contribution during the deployment of the software and to all persons who willingly interacted with the software and provided valuable feedback about their experiences.

References

[1] Komi Mensah Agboka, John Odindi, Elfatih M. Abdel-Rahman, Onisimo Mutanga, Henri E.Z. Tonnang, A visual and spatial tool for tracking, mapping and forecasting the dispersal of biological control agents, Softw. Impacts 19 (2024) 100609, http://dx.doi.org/10.1016/j.simpa.2023.100609.

[2] Komi Mensah Agboka, Henri E.Z. Tonnang, Beatrice W. Muriithi, Saliou Niassy, Shepard Ndlela, Elfatih M. Abdel-Rahman, Samira A. Mohamed, Sunday Ekesi, Economic impact of a classical biological control program: Application to diachasmimorpha longicaudata against batrocera dorsalis fruit fly in Kenya, BioControl (2023) 1–10.

[3] Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles (CORAF), November 07. Marché des Innovations et Technologies Agricoles (MITA), 2024, *Présentations MiTA 2024*. https://www.coraf.org/mita2024.