

## Introduction of a new programming tool, BSM, for vector biology and public health and measuring its likability using an online survey

Bishnu Goswami<sup>1\*</sup>, Sarmila Pal<sup>2</sup>

<sup>1</sup> Department of Zoology, The University of Burdwan, Burdwan, West Bengal, India

<sup>2</sup> Department of Zoology, Hooghly Mohsin College, Chinsurah, West Bengal, India

### Abstract

One of the major problems in the combined realm of vector biology and public health is the efficiency of effort in the eradication of vector-borne diseases. In the era of deep internet penetration and fast internet speeds, the barriers of collaboration between the experts, the affected population and other stakeholders have been considerably reduced. In this paper we are introducing a software application called BSM, which can be a step forward in the right direction. This software includes several simplified code-blocks which can prove very useful to new programmers and entomological researchers, who belong to the tier of experts. For another tier, the technology consumers, we are introducing three sub-programs using the same software and are gathering data on their likability using a survey. The results from the likability survey is very promising and it seems that further work along these new lines store a lot of promise.

**Keywords:** public health, entomology, information technology, programming, software tool

### Introduction

One of the biggest enemies of mankind in the context of public health is the scourge of insect vectors. This includes the prime culprit, mosquitoes, and other insects such as fleas, flies and ticks, some of which were also used in warfare<sup>[1]</sup> due to their potency as fast breeders and strength in numbers, and the capabilities to act as carriers of deadly diseases. Over the years, there have been significant progresses using technology to combat the insect vectors using numerous classes of technologies. These include mapping out the trends of rising vector borne diseases such as dengue<sup>[2]</sup>, using combined techniques that take both health and environment into account, such as "Integrated Vector Management" by the World Health Organization (WHO)<sup>[3]</sup>, and also by recent studies which takes zoonosis into account<sup>[4]</sup>, which was termed as a proximal cause behind the origin of the Covid-19 pandemic<sup>[5]</sup> which killed more than 1.85 million people around the globe as of early January, 2020<sup>[6]</sup>. According to WHO issued reports, these diseases which are carried by insect vectors have a worse effect on people of lower socioeconomic strata, some of the reasons being them not having adequate standards of shelter, potable water and sanitation<sup>[7]</sup>. Once we have been reminded of the plethora of aspects which are intertwined in vector biology in the context of public health, there unfolds numerous opportunities which can be spotted in the sub-contexts itself. If we choose the approach of efficiency of effort, which can pay rich dividends as the problems related to vector biology and public health is global, and thus enormous in scale, technology that incorporates internet and information technology can be one of the golden candidates. The reason for the same is firstly the mobile internet data rates and penetration, which has a tendency worldwide to come down and especially for India, being especially affordable. The accelerated uptake of internet-ready and internet-connected smartphones are particularly notable in India<sup>[8]</sup>. Secondly, information technology has the

capabilities to scale really well, as the unparalleled successes of various information technology companies and initiatives in the last two decades have shown us. Thirdly, the costs for the end-user is low, as the technology devices themselves are already in high circulation. Finally, the technologies of web are in continuous development, with several important developments in recent times, partly with thanks to its profitability and therefore being attractive to both private and public investors. In this paper, we aim to highlight a tiered approach by the aforesaid methods, by introducing a new software tool called BSM, along with some premade example modules in the context of vector biology and public health.

### Materials and methods

Here we have created a prototypic computer software BSM which can take in custom programming codes that are easy for beginner level programmers to read, modify and use. The paradigm utilized here has several advantages over most of the common software applications in this context. The main focus is the brevity of the programming code, so that it is easy to understand, and without the workings of the code hampered. It is also possible to "lock" the programming code so that it is not editable for more sensitive applications of the end program which can be created using the master software.

The computer software so far developed includes the following code-blocks inbuilt, with more planned for the succeeding versions:

- a. Imager: Displays custom image files from the file-system depending on specific conditions. The usage of the code is illustrated once the "help: Imager" code is launched from the core BSM application.
- b. Diskvid: Diskvid can play video files from the local file-system depending on various programming conditions. The usage of the code is illustrated once the "help: Diskvid" code is launched from the core BSM

- application.
- c. Mails: Mails can be used to access the popular and not so popular email services which is an indispensable tool for research and development in the modern era, for the regular user and also for experts. The usage of the code is illustrated once the "help: Mails" code is launched from the core BSM application.
  - d. Map Display: Map display can be used to display maps of numerous kinds, which are accessible in the web. The display can be controlled by parameters such as the timespan of the display so that it can have autonomous, hands-free uses. The usage of the code is illustrated once the "help: Map Display" code is launched from the core BSM application.
  - e. Document Show: Document Show can be used to show documents, in the text or Rich Text File (RTF) format. It is useful for the end user in many ways compared to manual opening of documents, as it can be controlled by programming logic as with all the other preceding codes. The usage of the code is illustrated once the "help: Document Show" code is launched from the core BSM application.

In addition to these code-blocks, regular programming commands which are popular in most of the programming languages in use, such as "if", "else", "message" and regular expressions are also supported in BSM. A list of those popular commands are integrated in the main BSM

application. As we are utilizing BSM in the context of vector biology and public health here, we have created various sub-applications using BSM which uses the above code-blocks. The preliminary testing of the easiness of use and understanding of the code was done using an online survey service (Google Forms) among volunteers who wished to participate. Focused groups, such as entomological researches, or rural users affected by vector borne diseases, are left out from this preliminary study and future work can be on this direction. In the next section, we are demonstrating the use of the various sub-programs created using BSM for vector-borne disease control and public health.

**Binary Choice Mosquito Genus Finder**

The Binary Choice Mosquito Genus Finder (BCMGMF) is an application to determine the genus of a mosquito using binary yes/no choices. It is aimed strictly for younger children as a demonstration tool, and is not an entomological research tool. It utilizes the Imager and Document Show code-blocks to show the images of the species at the end and to show documents related to the species in question. In this prototypic version only a few mosquitoes genera are shown, but it can easily be expanded. The workflow of BCMGMF is shown using the diagram below:

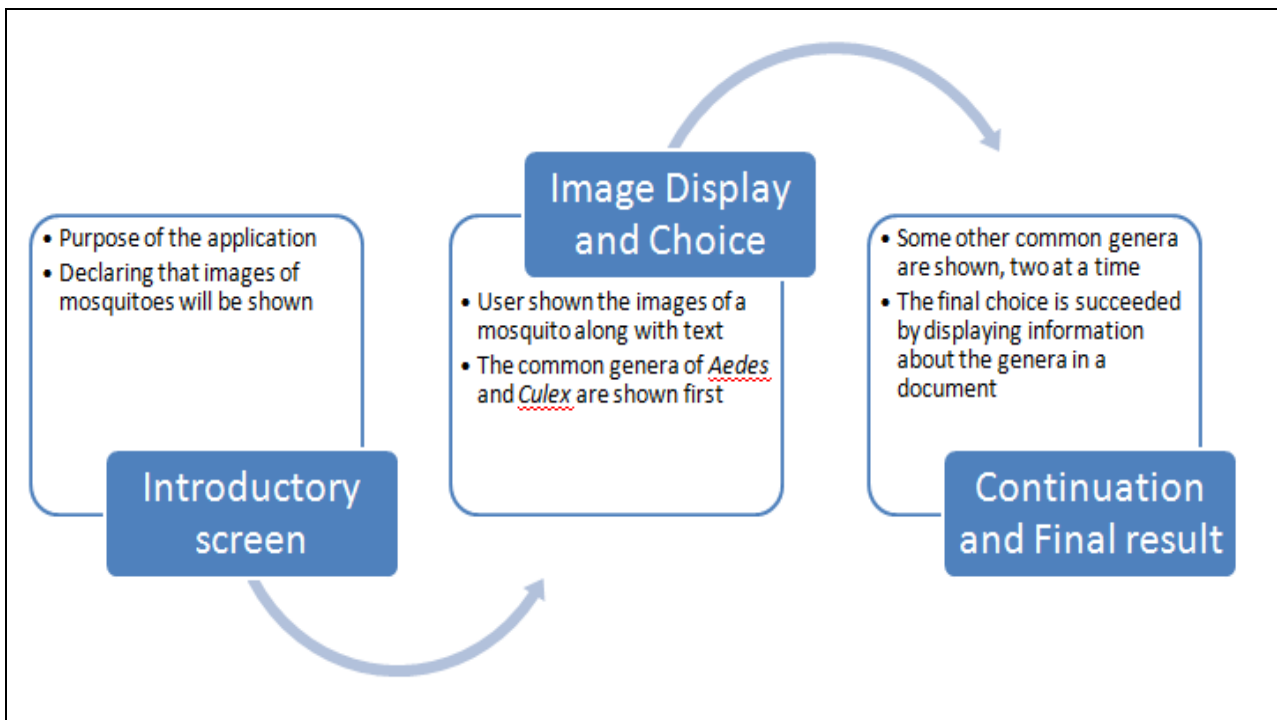


Fig 1: Workflow of BCMGMF

**Study Area Map Creator**

The Study Area Map Creator (SAMC) is an application created using BSM to draw custom maps using online sources, specifically the Open Street Maps. The magnification level is one of the parameters that can be selected. Using the HTML display, the user can also modify the shown map with a continuous stream of data packets from the World Wide Web. As the local data storage is

minimal, SAMC can be used in low powered and low storage computing devices, even for extended usage by numerous users. SAMC primarily utilises the Map Display code-block. SAMC is created to show vector disease prevalent areas, locations of health camps, and hospitals specializing in their care. The data for these information must be supplied externally. The workflow of SAMC is shown using the diagram below:

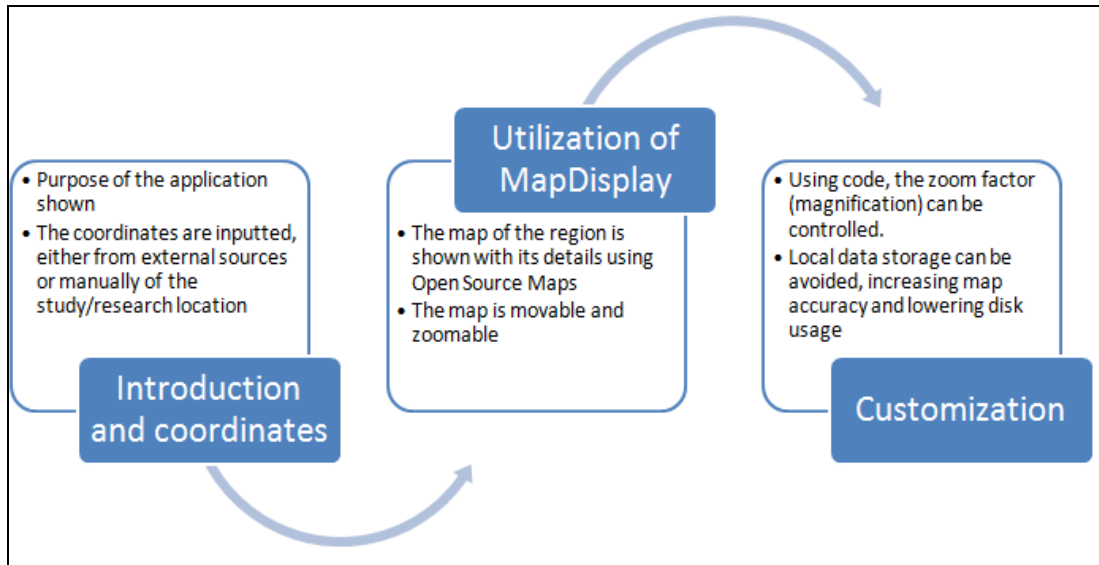


Fig 2: Workflow of SAMC

**Multilingual Tool against Vector Borne Communicable Diseases**

The Multilingual Tool against Communicable Diseases (MTAVBCD) utilizes all four of Diskvid, Imager, Mails and DocumentShow code-blocks to show information about vector borne communicable diseases. It includes information about how to prevent their transmission, which signs to look for when an infection has happened and finally

how to work as a team to eradicate vector borne communicable disease. The last aspect includes using technology to send back data in emails and other forms of web upload, all integrated inside the application. All of these is preceded by a choice given to the user to select their language, and therefore the images and videos are tailored to that specification.

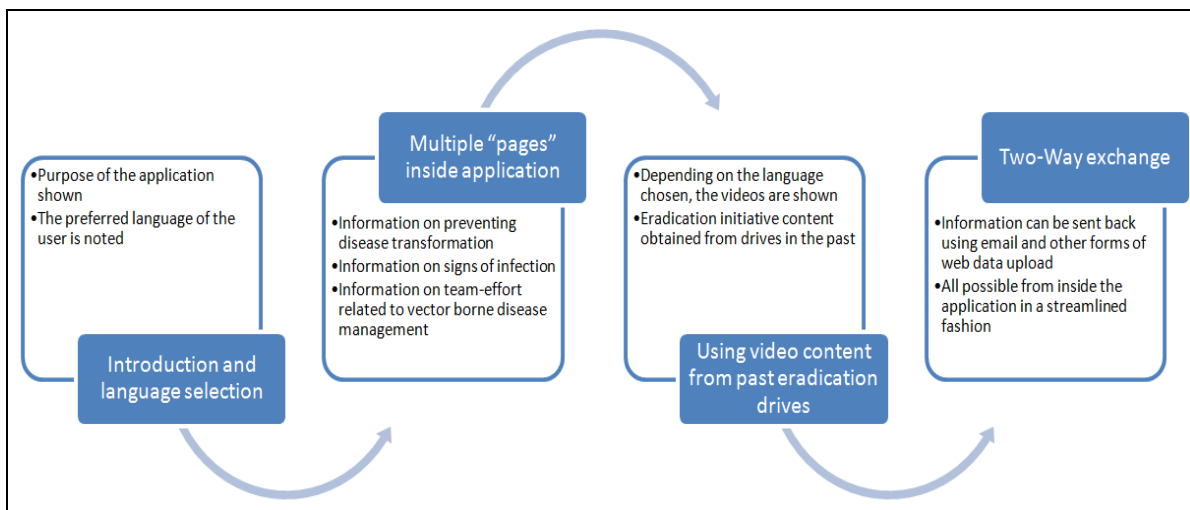


Fig 3: Workflow of MTAVBCD

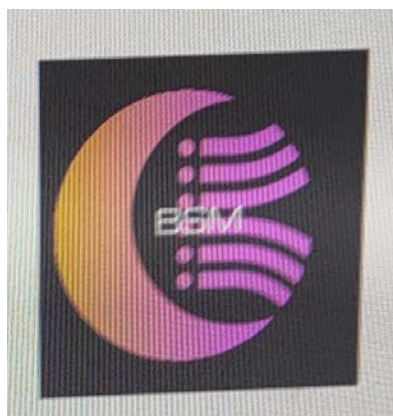


Fig 4: The BSM application logo, seen running on a desktop

**Results and Discussion**

The introductory reception study to this initial version of BSM was done in a web survey open to participants who have utilized programming tools in the past and have a high school knowledge in the subject of Biology, which includes a basic knowledge about mosquitoes and vector borne studies. Several schools in the district of Purba Bardhaman, West Bengal, India was included. All responses were taken digitally as the normal schedule of schools were hampered due to the Covid-19 menace.

The survey design was made to test the usability, uptake and sustainability as a software application in the context of vector biology and public health. The surveys were conducted based on the USE questionnaire [9], based on the version 2.7 of BSM. The survey was open to inputs for a

period of 7 days after its introduction. In the USE questionnaire, the quantitative results were obtained. The 1-7 point Likert scale was used, where 7

implied "strongly agreeing" and 1 as "strongly disagreeing". The mean and standard deviation was calculated using the open source software Libre Office Calc.

**Table 1:** The Likability scores using USE questionnaire

Statement	Mean score (Between 1-7)	Standard Deviation (up to 3 decimals)
1. It helps me be more effective	5.74	1.009
2. It helps me be more productive	6	0.852
3. It is useful	5.87	0.919
4. It makes the things one would want to accomplish easier to get done	5.74	0.915
5. It saves me time when I use it	5.78	1.043
6. It is easy to use	5.87	1.058
7. It is simple to use	6	5.870
8. It is user friendly	5.87	1.014

In the next table, the easiness of the operation of the software is shown as a part of the survey results.

**Table 2:** The Easiness of Operation scores using the USE questionnaire

Statement	Mean score (Between 1-7)	Standard Deviation (up to 3 decimals)
9. It requires the fewest steps possible to accomplish what I want to do with it	6	0.905
10. I learned to use it quickly	5.91	1.276
11. I easily remember how to use it	5.61	1.616
12. It is easy to learn to use it	4.39	0.891
13. I am satisfied with it	4.57	0.662
14. I would recommend it to a friend	6.17	0.834
15. It is fun to use	5.91	1.125

## Conclusions

The results of the preliminary survey shows that there is a healthy amount of satisfaction among the users of the software of BSM in the context of vector biology and public health. The mean rating of 6(out of 7) in the parameters of requiring the 'fewest steps to accomplish a given goal', its 'simplicity of use', and 'helping the user to become more productive' was the highlights of the survey study. The cherry on top was the very high mean rating of 6.17 (out of 7) about recommending the software to a friend.

Our study had some limitations, which can possibly be addressed in future work of this kind. One of them is the limitations of the BCMGF in its current form which does not allow it to be of use in more serious, non-educational purposes. This can be addressed in a collaborative effort with mosquito experts and researchers to increase the number of genus the binary tool can support. Another limitation was MTAVBCD supporting a limited number of languages, which restricts its use in the broader contexts. This is however very easily rectifiable by including more audiovisual content in different language from reputable sources.

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