



## 4<sup>th</sup> Intercontinental Geoinformation Days

igd.mersin.edu.tr



### Developing a participatory WebGIS for monitoring the physical problems of rural settlements

Fatemeh Sadate Hosseini <sup>1</sup>, Mohammadreza Jelokhani-Niaraki <sup>\*1</sup>, Hasanali Faraji-Sabokbar <sup>2</sup>

<sup>1</sup> Department of Remote Sensing and GIS, Faculty of Geography, University of Tehran, Tehran, Iran

<sup>2</sup> Department of Human Geography, Faculty of Geography, University of Tehran, Tehran, Iran

#### Keywords

Rural settlements  
Physical problems  
Participatory GIS

#### Abstract

Nowadays, with the growth of population in rural settlements and the complexity of the relations governing these settlements, the physical problems have become wider and more complex. The physical problems of the rural areas are related to water resource, waste water, roads, healthcare centers, electricity, as well as other infrastructures. There are various ways to monitor these problems, many of which are traditionally implemented in rural areas. The present study seeks to develop a web-based participatory Geographic Information System (GIS) to monitor the physical problems of rurals. For this purpose, a web GIS was first designed and developed. This system was implemented for participatory monitoring of the problems of Eskaman, Dehshad Bala, Razi Abad and Asilabad villages. The people of these villages were invited to report their problems locally through the web GIS and complete a questionnaire related to the usability of the system. The results show that the highest number of problems reported by villagers (24%) is related to water and sewage problems. Assessing the usability of the system shows that despite the desire of villagers to use the system, the need to teach the use of GIS tools and simplification of the user interfaces is of critical importance.

#### 1. Introduction

Given that the majority of the country's population lives in rural areas, addressing issues and problems in this area is of great importance. In examining the problems of rural settlements, addressing the physical dimensions is of particular importance. The natural environment of a settlement and the changes made to it, such as buildings, streets, facilities and major facilities, are considered as physical elements occupying space (Bahraïni 1370).

There are various methods for monitoring the physical problems of the villages, many of which are traditionally utilized in the villages. Due to the increasing number of rural problems, the need for prompt and optimal treatment of physical problems in rural areas is felt more than ever. One of the appropriate methods to identify, monitor and solve physical problems is to use participatory web Geographic Information System (GIS) tools. On the one hand, the use of GIS as a platform that manages, visualizes and analyzes spatial data, and on the other hand, web technology that can provide a platform

accessible to the public, enables the location-based participation in monitoring the rural physical problems. Easy access to the required GIS data and tools, anywhere, anytime and through any device, has led to the increasing use of web-based GIS systems for people to participate in solving spatial problem or spatial planning/decision making processes (Jelokhani et al. 2016). This technology provides the ground for the participation of the villagers in identifying the physical problems of the village by providing more interaction and participation, connection to wider networks and multiple communication channels. Using this technology, villagers become active observers and act as active, analytical, intelligent, responsible, conscious, mobile, distributed and interactive sensors to monitor and report on their surroundings (Jelokhani et al. 2017). This type of monitoring is based on the notion that villagers can use their five senses, like artificial sensors or even better (Goodchild 2007), to provide information about rural physical problems in more detail and accurate manner.

The present study seeks to develop and evaluate a web-based participatory GIS for monitoring and

#### \* Corresponding Author

(fa.s.hosseini@gmail.com) ORCID ID 0000-0001-8433-0290  
(mrjelokhani@ut.ac.ir) ORCID ID 0000-0001-7448-7833  
(hfaraji@ut.ac.ir) ORCID ID 0000-0002-5470-4287

#### Cite this study

Hosseini, F. S., Jelokhani-Niaraki, M., & Faraji-Sabokbar, H. (2022). Developing a participatory WebGIS for monitoring the physical problems of rural settlements. 4<sup>th</sup> Intercontinental Geoinformation Days (IGD), 55-57, Tabriz, Iran

reporting rural problems. For this purpose, in the first step, the need assessment of the web-based GIS was performed, and in the next step, the system was used experimentally to report the problems of Shahriar villages. Finally, the system was evaluated through a questionnaire in the system.

## 2. Method

To explain the objectives of the present study, a web-based GIS was designed. The designed system was developed based on the views of the residents of Shahriar villages. After the implementation of the system, the results of the participation of villagers including the number and type of problems reported, the type of spatial data (point, line and polygon) and views on the usability of the system were examined.

### 2.1. Research objectives

The main purpose of this study is to develop a participatory GIS in order to solve the physical problems of rural settlements. In order to achieve this goal, the present study pursues the following sub-objectives: (1) Needs assessment and design of a participatory GIS for rural areas in order to solve physical problems of rural settlements and (2) Evaluation of the participatory GIS from the perspective of villagers in order to assess the usability of the system in rural areas.

To start working with the system, first the villagers register on the site and then the tools in the site become available to each user. Villagers can report the problems and location of the problems using the tools available on the map, and for each problem, upload text, photos and videos, and complete a questionnaire related to the usability of the system. These inputs are stored in the database and then categorized and analyzed by the admin (Figure 1).

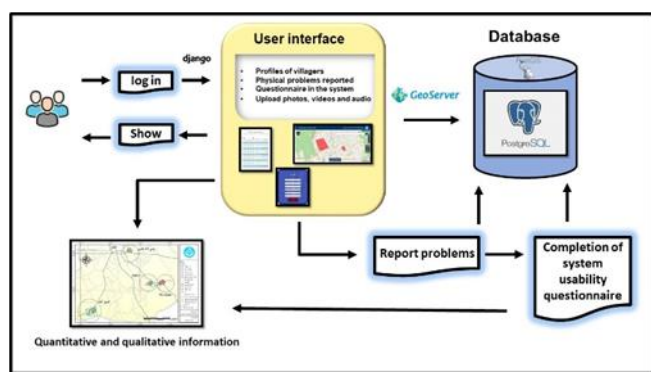


Figure 1. System process

One of the important tools of the system is the ability to draw shapes in the form of points, lines and polygons, so that the user can specify the location of the physical problems to be shown for officials on the map. The possibility of deleting and editing drawings is also considered in this section (Figure 2). Immediately after drawing the desired location on the map, a window opens for the user, which has features such as the problem submission box, the suggestion box, and the comment box and follow-up of the person in charge

about the problem. The user can also talk about the place and the problems with other villagers and officials, and it is possible for other villagers to talk about the problem in the same box.



Figure 2. Drawings in the system

### 2.2. Study area

Shahriar city with an area of 320 square kilometers is one of the 12 cities of Tehran province. This city is located in the west of Tehran province, which is bordered by Mallard city from the west, Quds city from the north, Robat Karim city and Baharestan city from the south, and Islamshahr city from the east (Figure 3).

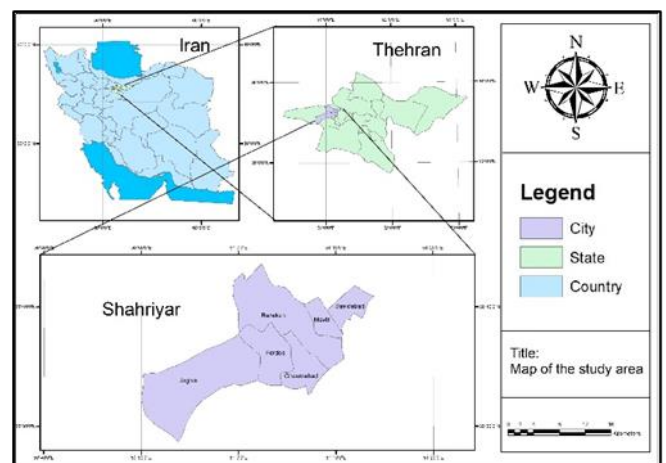


Figure 3. Study area

## 3. Discussion and Results

In terms of using the capabilities of the system, 92% of the participants used the data type of point to record problems, 100% of the recorded problems were accompanied by text, and 95%, in addition to the text of the report, presented their suggestions to solve the problem. Furthermore, 20% and 2% of the participants uploaded reports along with photos and short videos, respectively.

The results of the system usability assessment show that 31% want to use the system. Analysis of statistics related to the usability of the system shows that although statistically the majority were willing to use the system and participate in reporting problems or considered the use of the system simple, but close to the pros and cons and the relatively high statistical people who were hesitant about responding indicate that the villagers, despite their desire to participate in this field, need to be

trained and have the cultural background to use the system. The need to use the system is still not clear to many villagers and they prefer to use the traditional methods of the past to convey their problems to the authorities. Also, the user interface of the site needs to be strengthened and reviewed in order to be able to attract the audience in the first place and encourage them to use the system. Villagers also need to learn to interact with systems and map-based tools. One of the problems they faced when working with the system was finding the village where they lived on the map, and this made them think first that working with the map could be difficult and complicated.

#### 4. Conclusion

The study has presented a participatory Web GIS tool for monitoring and reporting rural problems. The proposed system involves using the map-based visual tools to report physical and spatial problems of rural areas. In general, the findings show that villagers are willing to participate in monitoring and reporting rural problems in a location-based way and through the web-based system, but considering a number of prerequisites and trainings, as well as eliminating system flaws and correcting the wrong mentality of the past, can alleviate the matter.

#### 5. Recommendations

In general, it seems that considering the existing capacities, using a participatory GIS to report the physical problems of the villages can be helpful, but it requires that the public awareness be increased in relation to the benefits of the system among the rural people and officials. As the future work, the system user interface should be strengthened and look simpler and freer of any complexity according to the usability assessment results. Infrastructure issues such as antenna problems and the Internet should also be addressed with the help of officials to enable the use of system capabilities. Once the problems are solved, people gradually trust the authorities and gradually learn to use

the system and can report problems in much more detail and accuracy.

It is also suggested that the future studies adopt data logging approach to better monitor the behavior of users while interacting with the system. Moreover, production of mobile applications for the system can also make the capabilities of the system better, faster and more accessible to the villagers.

As another suggestion, future study might investigate and evaluate the relationship between villagers' motivation and system use. Obviously, the more motivated villagers are to report problems (for example, problems related to where they live), the more time and effort they will spend reporting the problems. This would lead to increased participation and use of the system in reporting rural physical problems. The results of a study conducted by Amini Rad (2021) show that there is a direct relationship between the motivation of participants and the quality of participatory geographic data.

#### References

- Amini, Rad, M. (2021). Assessing the relationship between participants' motivation and the quality of citizen-centered geographic data. Thesis, University of Tehran, Faculty of Geography
- Bahraini, H. (1991). Concept and characteristics of physical planning, Proceedings of the First International Conference on Physical Planning (national and regional).
- Goodchild, M. F. (2007). Citizens as sensors: The world of volunteered geography, *GeoJournal*, Vol. 69, No. 4, pp, 211–221.
- Mir-Mohammadi, F., Jelokhani-Niaraki, M., Alavi-Panah, K. & Neysani-Samany (2016). Development of Support System Participatory spatial decision-making under the web based on user-assigned spatial options (Case study: Location of permanent health services in Region 1 of Mashhad), *Journal of Surveying Science and Technology*, Volume 6, Number 1.