Desimination of Technology Assistance for the Development of Road Network Geospatial Information in Murtigading Village, Bantul

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ABSTRACT

To realize sustainable village development, the village government is obliged to prepare the Village Medium-Term Development Plan (RPJM). Considering that the RPJM of Murtigading Village, Sanden District, Bantul Regency is still in the form of ordinary digital data, mapping and making maps of geospatial information for earth-oriented village infrastructure is very important in supporting integrated development planning and in accordance with the One Map Policy. This service activity aims to assist the Village Administration in mapping and developing thematic geospatial information (IGT) for roads and public infrastructure in Murtigading Village using the Quantum GIS (QGIS) version 3.10.1 program. The data used is a map of Indonesia's Earth and Quickbird imagery of Bantul Regency. This activity involved Murtigading Village Pamong, 18 Padukuhan Heads, and KPMD, both in preliminary surveys, data collection and mapping, making IGT roads and other public infrastructure with QGIS, synchronization and dissemination of geospatial information data. The results of the activity are in the form of a Geographical Information System (GIS)-based IGT map containing data on the distribution of locations, names, history, current network conditions, geometrics, and road pavements as well as public facilities in shape file (shp) format as well as thematic analog maps with a scale of 1:2000, 1:3000, 1:3,500, 1:4000, and 1:7000 which are expected to be guidelines in planning and prioritizing the development of village infrastructure that is right on target.

KEYWORDS
Geographical Information System (GIS);
Thematic Geospatial Information (IGT);
Village Infrastructure

1. Introduction

Murtigading Village is located in Sanden District, Bantul Regency, Yogyakarta Special Region. According to the Regulation of the Governor of the Special Region of Yogyakarta Number 25 of 2019 concerning Guidelines for Institutionalization of Privileges in Regency/City and Village Governments dated April 19, 2019, the nomenclature of this region becomes Kalurahan Murtigading, Pakanewon Sanden, Bantul Regency. According to its geographical location, Murtigading Village has an area of 4.32 km2 with a distance of 15 km from the district capital. Murtigading Village has a population of 8,528 people spread over 18 Padukuhan or Hamlets (Murtigading Village Government, 2019). Spatially, 18 Padukuhan/Dusun in Murtigading Village are spread out as shown in Fig. 1. Murtigading Village is bordered by Caturharjo Village (Pandak District) in the north, Srigading Village (Sanden District) in the east, Gadingharjo Village (Sanden District) in the east. south, and Gadingsari Village (Sanden District) in the west. To realize sustainable village development, the Village Government is obliged to prepare village development plans as set out in the Village Medium-Term Development Plan (RPJM). Considering that the existing RPJM Murtigading Village is still in the form of ordinary digital data, mapping and making geospatial information maps of earth-oriented village infrastructure is very important in supporting integrated development planning between sectors and in accordance with the One Map Policy as stipulated in the Presidential Regulation of the Republic of Indonesia. Indonesia

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Number 9 of 2016. The Law of the Republic of Indonesia Number 4 of 2011 concerning Geospatial Information mandates the importance of Thematic Geospatial Information (IGT) organized by the Regional Government as a tool in the formulation of policies and decision making in determining priorities for the development of infrastructure and facilities. This community service uses some literature from Geospatial research. A comprehensive approach to the evaluation of off-road traffic capability and the development of a modified equation for RCI estimation to assess regional soil variations using geospatial technology was investigated by Pundir [1]. An exploratory study on the impact of physical and geospatial characteristics of the urban built environment on the annual electricity use of buildings was investigated by Mohammadi [2]. Estimating access to health care in Yemen, a complex humanitarian emergency setting: a descriptive applied geospatial analysis researched by Garber [3]. Geospatial intelligence and health analytics: Its applications and uses in a city with a high incidence of tuberculosis in Brazil was investigated by Gehlen [4]. Equality of access to primary dental care in São Paulo, Brazil: A geospatial analysis studied by Yuen [5].

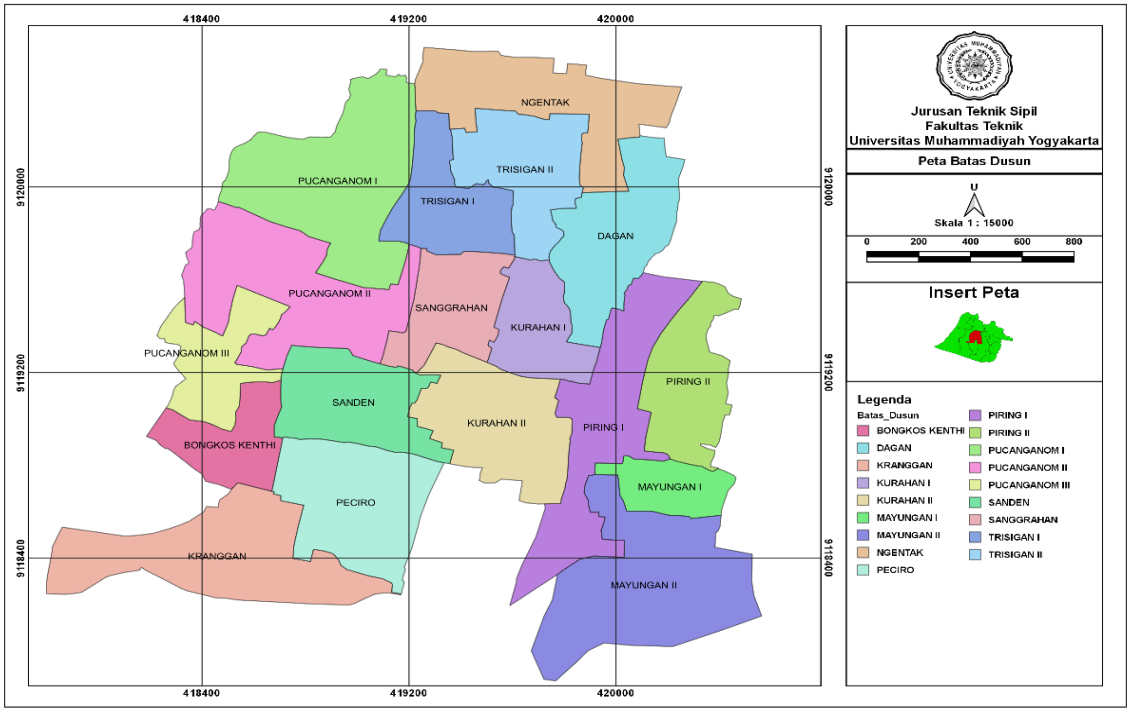

Fig. 1. Map of murtigading village, sanden district, bantul regency

Geographic and temporal encoding to improve the estimation of PM2.5 concentration in China using an edge-to-edge gradient enhancement was investigated by Yang [6]. The Global Discrete Grid System as a scalable geospatial framework to characterize the coastal environment was investigated by Bousquin [7]. Monitoring progress of the Sendai Framework using geospatial models: An example of people affected by agricultural drought in the Eastern Cape, South Africa studied by Walz [8]. A high-resolution geospatial assessment of the photovoltaic potential of rooftop solar in the European Union was investigated by Bódis [9]. Temporal and geospatial trends of pediatric cancer incidence in Nebraska over a 24-year period were studied by Farazi [10]. Integrating geospatial fire models to describe landscape management zones and inform decision making in the Mediterranean region was researched by Rodrigues [11]. Delineation of groundwater potential zones using the integration of geospatial and MIF techniques: A case study in the Rarh region, West Bengal, India investigated by Mandal [12]. Geospatial variation in measles vaccine coverage through routine strategies and campaigns in Nigeria: Analysis of a household survey recently investigated by [13]. BonaRes metadata schema for soil-agricultural geospatial research data – Combining

the INSPIRE and DataCite metadata schemas studied by Specka [14]. Empirical Analysis of Geospatial Classification for Agricultural Monitoring was investigated by [15].

Loading and removal of trace elements in wastewater in the Great Lakes basin was investigated by Pinter [16]. Barriers to child welfare in Dhaka settlement: Stakeholder perspective and geospatial analysis investigated by Vostanis [17]. A new approach to geospatial risk analysis in the energy-water-food nexus using the EWF nexus node was investigated by [18]. The use of geospatial data and the Bayesian Network to assess the risk status of Mexican amphibians was studied by Ramírez [19]. The framework for integrating geospatial information systems and hybrid cloud computing was investigated by Helmi [20]. Observing the effect of climate and environmental variability on changes in soil salinity in the Noakhali Coastal Region of Bangladesh using geospatial and statistical techniques investigated by [21]. Assessing the potential for large-scale solar energy generation in Eastern Nigeria with geospatial technology was investigated by Chiemelu [22]. Identifying geospatial patterns in wealth disparities in child malnutrition in 640 districts of India was studied by Liou [23]. Development of landscape ecology supported by geospatial technology: A review researched by Yu [24]. Data on artificial recharge sites identified by geospatial tools in the semi-arid region of Anantapur District, Andhra Pradesh, India were studied by Rajasekhar [25].

Geospatial Information, hereinafter abbreviated as GI, is geospatial data (DG) that has been processed so that it can be used as a tool in policy formulation, decision making, and/or implementation of activities related to terrestrial space. Furthermore, Thematic Geospatial Information, hereinafter abbreviated as IGT, is a GI that describes one or more certain themes that are made referring to Basic Geospatial Information (IGD). According to Article 23 paragraph 1, IGT can be organized by Government Agencies, Regional Governments, and/or any person. Thematic Geospatial Information (IGT) must be collected, processed and stored in a Geographical Information Systems (GIS) based digital format. Several previous studies on Geographical Information Systems were applied to this service. Geographic information system and weather-based dynamic line ranking for generation scheduling was investigated by Hemparuva [26]. Analysis of the distribution of dental services in Malaysia: geographic information systems – based approach researched by Md Bohari [27]. Geographic information system (GIS) - A multi-criteria analysis of flood hazard and risk based in Ambo City and its watershed, West Shoa Zone, Oromia State, Ethiopia was studied by Ogato [28]. Morphometric analysis of Lake Toshka in Egypt: A brief overview of geographic & Remote sensing based technique was investigated by Abd Ellah [29]. Using a Geographic Information System (GIS) to Study Trends in Utilization of Incretin and Peptide Based Therapy for Type 2 Diabetes in the US Medicaid Program was studied by Almarhoon [30]. Long-term unmeasured rainfall projections using the integrated Statistical Downscaling Model and Geographic Information System (SDSM-GIS) were investigated by Tukimat [31]. Modeling and monitoring of the house fly M. domestica using remote sensing data and geographic information systems was investigated by Abutaleb [32]. National coverage of out-of-hospital cardiac arrest using drones equipped with automated external defibrillators — Geographic information systems analysis was studied by Schierbeck [33].

Testing the suitability of geographic information. A case study of the Land parcels Identification System was investigated by Tóth [34]. Spatial assessment of suitable areas for the drug species Astragalus (Astragalus hypsogeton Bunge) using the Analytic Hierarchy Process (AHP) and Geographic Information System (GIS) was investigated by Piri [35]. Spatial distribution of dengue in Ecuador during 1994–2018 using geographic information systems (GIS) – Public health implications and travel medicine investigated by Spatial distribution of dengue in Ecuador during 1994–2018 using geographic information systems (GIS) – Implications of public health and travel medicine Cabrera [36]. Determination of land use balance using satellite imagery and geographic information system: a case study in South Sulawesi Province, Indonesia researched by Saing [37]. Community structure of actinobacteria in Arctic Frontal waters in

the Southern Ocean of Antarctica using Geographic Information Systems (GIS): A new approach to studying the Marine Microbiome was investigated by Sivasankar [38]. Assessing connectivity in single and multimodal networks using Geographic Information Systems (GIS) was investigated by Moreno [39]. A cost-effectiveness analysis of a micro-planning approach supported by traditional and geographic information systems for routine immunization program management in northern Nigeria was investigated by Ali [40]. Evaluation of environmental resources and mental health in American military veterans using a geographic information system was researched by Shin Park [41].

Mapping the spatial location trends of informal economy firms using mobile geographic information data in a city in Harare, Zimbabwe studied by Gumbo [42]. Implications of Geographic Information Systems (GIS) for the targeted recruitment of older adults with dementia and their caregivers in the community: A retrospective analysis investigated by Scerpella [43]. Using a geographic information system to assess local-scale methylmercury exposure of fish in nine communities of the Eeyou Istchee region (James Bay, Quebec, Canada) was studied by Moriarity [44]. Application of Geographic Information System (GIS) in the provision of immunization services; its use in the 2017/2018 measles vaccination campaign in Nigeria was investigated by Oteri [45]. Given the lack of knowledge and human resources who master this GIS-based technology, collaboration between academics, village officials, and the community is needed in mastering and implementing it. Therefore, the contribution of this service activity is to assist the Village Pamong in mapping and developing Thematic Geospatial Information (IGT) for roads and public facilities in Murtigading Village using the Quantum GIS (QGIS) version 3.10.1 program which is expected to be a technical document for planning and prioritizing village infrastructure development. The data used is the Indonesian Earth Map (RBI) scale 1: 25,000 and the Quickbird image of Bantul Regency as well as primary data from the field survey. This activity involved the Murtigading Village Pamong, 18 Padukuhan Heads, and Village Community Empowerment Cadres (KPMD, both in preliminary surveys, data collection and mapping, development of IGT roads and other public infrastructure with QGIS version 3.10.1, as well as synchronization and dissemination of geospatial information data thematic (IGT).

2. Method

According to the Regulation of the Minister of Public Works Number 16/PRT/M/2009, the Regional Spatial Planning (RTRW) including the Spatial Planning for Rural Areas requires the availability of digital data based on earth (spatial) for regional development planning. The one map policy which includes four elements, namely one reference, one standard, one database, and one earth-based portal is a guideline that must also be adhered to in the preparation of regional spatial plans. The stages of activities in making thematic geospatial information on roads and infrastructure in Murtigading Village as illustrated in the flow chart in Fig. 2. This activity begins with preparations which include coordination with the Village Pamong, preliminary surveys, and collection of the latest village profile data. Primary data collection through field surveys includes road data (geometric, structure, and current conditions) and village infrastructure such as schools, mosques, health centers, and other public facilities.

The secondary data in the form of Quickbird imagery of Bantul Regency was obtained from the Bappeda of DIY Province, while the 1:25,000 scale Indonesian Earth Map (RBI) was downloaded from the Indonesia Geospatial Portal website (https://tanahair.indonesia.go.id/portal-web/ web-app/). Data synchronization was carried out through a participatory Focus Group Discussion (FGD) which was attended by the Lurah, Pamong Desa, and all Padukuhan Heads. The Service Team provides data from the field survey results in analogue forms and maps (printed from RBI) for FGD participants to fill out and complete the data. The results of the FGD in the form of location data, names, geometries, pavements, and road damage, data on village public infrastructure/facilities including schools, mosques, health centers,

and others were then made and developed into Thematic Geospatial Information (IGT) on a scale of 1: 25,000.

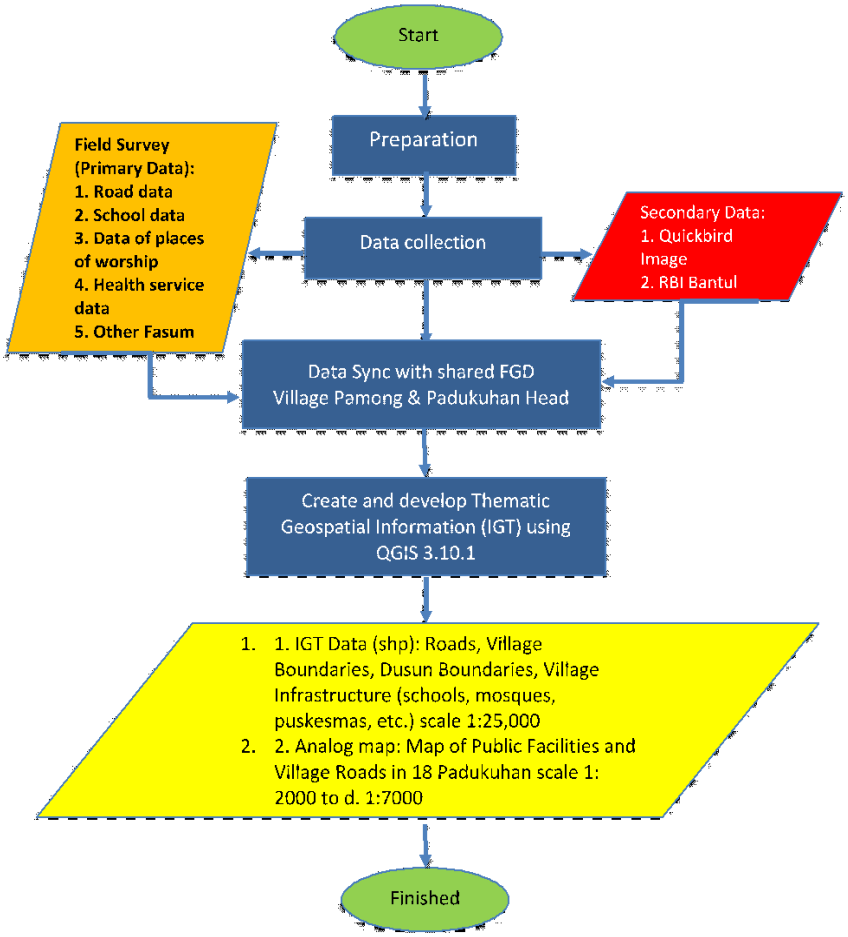

Fig. 2. Flowchart of service activities stages

The tool used for making IGT in shapefile (shp) format is a computer equipped with Quantum GIS (QGIS) version 3.10.1 software. The QGIS 3.10.1 program is open-source software and is complete enough to be used in the process of creating IGT and other spatial analysis. The materials/data needed for the manufacture of IGT are Quickbird images and a map of the Indonesian Earth (RBI) of Bantul Regency. Quickbird image is a photo (image) from a satellite that has the advantage of presenting data with a spatial resolution of up to 61–72 cm (panchromatic) and 2.44–2.88 m (multispectral), so it is expected to be able to provide accurate infrastructure information with a high level of detail. tall one. At a resolution of 61 cm buildings, bridges, roads and various other infrastructures can be seen in detail. Therefore, Quickbird images are widely used for spatial or spatial-based studies and research.

In this service activity, Quickbird images are needed to extract and digitize maps of road infrastructure and other village infrastructure that are not yet on the RBI map of Bantul Regency with a scale of 1: 25,000. The IGT is also equipped with data on the condition of roads and village infrastructure, the year of construction and maintenance of the infrastructure. For data supporting educational infrastructure, data from the website http://school.data.kemdikbud.go.id/ belonging to the Ministry of Education and Culture of the Republic of Indonesia (2016) is also used. The distribution of village infrastructure locations in Murtigading Village along with their current conditions is then made and developed in a geospatial-based digital map called thematic geospatial information (IGT) in shapefile (shp) format and analog (printed) maps from IGT in the form of maps for village areas with scales of 1: 3,500 and 1: 7,000

as well as a map of the hamlet area at a scale of 1: 2,000, 1: 3000, and 1: 4,000. The condition of village infrastructure mapped in this service is shown in Fig. 3.

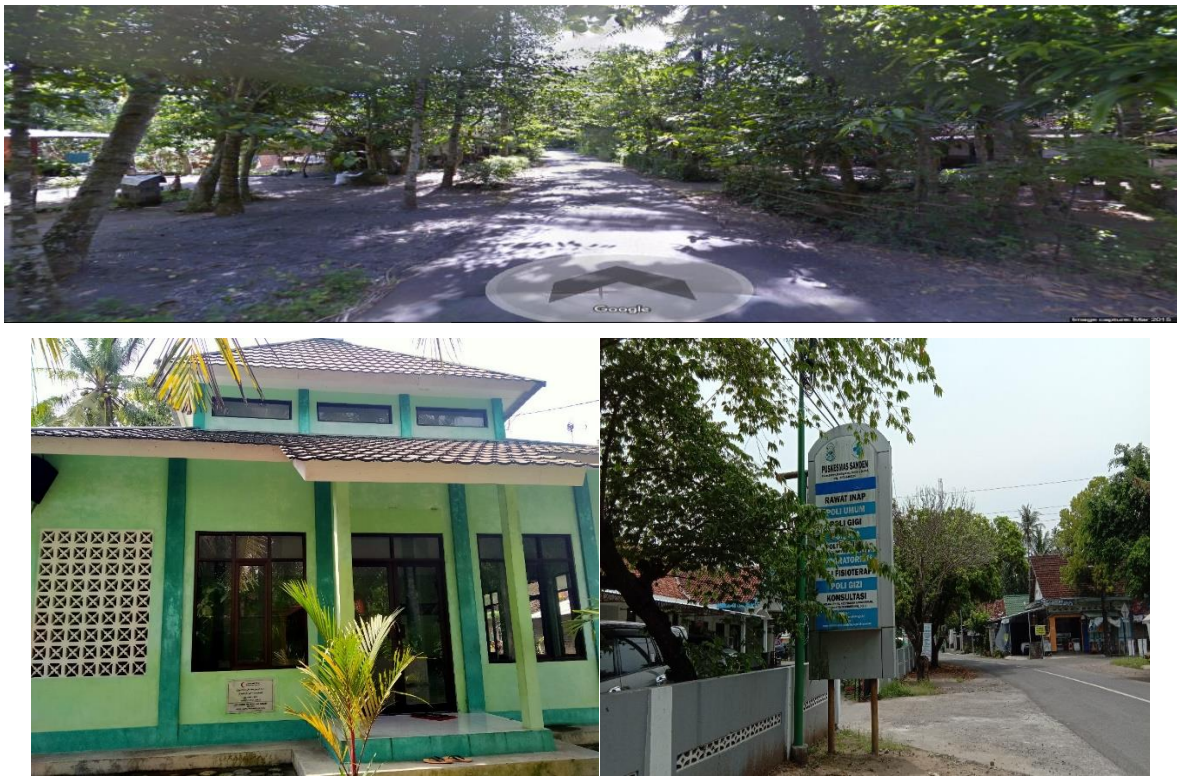

Fig. 3. Infrastructure of murtigading village, sanden district, bantul regency

3. Results and Discussion

The results of the field survey for the inventory of roads and village infrastructure in 18 Hamlets (Padukuhan) which were carried out at the beginning of the PKM PPDM UMY activity, to be precise in February 2021, are as shown in Fig. 4.

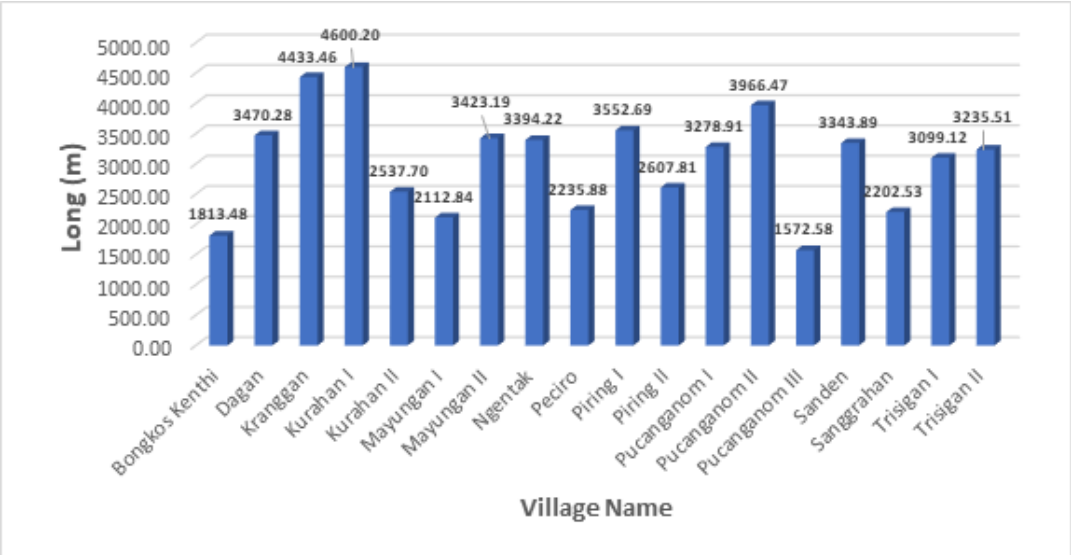

Fig. 4. Road length inventory data in murtigading village, sanden, bantul

The data obtained from this field survey was then cross-checked and completed by the Lurah, Pamong Desa, and all Padukuhan Heads through participatory FGDs as illustrated in Fig. 5.

Fig. 5. Infrastructure of murtigading village, sanden district, bantul regency

The distribution of village infrastructure locations in Murtigading Village and their current conditions were then made and developed in a digital earth-based map in shapefile (shp) format. This IGT data is important spatial data (spatial) that can be integrated with other GIS data for village infrastructure development planning based on the One Map as launched by the Indonesian government. Complete data on the results of mapping road infrastructure in Murtigading Village in the form of IGT and thematic analog maps produced from this service activity are detailed in Table 1.

Table 1. Table Styles

No	Name	Data Type	Year	Amount
1	Name, Type of Pavement, and Road Condition in Murtigading Village	ESRI Shapefile (shp)	2021	1
2	Facilities for Education, Worship, Health, BUMDES, etc	ESRI Shapefile (shp)	2021	1
3	Village Limit (1:25,000)	ESRI Shapefile (shp)	2021	1
4	Hamlet Boundary (1:25,000)	ESRI Shapefile (shp)	2021	1
5	Murtigading Village road and infrastructure map	Analog Map size A1 and A2	2021	2
6	Map of hamlet roads and infrastructure in Murtigading Village	Analog Map A3 . size	2021	18

There are 20 thematic analogue maps made from this IGT, namely 2 infrastructure and road maps for village areas with a scale of 1: 3,500 and 1: 7000, as well as 18 maps of infrastructure and village roads

for 18 hamlet areas with a scale of 1: 2,000, 1 :3,000, and 1:4,000 which is one example like Fig. 6 below.

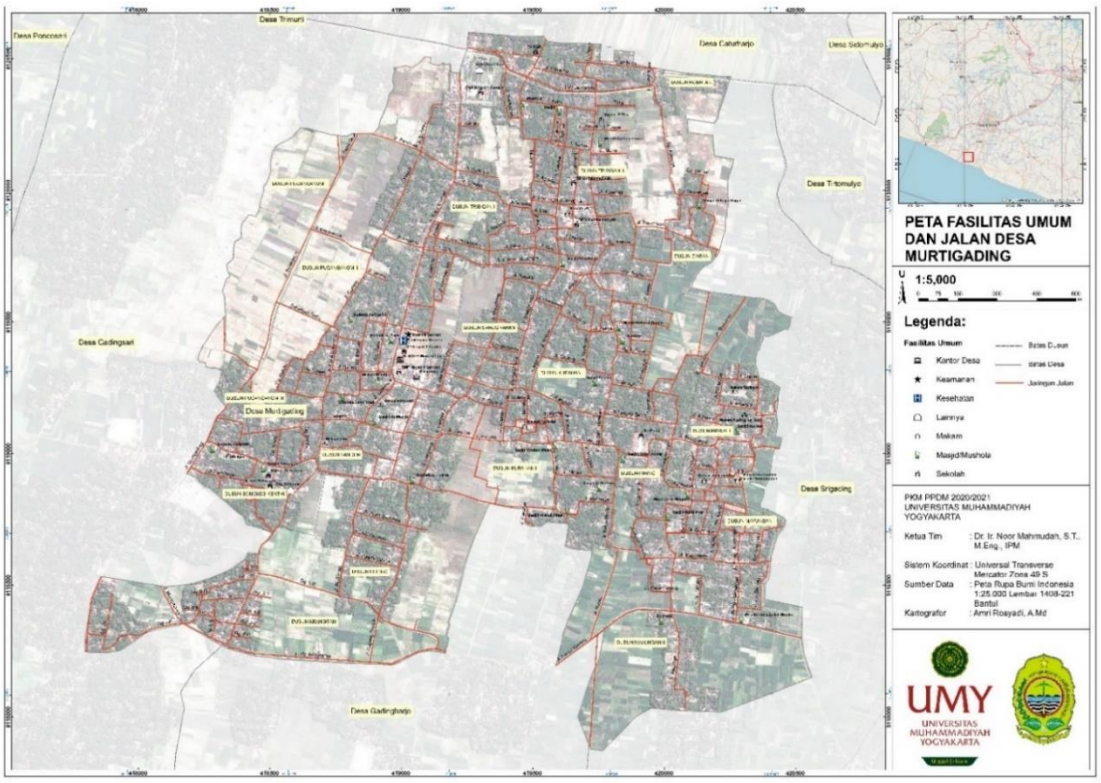

Fig. 6. Map of road infrastructure and public facilities in murtigading village

4. Conclusion

This service activity aims to assist the Village Pamong in mapping and developing IGT roads and public facilities in Murtigading Village based on RBI maps and Quickbird images using the QGIS 3.10.1 program. IGT is important for the Village Government, especially as a tool in planning and setting priorities for the development of village infrastructure that is spatially based and integrated between regions. The results of the service are in the form of a GIS-based IGT map containing data on the distribution of locations, names, history, current network conditions, geometric, and road pavements as well as public facilities in shape file (shp) format as well as thematic analog maps printed from IGT with a scale of 1:7,000. and 1:3,500 for the village area and a scale of 1:2,000, 1:3,000, and 1:4,000 for the 18 Dusun (Padukuhan) maps.

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Our gratitude and appreciation goes to LP3M UMY which provided support for the 2021 FY PKM grant, the Murtigading Village Pamong along with all Padukuhan Heads, lecturers and students of Civil Engineering FT UMY, as well as all parties who have helped carry out this service activity.

Author Contribution

According to the Regulation of the Minister of Public Works Number 16/PRT/M/2009, the Regional Spatial Planning (RTRW) including the Spatial Planning for Rural Areas requires the availability of digital data based on earth (spatial) for regional development planning

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Conflict of Interest

The authors declare no conflict of interest.

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