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Supporting e-Participation in Rural Areas: the Greek Case

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ABSTRACT:*The objective of this article is to propose a framework for supporting electronic and mobile participation for rural stakeholders to actively involve them in solving local problems and in decision-making, and strengthen their co-operation and dialogue capabilities with local pub-lic authorities. The framework includes an electronic collaborative platform that will support mobile applications and drone-assisted services, as well as the co-creation of innovative electronic and mobile participation services by rural stakeholders. It comprises the initial phase of a research initiative that currently focuses on a case study for rural areas in Greece. It is estimated that the completion of this initiative will enhance citizen empowerment and will enable sustainable governance.*
KEYWORDS:*e-government, m-participation, drones, rural areas.*

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I. INTRODUCTION

Electronic participation (e-participation) is the most common form of participatory democracy for the largest part of the population [1]. According to the United Nations [2], e-participation refers to the process of citizens' engagement in policy and decision-making through Information and Communication Technologies (ICTs), in order to achieve participatory and collaborative public administration. Furthermore, e-participation involves the expansion and transformation of citizens' participation in the processes of social democracy and consultation, mainly supported by ICTs. Until today, several public bodies have made efforts to support e-participation for their citizens, either by promoting Government to Citizen (G2C) or Citizen to Government (C2G) communication. G2C communication focuses mainly on how to inform citizens (e.g. processes, applications, events), while C2G communication focuses on the provision of information from citizens to public agencies (e.g. views, comments, ideas [3].

In recent years, in the European Union there has been a growing interest in the development of e-participation by various government agencies, non-governmental organizations, and re-search institutes. E-participation is part of the European Commission's "Open Government" approach, which aims to provide opportunities for public administration to become more efficient and effective by increasing the exchange of information and knowledge and enhancing connectivity, transparency and openness [4].

Local public authorities are under increasing pressure to adopt e-participation services with a view to involving citizens more effectively in better organizing their lives at local level. The constantly emerging demand for participation in local governance reflects citizens' need for in-creased control over the decisions of local public authorities, as well as for transparency and accountability [5]. However, global surveys show that local public authorities have not extensively adopted e-participation, despite their early enthusiasm for its prospects [6],[7], [8]. Similarly, in Greece m-participation appears to be still at an early stage across Greek municipalities [9], [10]. In addition, the increased connectivity of citizens and the rapid development of ICTs and mobile technologies pose yet another challenge for public administration, namely the need to adapt to the digital transformation of society.

M-participation (m-participation) is considered as one of the aspects of e-participation and is essentially an extension or evolution through the use of mobile technologies [11]. It is defined as "the use of mobile devices to increase the participation of citizens and other stake-holders by enabling them to communicate with each other, to co-create and share information, to comment and to vote" [12]. M-participation

incorporates internet capabilities for participation through mobile devices, allowing to provide a wide range of mobile applications (apps) [13]. Mobile apps are software packages for smart mobile devices, tablets, laptops and other portable devices [14]. Examples of mobile apps include poll and voting applications, advertisements [15], payment systems, public consultations, information for public, interaction with the public administration, city guides for finding locations, buildings, offices and commercial services, travel booking ser-vices, warning services [16], public safety services, and health services. However, according to [3] most of the mobile apps are focused on dissemination and reporting, typically G2C one-way communication, failing to achieve a sustainable two-way communication between public administration and citizens. The same applies to Greece, since the majority of municipalities' mobile apps for citizens are mainly related to one-way G2C communication to provide information, especially related to tourist guides, municipal news, recycling tips, cultural events and travelling [9], [10].

A two-way communication is not always successful, since the society consists of citizens with different needs and skills [17] and consequently a "one size fits all" solution is not appropriate. It should consider the different needs of specific groups of citizens, such as farmers, elderly, and people with disabilities. Up to a certain extent, mobile technologies can enable the transformation, adaptation and customization of e-participation by offering citizen-centric involvement together with personalized solutions. Other promising technologies can also make significant and novel contributions in practice, such as Unmanned Aerial Vehicles (UAVs), i.e. drones, which are already being used by public and private operators for a variety of activities. Both mobile apps and drones can play a very important role in enabling e-participation for citizens in disadvantaged, mountainous and rural areas. Especially in rural areas that are far from the policy centers, residents experience limitations in accessing the necessary public information, making use of public services, or participating in collective processes and decision-making. Greece comprises a representative example, as mountainous and disadvantaged regions account for about 70% of its area [18].

In this light, a research initiative has been established for supporting two-way G2C electronic and mobile participation for rural stakeholders and local authorities to actively participate in solving local problems and in decision-making, and strengthening co-operation and dialogue capabilities among them. This is achieved through a novel framework that is based on mobile apps, drone services and an electronic collaborative platform enabling the co-creation of innovative electronic and mobile participation services.

The structure of the article is as follows: Section 2 discusses e-participation and m-participation, as well as the possibilities introduced by the use of drones and mobile apps. Section 3 presents the proposed framework for the implementation of specialized and customizable mobile apps and drone-assisted services for rural areas in Greece. Section 4 concludes the paper by presenting the scientific, social and environmental impact of the proposed framework, as well as future work.

II. BACKGROUND

Electronic democracy (e-democracy) is defined as the use of ICTs to support democratic decision-making in order to strengthen democratic institutions and processes. In the context of e-democracy, various aspects are included, such as e-government, e-participation, e-parliament, e-initiatives, e-voting, and e-campaigning. E-participation is the extension of public administration means to actively approach citizens and ensure their involvement and co-operation in identifying their needs and requirements for the development of new services. E-participation is distinguished in "government-driven" and "citizen-driven" participation, referring to government or citizens, respectively, as key levers for its achievement [19].

Various models have been proposed to determine the level of growth or maturity of e-participation [20], [21],[22],[23]. These models measure maturity using specific levels, reflecting different requirements and needs, according to the perspective of the researchers who have proposed them. The higher the maturity level the higher the citizens' empowerment within society [24], [25],[26], [27].

However, advances in communication technology influence existing models and the development of new ones, in order to better assess the growth of e-participation. Particularly, m-participation is a relatively new phenomenon in the field of e-government [12], so there is not yet extensive discussion about it. Also, the advantages of mobile technologies, such as device portability, low cost, and the ability to provide location-based information and services 24/7, can help promote e-participation. Mobile services involve a variety of personalized and context-aware services, where the content is generated either by human interaction with the mobile device, or by the interaction of the mobile device with the surrounding objects, as part of an ecosystem (smart infrastructure) in the Internet of Things (IoT). These services provide advanced capabilities for services such as healthcare services (home care, emergency alerts), banking, travel (vehicle telemetry, automated driving), as well as ubiquitous positioning services [28].

In addition, other emergent technologies, like drones, have created new opportunities for science and business, and even for the transformation of e-government. Drones are relatively small-factor and easy-to-use flying devices incorporating, among others, digital cameras, microelectromechanical sensors (gyroscopes,

magnetometers, and pressure sensors), small GPS units, powerful processors, and Wi-Fi antennas. Drones have been in use for a variety of purposes, both by public bodies (for public safety, material damage evaluation, border patrol, infrastructure monitoring and control, real estate management, aerial photography, park supervision, school and sporting events) and private operators (for infrastructure inspection, commercial aerial photography, private surveillance and research, agricultural surveys, inspection, evaluation and maintenance, entertainment). Surveys have been carried out to ensure that drones in the near future can be used for air traffic management, detection systems and geo-fences [29].

In rural areas, their use for agricultural activities is extensive. Drone services ensure continuous crop monitoring, from sowing to harvesting. The data collected by drones are transformed into useful and understandable information for farmers, such as plant counting, crop height and density, vegetation indices, disease detection, fertilizer and pesticide efficiency, and watering needs. Drones can help agricultural stakeholders optimize the use of inputs (seeds, fertilizers, water), tackle threats (weeds, parasites, fungi) faster, and estimate their crop yields with higher accuracy. Several attempts and trials are underway for the use of drones in mountainous, re-mote or isolated areas, e.g. for the delivery of medicines, products and mail correspondence, such as in the Bavarian Mountains of Germany [30], in rural areas of Australia [31], in the isolated villages of the African continent [32], and in the Chinese province of Jiangsu with its coastal plains that are crossed by canals [33].

III. PROPOSED FRAMEWORK

This section focuses on a research initiative established for supporting electronic and mobile participation for rural stakeholders and local authorities. It involves a framework that integrates mobile apps, drone-assisted services and an electronic collaborative platform to act as an incubator for e-participation and m-participation services for rural areas. The overall strategy in the development of the framework is based on an agile development methodology, which involves frequent software releases made available to the end-users for testing and evaluation, resulting in keeping them continuously in the production loop and, thus, in more high-quality and well-validated outputs. The framework (depicted in Fig. 1) includes the following types of stakeholders: local government (e.g. municipalities and regional departments), local action groups (e.g. non-governmental organizations), agricultural population (e.g. farmers), and agricultural stakeholders (e.g. agronomists and agricultural economists).

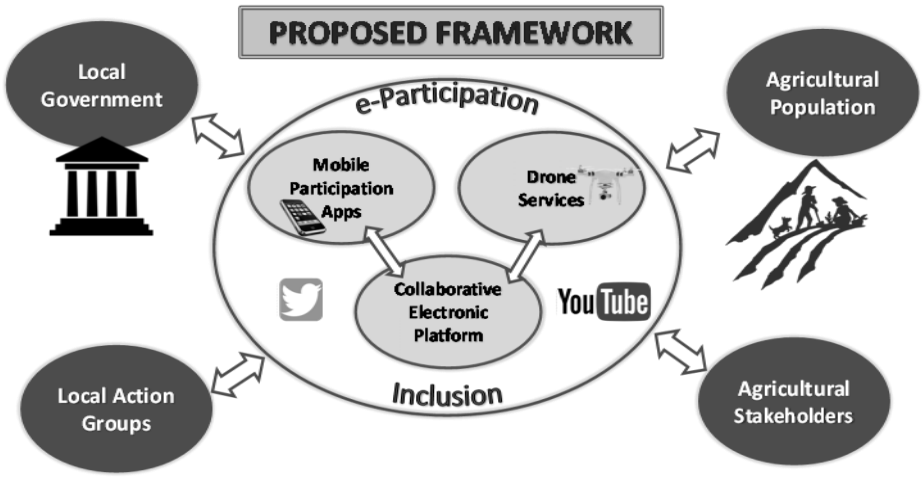

Fig.1. E-participation framework for rural areas

In the context of the initiative, the investigation and identification of the user requirements concerns specific pilot regions. These pilot regions comprise a representative sample of Greek communities in terms of their characteristics (e.g. demographics, population density-per km2, type of communities, geographic region and location). The regional department of Viotia and the municipality of Levadia act as the main case study. The regional department of Viotia comes under the Central Greece Region, covers an area of 2,952 km2 and has a total population of 117,730 inhabitants. Its capital is Levadia and consists of six municipalities. It is a fertile region with mountainous terrain. In particular, the regional distribution is 40% plain, 38% semi-mountainous and 22% mountainous. The municipality of Levadia covers 690 km2 and has a population of 31,315 inhabitants. Mountainous areas are characterized by sheep and goat breeding, producing famous dairy products and meat.

III.1 Mobile Participation Applications

The implementation of m-participation apps involves, firstly, the identification of the requirements of the agricultural population for supporting the interactions with local government, and secondly, the design and development of these specialized mobile apps, such as sustainable irrigation management, efficient pest monitoring, reduced pesticide application, as well as natural disaster reporting (fire/flood).The mobile apps should be suitable for covering the citizens' needs in rural areas, promoting either government-driven m-participation, or citizen-driven m-participation. Requirements elicitation includes interviews and questionnaires with civil servants of local governments (municipality and regional department), as well as with samples of the agricultural population living in the two aforementioned rural areas in Greece. The goal is to help local governments to provide more efficient m-participation apps to the agricultural population, local action groups, and agricultural stakeholders, strengthening their engagement in the commons.

III.2 Drone Services

The implementation of e-participation services using drones for rural areas includes the specification of relevant drone-assisted services in terms of content, characteristics and provision means. Indicative examples of proposed services include environmental monitoring services, such as assessment of damage from fires and extreme weather conditions, crop pest infection, and free grazing monitoring, as well as monitoring of protected areas. Specifically, the implementation of these services involves data collection and data transfer from the drone to the electronic collaborative platform, data analysis, extraction of useful information, and dissemination of the generated information to the concerned local public agencies and agricultural stakeholders.

III.3 Electronic Collaborative Platform

The electronic collaborative platform will support: a) mobile apps and drone-assisted e-participation services; and b) the co-creation of innovative e-participation and m-participation services by the rural stakeholders. In this way, the platform will use open data, provided by stakeholders, and will enable them not only to provide their proposals and feedback for new services, but also to become more actively involved in the design, implementation and development of the services.

The implementation of the platform is divided into hardware, software and services. A hardware platform can be defined as a "foundation or tool for creating a variety of products through processes". The software platform provides the execution infrastructure of the proposed services. The service platform is defined as an Information Technology (IT) based environment that enables other services to use service functions in an easy and seamless manner.

In particular, in order to allow the co-creation of new services, the electronic collaborative platform will serve rural stakeholders in getting involved and interact, by means of an online structured dialogue with questions. These questions will guide stakeholders to provide structured data needed to model new services. Open technologies will be used to develop the plat-form and applicable legislation regarding the protection of personal data will be taken into account. The data provided by open sources, mobile devices and drones will be combined with the use of Web technologies and social networking tools (Twitter, YouTube). An overview of the technical architecture of the proposed electronic collaborative platform is given in Fig. 2. This architecture consists of the following components:

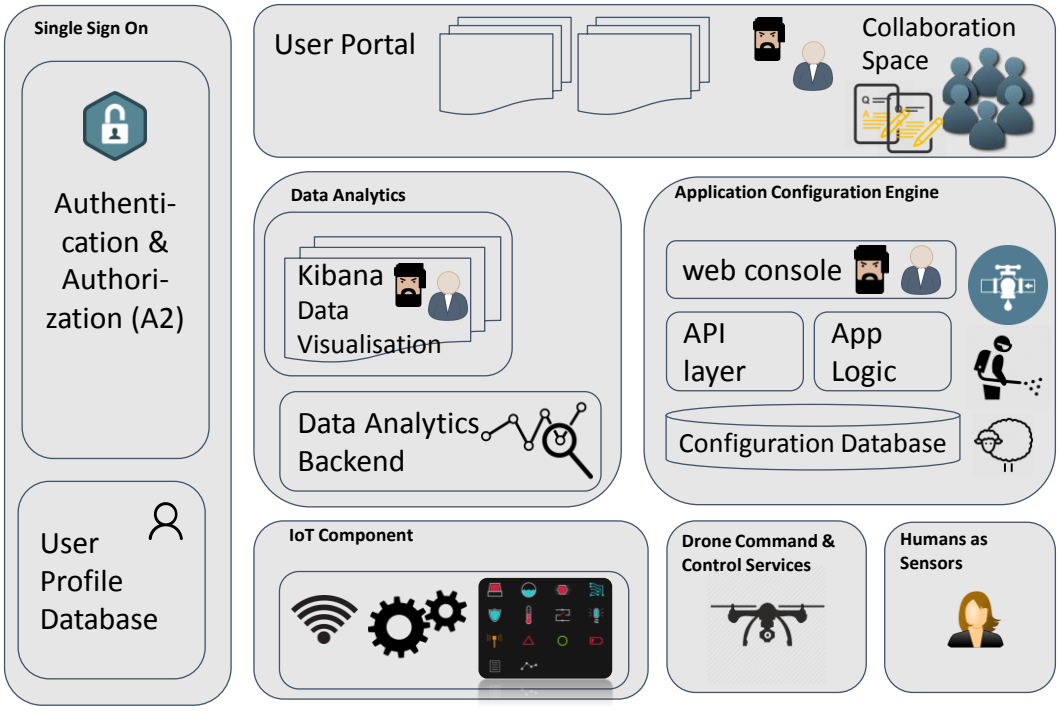

Fig. 2. Architecture of the Electronic Collaborative Platform

- An open-source Single Sign On (SSO) component, which offers Authentication and Authorization (A2) services, including login and signup capabilities through Web-based (REST) Application Programming Interfaces (APIs). Moreover, it provides a configuration dashboard to plug applications under proxied authentication. It also includes a User Profile Database that can be used to extend the standard dataset present in the A2 data-base (e.g. with avatar thumbnails, secondary email addresses, etc.), and is linked with the A2 services through anonymous user tokens.
- An Application Configuration Engine, which is responsible for the personalization and customization of the application experience. This holds the logic for the individual applications (pertaining to irrigation management, pesticide usage, herd monitoring, etc.), and also includes a web console for administrators and developers.
- The Data Analytics Component, which includes an open source and customizable reporting tool leveraging on xAPI data (Kibana), providing almost real-time data analytics and traces management, as well as almost real-time support for application alerts. Administrators and local stakeholders can customize or build brand new visualizations.
- A User Portal, which represents the main entry-point and marketing tool for the entire digital ecosystem, fostering communication toward the creation of communities. Developers and stakeholders can sign up and stay informed about the latest activities of this digital ecosystem. The portal also provides statistics about developers and applications, as well as access to documentation and open source assets.
- The Internet-of-Things (IoT) Component, which is responsible for receiving and managing events and alerts coming from various deployed sensors in the field and other open data sources. It is implemented using an open source framework (Kaa). This component sends push notifications about detected events to the Application Configuration Engine, which in turn proxies them to the application clients (mobile apps).
- Human-as-Sensor (HAS) events are real life events triggered by humans. Such information can typically be gathered through web questionnaires filled by local actors.
- Drone Command & Control Services, which are responsible for abstracting and facilitating the management, command and control of registered drones (e.g. in terms of mission assignment, dispatching, navigation, return-home, flight durations, etc.), regardless of their brand.

IV. CONCLUSIONS

This article proposes an innovative framework for the integration of ICTs and IoT for supporting e-participation and m-participation of citizens in rural, mountainous and disadvantaged regions. This implementation of this initiative provides local communities with the means to enhance their agricultural

activities through the use of specialized drone-assisted services (e.g. crop monitoring), strengthen their resilience and environmental sustainability (e.g. natural disaster management, irrigation and water management), and close the gap between them and the local policy and decision-making authorities.

It can contribute in multiple ways to the uptake of m-participation services in the agricultural domain, as the electronic collaborative platform will become openly available to develop further components and services on top of it; and will adopt well-established software engineering, IoT and communication standards to ensure compatibility and interoperability. This platform will constitute a novel solution for raising social inclusion of rural stakeholders, providing tangible results that will motivate them to actively participate in local decision-making. The adopted citizen-driven approach, following the participatory co-creation paradigm, acts as a pioneer implementation that supports the role of local authorities, rural citizens' e-participation and e-democracy. Especially the deployment of m-participation apps will support stakeholders solving daily life problems and raising engagement with the community.

Future work will focus on the technical implementation, as well as the empirical validation of the proposed framework in the pilot regions. Feedback from the various stakeholders involved will guide the improvement and expansion of the proposed solution for supporting e-participation and m-participation in other sectors in rural regions, such as agritourism, health, and natural disaster crisis management.

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