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## **Docile Smart City Architecture: Moving Toward an Ethical Smart City**

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**Abstract:** A recent idea of providing better civic facilities to modern societies is the concept of the Internet of Things (IoT) enabled smart city. IoT seeks to connect all things to the global Internet. Though varied smart city architectures are proposed in literature, it is observed that they lack thorough consideration for the principal element of a smart city i.e. citizens. We opine that a technologically intensive city that provides modern citizen services is not a sufficient criterion for conferring a city to be smart. Sociological factors such as culture, legal system and ethics represent essential components of a healthy functional city. In this work, we propose Docile Smart City Architecture (DSCA) to address the pressing need of ethics in smart cities. The distinguishing feature of our architecture vis-a-vis other architectures presented in literature is that we include sociological and ethical considerations of a city within smart city architecture itself. Such development would promote smart city paradigm among masses and increase its marketability.

Keywords: Smart city, Architecture, Internet of Things, Ethics, Societal impact

## 1. INTRODUCTION

In recent times better facilities and civic amenities for modern societies is represented by the idea of smart city facilitated by the Internet of Things (IoT). IoT is a paradigm shift in our understanding of networking that endeavours to connect even ordinary things to the internet, sensing environment for subsequent data processing and application [1]. Increasingly societies are heading towards urbanization and at the turn of 2050, 70 percent of global population is expected to live in urban areas [2]. Smart city paradigm offers promising solutions for addressing the challenges of urbanization and many countries have already embarked on the mission to offer smart cities to their citizens including the US, European Union, Toronto, Paris and London. There is a general agreement among the researchers that smart cities utilise Information and Communication Technology (ICT) to provide better civic amenities like healthcare, transportation, communication, sanitation etc. Smart city leverages advanced technology to sense and process routine data of a city to provide solutions to the problems faced by citizens [3]. Apart from academia, smart city research has also attracted significant attention from many technological vendors [4]. Notwithstanding immense research effort, the definition of smart city has failed to achieve consensus resulting in varying architectures [5].

The architectures presented in literature primarily focus on infrastructure, technology and application whilst due attention is not paid to the recipients of such technology i.e. people. A three layer smart city architecture is proposed in [6] comprising of information storage layer, application layer and user interface layer. All smart city related data is stored in the information storage layer that is subsequently used by application layer to provide smart services to citizens. User interface layer adopts a variety of graphical interfacing mechanisms to facilitate interaction of people with the application services. A four layer architecture is proposed in [7] that consist of bottom tier, intermediate tier-1, intermediate tier-2 and top tier. The first layer is responsible for data collection, second layer manages communication technologies and third layer performs data analytics on the smart city data. Various smart city application services are provided by the top tier. Authors in [8] propose a five layer architecture. All the sensors used to collect smart city data are grouped into data acquisition layer and data are exchanged using communication infrastructure of the data transmission layer. Refining of the data is performed at data vitalization and storage layer and end-user services are provided by support service layer. Various smart city systems are integrated at domain service layer. Authors in [9] provide a detailed survey of smart cities, however