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Review on techniques of automatic solid waste separation in domestic applications

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Article Info	ABSTRACT
	The accelerated modern day urban development is accompanied by an increasing production of solid waste. While managing solid waste on an industrial scale presents different technological challenges, managing household waste requires decentralized solutions dealing with the associated logistic and technical difficulties. In this review, we identify the research trends on household waste recycling by providing a brief description of the main technologies, and the traditional formats commonly used for solid waste (SW) separation. We identify two main threads: the SW management systems within a smart city framework and the design of domestic waste classification systems based on intelligent mechanisms tailored to user psychology. Among the main conclusions, we verify a growing interest in the subject of SW separation in domestic applications, mainly through solutions based on automation and internet of things (IoT). Also, we detected a increasing interest in the analysis of psychological aspects and in citizen education in relation to the importance of recycling, since without this notion the success of proposed solutions might be limited.

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1. INTRODUCTION

Due to economic growth and urbanization, more polymer waste is generated in industry and households nowadays [1]. In literature, there is a noticeable spike in scientific works aiming at introducing new solutions for recycling processes since 2003 [2]. Recycling of household wastes has been widely considered as a key factor for reducing the pollution caused by municipal solid waste and promoting sustainable development [3]. Solid waste (SW) separation techniques refer to modifying a body, suppressing local consistency, and allowing the selection of its unique components [4]. Such processes play an important role in various fields, especially in industry and in the reuse of SW.

The selection and classification of waste are some of the main challenges [5]. Manual sorting is considered expensive and inefficient when large amounts of SW are involved. Literature reports automatic SW separation approaches based on techniques such as dense separation [1], column flotation [6], image recognition [7], magnetic separation [8], Foucault streams [9], sensors [10], robotics, and artificial intelligence [11], [12]. Automatic separation techniques are also applied in different industries for recycling processes in solid waste deposits [13]. However, the implementation of this type of separation in the domestic context is not recurrent. If implemented, it would represent a great advance in terms of waste use by decentralizing the whole recycling process [14]. To the best of our knowledge, an up-to-date systematic