Chapter 2

Wireless Sensor Networks Technologies and Applications for Smart Farming

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ABSTRACT

In recent years, there has been increased use of wireless sensor networks (WSNs) which consists of sensor nodes and the intelligent machine learning algorithms to improve the performance of various applications in smart environments. These smart environments include smart home, smart agriculture, smart office, and smart hospital. In various countries throughout the world, agriculture is regarded as the backbone of the economy. To date, many families in Africa are employed in the agriculture industry. The dawn of information communication technologies (ICT) has changed the conventional way in which farming is conducted. However, quite a large number of farmers in Africa are still stagnant and highly dependent on the traditional ways of farming which started hundreds of years ago. This chapter has presented the current problems in farming and irrigation systems and suggests solutions through proposing the intelligent WSNs in a smart environment.

DOI: 10.4018/978-1-5225-5909-2.ch002

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INTRODUCTION

In various countries throughout the world, agriculture is regarded as the main backbone of the economy (Ruby & Jawahar, 2017). Various studies have shown that the main occupation of many families in Africa is agriculture (Ruby & Jawahar, 2017). In most African countries, more than 70% of the land is suitable for agricultural uses especially cultivating of various crops. The most well-known crops that are planted in Africa are maize, sweet potatoes, potatoes, sorghum, wheat, beans, cotton, tomatoes, onions, rice, sugar cane and cereals (Lokesh, Silver & Anuradha, 2017).

In this modern day and age ICT technologies can be used to improve any kind of business in any industry (Spijker, 2014). ICT technologies can be adopted to reduce human intervention. The power of ICT can be used to reduce costs as well as to increase efficiency. According to Spijker (2014), whenever ICT is implemented in any industry, there are significant improvements that are noticed. It is against this background that agriculture is also trying as much as possible to implement ICT technologies so that all the agricultural tasks can be automated. This is important because the costs would be reduced and production would be increased significantly (Verdouw, Beulens & Vorst 2013).

In recent years, farmers are beginning to realise the importance of implementing ICT technologies in their daily operations (Verdouw, Beulens, Reijers & Vorst, 2015). According to Verhoosel, Bekkum, and Verwaart (2016), most farmers are now using latest technologies in order to improve the way in which they do their farming. For instance, the latest technology is now being considered by farmers to switch on and off irrigation systems, monitoring the crop production, monitoring harvest volumes, detecting moisture content of the soil, monitoring the temperature and humidity conditions as well as monitoring the health of the crops and plants.

To date, the technologies that are being implemented by farmers are so intelligent and they are able to provide farmers with the most valuable information that could help them to achieve good harvests. Furthermore, these technologies help farmers in making sound decisions. This type of farming is referred to as smart farming (Vogt, 2013). According to Wamba and Wicks (2010), smart farming is sometimes referred to as precision agriculture. However, Wamba and Wicks (2010) noted that smart farming and precision agriculture are sometimes used interchangeably to mean the same but they are actually different.

Precision agriculture mainly focuses on decision support system (DSS) for the entire farming system (Welte, Ault, Bowman, Ellis, Buckmaster, Ess & Krogmeier, 2013). On the other hand, smart farming mainly focus on the monitoring of the agricultural fields as well as performing some intelligent operations (Wigboldus, Klerkx, Leeuwis, Schut, Mulierman & Jochemsen, 2016). Therefore, smart farming generally focuses on the monitoring of the outside environment whilst precision
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