



Development of a Biometric Based Car Park Access Control and Billing System

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ABSTRACT

Access control involves the granting of authorization for a service to selected persons while restricting others. This paper involves the development of a car park access control system using both biometric and barcode system for the authentication. In addition to providing security to the parked cars, the developed system also automates billing for the car park users. The associated barcode is scanned while entering and exiting the car park. The difference in time is used to compute the amount payable and this is deducted from the specified user's account. Furthermore, the developed system was evaluated using response time, false acceptance and rejection metrics. The result derived therein proves that the system is reliable with very low false rejection and false acceptance rates of 0.5% and 0.45% respectively. The response time of the system, measured as 1.407s, demonstrates its level of efficiency. In conclusion, the working prototype designed, proves that it can be easily implemented on a large scale with a low maintenance cost.

Keywords: *Fingerprint, Barcode, Car Park, Access Control, Billing System.*

1 INTRODUCTION

Biometrics is a means of uniquely identifying people using human characteristics, an example is the use of fingerprints (Habib, 2013). Fingerprints are impressions or marks made on any surface by a person's fingertip. Barcodes on the other hand are machine readable parallel lines (Bulka, 2005). It is used to encode information (Zhangy B., 2015). Barcodes provide improved efficiency, reduced overhead, and increased reliability, thus, making it a preferred choice for public businesses (Gao, 2009). Barcodes also provide a panel for access control and automated billing for items (Meng J., 2008) and (Kawale, 2013). In this work, the fingerprint scanner is used to uniquely link individuals to their cars at a parking lot, while the barcode is adopted as a form of security to identify each registered car.

The system will help overcome problems such as reduced operational cost, improved security measures, while still having a simplified way of identifying drivers and linking them to the cars they were registered with. In addition, the monitoring of all entrances and exits of the car park is also achieved by the system for proper inventory.

Other related research works in this area are discussed further: Access control and billing systems have separately been developed all around the world (Oladele, 2015), providing users with a means of authorizing user passage to restricted assets and simplified payments (Cortez, 2016) and (Fu, 2015), removing and replacing the method of payment from its tedious form of collecting physical cash (Sexton, 2015), (Gao, 2009), to simply carrying a card around. Now just a user's fingerprint or barcode can be used to conduct payment (Kumar, 2012).

A few car park management systems exist, that encompasses a wide area of functionality (Mittal, December, 2015), (Wei, 2012). Yet the developed system being considered is based on two aspects, and imbibed two unique combinations of components to archive what was lacking in previously developed systems, some of which are: (Oladele, 2015), (Chow, 2006), (Idris, 2009) (Kwok, 2010) and (Tang, 2006). Biometric authentication has found several application in day to day facility and equipment usage (Cortez, 2016). Some electronic implementations of this system for security is seen in: (Kamble, Bharti, & Gawali, 2012), (Ikuomola, 2015) and (Krishnamurthi, 2015). How the separate means (fingerprint biometrics and barcode) of authentication is fused to achieve the design for this system is what this paper intends to expose.

This work is divided into sections; the methodology is discussed in section 2. The section 3 contains the system design which is followed by the result and discussion in section 4. And finally, the conclusion of the work is presented in section 5.

2 METHODOLOGY

This system design is achieved via an embedded system operation. First, the fingerprint and barcode is read by their respective scanners on arrival. This is then processed and sent to the Arduino board, where it is compared with data stored in the memory (SD) card's database. If there is no matching, the system simply rejects the input and does nothing. However, if it contains the corresponding information, the system checks the registered user's account to confirm if there is available funds. If there is enough funds, a time stamp is taken, where there isn't, it requests that the user to top-up funds before providing access through the control of a servo