Contactless Billing Solution for the Hypermarkets Using IoT

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Abstract

Contactless billing solutions considerably decrease the threat of contamination throughout the billing process. The viruses can stay alive on the outside or covers the items for several days. This can then be reached from people to people by touching the contaminated surfaces. All over the globe, strict sanitization methods are being put into place to prevent the spread of infections. In the hypermarkets, car parking, ticket counters, etc., contactless billing should be implemented to carry out the process with complete hygiene and human touch. This leads to a decrease in contamination rate and intrudes the chains of contamination. During day-to-day shopping from the hypermarkets, the buyers have to spend a lot of time billing at the counters. This leads to wastage of time, congestion, and fatigue. Crowds in the markets during discount offers, weekends, festivals, and other occasions lead to mismanagement of services due to long delays involved in the barcode-based billing process. This work aims at proposing a contactless billing solution based on the Internet of Things (IoT). It comprises of Radio Frequency Identification (RFID) sensors, Arduino microcontroller, Bluetooth module, and Mobile application. The anticipated billing system can be deployed and tried at any marketable place for real-time testing. The methodology used in the research work to collect the information are literature review, SWOT analysis, and questionnaire (survey).

Keywords – IoT, RFID, Arduino, automated billing, Mobile application

Introduction

This research work aims to stimulate the use of IoT in hypermarkets in the Sultanate of Oman. It facilitates the process of shopping inside the hypermarket using contactless payment technology. It contributes to making the payment and purchase processes smooth, safer, and healthier. Where the user makes the purchase in an easy way through a programmed device in the Arduino language to scan the barcode of the product. And then will be recorded spontaneously on the mobile phone through an application that is easy to use. Through this application, the user will pay electronically without the need to go to the cashier. This work will contribute to developing the services provided by hypermarkets.

Literature review

The paper, "Understanding Consumer Intention to Pay by Contactless Credit Cards in Taiwan" describes the novelty of contactless credit card payment. As it aids the customer in terms of transaction efficacy, safety, and convenience. Taiwan also cleared data from 246 consumers. The results indicated that the two main determinants of consumers' intent to use a contactless credit card are compliance and perceived risk. Also, the paper "A New Internet of Things (IoT) Session Payment System" described designing an electronic credit card on the mobile phone and transferring money through the Internet without the need to carry many credit cards in the wallet (wireless method). This system reduces the burden of protecting the database for a solitary payment period. However, a system must be in place to defend against theft, viruses, and attacks (Muhannad Faiq Ali, 2017). The paper "IoT Smart Shopping Cart for Smart Shopping" deals with envisioning a smart and efficient shopping cart through the use of the Internet. This innovation solves the problems that customers face in supermarkets due to the increase in population. Also, it saves time and eases effort instead of standing in a long line at the cashier. In addition, the customer's behaviour during shopping should be analyzed and the stock rate of individual products should be predicted and made available based on continuous customer requirements (Srinidhi Kargul, Anusha K. Lula, 2018).

Problem definition

There are several problems that this project will solve, as shown in the table below:

The problem	The consequences of the problem	The solution	How does my project address the problem?
Contact payment	It leads to the spread of viruses. Also, at present, there is a Coronavirus, which is a dangerous virus that is transmitted by touching contaminated surfaces. Therefore, individuals seek to change the technique of performing life activities, by finding ways to encourage physical distancing.	Putting the system for contactless payment.	The device programmed in the Arduino language scans the barcode of the product and it will be recorded automatically via the mobile phone to allow the buyer to pay automatically through electronic payment. Therefore, the payment is contactless.
Clients congestion at the cashier.	It slows down the payment process and the time is wasted waiting the turn.	Electronic payment	When the customer makes the payment automatically through electronic payment, he does not need to queue at the cashier, thus not wasting time.
Violation of privacy	When using sensors that contain GPS and surveillance cameras, this leads to easy data leakage because these technologies require high technology of security and confidentiality. Also, storing this data is at risk of hacking or fraud.	Avoid using sensors that contain GPS and surveillance cameras.	The device contains the scanner sensors.

Figure 1. Problem definition

Methodology:

The investigators have used diversified exploration practices in this investigation work. Both the measureable and qualitative ways and means have been used to acquire facts about the work apprehensively. The quantitative method was useful and implemented using online questionnaire. This method is destined to back the study goals and analyse the problem identified. The qualitative investigation technique was utilized for steering article reviews. This technique is preordained to acquire further facts on the application, and technology in this field and detecting the gaps in the previously existing applications of the identical nature.

Questionnaire

An electronic questionnaire (survey) method was used to collect and analyze data through the use of the Survey Monkey application. Data are collected via the Internet from the largest possible category in the shortest possible time. This method is considered the most used because it is less expensive and less effort. The following is an analysis of the survey data:

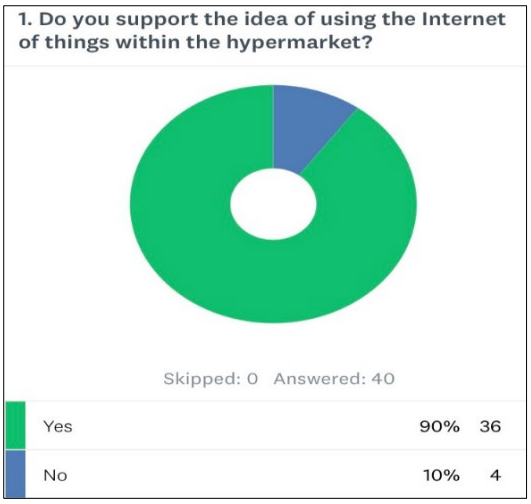

Figure 2. Q1

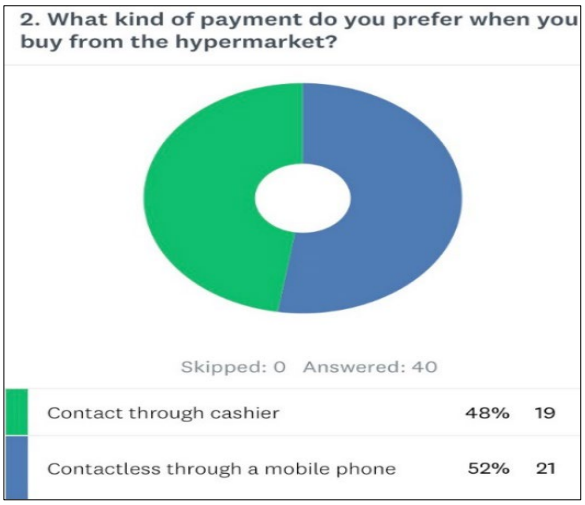

Figure 3. Q2

This chart for Q1, spectacles the fans of the clue of using the Internet of Things inside the supermarket. The percentage of those who supported “Yes” was the maximum and gave 90%. While the percentage of those who did not support, “No” was 10%. So, the clue of using IoT inside a supermarket is prized by numerous persons.

The chart given for Q2, above displays what category of payment shoppers prefer when purchasing from a supermarket. The percentage of the first type (Contact through cashier) is 48%. The percentage of the second type (Contactless through a mobile phone) is 52%, which is the maximum. This is a good thing, as mostly people have chosen the second type, evidently since the Sultanate of Oman does not have such a system in the supermarket.

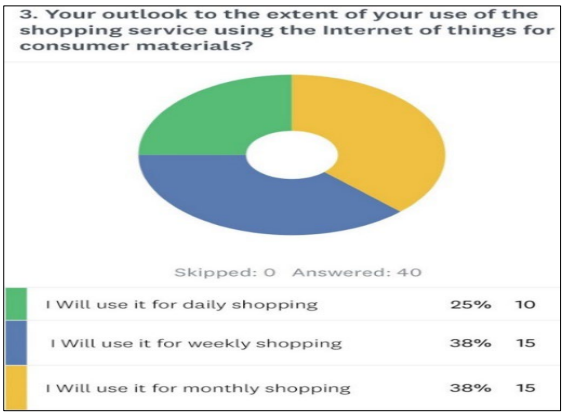

Figure 4. Q3

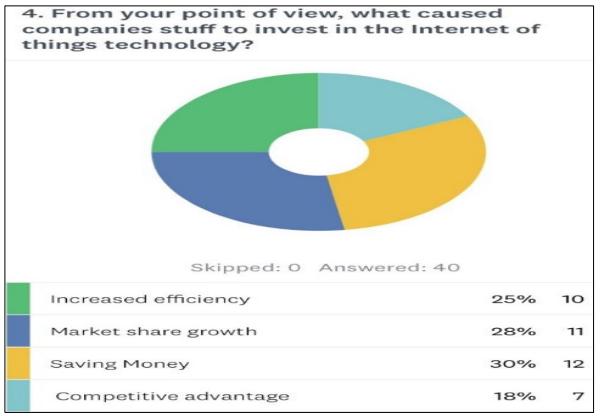

Figure 5. Q4

The pie chart above for Q3, displays the scope to which the customer is using the shopping services using IoT for goods. The weekly and monthly usages were the two main preferences, at 38%. While the daily usage rate was 25%.

This pie chart for Q4, explains why businesses are capitalizing in IoT technology from a consumer's point of opinion. The choice "Saving Money" was the maximum, at 30%. As the apparatus for the Internet of things is considered by low cost and low electricity consumption. Then "Market share growth" by 28%. Then "Increased efficiency" by 25%. Finally, "Competitive advantage" by18%.

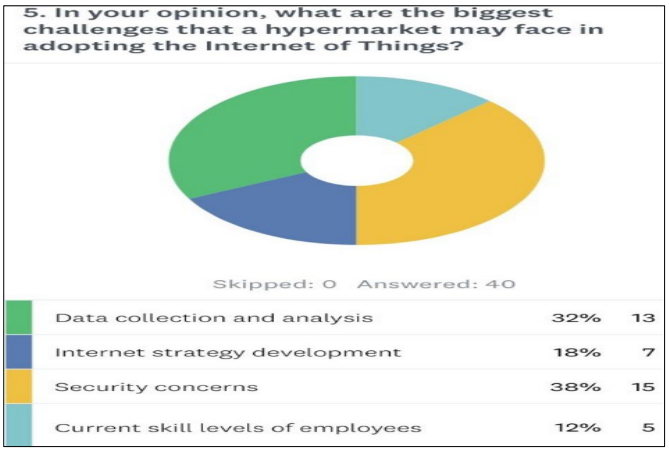

Figure 6. Q5

This pie chart for Q5, displays what are the prime challenges that a supermarket may face in embracing the Internet of Things from the consumer's opinion. The trial was "security concerns" more choice by 38%. As the Internet of Things technology depend on on the internet and cloud data, so it may be susceptible to scam. Then "Data collection and analysis" by 32%. Then "Internet strategy development" by 18% and "Current skill levels of employees" by 12%.

Design Diagrams

Based on the analysis of the data collected through the questionnaire and the review of the literature the design diagrams have been made to implement the application.

Context diagram

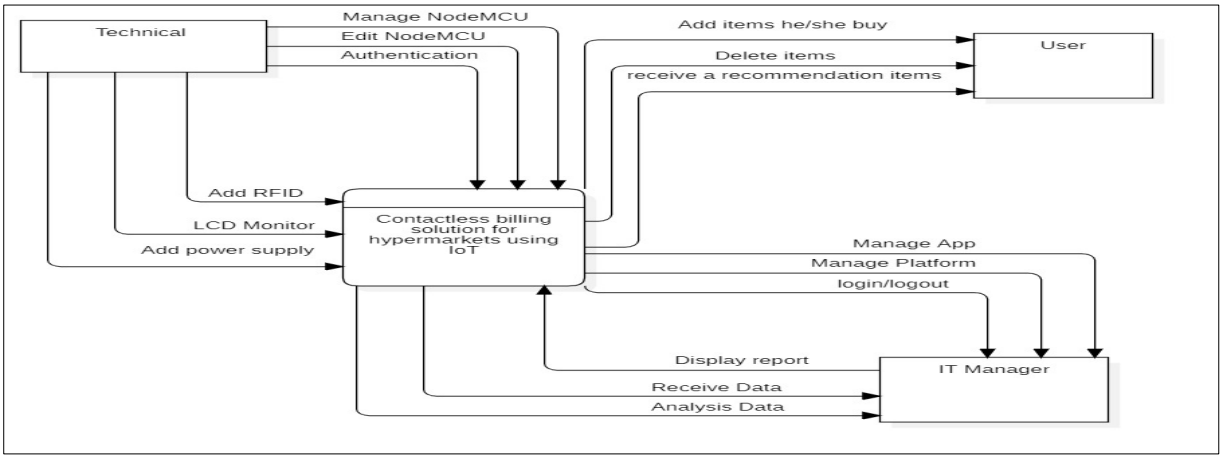

Figure 7. Context diagram

Flow chart diagram

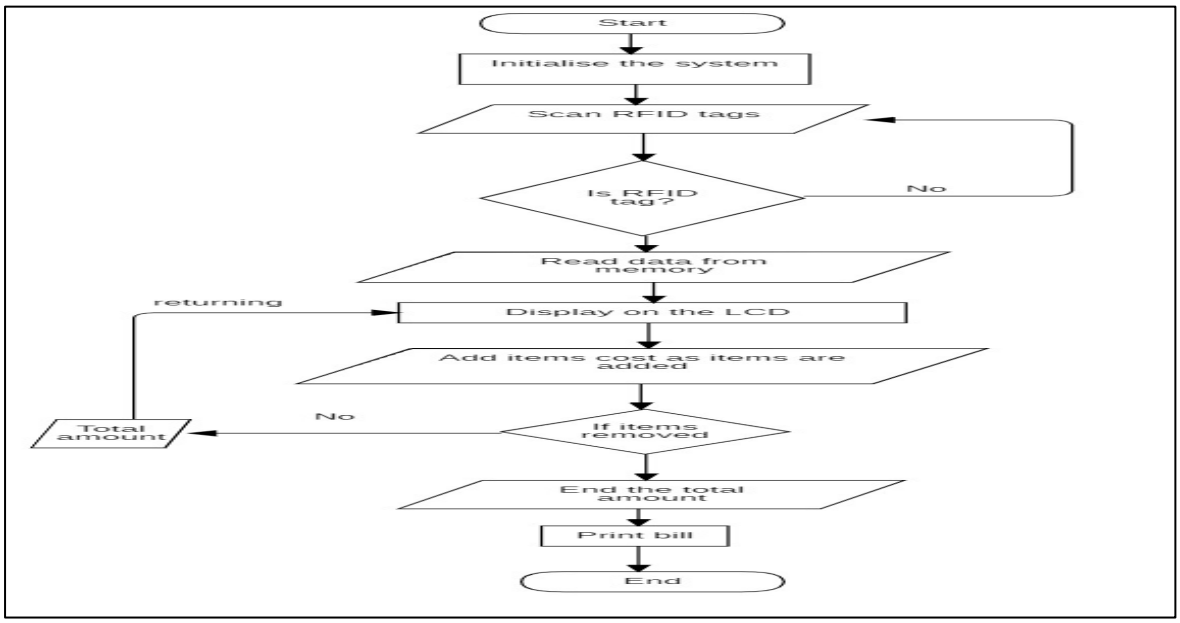

Figure 7. Flow chart diagram

Use case diagram

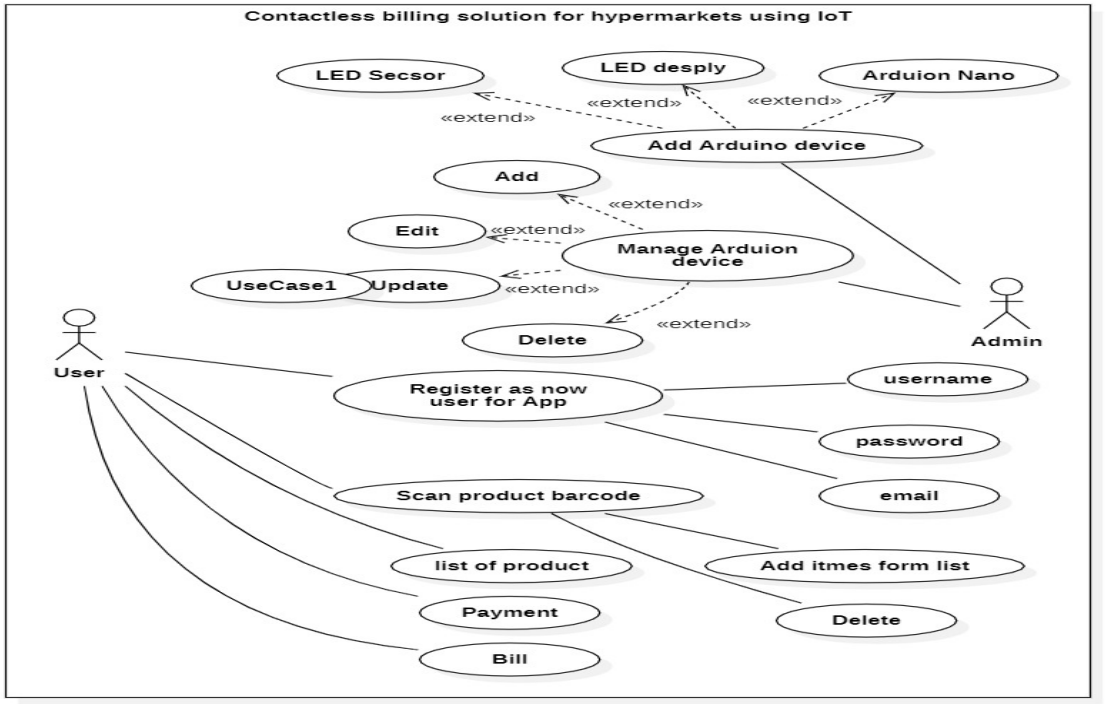

Figure 8. Use case diagram

Class diagram

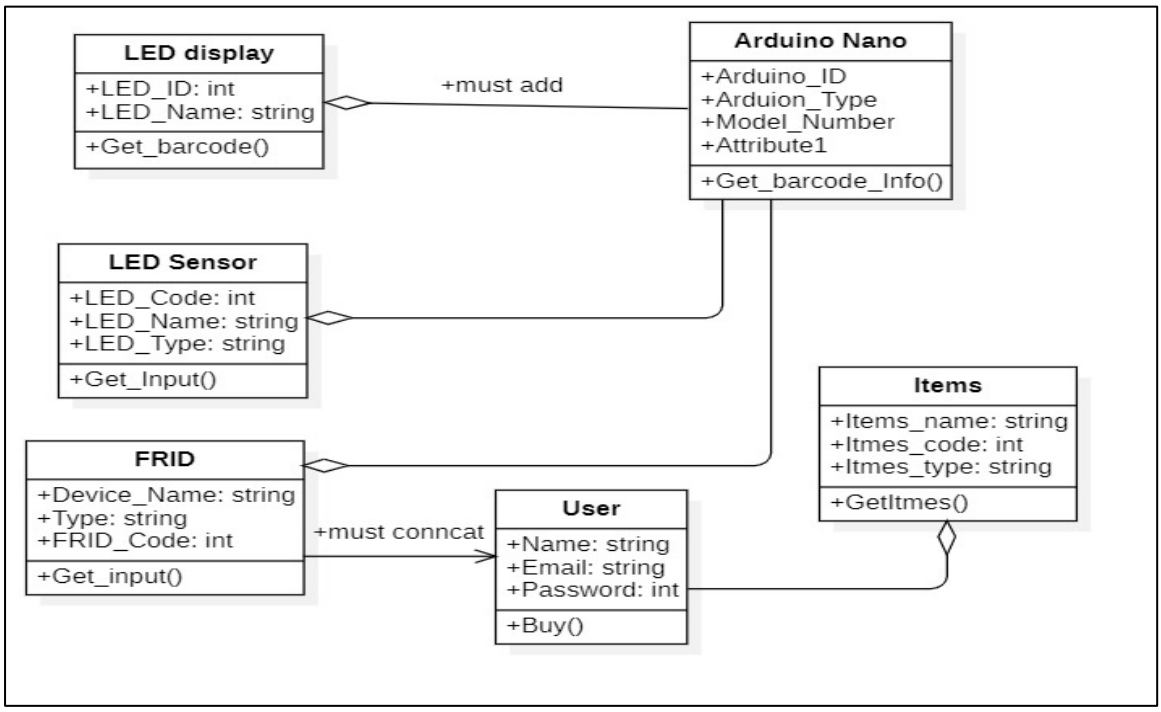

Figure 9. Class diagram

Conclusion & Recommendations

This work was carried out for the benefit of society, especially in the conditions of a pandemic COVID-19. As it makes it easier for the person to do the shopping inside the hypermarket more safely and smoothly. This application will help in developing the services provided by the hypermarkets and facilitate their work.

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