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Implementation of Digital Basket to Ease the Waiting Time during Customer Check-Out

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Abstract—Billing/Checkout process at shopping mall is time-consuming as each item has to be scanned for its name and price and for other information. This wastes a lot of time of customers and they feel distressed too. The need to reduce the waiting time the customers spend in queue is of very importance. We have designed a basket which will automatically scan the product information like the name, price etc. once the product is kept in it and will calculate the final price instantly. The customer can choose to pay directly from basket and amount will be deducted from the customer's online wallet. This will save a lot of time of customers as well as the billers.

Keywords-*component; digital basket, aritficial intelligence, shopping mall.*

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I. INTRODUCTION

"Optimizing a performance criterion using example data and past experience" gives easy and faithful description about machine learning.

In machine learning, data plays an indispensable role, and the learning algorithm is used to discover and learn knowledge or properties from the data[1]. The quality or quantity of the dataset will affect the learning and prediction performance. We might, for instance, be interested in learning to complete a task, make accurate predictions or behave intelligently. The learning that is being done is always based on some sort of observations or data, such as examples, direct experience, or instruction. So in general, machine learning is about learning to do better in the future, based on what was experienced in the past.

The emphasis of machine learning is to automate methods. In other words, the goal is to devise learning algorithms that do the learning automatically without human intervention or assistance.

In machine learning, we seek methods by which the computer will come up with its own program based on examples that we provide. Machine learning is a core subarea of artificial intelligence. It is very unlikely that we will be able to build any kind of intelligent system capable of any of the facilities that we associate with intelligence, such as language or vision, without using machine learning. These tasks are otherwise simply too difficult to solve. Further, we would not consider a system to be truly intelligent if it were incapable of learning since learning is the core of intelligence.

1.2 PROBLEM DEFINITION

After negotiating busy supermarket aisles, you often have to pick the queue you think will move faster to stand a chance of getting your shopping home before the ice cream melts[2]. Now a days purchasing and shopping at big malls is becoming a daily activity in metro cities. We can see huge rush at malls on holidays and weekends. The rush is even more when there are special offers and discount. People purchase different items and put them in trolley. After total purchase one needs to go to billing counter for payments. At the billing counter the cashier prepare the bill using bar code reader which is a time consuming process and results in long queues at billing counters.

1.3 PROJECT PURPOSE

In the modern world, every supermarket employs shopping baskets and shopping trolleys in order to aid customers to select and store the products which they intend to purchase. The main motivation behind this project idea is to JUMP the long payment queue in shopping malls. To increase productivity time as well as resource utilization. The customers have to drop every product which they wish to purchase into the shopping cart and then proceed to checkout at the billing counter. The billing process is quite time consuming. Today's most common issue in Shopping mall is of payment queues. Even though, malls provide 10-12 outage, but still in rush hours it is very heavily loaded, and users need to wait for 30 minutes to 60 minutes in queue. These problems are most common in "Big-Bazar","D-Mart" like supermarkets.

The system will be placed in all the trolleys. It will consist of a RFID reader. All the products in the mall will be

equipped with RFID Tags. When a person puts any products in the trolley, its code will be automatically detected and the price of those products will be stored. Thus the billing will be done in the trolley itself. Item name and its cost will be displayed on local display as well as remote display connected via WiFi.

1.4 PROJECT FEATURES

Our project was developed to reduce the time taken while checkout counter at malls or super market or at any place. In our consideration we have used Raspberry Pi and RFID Reader to read the RFID tags that are attached to the products.

Reducing the training time was not enough for our project. We also required best accuracy possible. For better accuracy we tried with many of the test products and also optimized the reading time of the RFID reader by optimizing the code and the algorithm used.

1.5 MODULES DESCRIPTION

1.5.1 RASPBERRY PI

The **Raspberry Pi** is a series of small single-board computers developed in the UnitedKingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries[3]. The original model became far morepopular than anticipated, selling outside of its target market for uses such as robotics. Peripherals (including keyboards, mice and cases) are not included with the Raspberry Pi. Some accessories however have been included in several official and unofficial bundles[4].

Several generations of Raspberry Pis have been released. The first generation (**RaspberryPi 1 Model B**) was released in February 2012. It was followed by a simpler andinexpensive model **Model A**. In 2014, the foundation released a board with an improved design in **Raspberry Pi 1 Model B+**. These boards are approximately credit-card sized and represent the standard *mainline* form-factor. Improved A+ and B+ models were released a year later. A "compute module" was released in April 2014 for embedded applications, and a **Raspberry Pi Zero** with smaller size and reduced input/output (I/O) and general-purposeinput/output (GPIO) capabilities was released in November 2015 for US$5. The**RaspberryPi 2** which added more RAM was released in February 2015. **Raspberry Pi 3 Model B** released in February 2016, is bundled with on-boardWiFi,Bluetoothand USB boot capabilities. As of January 2017, **Raspberry Pi 3 Model B** is the newest mainline Raspberry Pi. Raspberry Pi boards are priced between US$5–35. As of 28 February 2017, the **Raspberry Pi Zero W** was launched, which is identical to the Raspberry Pi Zero, but has the Wi-Fi and Bluetooth functionality of the Raspberry Pi 3 for US$10.

The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.

1.5.2 RFID Reader

Radio-frequency identification (***RFID***) useselectromagnetic fieldsto automaticallyidentify and track tags attached to objects[5]. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radiowaves. Active tags have a local power source such as a battery and may operate at hundredsof meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

RFID tags are used in many industries, for example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line; RFID-tagged pharmaceuticals can be tracked through warehouses; and implanting RFID microchips in livestock and pets allows positive identification of animals.

1.5.3 TFT Screen

A **thin-film-transistor liquid-crystal display** (**TFT LCD**) is a variant of a liquid-crystaldisplay (LCD) that uses thin-film transistor (TFT) technology to improve image qualitiessuch as addressability and contrast. A TFT LCD is an active-matrixLCD, in contrast to passive-matrix LCDs or simple, direct-driven LCDs with a few segments.

TFT LCDs are used inappliances including television sets, computer monitors, mobilephones, handheld video game systems, personal digital assistants, navigation systems and projectors.

TFT LCDs are also used in car instrument clusters because they allow the driver to customize the cluster, as well as being able to provide a skeuomorphic, analog-like display with digital elements.

1.5.4 POWER SUPPLY

A **power supply** is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads. Examples of the latter include power supplies found in desktop computers and consumer electronics devices.

1.5.5 TTL TO USB

A **USB adapter** is a type of protocol converter which is used for converting USB data signals to and from other communications standards. Commonly, USB adaptors are used to convert USB data to standard serial port data and vice versa. Most commonly the USB data signals are converted to either RS232, RS485, RS422 or TTL serial data. The older serial RS423 protocol is rarely used anymore, so USB to RS423 adapters are less common.

II. LITERATURE SURVEY

2.1 1D AND 2D BARCODE TOCAPTURE PRODUCT INFO

We had visited few of the shopping malls for collecting the present working methodologies and technologies used[7]. A barcode is an optical machine-readable representation of data relating to the object to which it is attached (Refer Fig.1). Still (1D) barcode system are used in super-market for reading the product information. Generally, in supermarket the cashier scan the product using (1 or 2) D scanner device and displayed on the screen. [2]

Figure 1: 2D Barcode

Barcodes became commercially successful when they were used to automate supermarket checkout systems, a task for which they have become almost universal. Their use has spread too many other tasks that are generically referred to as Automatic identification and data capture (AIDC). The very first scanning of the now Ubiquitous Universal Product Code. (UPC) barcode was on a pack of Wrigley Company Chewing gum in June 1974. At Store: This process is much time consuming for cashier. Some of the scanner read the barcode in correct alignment only. Multiple grid barcode is alternative for 1D or 2D barcode scanner where the alignment of product during scanning doesn't makes any difference

2.1.1 USING NFC (Near Field Communication) TECHNOLOGY

Near field communication (NFC) is the set of protocols that enable electronic devices to establish radio communication with each other by touching the devices together, or bringing them into proximity to a distance of typically 10cm or less[8].Early business models such as advertising and industrial applications were not successful, having been over taken by alternative technologies such as barcodes or UHF tags.

2.2 SOFTWARE DESCRIPTION

2.2.1 PYTHON

Python is a widely used high-level, general-purpose, interpreted, dynamic programming language. Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles[9]. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library. Python interpreters are available for many operating systems, allowing Python code to run on a wide variety of systems.

Python uses dynamic typing and a mix of reference counting and a cycle-detecting garbage collector for memory management. An important feature of Python is dynamic name resolution (late binding), which binds method and variable names during program execution. Python has a large standard library, commonly cited as one of Python's greatest strengths, providing tools suited to many tasks.

The Python Package Index, the official repository of third-party software for Python, contains more than 72,000 packages offering a wide range of functionality, including: graphical user interfaces, web frameworks, multimedia, databases, networking and communications. Test frameworks, automation and web scraping, documentation tools, system administration. Scientific computing, text processing, image processing.

III. REQUIREMENT ANALYSIS

3.1 FUNCTIONAL REQUIREMENTS

In software engineering, a functional requirement defines a function of a software system or its component. A function is described as a set of inputs, the behavior, and outputs. Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements are captured in use cases. The following list shows functional requirement of our project:

All the product should have RFID Tags.When the product is placed in basket, the RFID reader should read the product in no time.After reading the product information, it should sent the info to Raspberry Pi as quikly as possible.Getting this info from reader, the Raspberry Pi should interpret it accordingly.If no such item has been added previously then it should add that item in the list and should it in GUI.If item is already present in the list then it should increase the count and also alter the price.In the similar way if product is removed from the basket then it should delete the item from the list if the count is one.If count is more than one then is should decrease the quantity and also alter the list.

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3.2 NON-FUNCTIONAL REQUIREMENTS

In systems engineering and requirements engineering, a non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. This should be contrasted with functional requirements that define specific behavior or functions. The plan for implementing functional requirements is detailed in the system design. The plan for implementing non-functional requirements is detailed in the system architecture.Other terms for non-functional requirement are constraints", "quality attributes", "quality goals", "quality of service requirements" and "non-behavioral requirements".

Some of the quality attributes are as follows:

- ACCESSIBILITY
- MAINTAINABILITY
- SCALABILITY
- PORTABILITY

3.2.1 ACCESSIBILITY:

Accessibility is a general term used to describe the degree to which a product, device, service, or environment is accessible by as many people as possible.In our project people who have registered with the apps on twitter and have all four OAuth key should be able to fetch tweets from twitter using internet anytime.

Our program interface is simple and efficient and easy to use.

3.2.2 MAINTAINABILITY:

In software engineering, maintainability is the ease with which a software product can be modified in order to:

- Correct defects
- Meet new requirements
- New functionalities can be added in the project based on the user requirements just by adding the appropriate module and functions to existing project using simple Python GUI.
- Since the programming is very simple, it is easier to find and correct the defects and to make the changes in the project.

3.2.3 SCALABILITY:

System is capable of handling increase total throughput under an increased load of training data when resources (typically hardware) are added.

System can work normally under situations such as low bandwidth and using less hardware resources.

3.2.4 PORTABILITY:

Portability is one of the key concepts of high-level programming. Portability is the software code base feature to be able to reuse the existing code instead of creating new code when moving software from an environment to another.

Project can be executed under different operation conditions provided it meet its minimum configurations. Only python environment and common libraries would have to be configured in such case.

IV. DESIGN

4.1 ARCHITECTURAL DESIGN

Fig 4.1 An Architectural Diagram of the proposed Digital Basket System.

4.1.1 RFID Tags

RFID tags contains 12 bit Alphanumeric codes. That can be used to add information about the product to the database

4.1.2 FEATURES

If used commercially, the portable system should be operated at 915 MHz and used 12-bittags but in our project we have used 125 KHz RFID tags.

4.1.3 ALGORITHM

We have not used any of the special algorithm used worldwide. We have made our own algorithm that can be further improved in the future. The current algorithm is fast enough to process the result in required time.

4.2 DATA FLOW DIAGRAM

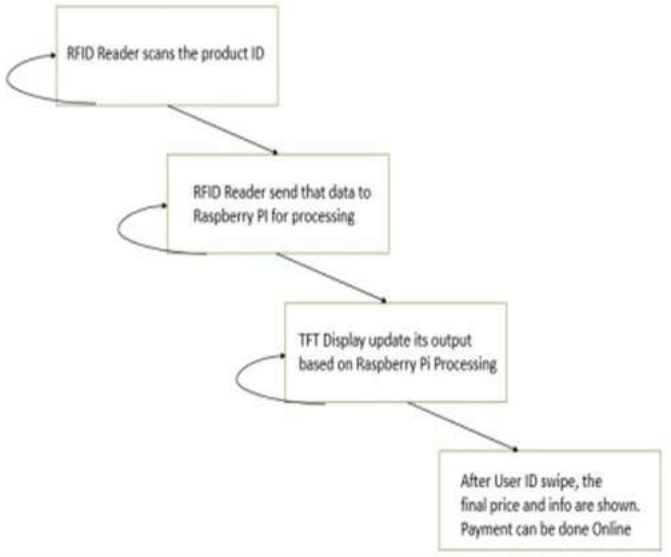

Fig 4.2 Data Flow Diagram

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4.3 SEQUENCE DIAGRAM FOR DIGITAL BASKET

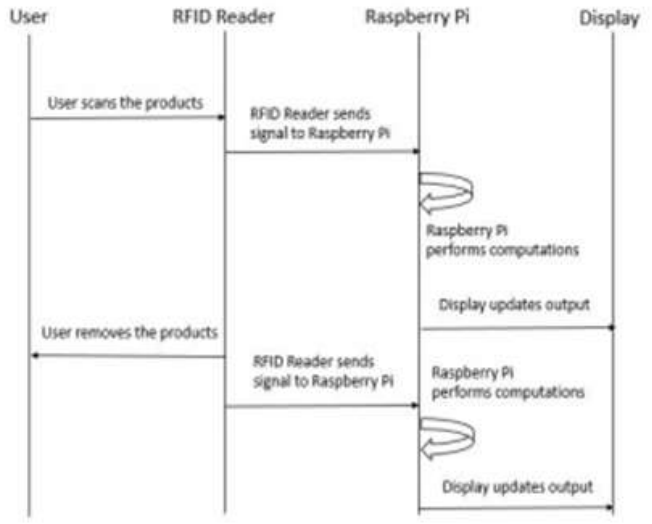

Fig 4.3: SEQUENCE DIAGRAM FOR DIGITAL BASKET

The above diagram shows how to products are added and removed from the digital basket

4.4 CONCLUSION

Taking into account the changing trend in retail shopping we come to a conclusion that the Digital Shopping Basket is most certainly a definite necessity for the Retail marketing industry to step up their portfolios, cope up with the advancement in technology, save time, save extra manpower and proper utilization of resources overall efficiency.

V. FUTURE ENHANCEMENT

Future enhancement of this product is endless. New technology is evolving day by day and it can be incorporated in it easily. The basket can have the following functionality in the future:

- Smart Home Solution: If a user have smart home where all the equipment is connect to internet then for example, if there is no milk in the refrigerator and the user has come for shopping and without buying milk he/she is leaving the center then the system will alert the user for this.
- Can be used to show personalized shopping list
- Can be used to provide differentiated discount based on user's activeness in the shopping center
- Amount can be deducted from bank account linked to user wallet
- Bill receipt can be sent via SMS and email to save paper
- Can be used to share on Social media about the shopping experience

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