Review on Smart Shopping Carts using RFIDs, AI and IoT

V Arun[1] | S N Vedhika[2] | Bavanika M[2] | Shreemadhi B[2]

[1]Assistant Professor, Artificial Intelligence and Data Science, Sri Sai Ram Engineering College, Chennai, India
[2] Artificial Intelligence and Data Science, Sri Sai Ram Engineering College, Chennai, India

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ABSTRACT

As the population is increasing and the daily necessities also increase. This makes shopping time consuming and tedious work. Generally we have a regular procedure when we purchase things in a shop, we pick up things, load them in a basket and unload them in the cashier section, then pay for them and pack it in the bags and leave. During this we might have crowds in the isles and delay in counters, so we aim to deal with this problem using the latest technology of Artificial Intelligence and IoT. Using these we develop a Smart Cart that can recognize the item to be shopped and will be added to the bill to be played by the customer. This project relates to Goal 9 in sustainable development (Industry. Innovation and Infrastructure). This development will help to pick, pay and pack the items completely based on the user's interest and time. The main purpose of this project is to make shopping easier, quicker and convenient.

Keywords: Artificial Intelligence, IoT, Raspberry Pi, Smart cart, RFID.

1. INTRODUCTION

Grocery shopping is a don't want to but have to task. Although online shopping is becoming popular, it doesn't mean that the old traditional see and shop method is or will not be stopping. There are still about 25.3% people as of 2020 have never purchased online and many do not prefer buying groceries online because they aren't able to see and choose physically. This is why we are making sure to give them a convenient way to see, feel and choose for themselves, check out after paying for them in the cart and walking out as soon as it's done. We can always see queues in billing counters, rush in daily essentials aisle and especially during discount seasons. This project is a solution by bringing the latest technology in the play and advancement in the existing technology. It focuses on the billing process in the cart itself by using object recognition and scans the RFID and adds it to the cart. It has sensors to weigh the objects to check if it matches the scan or else a beep sound arises. This is done using the sensors, scanners and displayed through an LED to make it easier for the consumer to understand and shop. This method allows

the user to combine multiple tasks to make a single simple one.

2. LITERATURE SURVEY

Mobeen Shahroz et al [1] proposed an IoT based smart cart using Radio Frequency Identification (RFID) sensors, Wireless Sensor Network (WSN) for interfacing of multiple sensors, Zigbee module, Arduino microcontroller, Bluetooth module and Mobile application.

Susila Sakthy.S et al [2] proposed a smart payment and billing system using load cell sensor and HX711 module, NODE MCU ESP8266 for sensing weight and a QR code scanner for scanning the products.

Aiswarya Padma B et al [3] proposed an automation shopping using Raspberry Pi, Arduino UNO, Ultrasonic Sensors, DC Gear Motor, VNH2SP30 motor driver, Webcam and Buzzer.

T.R. Lekhaa et al [4] proposed an intelligent shopping cart using Bolt Esp8266, a updated version of IoT, Barcode Reader and LCD display.

Khalid Yusuf et al [5] proposed a smart shopping cart using Decision Tree algorithm for better accuracy and precision, RFID tag and sensor, Arduino UNO, LCD, NRF24L01 for data transfer.

Ragesh N et al [6] proposed a smart shopping cart for vegetables using YOLOv2 for object detection, Load cell, LCD, display Camera, Arduino .

SakornMekruksavanich [7] proposed an IoT based shopping basket using RFID tag ,HX711 module, ESP8266 NodeMCU modules, weight sensor and mobile phone holder.

Kowshika S et al [8] proposed IoT based Smart Shopping Trolley with Mobile Cart Application using RFID tag and reader, Raspberry Pi Microcontroller, LCD display, Load cell with amplifier HX711 , Buzzer and software tools like Android studio, Python idle, Tkinter GUI and My sql Database.

Thomas Arciuolo et al [9] proposed a smart cart for expedited shopping using Raspberry Pi, 4 load cells, GPS, RFID tag and scanner , LCD screen.

Dhiraj Thote et al [10] proposed an automatic shopping basket using Microcontroller, Voltage regulator IC LM 7805, LCD display 16 x 2, RFID card and reader and ZIGBEE module.

3. TECHNOLOGY

1.Raspberry Pi:

The raspberry pi is a series of single computer low cost boards. It is a basic computer that runs on an open source software that performs different computing tasks such as building network storage, tolerant machines, home automation, etc. Raspberry pi is a commonly used program in Internet Of Things(IOT) related computing tasks. Raspberry pi consists of hardware such as CPU, GPU, RAM used to process data, connect the power for power supply, to connect HDMI and USB cables with other device.Raspberry pi has a route into robotics, software development, hacking, game development, etc.
Disadvantages:

We cannot access, operate or run Raspberry pi through the Windows operating system.

Raspberry pi does not have any internal storage, we need to access an extra SD card for storage purposes.

2.Image Recognition:

Image Recognition is a software's ability to identify people, objects, places, actions, etc in images.This technology is a subcategory of Computer Vision and Artificial Intelligence software to achieve the image recognition model. Image recognition performs numerous machine based visual tasks like performing image content search, guiding robots, self driving car, etc. Image recognition works based on Deep Learning domain which refers to a set of automatic learning techniques and technologies based on artificial neural networks.Image recognition is playing an vital role in assisting today's education system, optimizing medical imagery, Augmented reality, boosting car technology, etc.

Disadvantage

It creates data vulnerabilities.

It provides opportunities for fraud and other crimes.

3.CNN

Convolution neural network (CNN) is a deep learning algorithm which takes an image as input and assigns it to various aspects in the image to differentiate one from other.CNN is a subset of machine learning and deep learning. Some applications of CNNs are facial recognition, image classification, speech recognition programs,etc. CNN is primarily used for image classification and recognition.

Disadvantage

A convolution Neural Network is significantly slower due to few operations like maxpool. A CNN requires a large dataset to proceed and train the neural network.[Image Recognition of Supermarket Shopping Robot Based on CNN]

4.Sensor

Sensor is a device which detects and respond to some type of input according to physical environment. The purpose of a sensor is to detect events or change in the environment and forward the information to the computer processor. Sensors are used in everyday object such as lamps, refrigerator, and many more which many people are not aware of.

Disadvantage

It has a narrow or limited temperature range. They have cross sensitivity of other gases

5.RFID

RFID refers to Radio Frequency Identification. RFID is used to identify and track tags that are attached to objects. It is an electromagnetic field. An RFID consists of a radio receiver, transmitter and a small radio transponder. When triggered by an electro-magnetic interrogation pulse from a nearby Radio Frequency Identification reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. RFID readers can be 10 times faster than barcode readers.

Disadvantage

Cons of RFID are an issue which need to be considered. Materials like metal & liquid can impact signal. Sometimes not as accurate or reliable as barcode scanners.
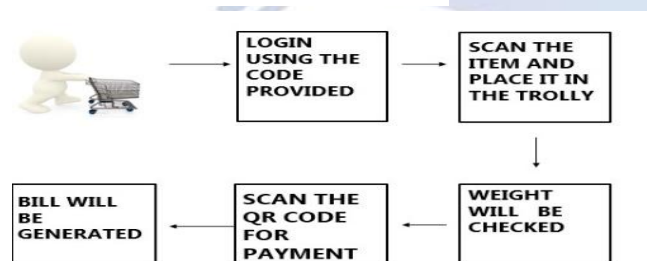
4. METHODOLOGY FLOWCHART

Fig:1 Proposed Methodology

5. CONCLUSION

Technology has advanced vastly over time and to use technology like AI, IoT, CNN and RFID in the modern day use in the retail industry only for convenience purposes is highly helpful. It brings various tasks in a supermarket into a single and much simpler one. This decreases labor dependence and also makes a consumer's job interesting and easy. This reduces the tedious time-consuming task of waiting in queues for payment and aims to prevent thefts using CNN surveillance. It makes sure that this brings an improvisation in the existing technology and to make it more accessible both feasible and viably.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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