Interactive Retail Shelf

Indrajith Sundaram[1], Ajay John[2], Merwin Joseph[3], Kavalakuntla Chakradhar[4], Sumitha BS[5]
[1,2,3,4,5] Dept of Computer Science and Engineering
[1,2,3,4,5] Atria Institute of Technology, Bengaluru, Karnataka, India

Abstract- *The problem observed in retail industries from the past few years is the restriction of general public in retail stores and dependency on the staff present there. Through this project we wanted to make the customers more independent at stores and bring the worlds of retail and technology together we have managed to up an interactive retail shelf which will make the above statement possible. The shelf consists of 3 phases, one for a video output, another for an audio output, the last one for a mechanical trigger. Each having its own functionality which will be discussed further. Through this shelf we not only bring technology and the retail business together but also make an environment which aids the public to independent.*

I. INTRODUCTION

1.1 Purpose

The importance of technology in retail for a small retailer is critical. With technology, expansion and wider reach is a possibility, but how do you ensure that the same warmth in customer interaction reflects across multiple channels and stores? In other words, how can you be a mom-and-pop store with a global outreach? Customers have dismissed street flea markets as havens for the hipster generation for way too long. They would much rather buy from a branded retailer than from a street store with no returns, no guarantees, and no brand. In spite of these apparent shortcomings, small retailers are doing fairly well for themselves. While people still turn to malls and brands for several of their requirements, they still buy home essentials, groceries, and fresh produce from the smaller stores and farmer's markets. Therefore an idea to build a shelf that will interact with the customers of an interactive shelf popped in our heads .

1.2 Problem Statement

Technology enables a machine to perform tasks that can be executed repeatedly with a standard set of instructions without getting tired, thus letting the human mind function and focus on what is more important.

Especially in retail, technology gives you the platform to better satisfy your customers by helping you concentrate on their needs. And happier customers mean more business. Small and medium businesses are the most vital part of the economy of any nation. If small retailers are the backbone of the economy, why do most of them ignore the potential to grow faster with technology? Everyone seems to think that a sophisticated system is only for the large enterprises and that it's something they don't need. But step into a mall and look at all these big brands. How did they get to be so big? This is where the role of technology comes in. Those who can see the potential of tech without getting lost in its complexities have been able to grow faster and bigger. Here's how technology can help you grow without compromising on what sets you apart. Consider a customer at a retail store who is waiting at the counter for billing. The clerk at the counter scans through the items at the POS (Point of Sale) and gives the final bill. Now, from this practice, what you get is data about the customer. Over time, this kind of information helps you have an understanding of the pattern of inventory flow. Why not take it a step further? As in the case with one of our clients, using the same software to collect and save data about revisiting customers has helped the store staff recall names and birthdays even when they expanded through the country. Primaseller now allows you to add custom notes to each purchase, thus enabling quicker recall of repeat customers. The primary purpose of the shelf will be to unite technology,retail industry and the customers. The shelf will have 3 interact phases through which the customers can interact with the shelf and have an independent and an attractive experience at the store.

1.3 System Overview

Our project being an interactive shelf basically consists of 3 phases , Video phase, Audio phase, mechanical phase.

Video Phase:An IR sensor connected to the Raspberry pi will detect when a dvd is picked up from the shelf and will play the respective trailer on the display unit.

Audio Phase:A capacitive touch sensor will detect when a customer touches a clothing and will describe the clothing and its specifications.

Mechanical Phase:An IR sensor will detect when a customer picks up a perfume bottle and the respective tester would spray on to the wrists of the customer automatically from a

tester bottle .These sensors are interfaced on to an Arduino board for the mechanical phase and on to a Raspberry pi for video and audio phases.

1.4 Objectives

- Developing a system that combines technology with retail industry and produce an independent experience for the customer at the store.
- To simplify the user experience at the stores.
- To overcome dependency at stores.
- To overcome the dependency on human help.
- To utilize technology to build an interactive shelf.

- To propose a system that will altogether put an end to the need of people needing human help at the stores .

1.5 Expected Results

The system is designed to as a shelf having 3 phases.

Video phase, Audio phase, mechanical phase.

Video Phase: An IR sensor connected to the Raspberry pi will detect when a dvd is picked up from the shelf and will play the respective trailer on the display unit.

Audio Phase:A capacitive touch sensor will detect when a customer touches a clothing and will describe the clothing and its specifications.

Mechanical Phase: An IR sensor will detect when a customer picks up a perfume bottle and the respective tester would spray on to the wrists of the customer automatically from a tester bottle.These sensors are interfaced on to an Arduino board for the mechanical phase and on toa Raspberry pi for video and audio phase**.** The system is expected to combine all these 3 phases and give the required outputs or triggers when the respective shelf is interacted with.

II. LITERATURE SURVEY

Several systems are proposed have been introduced to enhance the user experience at the retail stores but most of it being offers and discounts on the products to attract the customers but nothing was introduced where the customer would directly interact with the product.A few products like holographic posters, attractive displays etc.; were brought into the market but they did not serve the purpose of interacting with the customers.Then came the gaming industry which allows the user the have demos of the games with the consoles and they get to experience the look and feel of the game. This idea of giving such an experience to the customers was later brought into the electronic industries. Even then the retail industry was lagging and did not know how to incorporate technology into their stores other than fancy advertisements this led to ideas in creative heads to develop systems that would bring the worlds of technology and retail together.This shelf was built after looking at how amazon started their idea of an amazon store.This idea was one of a kind and we wanted to improvise on one the many things at the amazon stores.Since the kind od experience at amazon stores is not available here, we wanted to create a small or a mini experience of that using an interactive shelf.

III. SYSTEM REQUIREMENTS

3.1 Functional Requirements

- Arduino UNO
- Raspberry pi
- IR sensor
- Capacitive touch sensor
- Servo motor
- Display unit
- Bluetooth speakers
- Jumper wires
- Spray can

Arduino Uno:

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again."Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Raspberry Pi:

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi foundationto promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics.

Raspberry pi does not include peripherals (such as keyboards and mice) or cases. However, some accessories have been included in several official and unofficial bundles.[10]After the release of the second board type, the Raspberry Pi Foundation set up a new entity, named Raspberry Pi Trading, and installed Eben Upton as CEO, with the responsibility of developing technology. The Foundation was rededicated as an educational charity for promoting the teaching of basic computer science in schools and developing countries.

Ir Sensor:

IR detectors are little microchips with a photocell that are tuned to listen to infrared light. They are almost always used for remote control detection - every TV and DVD player has one of these in the front to listen for the IR signal from the clicker. Inside the remote control is a matching IR LED, which emits IR pulses to tell the TV to turn on, off or change channels. IR light is not visible to the human eye, which means it takes a little more work to test a setup.

Capacitive Touch Sensor:

The sense of touch is an important sensory channel in many animals and some plants. Our senses inform to us when our hands touch something. Computer input devices are indifferent to human contact as there is no reaction from software in the event of making, maintaining or breaking physical contact like touches or releases.

Thus, touch sensing input devices offers numerous possibilities for novel interaction techniques. Touch sensor technology is slowly replacing the mechanical objects like mouse and keyboard.A touch sensor detects touch or near proximity without relying on physical contact. Touch sensors are making their way into many applications like mobile phones, remote controls, control panels, etc. Present day touch sensors can replace mechanical buttons and switches.Touch sensors with simple rotational sliders, touch pads and rotary wheels offer significant advantages for more intuitive user interfaces. Touch sensors are more convenient and more reliable to use without moving parts. The use of touch sensors provides great freedom to the system designer and help in reducing the overall cost of the system. The overall look of the system can be more appealing and contemporary.

Servo Motor:

A **servo motor** is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through **servo mechanism**. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Doe to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.
Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity.

The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Display Unit:

This unit is used to display the video content as an output of the video phase when a dvd is pickedfrom the shelf.

Bluetooth Speakers:

An amplifier and loudspeaker with Bluetooth wireless connectivity that is paired (pre-associated) with one or more smartphones, tablets, iPods or computers. Available in all sizes, including replaceable battery and rechargeable models, as well as wall-powered units, the Bluetooth speaker receives digital audio streams from the host device, which are typically compressed. It then decompresses, decodes and amplifies the audio through the built-in speakers.Used as an output unit for the audio phase.

Jumper Wires:

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

Spray Can:

This is used to spray the tester perfume when a customer picks up a perfume bottle from the shelf.

3.2 Platform Requirements

Python Idle:

IDLE is Python's Integrated Development and Learning Environment.

IDLE has the following features:

- Coded in 100% pure Python, using the tkinter GUI toolkit.
- Cross-platform: Works mostly the same on Windows, Unix, and macOS.
- Python shell window (interactive interpreter) with colorizing of code input, output, and error messages.
- Multi-window text editor with multiple undo, Python colorizing, smart indent, call tips, auto completion, and other features.
- Search within any window, replace within editor windows, and search through multiple files (grep).
- Debugger with persistent breakpoints, stepping, and viewing of global and local namespaces.
- Configuration, browsers, and other dialogs.

Arduino Ide:

The Arduino Integrated Development Environment(IDE) is classplatform application(for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring.[5] The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards.

Embedded C:

Embedded C is a generic term given to a programming language written in C, which is associated with a particular hardware architecture.

IV. SYSTEM DESIGN

4.1 Algorithm

Video Phase:

1. Initially IR sensor is kept high as it will sense the object kept over it.
2. DVD is picked up from the shelf.
3. IR sensor is triggered it goes low.
4. When the signal is low, the video plays on the monitor.

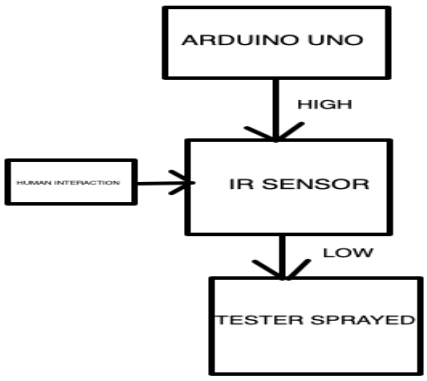
Audio Phase:

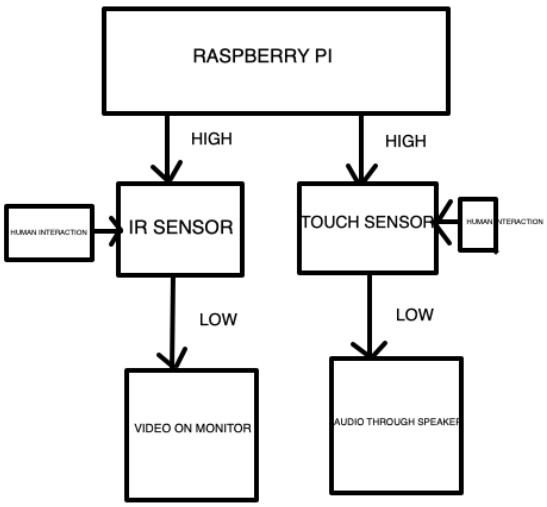
1. Initially capacitive touch sensor is kept high as it will sense the object kept over it.
2. The customer touches the cloth/any outfit from the shelf.
3. Capacitive touch sensor is triggered it goes low.
4. When the signal is low, the audio plays on the speaker.

Mechanical phase:

1. Initially IR sensor is kept high as it will sense the object kept over it.
2. Perfume bottle is picked up from the shelf.
3. IR sensor is triggered it goes low.
4. When the signal is low, the motor rotates and sprays the tester from the tester bottle from a spray can.

4.2 Block Diagram





V. METHODOLOGY

Video phase:

On the shelf , the DVDs are kept such that the IR sensor is kept high . When the DVD is picked up from the shelf the Sensor turns low and on low signal the video is played on the display unit.

Audio phase:

A capacitive touch sensor is place on clothes in a shelf .When a customer interacts with cloth and when the touch sensor is pressed, the signal goes high and an audio output is sent through a speaker.

Mechanical phase:

A motor is attached to a spray can.When a customer picks up a perfume bottle , the IR sensor is triggered n goes low (same as video phase) and the motor rotates inturn pressing the nozzle of the can and spraying out a sample for the picked up perfume.

VI. CONCLUSION AND FUTURE SCOPE

Our research provides a solution to upgrade retail industries by combining the worlds of technology, retail and products. I here by conclude that our major goal is to develop and deploy a time efficient system that will help individuals at a retail store become independent and also make the store more attractive. Hoping to see more such ideas in the near future and combine them into our model.

Further, we would like to integrate more newer technologies into the model. The DVDs can be replaced with any product, and a video output can be made possible. The touch sensor can be replaced with microphones and NLP can be used to interact with the product itself and the audio can be given out through a speaker. These are couple of the many things that can done further using this project

REFERENCES

[1] Kai Ding, Pingyu Jiang “RFID-based Production Data Analysis in an IoT-enabled Smart-shop” IEEE/CAA journal of Automatic a Sinca.
[2] F. Bao, and I. R. Chen, "Dynamic Trust Management for Internet of Things Applications," 2012 International Workshop on Se!f-Aware Internet o.fThings, San Jose, California, USA, September2012.
[3] Pooja N. Vengurlekar, Vivek S. Kulkarni, Piyush R. Kulkarni, Saket Z. Jadhav “Cloud Based Online Retail Management Framework: A Different Aspect” Imperial Journal of Interdisciplinary Research,Vol.2,Issue,2016.
[4] Rong Chen, Li Peng, Yi Qin,” Supermarket Shopping Guide System based on Internet of things”, School of IoT Engineering, Jiangnan University, Wuxi, Jiangsu 214122
[5] W.U.L.R.Perera, M.S. Karunarathne “Enhancing and Speeding-Up Real-Time-Shopping Using an Indoor Map, Intelligent Suggestions and Calculations, built upon a Smart Phone Application” 2013 IEEE 8th International Conference on Industrial and Information system ,ICIIS 2013,Aug,2013,Srilanka.
[6] Abhirup Khanna, Ravi Tomar “IoT based Interactive Shopping Ecosystem” 2nd International Conference on Next Generation Computing Technologies, Dehradun, India, October 2016.