JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

e-Trolley: An Affordable Intelligent Self-Guided Cart Featuring Anti-theft Safeguards

Dr. Dinesh D. Patil [1], Dimpal Liladhar Narkhede[2]

Department of Computer Science and Engineering

Shree Sant Gadgebaba Engineering College, Bhusawal

***Abstract*—Shopping and buying are an integral part of our daily lives. Big Supermarkets have a wide variety of items and different stores can have different varieties of goods. It is difficult for many consumers to stand in long queues, just for billing of the goods purchased. This leads to a waste of time and a poor experience for the customer. Trolleys are used in supermarkets & grocery stores to make shopping simpler. However, it is difficult for customers to handle the trolley while shopping.**

Keywords: Raspberry-pi, QR Scanner, Image processing.

I. INTRODUCTION

In the modern world, every supermarket and hypermarket employs shopping baskets and shopping trolleys to aid customers in selecting and storing the products which they intend to purchase it. The customers have to carry their trolleys everywhere and drop every product that they wish to purchase into the shopping cart and then proceed to checkout. The billing counter. This process is quite tedious and highly time-consuming and has created the need for shops to employ increasingly more human resources in the billing section and wait times remain considerably high at most times. Our Project Design and Development: A Low-Cost Intelligent Autonomous Trolley with an Anti-Theft Mechanism" Aims to remove the efforts required by the customers to move the trolley and reduce the Total waiting time of customers. Lower the total workforce requirement and expenses for Supermarkets and increase efficiency overall, as well as provide a contactless billing process to the customer.

Shopping and buying are an integral part of our daily lives, and trolleys are used as tools to make shopping simpler. It is usually a tiresome process for many consumers to shop for everything and then stand in long queues just for billing of the goods purchased leading to wastage in time and poor experience for the customer. However, it is often not easy for customers to handle the trolley while shopping. Also, considering the COVID situation - customers might even hesitate to touch the trolley. Our project work intends to solve this problem.

To summarize the complete shopping experience, the customer scans a QR code on the trolley from the Smartphone App, which uniquely identifies the trolley and a communication is established over Bluetooth between the trolley and the App. After capturing an image of the customer, the trolley can identify the human silhouette and can start following the customer.

Using an RFID (Radio Frequency Identification) scanner on the trolley, the items are scanned & billed concurrently in the Smartphone App. If a customer/meddler removes/adds a certain item from/to the trolley without scanning, a Vibration, along with a short message is displayed on the Smartphone, to indicate tamper/theft. The customer can finally Checkout using any Digital payment method to pay for the billed amount.

II. LITERATURE REVIEW

Paper [1]: "Automated Billing Smart Trolley and Stock Monitoring", 2021 by M. K. Dev et al. describes a design with Radio Frequency Identification (RFID) Technology for billing with Arduino Uno and an Liquid Crystal Display (LCD) Screen & also devised a stock monitoring IoT platform. They have provided for online or offline payment methods. No kind of theft / tamper detection and no autonomous movement devised.

Paper [2]: "Automated Shopping Trolley for Super Market Billing System", 2014 by J. Thangakumar et al. demonstrates a design with a Raspberry Pi as the main computing device with barcode scanners employed on the trolley to bill products with a barcode. Used an LCD monitor, increasing the overall cost and similar to the previous paper, no kind of theft / tamper detection and no autonomous movement devised.

Paper [3]: "Human Friendly Smart Trolley with Automatic Billing System", 2020 by Hanooja T et al. is using an elaborative design using RFID reader with a Raspberry Pi and using individual buttons to add/remove products, which is tedious for multiple products. Furthermore, no tamper protection is provided. They have also implemented a

following mechanism using a Color Tag, which would be given to the user, such that the camera detects a specific color to track and line follower to keep trolley in track. The line follower is useful to prevent collisions, but color detection is highly prone to false negatives, and thus is susceptible to false positives.

Paper [4]: "Travelmate Robot: Smart Touchless Trolley" by D. S. Radhika Shetty proposes a model using the concept of patterned color tags to follow a user and a camera to detect the color code. Color code detecting of the trolley for following customers is not ideal in a supermarket where the density of customers is high and light could affect the working.

The solution that was recognized as the most beneficial was to use a Pose Detection Model provided by TensorFlow Lite, which was originally built to detect different poses and classify them. However, we have employed the model to detect a human silhouette.

This idea was empowered by poor, inaccurate, and false-negative-ridden – object detection algorithms that can track objects but fail after a person goes out of frame or gets stuck on other elements in the environment rather than the person.

The pose estimation model accurately identifies several landmarks on the human body and joins them to create a human silhouette. This especially works well from behind, i.e., back faced towards the camera, since the model tries to estimate the human landmarks based on body structure. Other algorithms usually fail in this regard, making the 'literal following 'part failure-prone

Future scope could include merging interval-based Object Detection and pose Estimation Model-based Human detection together for faster processing

Pose estimation is using an ML model to estimate the pose of a person from an image or video. You estimate the spatial locations of key body joints (key points).

How the model works:

Pose estimation is important in computer vision. It identifies where humans are in pictures and videos, like where a person's elbow is. It's not accurate enough to know who's in an image or video, but it does estimate where the bodies are.

The pose estimation models take a processed camera image as the input and output information about key points. The part ID numbers index the key points found, and a confidence score from 0.0 to 1.0 is associated with each point. This score reflects the chance that a key point is present at that location.

TensorFlow provides a reference implementation of two TensorFlow Lite pose estimation models:

MoveNet: the latest pose estimation model available in two versions: Lighting and Thunder.

PoseNet: the previous generation pose estimation model released in 2017

The table below shows the different body joints that are picked up by the pose estimation model.

MoveNet is available in two versions:

MoveNet.Lightning is more compact, quicker, but not as precise as the Thunder version. It can carry out operations in real-time on contemporary smartphones.

MoveNet.Thunder is more precise than its smaller and quicker counterpart, Lightning, but it is also slower. It is useful for use cases that require higher accuracy.

MoveNet demonstrates higher accuracy than PoseNet on a range of datasets, particularly with respect to images depicting physical activities. Therefore, MoveNet is recommended over PoseNet.

REFERENCES

[1] M. Kabil Dev, R. Kannan, M. Agarshan, S. Karthik, and K. Lakshmi, "Automated Billing Smart Trolley and Stock Monitoring", 2021 5th International Conference on Computing Methodologies and Communication (ICCMC), doi: 10.1109/ICCMC51019.2021.9418043, pp. 500-505, 2021.

[2] J. Thangakumar, S. Sainath, K. Surender, and V. Vikram Arvind, "Automated Shopping Trolley for Super Market Billing System", International Conference on Communication, Computing, and Information Technology (ICCCMIT-2014), pp. 7-9, 2015.

[3] T. Hanooja, C. G. Raji, M. Sreelekha, J. Koniyath, V. Muhammed Ameen, and M. Mohammed Noufal, "Human-Friendly Smart Trolley with Automatic Billing System", 2020 4th International Conference on Electronics, Communication, and Aerospace Technology (ICECA), ISBN: 978-1-7281-6387-1, doi: 10.1109/ICECA49313.2020.9297439, Conf. Paper id No., pp. 1614-1619, 2020.

[4] D. S. Radhika Shetty, "Travel mate Robot: Smart Touchless Trolley", IJRESM, vol. 4, no. 8, pp.

[5] http://www.neilkolban.com/esp32/docs/cpp_utils/html/class_m_f_r_c522.html

[6] https://how2electronics.com/iot-weighing-scale-hx711-load-cell-esp8266

[7] https://randomnerdtutorials.com/esp32-hc-sr04-ultrasonic-arduino