

Readiness of the Vending Cart Design

Introduction

In India, a popular way of selling fresh fruits and vegetables is through local vendors, who would buy in small quantities and display them on the wooden/metal platform of a push/pull type cart. However, vendors face numerous challenges in their daily lives, including, but not limited to, storage, weather conditions, correct upkeep of goods, and so on. The product, for example, is constantly exposed to sunlight, heat, and dust, resulting in shorter shelf life. In these situations, the vendor must either sell the produce at a lesser price or discard it, resulting in a financial loss. Another issue is a lack of adequately labeled storage or divisions for various categories of goods.

To overcome the above-stated problems Office of the PSA and Department of Science & Technology, Govt. of India, approached various IITs. IIT Delhi has also taken up the project, and the following improvements are made in the cart:

Enhancement in the Existing Cart

Several improvements have been made to the existing cart to make it more advanced. Some of the significant improvements done are as follows:

(i) Incorporation of Aluminium Frame

An Aluminium frame has been attached to increase the holding capacity of the cart and to enhance the display of various types of fruits and vegetables.

To accommodate and display adequate amount of products in an orderly manner, an aluminium frame has been designed and fabricated, shown below (Fig. 1). This frame has flaps that can be opened from all four sides. The crates can be spread on these flaps when the cart is open for sale and can be stacked over each other at the end of the day and then closing the flaps. It is expected to make the deal convenient for both the seller and the buyer.



Fig. 1 Cart with aluminium frame

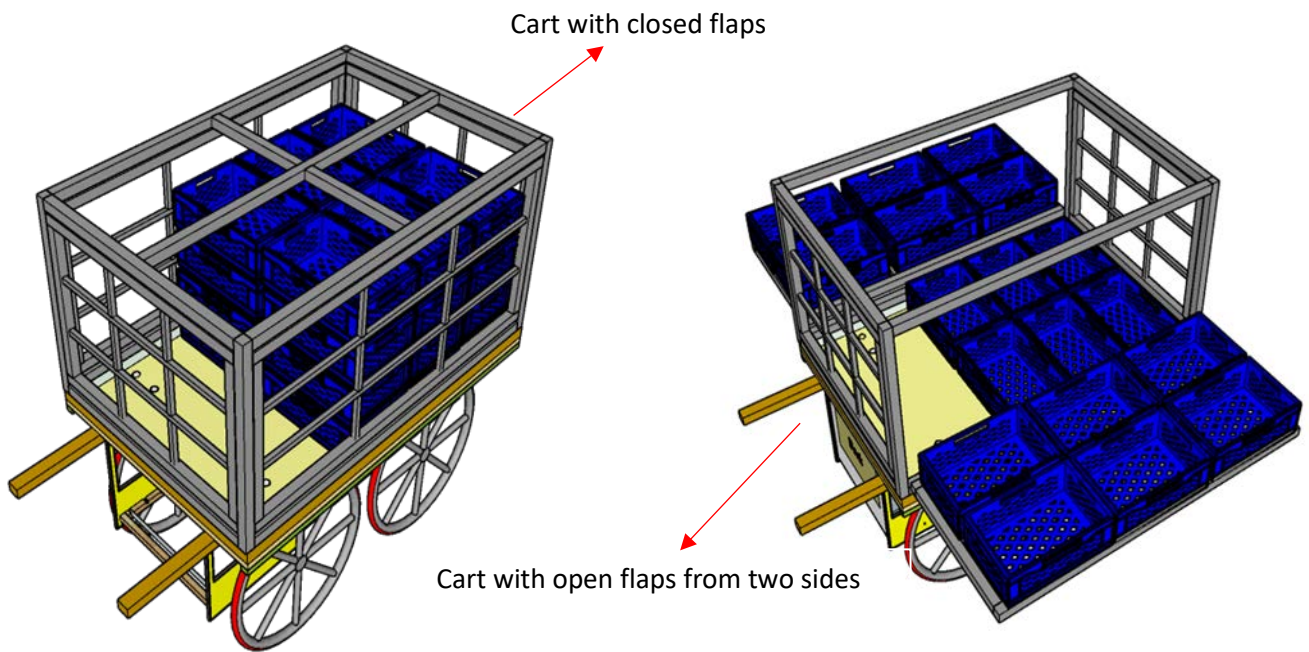


Fig. 2 Cart in packed-up and open state for sale condition

(ii) Cooling Cum Storage Unit

Fruits and vegetables are living tissues with continuing metabolism even after harvesting. They are subject to respiration, water loss, and cell softening in post-harvest conditions, and each of them has its own particular temperature and relative humidity requirements for maximum post-harvest shelf-life. The majority of the products have a low-temperature requirement.

Achieving such low temperatures generally requires refrigerant-based vapor compression-refrigeration systems that consume more energy and are costly as well. However, it's important to note that for vendors, a marginal few days extension in quality retention should suffice, and hence a marginal drop (not necessarily to the ideal storage condition) in ambient temperature accompanied with increased relative humidity should solve the purpose.



Fig. 3 Cart with cooling cum storage unit

(iii) Dual Axis Solar Tracker

Dual-Axis Solar trackers provide a dynamic method of harnessing energy that complements the active position changes in solar axes during the day.

To get the most out of the system, algorithms based on real-time sensory input data are employed to tilt the panel. The power generated by the solar panel mounted to the tracker system was compared to a static one to assess its performance. The tracker system was able to boost the amount of power generated by about 20%.



Fig.4 Experimental setup to demonstrate the effectiveness of solar tracker

(iv) Lighting Arrangement

A standard cart vendor has to depend on the street lights to sell his fruits and vegetables at night. So we have incorporated lights in the cart itself that are useful to sell fruits and vegetables at night.



Fig. 5 Cart with lights on at night

(v) Vegetable Freshness Detection App

Now a day's fruits and vegetables are available online. But to ensure high-quality vegetables, most of the online vegetable sellers sell hand-picked vegetables, which require a lot of human hours and human effort. The "Vegetable Freshness Detector" app will make this task easier and efficient. It will help in determining the freshness of vegetables. The app will classify the vegetable into 'Fresh', 'Semi-Rotten', and 'Rotten' categories. The user can easily log into the app and can easily check the freshness of vegetables with a single click. The user will have to choose the image of the vegetable from the image gallery, and the app will do the rest.

To begin with, we have included six vegetables which are 'Potato', 'Tomato', 'Onion', 'Carrot', 'Brinjal', and 'Capsicum'.

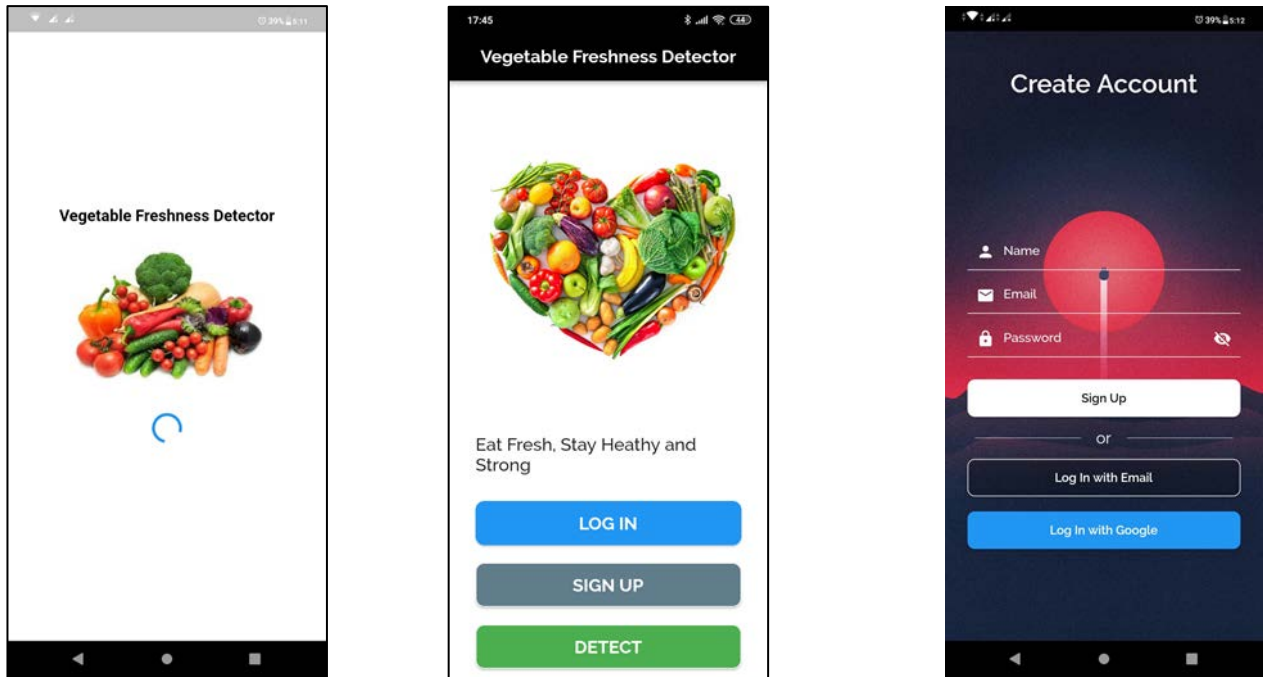


Fig. 6 Screen Short of the app

vi) Development of Lifting and Turning Mechanism

Lifting and Turning Mechanism is under development at IIT Delhi. One prototype (Figs. 7, 8, and 9) was fabricated and tested by putting various loads on the cart at IIT Delhi. Results of the trial were satisfactory. Modified prototypes are under development (Figs. 10 and 11) as per the feedback received during the trials. The modified prototypes will be manufactured and tested soon.

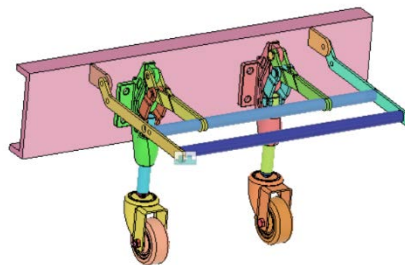


Fig. 7: CAD Model of manufactured Mechanism



Fig. 8: Prototype of Lifting and Turning Mechanism



Fig. 9: Testing of the prototype

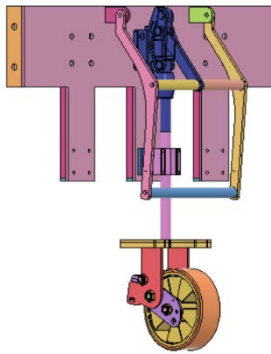


Fig. 10 : CAD Model of Single Castor Lifting Mechanism

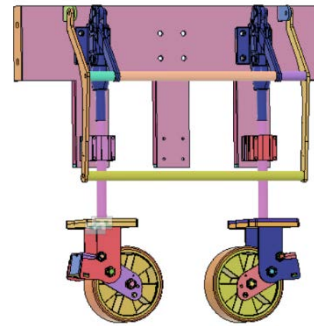


Fig. 11: CAD Model of Double Castor Lifting Mechanism

Future Work

- Weight optimization, space utilization, and identifying vending cart owner preference of vegetables and fruits to be stored and desired shelf life.
- Optimization of DC operated light and cooling unit, Optimization of Lifting and turning mechanism
- Integration of digital payment system
- Incorporation of smart weighing scale
- Integration of sanitization unit.

