DESIGN AND FABRICATION OFVEGETABLE CUTTER MACHINE

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Abstract

In the engineering sector, automation was all the rage. The examination into the present vegetable cutting machine looks at the disadvantages of manual processing, such as the high investment cost, contamination, additional labour, and time consumption. The pressure block is actuated by a pneumatic cylinder and has a reciprocatory motion along the vertical length of casing, while the cutting grid remains fixed, in this setup. The air supply to the cylinder is controlled by a microcontroller-controlled solenoid-actuated DCV. A pneumatic cylinder and a single bar mechanism govern the entry of vegetables into the grid system. Vegetables are fed by an angled tube. After the vegetable pieces have been processed, a tray is placed at the bottom of the equipment to collect them. The microcontroller controls the pressure level for cutting different vegetables. The type of veggies that such a system can process adds to its complexity. Because present automation is expensive and consumes a lot of energy, the system is advantageous. Pneumatic power, which is plentiful, is advantageous to the suggested work.

I. INTRODUCTION

Automation was all the rage in the engineering profession in the late 1990s. The brightest brains came together at all hours of the day and night to create big advancements that would have an influence in everyday life. Automation is now used in a variety of disciplines, including manufacturing, food processing, biomedical, and pharmaceutical industries. Domestic applications have also been designed with the ordinary man in mind in such a scenario. Processes that were formerly manual are gradually being changed to semi-automated and automated nature. Manual vegetable cutting is still common in educational institutions' dormitories, wedding catering services, and even restaurants that cater to a wide range of customer tastes and preferences. The quantity of vegetables to be sliced for the dishes is always greater than what is actually consumed. The related challenges, such as time constraints, contamination, and so on, make it difficult for anyone in charge of the job. Therein, arose a need to automate the process of vegetable cutting, and here we are with a proposal which can aid in easing the load off the people associated with it.

Existing automated vegetable cutterand its demerits

The automatic vegetable cutter is a Chinese manufactured one, currently available in the market. The cutter operates on the concept of 'rotating grid', wherein, the cutting grid is rotating inside a casing,powered by an ac motor. The vegetables are fed via the hopper arrangement, at the top. The cutting grid rotates at a high speed which cuts the vegetables as they pass through them. The cutting grids are varied according to the need of the customer. The shapes of the cut vegetable vary with the change in cutting grids.

The above-mentioned cutter has a few flaws in terms of functioning. To begin with, vegetable feeding is not automatic; instead, a person must dedicate time to feeding each vegetable individually until the proper quantity is sliced. The grids are then powered by a motor that consumes a lot of energy. The fact that the process must be electrically supplied continually for operation due to the variable power source is a drawback in and of itself. The initial investment in the cutter is the most critical factor. The cutter is estimated to cost between $ 3500 and $ 3500, including delivery and taxes. For individuals who manage a mid-level catering business, it is a significant investment. In light of all of these flaws, the concept for a pneumatics powered cutter is conceived.

The high cost of the existing automated system, power fluctuations, additional labour, time consumption in manual cutting, and the possibility of contamination in manual cutting are some of the primary challenges that were highlighted for the start of this operation.

Objectives

The fundamental goals of this research are to provide an alternative to the existing automated system, focusing on the initial investment component, and to power a home product with pneumatics, removing the associated challenges of manual vegetable cutting.

Literature review

This work was motivated by multiple patents filed on the same invention. In particular, the patent by Romeo et al (pub no: US2009/0193953 A1) depicted a basic arrangement, which served as the foundation for our work. The patent aided in the development of the notion of chopping vegetables with a cutting grid.

The second patent (W0 2008/011671 A1) by Romeo et al clarifies the actuation mechanism for a simple cutter with a box frame and a stack structure at the bottom.

The patent (patent number. 20120125172) of Javier Hidalgo Garcia, Aitor Aguirrezabalaga Zubizarreta, and Aitor Gogorza Segurota focuses on various cutting grids for the cutting process. For our grid design, we used this patent as a guide.

The cylinder parameters were extracted from Janatics pneumatic Ltd's product documentation. The equation 2.1, taken from Antonio Esposito's Fluid Power with Applications (6th edition), is used to calculate the force for the double acting cylinder. The material parameters of stainless steel were derived from Er.Strength R.K.Rajput's of Materials (Mechanics of Solids), while the microcontroller specs were acquired from Muhammad Ali Mazidi's The 8051 Microcontroller and Embedded Systems (2nd edition).

II System model and Design Calculation

The important responsibilities of regulating vegetable entrance and cutting are performed by the double acting cylinders. The parameters of the cylinders, as well as the needs of the two processes, are different. The following calculations were made for the cutting procedure. Because the cutting force cannot be determined in practise, a basic theoretical force calculation was performed, and the cylinder was chosen with working pressure as the primary consideration. The minimum pressure necessary for the cutting process was discovered to be 5 bar through trial and error experimentation. Potatoes were the vegetable used in the calculation.The assumed constants:

III.PROPOSED SYSTEM

The problem of water logging caused by the removal of aerial lotus leads to the development of a pest growth system. Because this is dangerous to human life, the concept for this research arose. The goal of the proposed project is to design and build a drainage cleaning machine that would protect individuals from being harmed by sewage when cleaning manually. The goal of this proposed system is to reduce or eliminate the problems associated with using a man-operated equipment, as well as the increased trash disposalrate.

DESIGN AND FABRICATION OF RIVER CLEANING MACHINE

The tank's whole contents are first removed. Detergent is then put on the tank's inner wall to make dirt removal easier. The cleaning arrangement is mounted on a frame near the water tank's opening, and manual rotation is given by a hand lever connected to a pinion gear that rotates in a clockwise manner. This causes the rack, which is attached to it, to move linearly downward, allowing the cleaning arrangement to enter the tank. This motor runs until the bottom-mounted brushes make contact with the tank's bottom surface. When the hand lever attached to the adjusting lever is pressed against the folding link, the adjusting link extends, causing the brushes positioned perpendicular to the link to come into contact with the side surface of the water tank. The cleaning motor is now turned on, causing the entire arrangement to revolve and scrubbing the inside walls of the tank with the brush action. In this way, the tank is cleaned in the shortest amount of time and with the least amount of human work.

The focus of this project is on the design and construction of a river trash cleaning machine.

• Working pressure P = 5 bar = 5105 N/m2 was used to complete the operation.

• D1 = 100 mm = 0.1 m cylinder diameter

• The diameter of the piston rod is d2 = 20 mm = 0.02 m.

As a result,

F = PA = P (d12 – d22) / 4 = 5105 (0.12 – 0.022) / 4 = 3769 N is generated by the double acting cylinder.

Table 1 Dimension – Mechanical Setup

Parts	Dimensions
Hopper block	150×150 mm^2
Hopper tube length	500 mm
Cutting case	100×100 mm^2
Cutting grid	100×100 mm^2

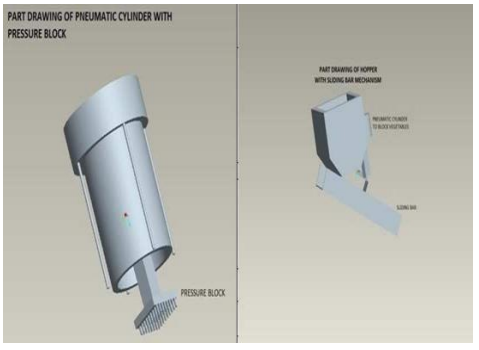

Figure 1 Part Drawings of the setup using Pro/E

The hopper is a device that controls the flow of vegetables into the cutting portion. It has a square cabinet that doubles as a vegetable stand. To ensure that the vegetable enters the hopper in a controlled manner, a sliding bar mechanism is employed in conjunction with the hopper. It's a single bar with one end connected to a pneumatic cylinder's piston rod plate and the other end connected to a 45-degree plate. Figure 1 depicts the situation. A square-shaped cutting grid with intermeshed blades is used. Stainless steel blades make up the mesh, which looks almost like a net in the top view depicted in Figure 1. The material is defined based on its high Young's modulus and food compatibility. The complete assembly view of the project is shown in figure 2.

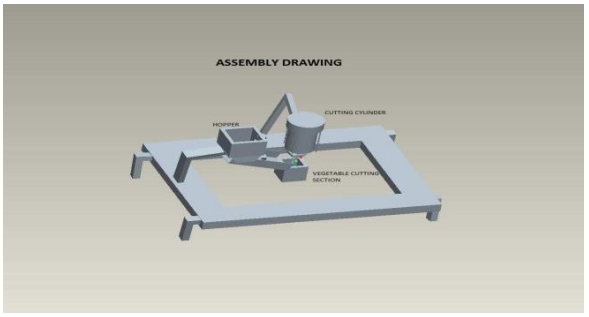

Figure 2 Assembly View

III Working of the project

This project is divided into two parts: the mechanical setup, which includes the hopper block, hopper tube, square cutting box, and grid, as well as the supporting frame, and the electrical circuit, which includes the AC – DC converter, relays, micro controller, LCD display, and keypad. The two sections work together in cooperation to automate the vegetable cutting procedure. The pressure plate is activated by the reciprocating motion of a pneumatic cylinder piston. Vegetables' entry number is 0'

Another pneumatic cylinder is used to control the cutting casing. Above the cutting grid, the veggies are positioned. The cutting grid is made up of stainless steel blades that are arranged in a mesh pattern. The microcontroller commands the pneumatic cylinder to execute a piston stroke at a predetermined pressure. The solenoid DCV controls the supply for the pneumatic cylinder's extraction and retraction. The veggies are forced through the cutting grid using the pressure plate. Between the cutting blades, there are regular, square-shaped spaces. The vegetables are pressed between the gaps, resulting in the same shape being chopped. The entire operation is automated, with the micro-controller assisting in the regulation of the number of vegetables sliced and the timing of the extension. A pneumatic cylinder with a single bar mechanism attached to the piston rod end controls the number of veggies that enter the equipment. An angled plate on the bar mechanism functions as a cup, keeping the vegetable at the hopper tube. When the vegetable is freed from the angled plate, it reaches the cutting casing, where it is cut by the piston stroke.

Figure 3 and Figure 4 depict the mechanical and electrical setups, respectively. The mechanical and electrical setups work together to demonstrate the cutter's automatic

operation. A hopper case, hopper tube, 45-degree angled plate, square cutting case, and square cutting grid make up the mechanical configuration. An AC-DC converter, two relay circuits, a microcontroller circuit, and a keypad are included in the electrical configuration.

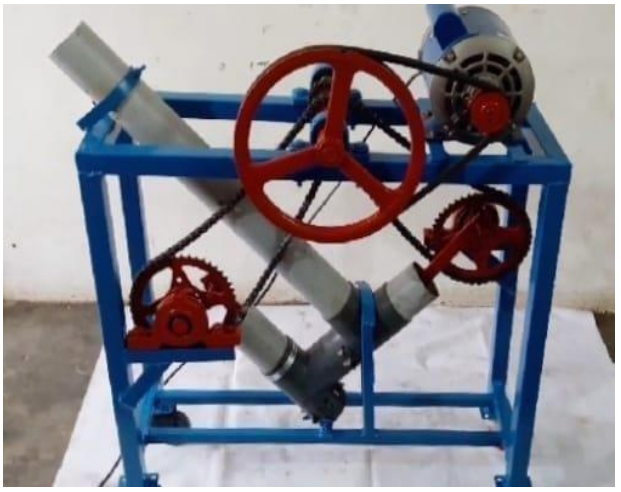

Figure 3 Mechanical Setup

IV Conclusion

As a result, this study offers an alternative to the current automatic vegetable cutter in terms of automating the vegetable entry into the cutting equipment, eliminating power fluctuations, and requiring a lower initial investment. When compared to manual cutting, it takes less time. This job produces the required result, and the variety of cuts is achieved by the employment of several cutting grids.

V References

1 Existing automatic vegetable cutter image andspecifications *from http://www.alibaba.com/produtcgs/ automatic_vegetable_cutter.html viewed on 27 July2012.*

2 Javier Hidalgo Garcia, Aitor Aguirrezabalaga Zubizarreta, and Aitor Gogorza Segurota (patent no:20120125172). *"Cutting grid patent"*

3 Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin D. McKinlay (2008) '*The 8051 Micro Controller and Embedded Systems', 2nd Edition, Pearson Education Inc.*

4 Pneumatic cylinder and solenoid DCV from product manual *of Janatics ltd, Coimbatore, Tamilnadu.*
Cutting grid types – image from *www.jasenterprise.comviewed on 23August 2012.*

5 Romeo et al (pub no: US2009/0193953 A1),"*Design of pneumatic powered cutter "*Romeo et al (intl patent no: W0 2008/011671 A1).