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Design and Fabrication of Semi Automatic Paper Bag Making Machine

Vignesh V[1], Dhanush K[2], Elango M[3], Gokul Kannan M[4], Heshvardhan D[5]
[1]*Assistant Professor,* [2, 3, 4, 5]*UG Student Department of Mechanical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil nadu, India*

Abstract: ***Despite all known hazards of plastic pollution, it's prevalent and pervasive in India. Polythene bags are major contributors to it. Polythene bag production is easier and cost effective as compared to its eco-friendly alternatives. Paper bags are the closest economical alternative to the polythene bag. This project tries to address several issues that makes paper bag production economically incompetent with polythene bags.***
Initially the paper bag making process was a manual process, which involves the process of gluing the three sides and cutting the bags one by one, which required a lot time. Then separate machines for feeding, cutting and gluing were invented, which also requires manpower. Now with the help of current day technologies all the three processes feeding, gluing and cutting have been brought under one roof, which requires no manpower. The existing machines in the current day market are based upon PLCs, pneumatic or DPDT switches which can cost around 6-7 lakh rupees and occupy a very large amount of space. This project is made specially to give hands to small scale industries which follow a semi-automatic paper bag making process. This automatic paper bag making machine is also less in weight, which makes it portable. This paper bag making machine will be capable of producing around 720 paper bags an hour. The current number of paper bags that is made per hour is achieved with the help of ESP32 Microcontroller.
Keywords: Hazards, Polythene, Incompetent, Feeding, Gluing, Pneumatic, DPDT

I. INDRODUCTION

We need small size bags every day for various purposes like grocery, fruits, vegetables, etc. We use plastic bags for such purposes plastic shopping bags have a surprisingly significant environmental impact for something so seemingly innocuous. Plastic shopping bags kill large number of wild lives each year. So, to avoid harmful effects of plastic bags, viable alternative is required which is Paper bags, Paper bag making machines that are currently available in India remain unaffordable to many poor workers who continue to make them manually paper bag by collecting various papers from localities. These entire problems are eliminated in the presented machine. A machine whose initial cost is less, which does not require any special paper, which can be used for small scale production is developed. This machine will help a poor family to earn money through small scale production of paper bags. The paper bag will be produced from the regular size brown paper to reduce the cost of bag. Once the bag is used it still can be sold to scrap vendor earning bags small amount of the cost for the paper bag. This not only reduces waste but also promotes the recycling. Even government is trying to reduce the impact of plastic bags. This news definitely proves to be our strong hold as we are also the one who are trying to oust the plastic bags.

II. COMPONENTS AND DESCRIPTION

A. Components
1) AC Motor
2) Bearings
3) Adhesive
4) Chain Sprocket
5) Roller
6) Object Sensors
7) Esp32 Microcontroller
8) 12v Dc Relay
9) 5v & 12v Powe Supply
10) Lcd Display

11) Potentiometer Or Pot
12) Worm gearbox of 25:1 ratio

B. Description

1) AC Motor

AC motor is an electric motor driven by an alternating current .The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field.
We have chosen 960 rpm, 1/5 Hp AC motor for paper feeding operation.

2) Object Sensors

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region.The wavelengths of these regions and their applications are shown below.

a) Near infrared region — 700 nm to 1400 nm — IR sensors, fiber optic
b) Mid infrared region — 1400 nm to 3000 nm — Heat sensing
c) Far infrared region — 3000 nm to 1 mm — Thermal imaging

3) ESP32 Microcontroller

At the core of this module is the ESP32S chip, which is designed to be scalable and adaptive. There are 2 CPU cores that can be individually controlled or powered, and the clock frequency is adjustable from 80 MHz to 240 MHz this is ESP WROOM 32 MCU Module. ESP WROOM 32 is a powerful, generic Wi-Fi-BT-BLE MCU module that targets a wide variety of applications, ranging from low-power sensor networks to the most demanding tasks, such as voice encoding, music streaming.

4) Roller

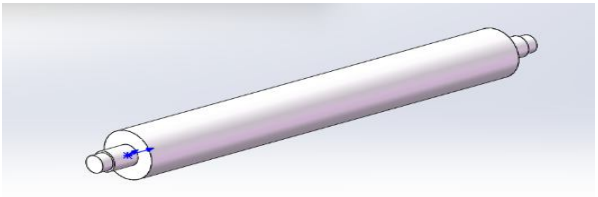

Fig.2.3 Roller

The Fig.2.4 shows the rollers that has been used to carry the machines for cutting operations. These rollers are used as conveyors. These are 50mm rollers and the gap in between 2 rollers can be adjusted in order to hold the paper coming from the rollers with friction.

5) Frame

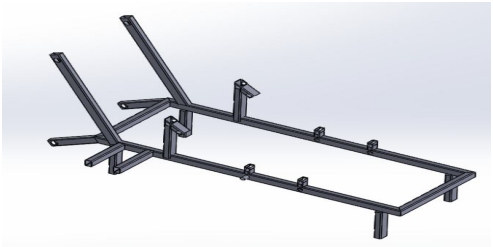

Fig.2.4 Frame

The frame shown in Fig.3.4 is the main frame used for the entire setup to assemble the rollers, cam plate, paper rolls, cutting setup, feeding setup and Microcontrollers.

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III. WORKING

The functioning of the machine setup is controlled using the ESP32 Microcontroller, which mainly controls the feeding motor, cutting motor and the IR sensor. When a hole is detected in the paper rolls by the IR sensor the whole process is stopped until the hole is cleared manually and the reset button is pushed. The microcontroller actuates the feeding motor for and stops it for one second. In the meanwhile, when the feeding motor is stopped for one second the cutting motor gets actuated.

The papers from both paper rolls are passed through the rollers for the sequential gluing and cutting operations. The primary 900 RPM motor is used for feeding operation, wherein the feeding time of the process is 4 seconds.

Fig.3.1 Front cutting assembly

When the paper roll is passed through the first roller the glue is applied on the both sides of the paper and for each 4 second glue is applied on the bottom side of the paper bag.

IV. CALCULATIONS & GRAPH

A. Cost to produce 1 paper bag with 120 GSM paper

1) Time of making 1000 bags - 83 min

2) Material:

Paper roll - 356 meter

Glue - 1 box

3) Price:

120 GSM paper price - 15 Rs./ meter

Glue price - 300

(356×15) + 300 = 5640

4) Paper bag price:

(5640/1000) + Production cost = 5.64 + 1 = 6.64

B. Cost to produce 1 paper bag with 100 GSM paper

1) Time of making 1000 bags - 83 min

2) Material:

Paper roll - 356 meter

Glue - 1 box

3) Price:

100 GSM paper price -12 Rs./ meter

Glue price - 300

(356×12) + 300 = 4572

4) Paper bag price:

(4572/1000) + Production cost = 4.57 + 1 = 5.57

C. Cost to produce 1 paper bag with 80 GSM paper

1) Times of making 1000 bags - 83 mins

2) Material:

Paper roll - 356 meter

Glue - 1 box

3) Price:

80 GSM Paper price - 9.2 Rs /meter

Glue price - 300

(356 × 9.2) + 300 = 3575.2

4) Paper bag price:

(3575.2/1000) + /Production cost = 3.57 + 1 = 4.57

D. Cost comparison

The cost comparison graph between existing machine and our machine for producing one paper bag using 120, 100 & 80 GSM papers are shown in Fig.4.1.Considering the above bar graph, it is noted that around 50 paise per bag is reduced when it is made in our machine, which means around approximately Rs. 500 is reduced for 1000 paper bags.

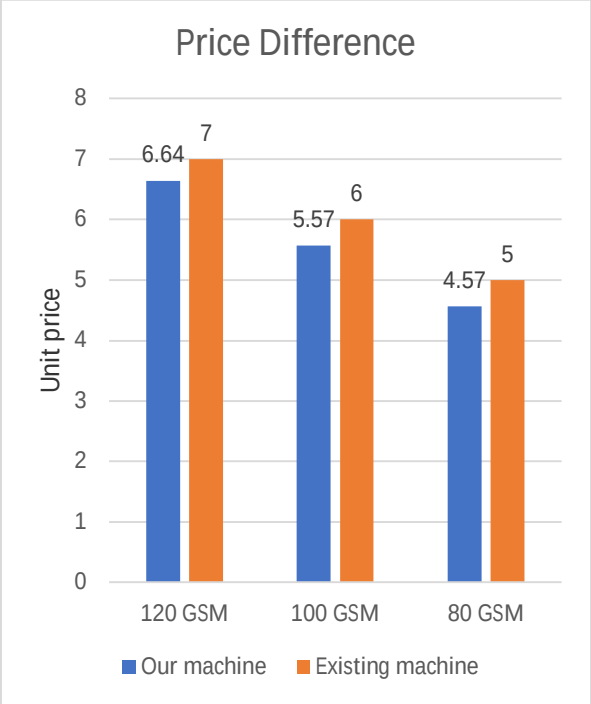

Fig.4.1 Cost comparison graph

V. CONCLUSION

The automatic paper bag making machine was designed and fabricated successfully which produces 720 paper bags in an hour. This was achieved by using ESP32 microcontroller, which is used to control the process of cutting and feeding.

Currently this this machine is capable of producing only paper bags of fixed size (13x17 inches). This is due to the fixed cam size that is used for the gluing process. The fixed cam size is can be changed to a motor and pulley setup and the timing of applying glue can be controlled using a potentiometer. Even more precise cutting can be achieved by installing razor blade for the cutting which is made specifically for paper cutting. The process can be made even more faster by replacing the 900 RPM AC motor which is used for feeding with servo motors which has more precision.

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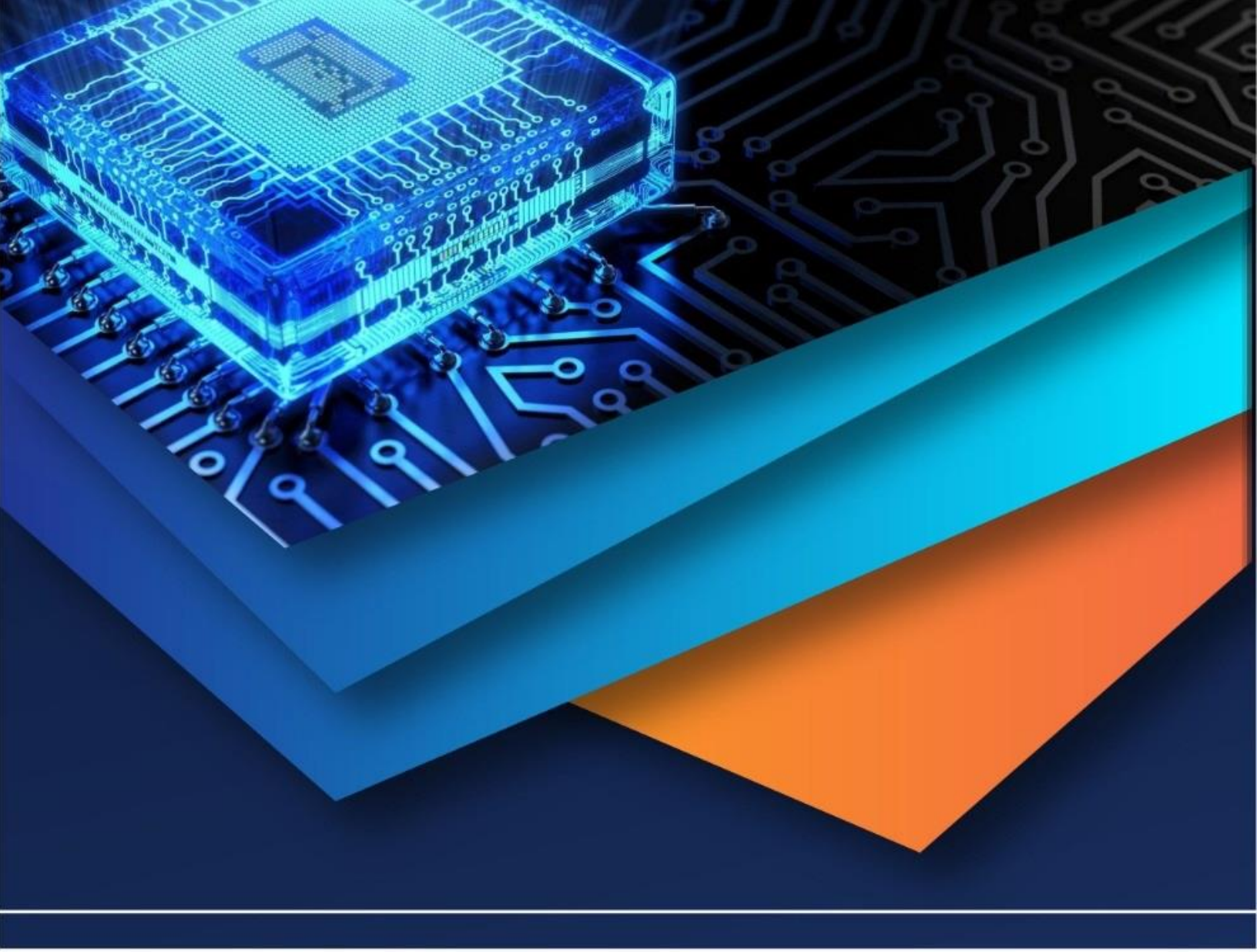

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