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AUTOMATED SYSTEM FOR PAPER BAG PRODUCTION

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ABSTRACT

The system is for production of paper bags. Our aim is to take the edge of the plastic bags which is the main cause of the plastic pollution afflicting land, air and water. Plastic has turned into a silent killer as it renders many natural life-cycles and also it takes ages to degrade. The key solution for this issue is the paper bag. This paper presents scheming of a system for automation of paper bag production; so as to increase the production rate and decrease the cost of production. We are making use of microcontroller to automate the system and keep the cost of system low as compared to the existing machines using PLC in the market.

INTRODUCTION

Today in every field there is requirement of carry bags for various purposes. Now, as we talk about carry bags the first alternative that crosses our mind is plastic bags. These plastic bags have tremendous effect on the environment and bio-diversities. Speaking of marine life, it can be harmed by entangling in plastic objects and also due to the chemicals within the plastics that harm their physiology. Also, large number of wildlife are killed each year due to plastic bags. As per research, about 380 million tonnes of plastic is produced worldwide each year. This is why recently the government is taking initiative to reduce plastic production by imposing the ban on usage of plastic bags.

The best alternative to plastic bags is paper bags which are handmade and uses special paper which therefore increases its overall cost and also requires human labor. Conventional paper bags cost around 5 to 10 rupees which is not convenient for layman for daily chores. This is the reason due to which paper bags are used on a very small scale.

The presented design eliminates all the above problems. The initial cost of the presented machine is less as it does not require any special paper and so can be used by small scale industry. The machine is suitable for common man to setup his own small-scale industry of paper bag production and make a living through it. The paper bag will be produced by recycled by paper roll to reduce to cost of bag. These paper bags can be sold to scrap vendor to earn back small amount of paper bag. This will help to reduce waste and to promote recycling of paper waste.

LITERATURE SURVEY

Till now very few attempts are made to automate a paper bag making system. One of it was in 1852, by Francis

Wolle a teacher from high school who invented the first machine to produce paper bag. He patented the machine and established the Union Paper Bag Company. Another one attempt was made by Margaret Knight. He invented a System that could automatically cut, fold, and glue flat- bottomed paper bags. His invention revolutionized the paper bag industry by substituting the work of thirty people in a single machine. Also, the attempt made by Peng and Yen provided an all-round solution to automate paper and yarn bags.

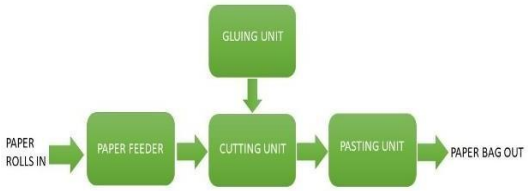
However, they used Siemens PLCs and a software called WinCC Flexible to design the system, which increase the overall cost of the system making it way too costly for layman to buy. The basic idea of our system is based on microcontroller (8051) so as to make the system automatic as well as cost effective. We have selected IC At89C51 which have large no. of advantages like low cost, less power consumption, open source development tools, counter in various useful modes, A/D Converters, various communication modes etc. All these features are useful for our system.

Our aim is to develop a system that could be available to the common man at very reasonable rate to make useable paper bags at higher production rate with minimum man power.

DESIGNAND IMPLEMENTATION

System Architecture

The input to automated system is a basic A4-A3 size recycled paper. The input is given with the help to two set of rollers. The rollers are rubber coated allowing the paper to pass properly and smoothly without tearing. For creating some delay two set of infrared sensors are used. Once the paper is in position the buzzer will buzz and the sarp cutter connected on one of the servo motor will cut the paper horizontally. After cutting process, the next gluing process will apply the glue on both the vertical edges of the paper using glue dispensers operated on servo motor. The servo motor are programmed by Arduino board. The glue is applied on the horizontal edge with the help of servo motor. Another set of rollers are assembled to press the paper edges together. The output from the roller is the final paper bag which can be used in daily household chores as well as for packaging purposes.



System Implementation

System consists of four stages namely, the feeding unit, gluing unit and the pasting unit. Every stage performs its operations by using motors and sensors. The input paper proceeds to the succeeding unit with the help of the rollers. The mechanism of the units are as follows:

- *Paper feeder –*

The paper feeder is the basic unit of the machine which feeds two input papers from the paper rolls at a

time through the roller assembly. The assembly consist of an *AC* motor and 4 rollers. The motor consists of a shaft which has gears through which the rollers are controlled. Through the motor the paper is given to the machine.

- *Gluing unit –*

Glue dispenser is used to spread the glue on the vertical edges of the papers, as well as servo motors are used which have a very thin rod connected to them which is used to glue the horizontal edges of the bag.

- *Paper cutting unit –*

The papers which arrive from the paper feeder mechanism are cut after the glue is applied to it. The servo motor is given a certain amount of delay to cut the paper uniformly in horizontal direction. An obstacle sensor is used to check whether the papers have arrived.

- *Pasting unit –*

After the papers are cut, they are passed through rollers which are used for pasting mechanism. After the pasting and pressing, the final output is obtained as a paper bag.

SYSTEM DESIGN

The basic block diagram of the automated paper - bag production system is depicted in fig below

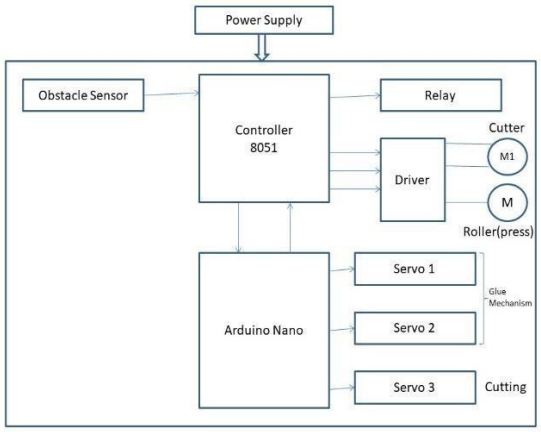


Fig. 1. BLOCK DIAGRAM

The major elements of the system are- microcontroller AT89S51, Arduino Nano, Servo Motors, Dc Motors, 3 sets of Rollers, L293D Driver, Buzzer, Relay and IR Obstacle Sensors.

- Microcontroller (At89S51):

  The microcontroller At89S51 is a low powered, high performance 8bit microcontroller with 4k bytes of on chip memory. The program is written in Kiel using Embedded C and burned in the chip using Flash magic. According to the program and the delay the motors and glue dispensers operate in coordination.

- Arduino Nano:

  The Arduino Nano is a microcontroller board used to control the servo motors in the system. It is controlled by

the main controller i.e. At89S51, it is usually programed using Arduino IDE and uses ATmega328P.

- Servo motors:

  Servo motors are used for the gluing and cutting of the paper. The cutting blade is attached to the shaft of the motor. These motors operate on DC supply from 4V to 12V.

- DC Motors:

  The DC motors are used in the pasting unit and to move the cutting blade in horizontal direction. The motors are operated on direct supply of 12V.

- L293D:

  The motor driver IC is used to control the Dc motors used in the pasting unit. The motor driver is used since the microcontroller cannot operate the motors as the voltage output of the microcontroller is low.

- Buzzer:

  The buzzer is used to give a beep when ever a bag is ready. The buzzer operates on 3V-5V.

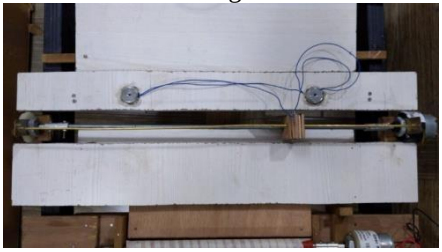
- IR Obstacle Sensors:

  The IR obstacle sensor is used to detect the paper. This is the modulated infrared sensor which senses the obstacle which comes in front of it. This sensor usually operates on 5V DC supply.

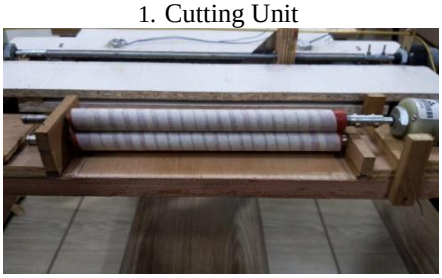
Main Frame of the System

Paper-Feeder Unit

Gluing Unit



1. Cutting Unit

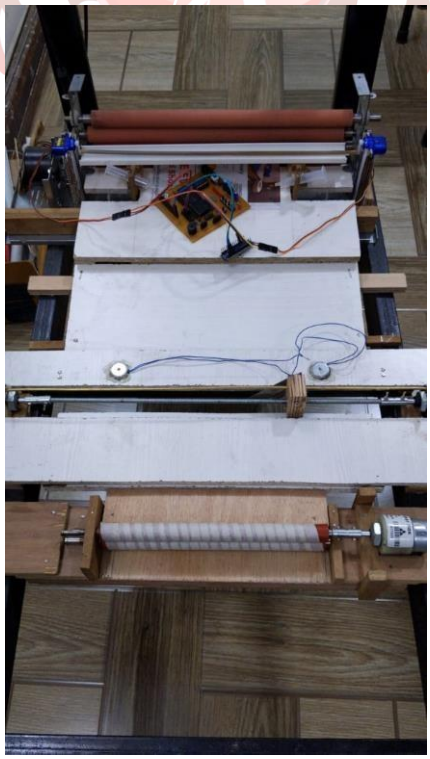


2. Pressing Unit

1. Feeder+Gluing Unit

1. Cutter + Pressing Unit

A. Complete Automated Paper Bag Production System.



RESULTS AND CONCLUSIONS

We provide a system which is fully automated as well as cost effective

- Any layman can setup his own business by simply purchasing our machine because of its ease of operation.
- Small scale industries having lower budgets can purchase our machine to produce paper bags for their packaging.
- Because of the machine being fully automated, the use of manpower is eliminated to its maximum extent.
- The size of the paper bag can be adjusted simply by adjusting the length of the roller.
- The paper of any quality can be used may it be virgin or recycled.
- Because of the automated mechanism and cost effectiveness of the machine, production of the paper bags can be increased by a large degree.

FUTURESCOPE

- The speed of the paper feeder can be increased or decreased by using Dc, Ac or stepper motor according to the requirement. The angular motion of stepper motor can be precisely controlled in a step by applying the pulses of desired width or duration.
- We can use ARM Cortex-A7 instead of Microcontroller 8051 in order to make our system more advanced.
- User can use waterproof paper to increase the quality as well as the life span of the paper bag.

A brand can be given to the paper bag by implementing another unit which can increase the production rate

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