DESIGN AND FABRICATION OF SEMI-AUTOMATED FACSIMILE STAMPING MACHINE

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Abstract: The main objective of this paper is to reduce the timing of higher officials to sign in large number of same documents. Manual signing of documents adds time shortage in Public Work Department. Moreover, the manual process is time consuming and not suitable for signing a greater number of documents. The proposed model involves the arrangement of documents, positioning of facsimile, stamping the facsimile and take out the printed documents to distribute station. Thus, this model signs a greater number of documents within a short time. Pneumatic power is fruitfully utilized in this paper and the system is controlled by an Arduino controller. Positioning of facsimile is done by the lead screw arrangement with the help of sensors. The finished documents are then sucked by vacuum cup and taken out simultaneously. Our real time implementation helps them in unveiling such condition. The paper consists of two sections namely mechanical section and control section. The control section consists of Arduino controller and Relays. Arduino controller is used to control the DC motor and the relays are used to actuate the mechanical sections. The mechanical section consists of lead screw arrangement, pneumatic piston, suction cup and facsimile.

Keywords: Arduino controller, pneumatic piston, lead screw arrangement, facsimile, suction cup.

1. Introduction

Automation was the rage of the engineering world in late 90’s. The best of the minds, reassembled day and night to bring forth improvements of significant magnitude, something which could make an impression in the day-to-day life [1, 2]. Today, its’ a overabundance of fields which have embraced automation, right from manufacturing, to food processing, biomedical and pharmaceutical industries [3]. In such a situation, domestic applications have also been developed with the common man in mind. Of late, processes which were labor-intensive before that they are slowly being converted to semi-automated and mechanized nature [4]. It is always accompanied with a host of intricacies on the part of understanding the process parameters, the methodology to bring in a control element to control it, without any human intervention, the selection of components for that particular application [5].

The living standards of the people in India, has increased significantly over the last decade, prompting a much higher spending capacity [6, 7]. The higher officials are spent their time mostly in signing the document. The manual signing of documents adds on the time wasting one. So, the facsimile is replaced their work [8]. Facsimile is the same as the seal which contains the signature of the person. This facsimile is pretty much used in college principal in signing the certificate and the...
government higher officials. Therein, ascended a need to automate the process of stamping of facsimile in document, and here there is an offer which can aid in easing the load off the people associated with it [9, 10].

The primary objectives of the paper are to control the process using Arduino and to stamp the facsimile automatically without human intervention in reduced time interval and in a hygienic method and to validate the machine for its performance and consistency with real time operations [11].

2. Existing /method of Stamping Facsimile

In the contemporary world, stamping of facsimile is done by manual method which involves the human effort. First of all, the system fully involves the human power. The man also exposed to high work tension and some body pain and after multiple stamping manually, the person involved is affected ergonomically. The precision of stamping becomes tedious in manual method. Therefore, considering all these shortcomings, the idea for a facsimile stamping machine is comprehended.

Figure 1. Manual Method

3. Methodology

3.1. Problem Identification:
Some of the key glitches, which were identified for commencement of this paper are:
- Manual placing of document in the tray.
- No means is there for arranging the document.
- Wastage of time
- No precision in the manual method

3.2. Proposed Methodology
The proposed model involves the arrangement of documents, positioning of facsimile, stamping the facsimile and take out the printed documents to distribute station. Thus, this model signs a greater number of documents within a short time. Pneumatic power is fruitfully utilized in this paper and the system is controlled by an Arduino controller. Positioning of facsimile is done by the lead screw arrangement with the help of sensors. The finished documents are sucked by vacuum cup and taken out simultaneously.

3.3. Economic Feasibility
Employing our solution is more possible in an economic way. The setup which is made up of mild steel and tray made of wood which forms the chief part in the system which is not expensive when compared to the existing system. Arduino controllers and motor driver circuits are voluntarily available in the market at a low-priced rate. DC motors are used for actuation and hence the paper evidences to be cost effective. The total amount sums up to Rs.6,750 and hence it can be financed to bring a abundant result.
Table 1 List of Components

| Sl. NO. | COMPONENTS USED          | QUANTITY |
|--------|--------------------------|----------|
| 1.     | Facsimile                | 1        |
| 2.     | Suction Cup              | 1        |
| 3.     | Wiper motor              | 1        |
| 4.     | Bearing                  | 2        |
| 5.     | Arduino UNO              | 1        |
| 6.     | Cast Iron                | 5 kg     |
| 7.     | Electronic Components    | -        |
| 8.     | Solenoid coil            | 4        |
| 9.     | Pneumatic Cylinders      | 3        |
| 10.    | Proximity sensor         | 1        |

3.4. Operational Feasibility:
Operation of the entire model can be achieved by process of two different sections namely the motor section and the control section. The control section consists of Arduino controller which is used to control the DC motor and relays to actuate the mechanical sections. The DC supply to the motor is nourished by the regulated power supply. The mechanical section consists of lead screw arrangement, pneumatic piston, suction cup and facsimile. In the controlling section, the controller is used to automatically control the temperature of the heater. Arduino controller controls the entire process.

3.5. Technical Feasibility
Technical success of the paper relies upon the work expected from the different section of the paper. When the document id is placed on the tray, the motor section actuates and the punching cylinder that starts the stamping action. Control action can be employed with the help of Arduino controllers and programming of Arduino controller for the stamping and picking. Many software stands are available to program the controllers. DC motor can drive the stirrer and it is technically feasible. The document can be picked up with the help of pneumatic suction cup. Hence, technically also the project can be employed.

4. Overall Design Model

4.1. Design Calculations [1, 5, 6]

**Weight of the system**
- Weight of the tray = 0.250kg
- Weight of the stand = 6.50kg
- Weight of the lead screw = 2.500kg
- Total weight of the system = 9.250kg

**Power Calculation of Motor**

\[ W = \text{Load(N)} \]
\[ \mu = \text{Coefficient of Friction} \]
\[ M_t = \text{Torque (Nm)} \]
\[ D_o = \text{Outer Diameter (mm)} \]
\[ D_i = \text{Inner Diameter (mm)} \]

**Effort**

\[ \text{Effort} = \frac{W (\mu \sec \alpha + \tan \beta)}{(1-\mu \sec \alpha \tan \beta)} \]
\[ = 19.62(0.1533+0.267)/(1-0.1533*0.267) \]
\[ = 8.5922 N-mm \]
Mt = \mu W/4 \cdot (D_o + D_i) \\
= 0.12 \cdot 19.62/4 \cdot (25+20) \\
= 1509.48 \text{N-mm}

**Lead Screw**

Power (kW) = \frac{2 \pi n(M_t)}{60 \cdot 10^6} \\
= 0.00332676

**Speed of the Motor**

Velocity = 0.06 \text{m/s} \\
Diameter of the stirrer = 0.430 \\
V = \pi D_n/60 \\
0.06 = \pi \cdot 0.430 \cdot n/60 \\
n = 45 \text{rpm} \\
Power = 2 \pi^2 n^2 T/60 \\
P = 2 \pi^2 45^2 5/60 \\
P = 20 \text{ Watts}

5. **Fabrication Model and Working Principle**

5.1. **Electrical Setup of The Project**

The electrical system consists of Arduino controller, 12V battery, DC motor and relay module. The entire setup will energize when the main push button switch is pressed. The proximity sensor senses the presence of documents in the tray and sends signal to the Arduino controller. According to the proximity sensor signal, the controller provides actuation signal to the lead screw arrangement, piston and suction cups for mechanical motions by using relay modules.
5.2. Dimensions of Mechanical Apparatus

The total mechanical setup is made up of mild steel. This SS 316 has good corrosion resistance, temperature resistance (up to 870- degree Celsius) and excellent weld ability.

| Table 2 List of Dimensions |
|-----------------------------|
| **Tray Dimension**          |
| Length = 260 mm             |
| Width = 320 mm              |
| Height = 20 mm              |
| **Support Dimension**       |
| Stand = 1000x450x300 mm     |
| **Facsimile Dimensions**   |
| Length = 60 mm              |
| Width = 20 mm               |
| Height = 40 mm              |

5.3. Mechanical Setup of The Project

The mechanical system consists of frame and a lead screw arrangement. The mechanical setup of this project is shown in figure 4.

5.4. Working Principle

This paper consists of three parts namely mechanical, pneumatic and control system. The mechanical system consists of frame and a lead screw arrangement. The pneumatic system consists of single acting piston, double acting piston, suction cup, 5/2 directional valve, pneumatic hoses and FRL unit. The electrical system consists of Arduino controller, 12V battery, DC motor and relay module. The system put together to perform the stamping process.

Firstly, placing the documents in the tray and then positioning of facsimile on its point by using lead screw arrangement. Punching cylinder is used to push down the arrangement. Then the suction head moves above the document and pick and place into the second tray (Sealing process). Then the counter counts the documents to be sealed. This operation continuous for a predetermined period.

6. Conclusion & Future Scope

6.1. Conclusion

Thus, semi-Automatic facsimile stamping machine is used to automate the facsimile stamping process without the much human intervention. Compared to the manual method of stamping it offers high level of accuracy and also time consuming. By this idea higher officials can reduce the effort and time that is need for the signing the document is also greatly reduced. The facsimile stamping machine
proves to be applicable predominantly in academic institutions and government offices.

6.2. Future scope
In this paper, only single facsimile for stamping is used. This can be replaced by adding few more facsimile which can be a same machine used for different process. And also, one can replace the proximity sensor with the image processing camera which is helpful in placing of facsimile in the required place.

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