Design and Fabrication of Automated Paper Punching Machine

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Abstract - *There is a lot of paper work that needs to be arranged into files and folders in various institutions, offices and industries. For this to be achieved, holes have to be made in paper using a punching machine. Employees in most offices and institutions usually share manual paper punching machines. Automated paper punching machines are a solution but existing brands are too costly for the working class in this nation.*

Paper punching is a tedious task and requires a lot of human effort. This leads to a lot of fatigue among workers especially those working in paper centric departments of institutions and offices. Punching multiple papers at a time requires a lot of energy as well as time when done manually. Plus, the existing automated paper punching machines are too costly to attain. The existing automated paper punching machines can be commonly found in high end offices and industries that manufacture stationary such as calendars and notebooks.

1. INTRODUCTION

Paper is a thin material produced from natural (or very rarely artificial) fibers, pressed together into solid structure after they were loosened in a hot water. This recipe was established more than 2000 years ago in Ancient China, and from that time it changed very little, only being enhanced by occasional advances of chemistry which caused creation of countless variations of paper types. Today, we are using paper all around us, and not only to write or paint on it, but also as a widely versatile material that can be used almost anywhere. Mostly used in organizations such as schools, offices.

Printing, scanning and other paper-based activities are alive and well in the corporate office. While there's been a shift away from the gargantuan multi-function device for some companies, mostly because employees prefer to stay in their work-pods, we're still relianton paper for our daily routines, according to a study by Wakefield Research and Info trends.

"Paper is portable, universal and familiar way to share and annotate documents," says Weilerstein. "It is easier to read long documents on paper than on-screen. Paper is universally accepted as valid for contracts and other legal documents, and the signatures are familiar and accepted to a greater degree than any sort of digital signature."

Keith Kmetz, program vice president for imaging, printing and document solutions at IDC, says that many companies have implemented a "paperless light" concept. It means, almostall internal processes are entirely paperless, but external processes still involve printing and scanning as a way to integrate into a digital storage system.

Another trend that Brother's Sandler points out is that the rise of mobile devices like smartphones and tablets has made larger companies more dependent on printing and scanning, not less.

2. Literature Survey

Rajshree Sahu
Abstract
The Auto roll punching machine is made of the Motor, driven wheel, punch and dc motor through which the feed is given to the work piece. When the AC motor starts the punch reciprocates as the rotary motion is converted into reciprocating motion.
Key words: Motor Driving wheel.

Sree Rajendra and Vijay vithal Bangale
Abstract
The proposed work describes the design and fabrication of prototype of automatic punching machine controlled by PLC and shedding light on the working principle and the hardware structure of the system. Punching or pressing process is one of the most important and necessary processing step in sheet metal industry. By automating this process one can have a greater control over the process.

Jinan China
Abstract
During sheet metal processing, the price of the mechanical punch is cheap, but its noise is too big, the price of CNC punch is too expensive, so it isn't suitable for small and medium-sized manufacturers as well. A kind of hydraulic punch which has convenient operation and low price is developed. And design process of mechanical part, X axis and Y axis blocking material design hydraulic system and electrical system are introduced in the paper.
Keywords: sheet metal processing, mechanical punch, hydraulic punch, punch design

4. OBJECTIVE

1) The aim of this project is to design and fabricate an automated paper punchingmachine
2) To determine functional requirements and specifications of the automated paperpunching machine.
3) To develop a preliminary and detailed design of the automated paper punching machine.
4) To reduce human effort
5) To reduce time of work operation

3. TECHNOLOGY AND HARDWARE IN PROJECT

A. MICROCONTROLLER: -

Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible.
The hardware consists of a simple open-source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a bootloader that executes on the microcontroller.

Fig. 1 ATMEGA328 microcontroller

In its simplest form, an Arduino is a tiny computer that you can program to process inputs and outputs going into and from the chip. The Arduino is what is known as a Physical or Embedded Computing platform, which means that it is an interactive system, that through the use of hardware and software can interact with it'senvironment. For example, a simple use of the Arduino would be to turn a light on for a set period of time, let's say 30 seconds, after a buttonhas been pressed (we will build this very same project later in the book). In this example, the Arduino would have a lamp connected to it as well as a button. The Arduino would sit patientlywaiting for the button to be pressed. When you press the button, it would then turn the lamp onand start counting. Once it had counted 30 seconds it would then turn the lamp off and then carry on sitting there waiting for another button press. You could use this set-up to control a lamp in an under-stair's cupboard for example. You could extend this example to sense when the cupboard door was opened and automatically turn the light on, turning it off after a set period of time.

B. 5V SINGLE-CHANNEL RELAY MODULE: -

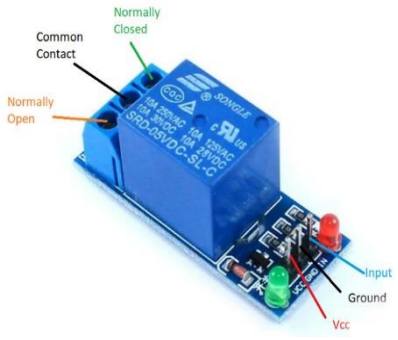


Fig. 2 5V Single-Channel Relay Module

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

Single-Channel Relay Module Pin Description

Pin Number	Pin Name	Description
1	Relay Trigger	Input to activate the relay
2	Ground	0V reference
3	VCC	Supply input for powering the relay coil

4.Single-Channel Relay Module Specifications

- Supply voltage – 3.75V to 6V
- Quiescent current: 2mA
- Current when the relay is active: ~70mA
- Relay maximum contact voltage – 250VAC or 30VDC
- Relay maximum current – 10A

C. Wiper Motor: -

A **Wiper motor** is any of a class of rotary electrical machines that converts directcurrent electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications

Fig. 3 Wiper motor

D. IR Sensor: -

An infrared point sensor is a point gas detector based on the non-dispersive infrared sensor technology. In the electromagnetic spectrum, the infrared portion divided into three regions: near infrared region, mid infrared region and far infrared region. IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

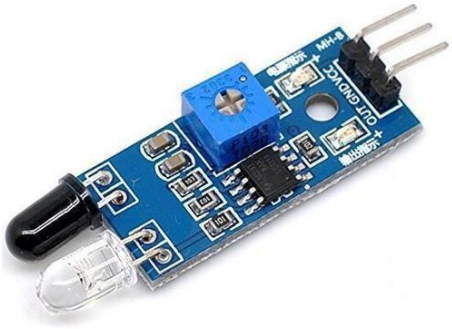
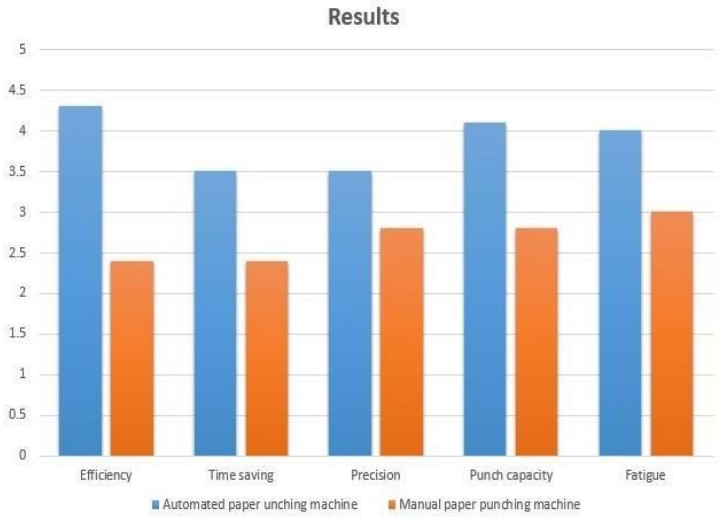
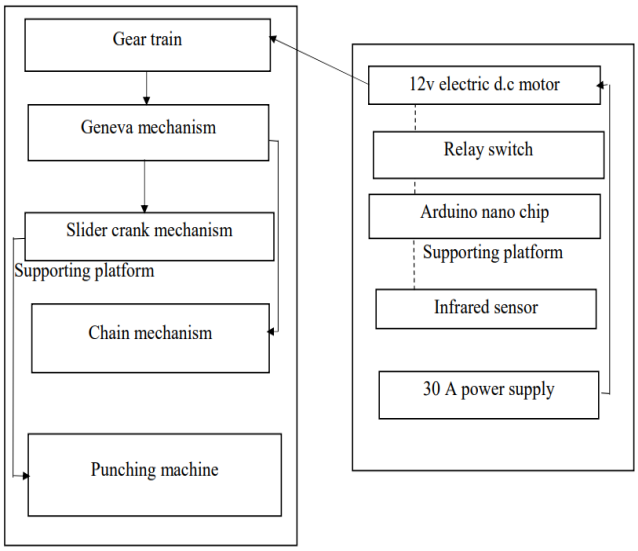


Fig.4 IR Sensor



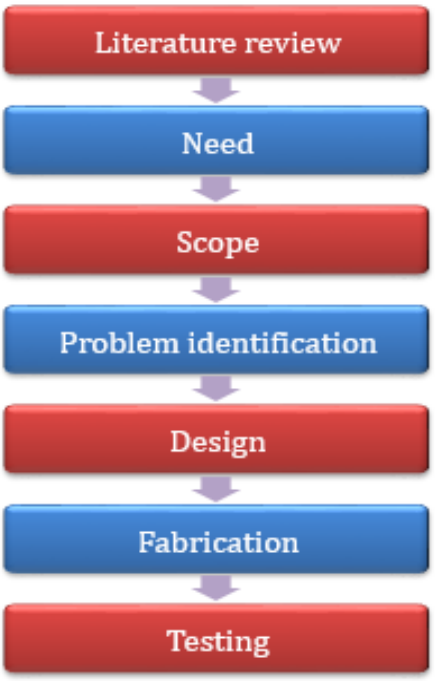
3.SCHEMATIC OF THE AUTOMATED PAPER PUNCHING MACHINE.



5.RESULTS & DISCUSSIONS

The various type of punching machines are used for punching the material. This is also one of the automatic job feeding and punching which is now operated through the Geneva mechanism. The operation and mechanism of this unit and its function have beenstudied. At the end, the machine is assembled. This machine is more advantages of other types of punching machines since it hasmore easier to operate comfortable automatic job feeding arrangement and also less time consumption, easy handling etc. However, much as the automated paper punching machine designed was able to meet the primary design requirements of time-efficiency and affordability, there is still room for improvement especially in the functionality of the punching tool.

6. METHODOLOGY



7. DESIGN OF CAD MODEL

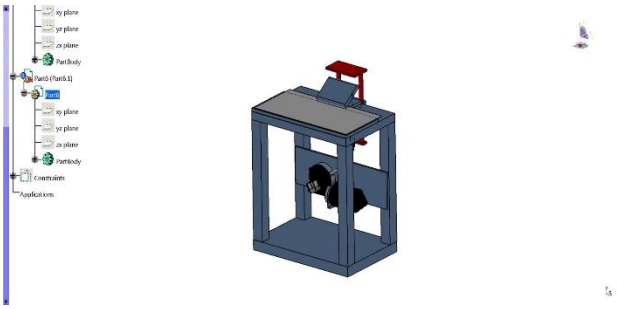


Fig. 5 CAD Model

8. ASSEMBLY OF THE PHYSICAL PROTOTYPE.

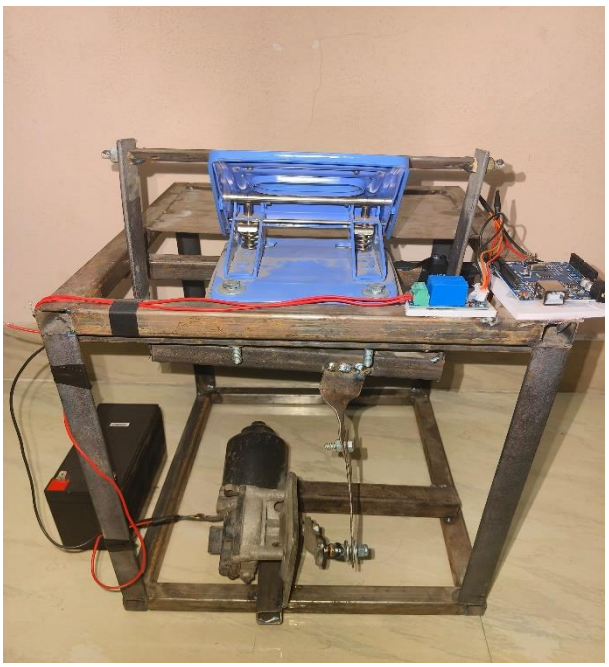


Fig.6 Hardware

9. FUTURE SCOPE AND CONCLUSION

An automated paper punching machines a mechanical device designed to punch holes insheets of paper with precision and speed. It is commonly used in offices, print shops, andbinding services. The machine operates automatically, meaning it can punch a large number of sheets in a short amount of time, saving manual effort. Users can usually adjust the punching pattern, hole size, and position according to their specific requirements. Automated paper punching machines are efficient, reliable, and improve productivity in tasks involving hole-punched documents.

The functional and design specifications of the automated paper punching machine were determined from customer needs analysis. Hence confirm the need for the machine, what and how it will perform the task. The preliminary design and detailed design of the automated paper punching machine was established basing on the functional requirements and design specifications.

The automated paper punching machine was built and upon testing was able to perform the required task. It also revealed that if unit cost of the automated paper punching machine is below UGX 25,000,000 it would be more affordable than existing systems. However, much as the automated paper punching machine designed was able to meet the primary design requirements of time-efficiency and affordability, there is still room for improvement especially in the functionality of the punching tool. Once the necessary improvements are met, this is a suitable solution to the problem raised in the problem statement.

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