# AUTOMATIC PAPER CUTTING AND COUNTING MACHINE

Syed Tajuddin V[1], Irfan Hamid Darzi U[2], Dr. S Jagadeesha [3],Prathibha Kiran [4] .

*[1] Student, Electronics and Communication Dept., AMCEC, Karnataka, India*
*[2] Student, Electronics and Communication Dept., AMCEC, Karnataka, India*
*[3] Professor, Electronics and Communication Dept., AMCEC, Karnataka, India*
*[4] Professor, Electronics and Communication Dept., AMCEC, Karnataka, India*

## ABSTRACT

*This Research Article Articulates design and development of Smart Automatic paper cutting machine implemented in use for institutions for cutting and counting question papers. Paper is one of the majorly used material in our day to day activities in taking information's down necessary information's, it is very important that there is a machine that can handle it at a domestic level to give the desired form for various use. The machine is made up of a motor, an Arduino board, plastic materials, blade, and belt. The machine also uses code which is programmed on the Arduino board which helps to set the length of cut and the slider which holds the blade slides to cut the paper. The machine is tested and the output is evaluated.*

**Keyword : -** *Smart Cutting Machine, Automated Counting Machine ,Sensors, Arduino UNO, Motors.*

## 1. INTRODUCTION:-

For counting of papers in academic institutions or in industries or wherever the usage of papers & documentation is high, there are no feasible machines or devices available for saving valuable time. The manual counting may result some error and costs time. Maintaining of databases in documentation area is difficult. Some of the available machines are high in cost and suitable mainly for heavy usages. The available machines also involve complex mechanisms. So that it is proposed to design a cost effective simple paper counting machine using simple mechanical & electronics systems. The design is mainly focused on cost effectiveness and for light to medium usages. It is also suitable for multiple usages and applications [1]. The introduced machine should be portable, effective, efficient and it should adopt to innovations to be made in future. A market survey states that major problem faced by reprographies, stationary shops, documentation sectors are counting and collecting of papers. An average of 1 to 50 papers become a easy task whereas more than 50 becomes a challenging one. So, the introduced machine will be more feasible for their problem.

An automatic paper cutting and counting machine is a type of machine used to accurately cut and count paper sheets. It is commonly used in printing and paper industries to increase productivity and efficiency. The machine works by feeding stacks of paper into the machine, where it is then cut into individual sheets according to the desired specifications.

One of the key advantages of using an automatic paper cutting and counting machine is that it saves a considerable amount of time and effort [2]. The machine is capable of cutting and counting large stacks of paper in a fraction of the time it would take a human operator to do the same task manually. This makes it an ideal solution for companies that need to process large volumes of paper on a regular basis.

In addition to its speed and accuracy, an automatic paper cutting and counting machine is also highly customizable. Operators can program the machine to cut paper sheets to specific sizes and shapes, making it suitable for a wide range of applications. This versatility makes it an essential tool for businesses that require precise and consistent paper cutting and counting.

Overall, an automatic paper cutting and counting machine is an indispensable tool for any business that needs to process large volumes of paper quickly and accurately. It can help companies save time and increase efficiency, ultimately leading to greater profitability and success.


## 2. METHODOLOGY:-

This project is centered on the design and fabrication of an Automatic paper cutting machine making use of some locally found materials. Paper is one of the majorly used material in our day-to-day activities in taking information's down necessary information's, it is very important that there is a machine that can handle it at a domestic level to give the desired form for various use [3]. The machine is made up of a motor, an Auridon board, plastic materials, blade, and belt. The machine also uses code which is programmed on the Arduino board which helps to set the length of cut and the slider which holds the blade slides to cut the paper. The machine is tested and the output is evaluated. For cutting papers to precise dimensions, the design and construction of a paper cutting machine based on the mechanism is advantageous. The wheel is an arrangement device that changes continuous motion to intermittent motion, allowing paper to be delivered at uniform intervals between cutting phases. A crank and lever mechanism is then used to slice the paper. The idea of this concept is to design a mechanism that drives paper cutter that reduces the amount of hour specified for paper marking and also aids in the of equal-sized paper in each revolving. It saves time due to its automated operation [4]. This machine is useful in the paper manufacturing sector since it eliminates human errors. It can also be used in schools, colleges, stationary stores, and paper stores, industries etc.


### 2.1 MODULE EXPLANATION:-

A.   Acrylic sheets
The medium impact acrylic sheet is selected as a base material of the machine. The vertical plates and bottom plate are made using sheets of thickness 10 mm. The Electronic unit cover, Top cover are made using thickness of 4 mm. The material is easily available in variety of colours, thickness and transparency which is also compact in weight and effective in cost.


B.   Frame
The Frame used is easily available aluminium frame with a square section of 30 X 30 mm. The frame is chosen as it is most feasible for mechanical mountings, light weight and low cost. The frame part joins the bottom and vertical plates, collecting and feeding tray.


C.   Sheetmetal
The Collecting tray and feeding tray of this machine is made using Sheetmetal. The glass fibre may be effective in some cases as surface finish is helpful for smooth flow of papers. But, as the machine is  cost effective and  easily portable,  the best  choice is Sheetmetal. The Sheetmetal used has a thickness of 1.5 mm.


D.   Arduino
The Electronic controller used in the machine is Arduino UNO R3 board. The board acts as a controller which controls the DC Motor and IR Sensor. The inputs such as IR signals and outputs such as Motor control and LED Display count are processed in this board. The board is feasible in cost and the electronic connections are easy.


E.   DC Motor
Three DC Motors controls the feeding, flowing and collecting of papers. The motors are connected with the Arduino with the help of drivers. The motors consume low power and provides enough torque. The motors used are 12 V DC with a speed of 150 RPM. F Motor Driver The electronic power voltage fluctuation may burn out the Arduino. So, to overcome this effect and to provide better electronic connection, a motor driver module is used here. In this machine, the module used is L293D chipset. There are two Motor driver modules used here.


G.  IR Sensor
The main objective of the machine which is counting is obtained by the use of Infrared (IR) Sensor. The sensor is very low in cost.
It is easily connectable with the Arduino and high efficiency in object detection.

H.   LED Display
The outcome of this machine is recorded by the use of 8 segment LED Display connected with the Arduino.

I.      Belt Drive
As the End part of the flowing process of papers requires more precise separation so that the detection and counting process becomes more efficient. The end part which has two rollers rotating in opposite directions is connected through a belt driven pulley. The belt is Rubber made.

J.      Rollers
There are three different sized rollers in this machine which acts as a mechanism for separation and smooth flow of papers. The Rollers are Connected with the motors through Shafts and bearings. The rollers are made up of ABS Plastic as it is very light weight and has smooth surface finish which does not do damages for the paper.

K.   Bearings
The bearings ensure the smooth rotation of the shafts in this machine. This also mounts the shafts and motors with the vertical plates of the machine. Two different sized bearings are used with Inner diameter of 10, 6 mm and outer diameter of 30,19 mm respectively.

## 3.  IMPLEMENTATION :-
Implementing an automatic paper cutter and counting machine can be a complex project that involves multiple components such as sensors, motors, and control systems.

Before starting the implementation, it is essential to define the requirements of the project. This includes the types of paper to be cut, the size of the paper, the cutting precision required, and the number of papers to be counted, among others. Based on the requirements, select the necessary hardware components such as sensors, motors, and control boards. For instance, you may use a stepper motor for the cutting mechanism, optical sensors to detect the paper, and a microcontroller to control the overall system. Design the mechanical system to hold and feed the paper to the cutting mechanism. It should be able to handle different sizes and types of paper [5].

Write the code for the microcontroller to control the motors, sensors, and other components. The code should be able to detect the paper, cut it precisely, and count the number of papers cut. Test the system to ensure it works as expected. Make necessary adjustments to improve the cutting precision, paper handling, and counting accuracy.

Implementation of automatic paper cutting and counting machine is described in fig 3.1,



Fig 3.1 Structure of Paper Cutting and Counting Machine

### 3.1 MECHANISM :-

The machine works on the basic objective which is obtained by the use of two processes explained below.

A.    Counting Mechanism

The Papers are initially fed on the feeding tray. Then the Machine is Reset and the Papers are flown through the tray and each single sheet is separated and the IR sensor detects the flow and the flow is counted and it is displayed in the LED display.
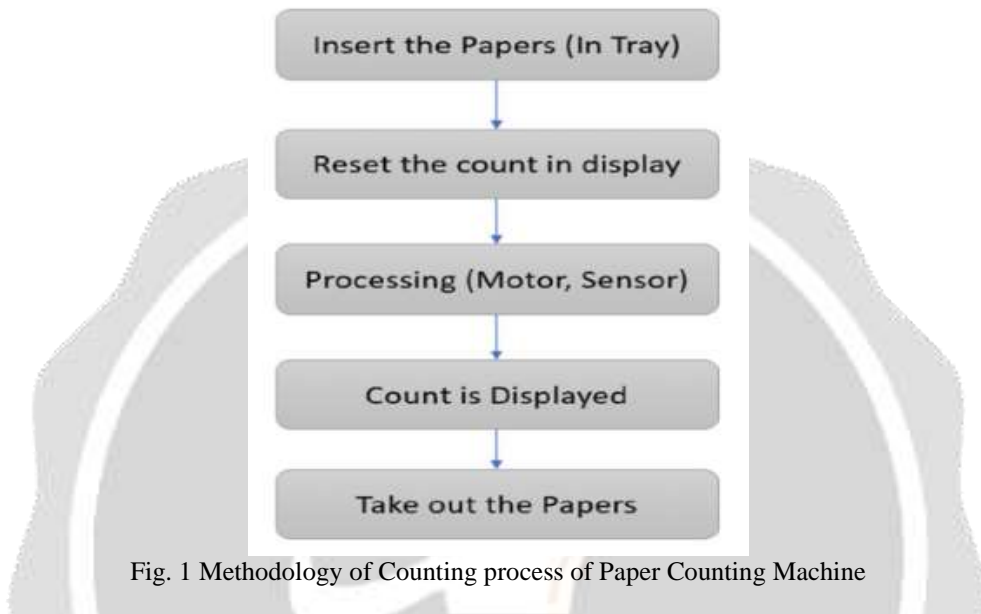


Fig. 1 Methodology of Counting process of Paper Counting Machine

B.    Collecting Mechanism

The other process is collecting of papers. Initially the paper is fed in the feeding tray and the required number of papers are set with the help of Arduino and the papers will get  separated and counted with the above counting procedure.  When the set number of papers are collected, the machine will stop.
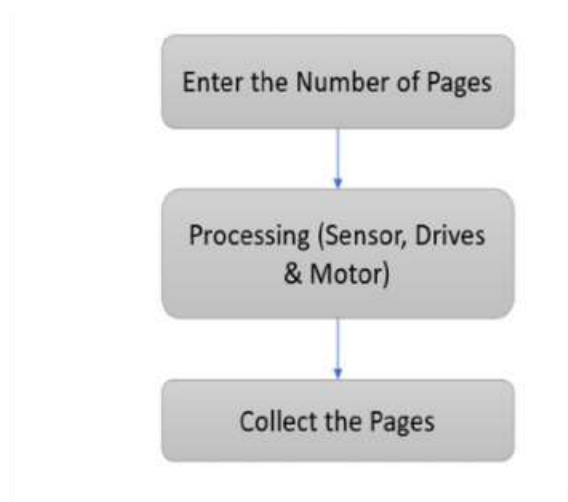


Fig. 2 Methodology of Collecting process of Paper Counting Machine

C.   Working Methodology

The machine consists of mechanical components such as Motors, Rollers, Acrylic sheets, Sheetmetal, Shafts, bearings, nuts, bolts, frames, clamps, screws. And the electronic components are Infrared sensor, Arduino board, breadboard, L293D chipsets, wires, battery and LED display. Initially the paper bundle is fed in the feeding tray of the machine, then after resetting the Arduino the motors starts and the first roller which is a tyre like in both the ends starts pulling the papers and the separation of papers starts here [6].

For more efficiency there is a roller in middle part which is also pulls the paper to the end part. The first and middle roller and controlled by individual motors connected with Arduino with single motor driver. The end part has two rollers because of more requirement of precise separation of paper which is controlled by a single motor and a motor driver.

The two rollers rotate in opposite direction which is obtained by using a belt pulley drive. Then the paper is flown and the Infrared sensor detects and the count is displayed in the LED display. The process is repeated.
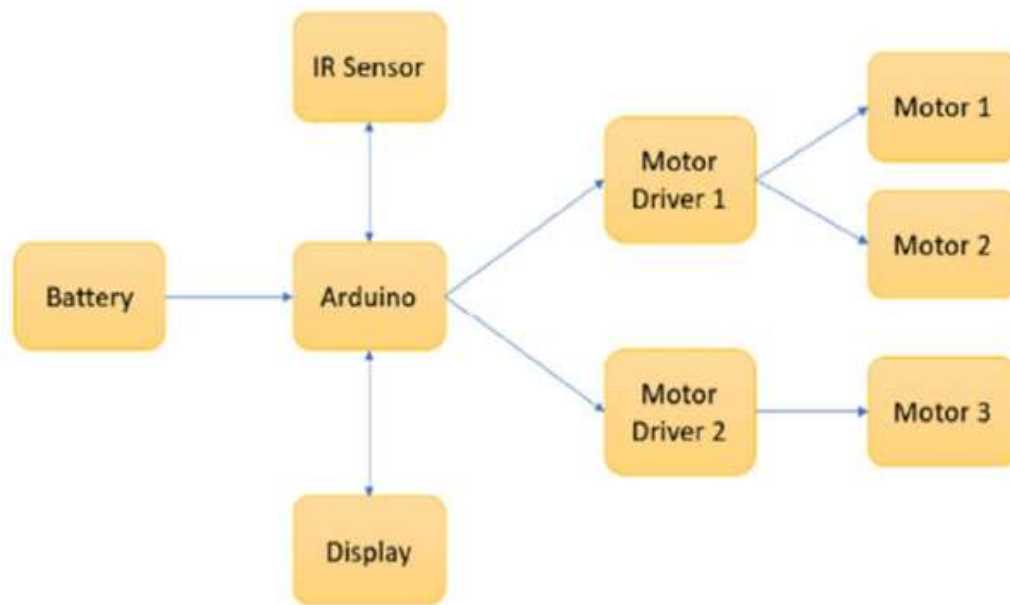


Fig. 3 Electrical connections of Paper Counting Machine

**3.2 ALGORITHM :-**

1. Initialize the system and set the desired cutting length and number of papers to cut.
2. Wait for the paper to be inserted into the system.
3. Use optical sensors to detect the paper's edges and calculate the paper's length.
4. If the paper's length is longer than the desired cutting length, activate the cutting mechanism to cut the paper.
5. Update the paper count and check if the desired number of papers have been cut.
6. If the desired number of papers have not been cut, repeat steps 2-5. If the desired number of papers have been cut, end the process.
7. If the system encounters an error, such as a jammed paper or a malfunctioning component, stop the process and notify the user.

## 4.  RESULTS AND DISCUSSION :-

➢ The machine is designed and fabricated with electro-mechanical systems at very low cost. This machine is portable and affordable.  The machine is mainly suitable for low to medium usages in offices, accounts section, stationery shops, Reprographies etc., This machine is also maintenance free. It also occupies less space only. Setting the allowance between the roller and the tray is the difficult task, as it leads to improper separation of papers.

➢ The output expected in this machine is to reduce the human power and the time taken to count the papers in industries and in educational institutes and it is achieved. Further improvements like increasing the capacity of papers in the tray can be made by incorporating additional rollers.

## 5. CONCLUSIONS :-

In conclusion, the number plate detection and pollution measurement project has shown promising results in its ability to accurately detect and recognize license plates from images or video feeds, as well as measure the level of pollution emitted by vehicles on the road.

This project has important applications in traffic management, environmental protection, and law enforcement. By detecting and tracking license plates, traffic authorities can identify traffic violations and enforce traffic regulations more effectively. Moreover, by measuring the pollution levels of vehicles, authorities can take steps to reduce harmful emissions and promote cleaner air [7].

Overall, this project has demonstrated the potential of technology to solve complex social and environmental problems. As such, it represents a valuable contribution to the fields of computer vision, environmental science, and transportation engineering. With further development and refinement, this project has the potential to make a significant impact on society by promoting cleaner, safer, and more efficient transportation systems.

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