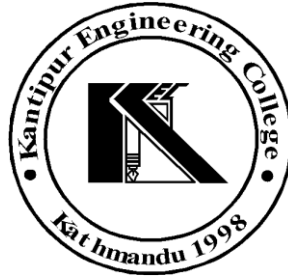


**TRIBHUVAN UNIVERSITY  
IOE  
KANTIPUR ENGINEERING COLLEGE  
DHAPAKHEL, LALITPUR, NEPAL**



**A CASE STUDY REPORT  
ON  
INSTRUMENTATION II  
BASED ON  
CURRENT PROCESS AND CONTROL SYSTEM  
AT  
SAKUN COPY INDUSTRY  
THECHO, LALITPUR  
NEPAL**

**SUBMITTED TO  
DEPARTMENT OF COMPUTER AND ELECTRONICS ENGINEERING**

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Finally, we wish to record our appreciation to our classmates and other friends, directly or indirectly involved, for their co-operation in this case study.

## **ABSTRACT**

As directed by the syllabus of IOE, Pulchowk, we were made clear the objectives of the case study. Hence, we formed a group of three members and chose Sakun Copy Industry located at Thecho, Lalitpur for studying the current process and control system and eventually modifying the system to full automation.

Though we claim this age to be the era of computer, we are still practicing the teaching-learning process through writing which require copies. From the very past, copies have been continuously used for writing as a memory device allowing us for future references. Hence, we preferred Sakun Copy Industry that has been working in this field for past 20 years.

In this report, we have described the existing process on how a copy is made in the industry. It includes the purchasing of blank papers, processing in the rolling machine for creating lines, folding the paper, stitching, cutting and finally finishing and packing. The prevalent control system in the Copy industry we visited is not fully automatic. About 60% of the total work needs to be done by people compulsorily. We have also depicted the problems being faced by the industry in present situation. A slight mistake in feeding the paper to rolling machine causes damage of paper and also needs proper handling of other machines to prevent any damage. Therefore, we have proposed an improvised system that would reduce the human labor to great extent and make the system control automatic that would surely need much installation charge and offering the industry's rapid progress and profit at long run.

Thus, considering the above mentioned facts, it can be summarized that the modification of existing system to full automatic system guarantees very less damage and more profit above all.

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# **1 INTRODUCTION**

Sakun Copy Industry was established in 2049 B.S. with the primary objective of fulfilling the demand for copies. It is located in Thecho VDC, Lalitpur district. Almost 90% of the total students in Thecho use Sakun products for their study. It is one of the copy industries that have been gripping the market continuously for past 20 years. It is well known in the market for the manufacture of quality exercise books, register files, spiral pads, loose sheets etc. The most convincing factor why one should be using Sakun products is that we can order for copy of any size with required number of pages and cover page as per our choice.

Sakun Copy Industry has few modern technology instruments and automated machine that made the case study easier.

## **2 OBJECTIVES OF THE INDUSTRY**

- To meet the demand for exercise books at fair price
- To satisfy the consumers in both qualitative and quantitative aspects
- To manufacture copies in different size, pages and line colors as per market
- To help the rays of education spread by producing the study related materials
- To provide employment opportunities to local people

## **3 PROCESSING METHOD**

### **3.1 Manufacture of Large-Sized Copy**

#### **3.1.1 Purchase of blank sheets**

The very first thing that the Sakun Copy Industry does is the purchase of blank sheets. The blank sheets in the size of 18\*22 square inches are purchased from Baba Trading Company in quantity as per the market demand for copies. Basically there are two qualities of sheets: one that of 60 gm and the other 48 gm per sheet.

#### **3.1.2 Processing in the rolling machine**

The most important work during exercise books manufacture is the drawing of lines over the blank paper. As per the preference of the consumers, first it is decided which color is to be used for creation of lines. Then threads are adjusted in the required positions to create the lines. Generally, 2.5cm gap is maintained on the top and 1.7cm to 1.8cm gap is maintained between the lines. The purchased blank sheet can be made into two paper sheets each of size 9\*11 square inches. So, a mixture of red ink and water is fed to two threads to create the horizontal border lines and rest of the threads are supplied with blue, black or green colors along with water to create horizontal lines in accordance with the customer's choice. A bundle of blank sheets are placed on the rolling machine and only a single paper is to be fed at once to the rolling machine continuously by the worker. The paper with lines created on a single side is collected by another worker and properly bundled so that it can again be supplied to the rolling machine for repeating the same process on the next side of the sheet. If the vertical border is to be created on the left side of the sheet, the sheet is again processed in the rolling machine with a single thread for creating red border.





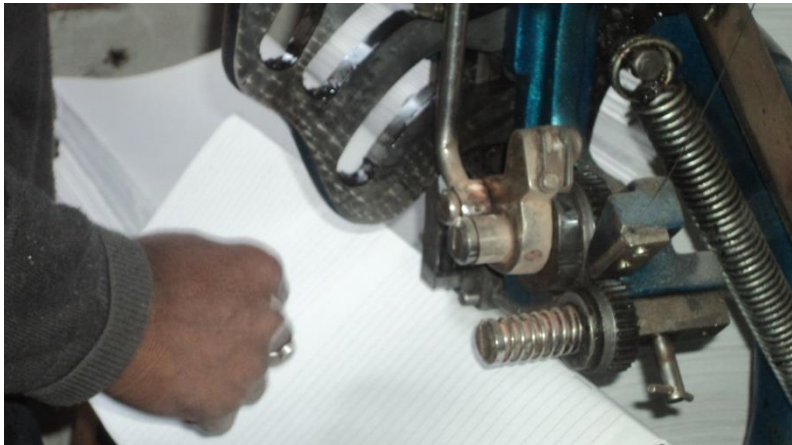
**Figure 3.1** Processing in the rolling machine

### **3.1.3 Paper counting and folding**

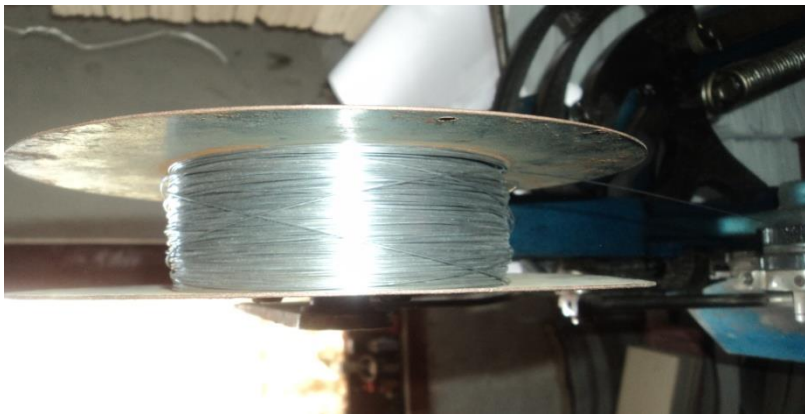
After the creation of lines on the blank sheets, the numbers of papers required per copy are counted manually. Usually, each copy contains 33 to 34 sheets of paper. Then, the counted papers are folded vertically about the mid-point of the sheet. This task is accompanied by cover fitting side by side. Sakun Copy Industry uses the cover designed at Variety Printing Press, Kalimati.

### **3.1.4 Stapling the copies at stapling machine**

The cover fitting in the folded paper is followed by stapling. For this, the folded papers are carried towards the stitching machine. Each folded bundle is stitched at four places; 2 per copy. The staples used are not of ordinary type instead the stitching roll is used.



**Figure 3.2** Stapling copies



**Figure 3.3** The stitching roll

### **3.1.5 Cutting in size and finishing**

After stapling, the copies are taken towards the cutting machine where the bundle of folded papers are cut horizontally into two equal halves thus forming two copies per folded bundle of sheets. The folded sheets are kept on the cutting machine by the worker and the cutter is adjusted in such a way that the non-uniformly extended sheets can be cut sideways. At a time, about 4 dozens of copies are cut properly in the required directions. In this way, copy is prepared and then packed. Generally, gross packing is done in boxes which are purchased from Baba Trading Company and hence ready to be supplied to the market.



**Figure 3.4** Cutting the copies to size

### **3.2 Manufacture of Small-Sized Exercise Books**

The manufacture of small-sized copy is exactly similar to the large ones. Only difference is that the blank sheets purchased for this purpose is 14\*21 square inches size.

### **3.3 Manufacture of Register Files**

For the manufacture of register file, the blank sheets purchased are double the size of sheet to be used in the register file. The sheets are then processed through rolling machine twice for making lines on either side of the sheet. The lined sheets are then counted and folded vertically to place on the cutting machine to give the uniform size to all sheets. The register files are not stapled instead they are sewed manually and then fitted with the cover. The covers designed at Variety Printing Press for files are thicker and binding cloth is used along with glue to fit the cover.

### **3.4 Manufacture of Spiral Pads**

Alike the manufacture of register files, the sheets double the size of sheet to be used in spiral pads are lined in rolling machine. The sheets are then counted and covered to take to cutting machine. The arranged sheets are cut into two equal halves and then punched in punching machine in order to fit the spring into the punched holes.



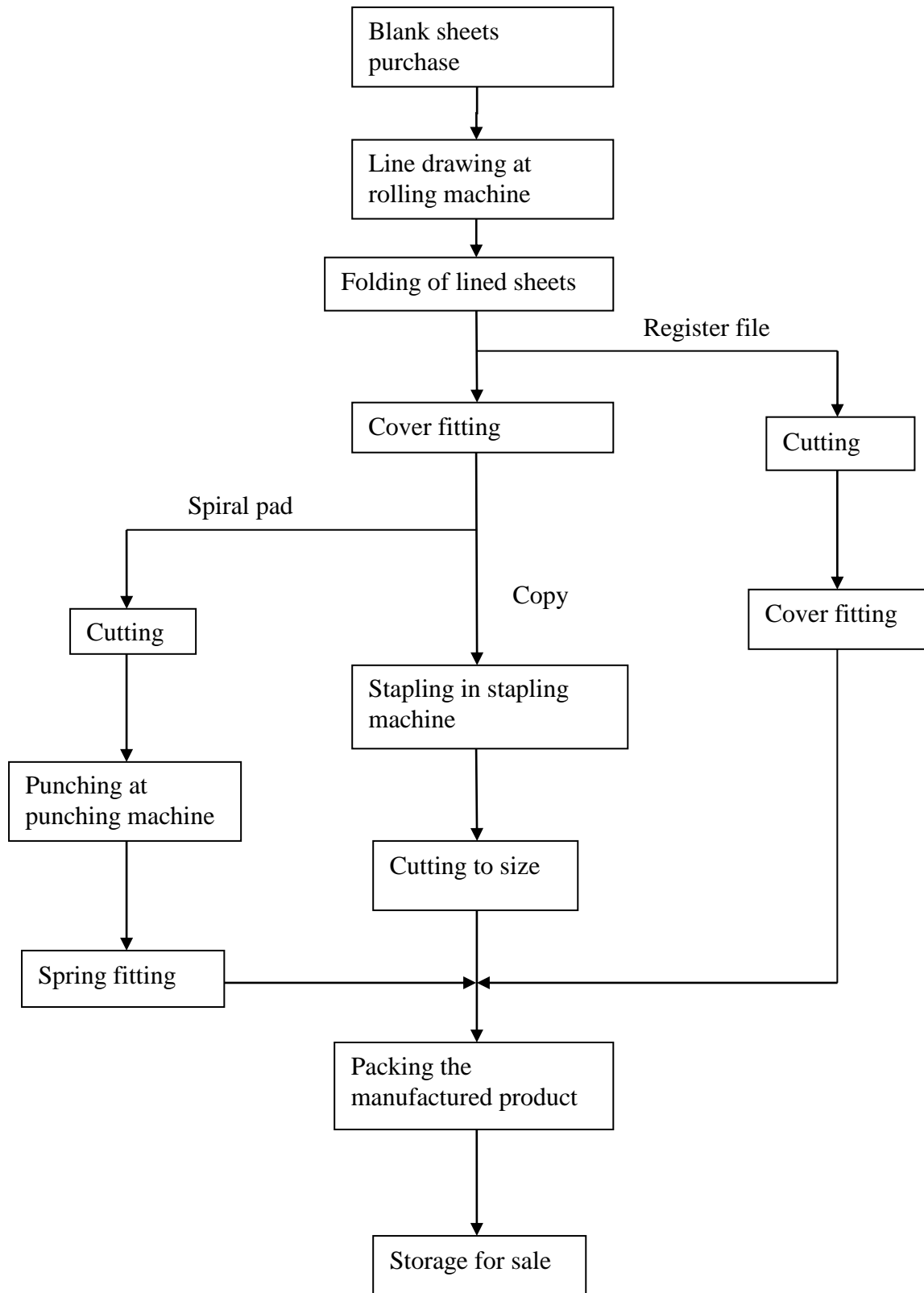
**Figure 3.5** The punching machine

## **4 DESCRIPTIONS AND ANALYSIS OF CURRENT SYSTEM**

The machines that are being used currently in Sakun Copy Industry are all manually operated. The rolling machine needs supply of ink at regular intervals and also the sheets of paper are to be shifted towards the roller one by one pushing one at the top of bundle of sheets. The sheets after being lined are collected manually. Folding, sewing and cover fittings are entirely manual works. Also the stapling machine, cutting machine and the punching machine are manually operated.

Present system is completely manual and is operated only in the presence of workers under strict supervision. Operating status of existing system can be summarized as:

- Chances of sheet being blank even after processing through rolling machine due to lack of timely ink supply
- Damage of paper when sheets are not properly fed and also when not collected from the bottom of rolling machine at time
- Stitching and punching machines are handled manually
- A slight mistake in positioning the copies at the cutting machine causes great loss.



**Figure 4.1** Overall Layout of the Existing System

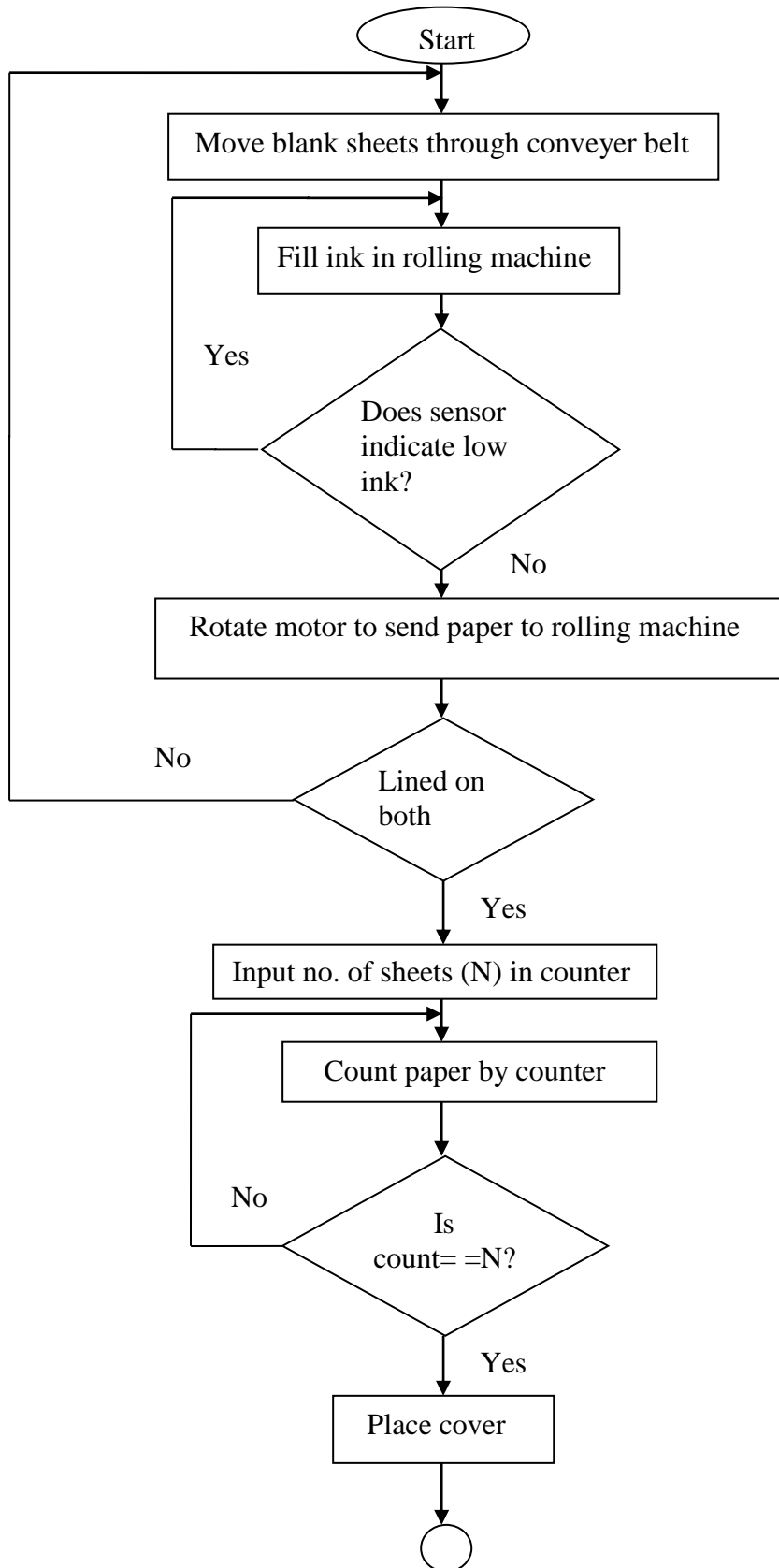
## **5 PROPOSED IMPROVEMENT TO THE SYSTEM**

### **5.1 Analysis and Descriptions of Proposed System**

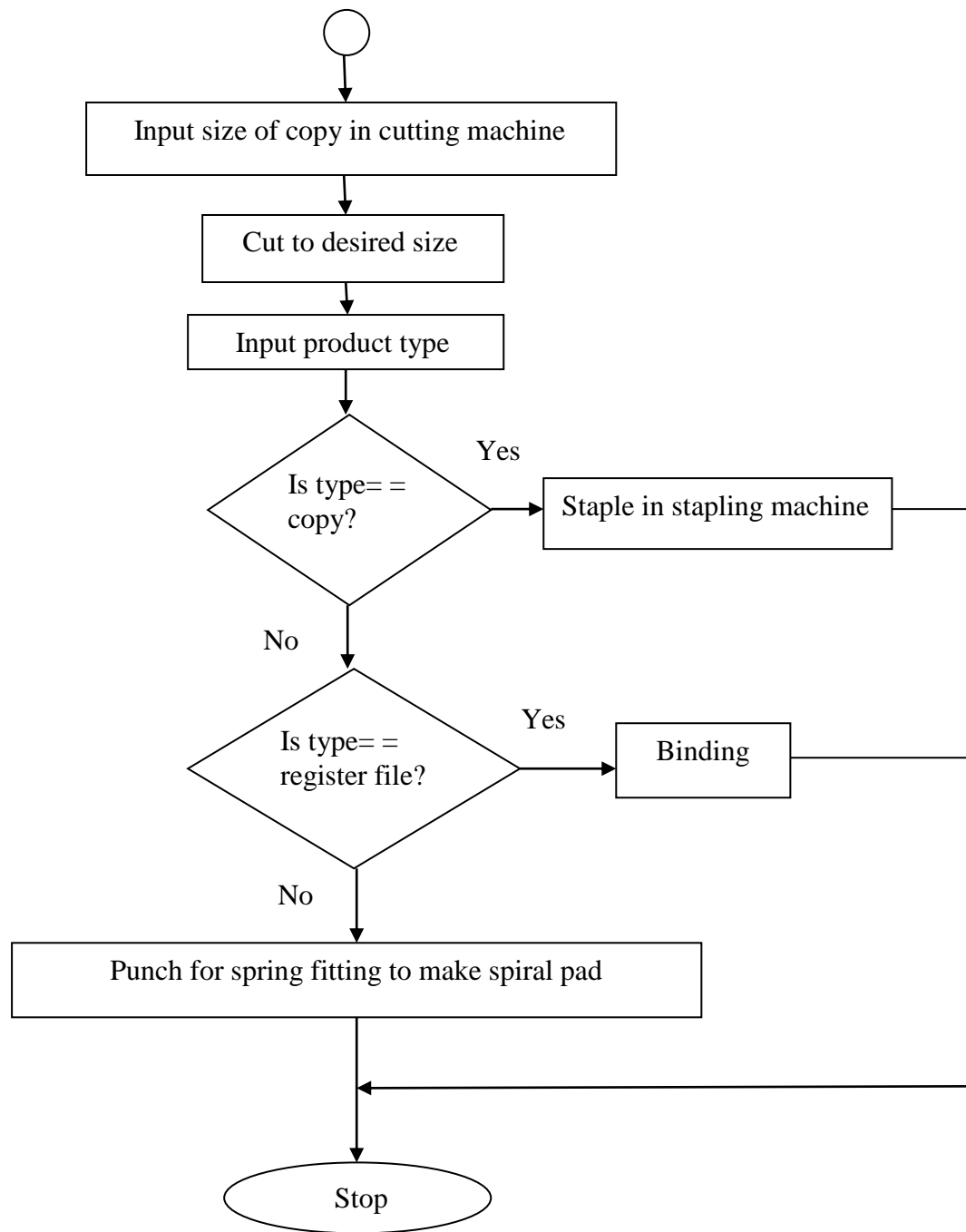
Since the existing system is not fully automatic, we have proposed an improvement to the current system so that the manual tasks are highly reduced. The blank sheets from the storage can be moved towards rolling machine through the use of conveyor belt. An electric motor can be rotated at certain speed in order to supply a sheet of paper to the line creating machine at once. A definite volume of water and ink can be supplied to the machine at regular interval where the shortage of ink can be indicated by sensor.

The sheets from the rolling machine can be sent through a checking system which checks whether line has been drawn on both sides or not. If not, the paper can be sent through the belt again towards the rolling machine. Otherwise, the belt can be diverted to paper counter similar in function to money counter in banks. The counter can be programmed to take input the number of sheets to be included per copy and then place a cover after reaching count equal to the inputted one.

The sheets with a cover over it can be sent through the conveyer belt to cutting machine which inputs the size to which the sheets are to be cut. It can then be carried to three separate units by the belt depending upon which switched has been closed. If the switch for exercise book has been turned on, the sheets are moved to stitching machine to staple the copy. If the switch indicates the register file, the sheets are supplied to binding system otherwise to punching machine followed by spring fitting unit for production of spiral pads.







**Figure 5.1.1** Flow diagram showing the process involved in improved proposed system

## **5.2 Modifications Required**

Some of the modifications required in the Sakun Copy Industry to implement the improved system are:

- ✓ The conveyer belt should be used for transportation of sheets to avoid the manual transportation.
- ✓ Ink should be spread over the cloth in rolling machine using sprayer and sensors should be used to indicate low ink.
- ✓ Electric motor should be used to feed paper properly to rolling machine.
- ✓ Checking unit should be imposed in order to ensure line has been drawn on both sides of sheet.
- ✓ A paper counter is required to count paper.
- ✓ The cutting machine should be controlled so as to cut papers to size entered by user.
- ✓ A switching system is required to choose whether to produce copies, register files or spiral pads.

## **5.3 Merits of the Proposed Plan**

After the implementation of the proposed system in the industry the major advantages that would be observed are as follows:

- ✓ Very less chances of paper damage during processing.
- ✓ The counting of sheets is exact which is much tedious to be performed manually.

- ✓ No difference in copy size since cutting machine cuts to the size specified.
- ✓ Increase in quality and quantity of products with no wastage of time and manpower.
- ✓ The whole system is converted to the automated system, so the system is precise than manual mode.
- ✓ The system will run with less manual workers and the outputs can be more profitable.
- ✓ The system becomes more efficient and long lasting.

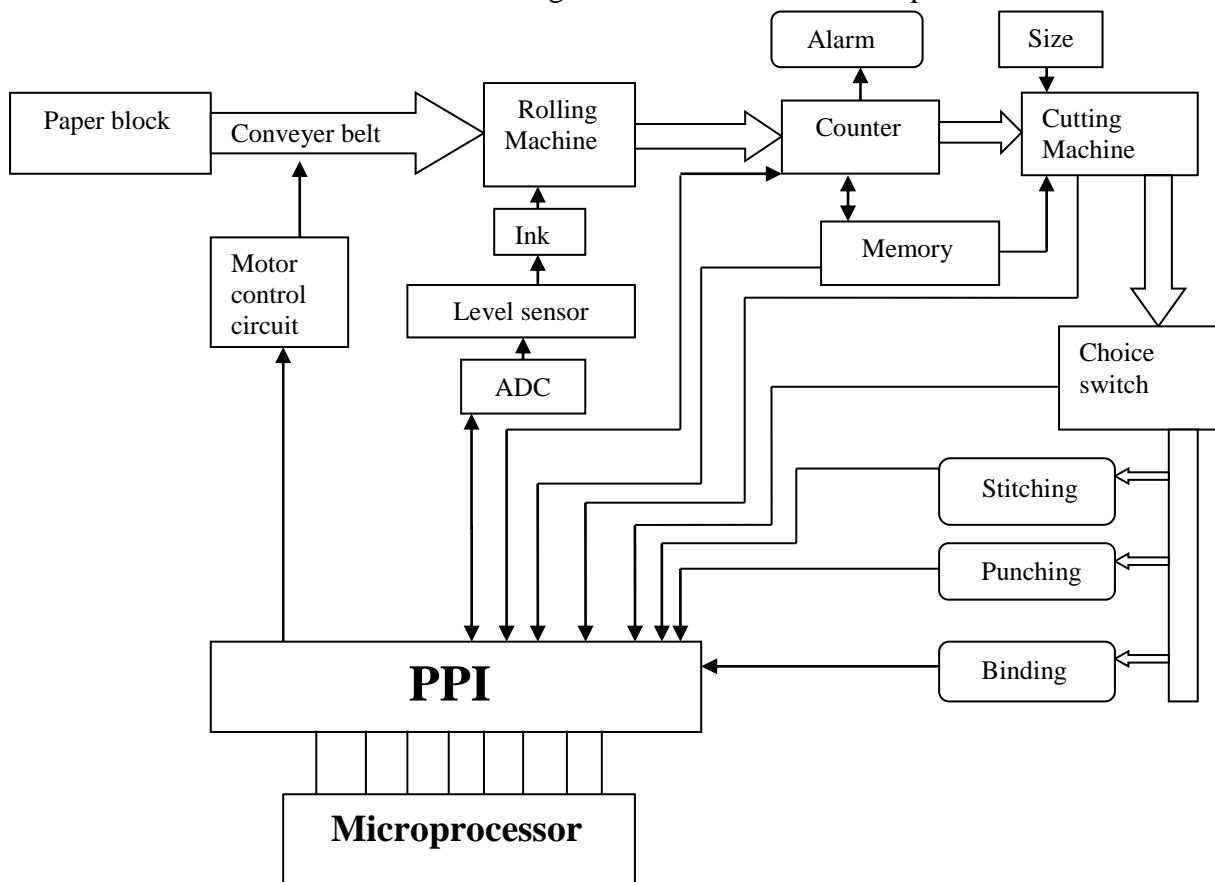
## 6 ALTERNATIVE APPROACH

### 6.1 Overview of the Microprocessor Based Design

The whole above system can be controlled by using a single microprocessor .For this purpose we require the following components.

- a) Programmable Peripheral Interface(PPI)
- b) Analog to Digital Converter(ADC)
- c) Microprocessor
- d) Digital to Analog Converter(DAC)
- e) Liquid Level Sensor

8255A is the PPI with three programmable parallel ports which can be used as the input and output. We can check the bits in the code for the analysis of the plant conditions. It is used for interfacing the devices with the microprocessor.



**Figure 6** Block diagram of controlling using microprocessor

## **6.2 Controlling Using the Microprocessor**

The input for the microprocessor is read from the rolling machine and from the port C lower of the PPI, the first three bits signifying the condition of the machine. The output is given from the port A to Control the corresponding motors, valve for filling up of ink and switches. The liquid level sensor sends some output voltage which is converted to digital signal using the ADC and microprocessor compare it to the certain value for the ink level maintaining. Similarly the motor and the other machines are controlled using the PPI and microprocessor as shown in the diagram. The cutting tool takes the size as its input from the user and stored in the memory and also the counter is set to count up to fixed values to count the number of paper in the copy.

## **7 PROBLEMS ENCOUNTERED & LESSON LEARNED**

During the case study, some difficulties have been faced. Some of the problems encountered are as follows:

- Difficult to understand the whole process involved in the system.
- Harder to analyze the present processes and their drawbacks or failures.
- Difficult to integrate the report. Information gathering and report preparation seemed tedious.
- Confusing to choose the type of design technique to employ. Lack of basis / experience on which to extend the design procedure.

The case study gave us a clear vision on the basic processes involved in the manufacture of exercise books. It has taught us how to interact with other people to extract the information from them and we experienced working in group.

## 8 COST BENEFIT ANALYSIS

### Existing System

Cost per copy (33 pages)	Rs. 25
Selling price per copy (33 pages)	Rs. 30
Salaries to the staffs(per month)	Rs. 40,000
Copies produced (per day)	1000
Total Production(per day)	Rs. $1000 \times 25 = 25,000$
Profit(per copy)	Rs. 5
Profit(per day)	Rs. $5 \times 1000 = 5,000$

**Table: 8.1 Cost description of existing system**

### Proposed System Installation

Research	Rs. 10,000
Installation	Rs. 50,000
Salaries to the staffs(per month)	Rs. 25,000
Total Production(per day)	Rs. $4000 \times 25 = 1,00,000$
Profit(per copy)	Rs. 7
Profit(per day)	Rs. $7 \times 4000 = 28,000$

**Table: 8.2 Cost description of proposed system**

It is clear that the implementation of the new plant though the initial installation cost is high. But as we see the number of manual worker is decreases the salary wages is decreased by the fifteen thousand per month and profit increases by seventeen percent of the previous amount. The new implementation required the skilled men power but the little training to the worker can be beneficial.

## **9 RECOMMENDATIONS**

From this case study we can conclude the following recommendations for the industry:

- ✓ Instead of purchasing blank papers, they should be manufactured in the industry itself with the raw materials and processing plants required.
- ✓ The staffs should be trained of the new plants and systems.
- ✓ The industry should be extended to large scale.
- ✓ Safety measurement should be considered.
- ✓ Adequate space for the new design.
- ✓ More investment for better profit of the industry.
- ✓ Better advertisement and publicity of the Sakun products.



## **10 CONCLUSION**

The chief objective of the case study for Instrumentation-II is to understand the prevalent system and control in an industry and to propose an improvement to the existing system in order to implement a complete automatic system. After the case study in Sakun Copy Industry, we got clear idea behind the production of copies. The blank paper is lined at rolling machine, folded manually and covered, stapled and finally cut at the respective machines. We also understand about the operation of different machines used over there. After the field visit, we found out that almost all the machines are manually operated and only about 40% of the works are done by the machines. Various activities such as transportation of sheets from one machine to another, sending sheet and supplying ink to the line drawing machine, collecting sheets, counting them and folding etc. have been done manually. Therefore, we felt an urge for better automation and hence proposed an improvement in the system so that the system becomes more reliable and long lasting. With the proposed system, the product waste and manual tasks are reduced. Moreover, production rate can be magnificently increased owing to great profit of the company.

To conclude, the case study was successfully conducted with the joint co-operation of the group members and workers in the visited industry.

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## 12 PHOTOS OF STUDY



**Figure 12.1** Sakun Products

**Figure 12.2** Group members inside Sakun industry



**Figure 12.3** Storage of sheets

**Figure 12.4** Product waste



**Figure 12.5** Workers in the factory



**Figure 12.6** Various machines available