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Automation of Plain Weaving Machine using PLC

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Abstract: *The aim of this paper is to design system which increases production and efficiency of loom in various aspects without increasing cost. PLC is used for handling, controlling all necessary computational and control. Thus, proposed system will be cost effective and efficient. The main aspect of the paper is to modify the basic power loom to function as an auto looms utilizing benefits of Programmable logic Controller (PLC) as the heart of the system The process generating fabric by interlacing warp and weft threads is called as weaving and the tool used for this is known as weaving machine. In proposed system is based on "plain power loom" which is mainly controlled by mechanically and don't have any electronic controlling and monitoring system. Since the number of plain power looms owner is very large in INDIA, there are small industries and they cannot offer the automatic looms due to its very high cost.*

Key Words: PLC, Automation, Weaving, Power Loom, Control.

1. INTRODUCTION

The purpose of the paper "AUTOMATION IN PLAIN WEAVING MACHINE USING PLC" is retrofitting mechanical weaving machine into automatic weaving machine using a PLC with low price. PLCs is widely used and favorite tools in the factory automation industry because of their robustness, simplicity, I/O interface and reliable performance [1]

Current scenario of Textile Industry:

- Since the total number of plain power looms owners is very large in INDIA as India manufactures 60% of cloth through power loom sector.
- India is having 20-30 lakhs of power looms, weaving almost 25,000 million meters of fabric.
- Maharashtra has approx. 10 lakhs of power loom.
- Tamilnadu is 2nd with 5-7 lakhs units.
- Gujarat is 3rd with 4-5 lakhs units.

Another motivation to do this paper is the price difference between plain power loom and auto loom, plain power loom owners are having small scale industries and many of them cannot afford the automation looms due to its very high cost.

Price of loom:

- Auto loom: Rs.10-40 lakhs/loom
- Plain loom: Rs.1-2 lakhs/2loom

2. PROPOSED SYSTEM

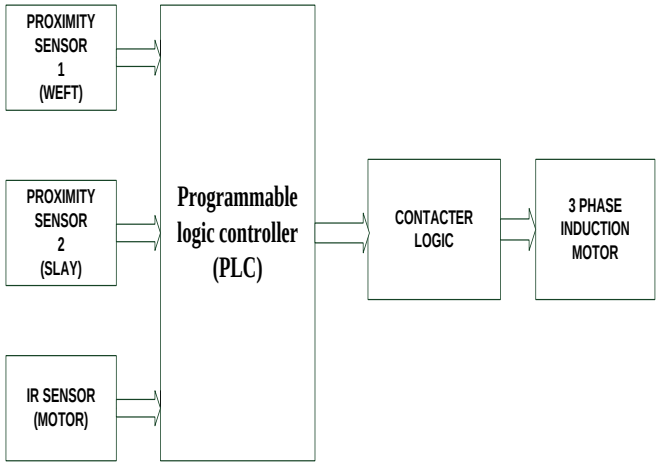


Fig.-1: Block diagram of the proposed system
Description of Block Diagram:

Power supply:

There are two ways to give supply to the PLC. 230V AC can directly to the PLC or we can use 24VDC SMPS also.

Sensors:

In proposed system various sensors are used for different parameters like weft break, slay and measurement of

cloth. The proximity sensor is used for the weft and slay. IR sensor used for cloth measurement.

PLC :

The controller is used for this system is PLC, that is "Programmable logic controller". It is mainly adapted for Industrial automation and factory

Application. Allen Bradley's Micrologix1100 PLC is used. The programmable logic controller is solid state equipment, basically design to perform logical decision making for industrial control applications and automation purpose.

3. HARDWARE DESIGN

The hardware part of system compromises of following modules,

PROXIMITY SENSOR:

1. Specification:

Sensing distance: 4mm
Voltage: 10-30V DC
Current: 300mA
Diameter: 12mm
Logic output: NPN-NO
Type: Inductive

Interface between Proxy sensors with a programmable logic controller (PLC):

When selected a sensor to be interfaced with a PLC, it is mandatory that the sensor output matches the input type of PLC card to be used. In PLC two types of input cards present,

1) 'Sink' current (positive logic) and
2) 'Source' current (negative logic).

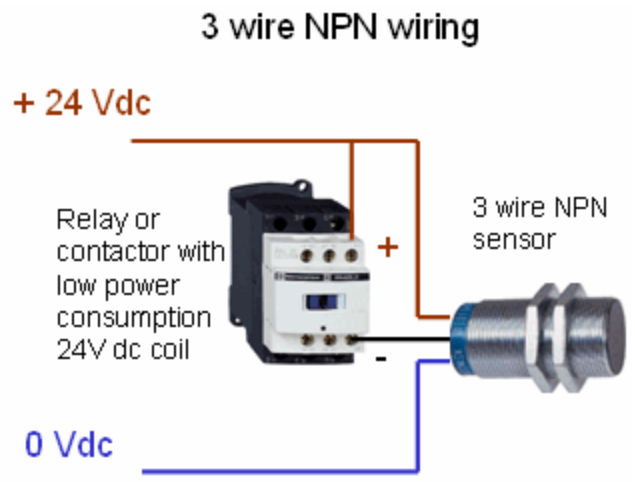


Fig- 2: Connection NPN Sensor

In Europe 'sinking' type of input is widely used; sinking type input is to be used with the PNP sensor.[2]

PLC Allen Bradley Micrologix 1100 Specifications:

Input Power: 24V DC
Digital Input :(6) 24V DC
Digital Output :(6) relay
Analog Input: Embedded, 2 in local, with additional 1762 analog modules
Ethernet Ports: (1) 10/100 Mbps port
Serial Ports: (1) RS-232/RS-485 Combo Port

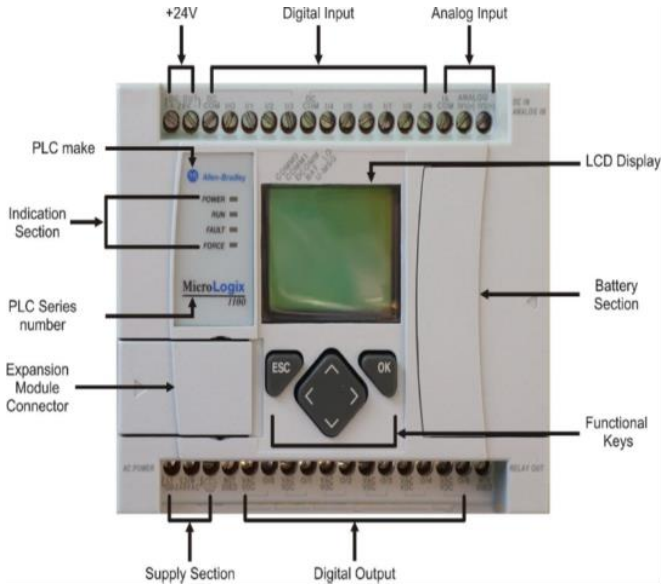


Fig. - 3: Micrologix 1100

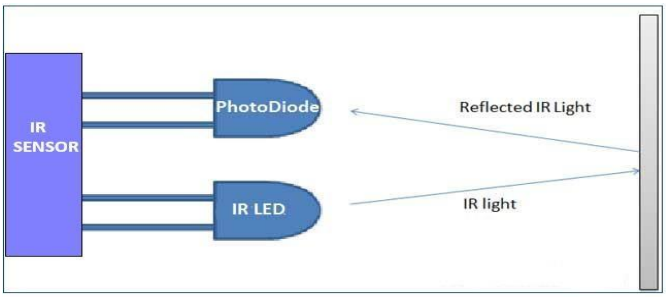


Fig. –4: IR Sensor

IR Sensor

Standard IR sensor used here for obstacle detection and line detection purposes. The Sensor comes with a variable resistor for calibration and comes with facility of selecting either analog or digital output. By default, the IR sensor provides digital output.

Flow Chart

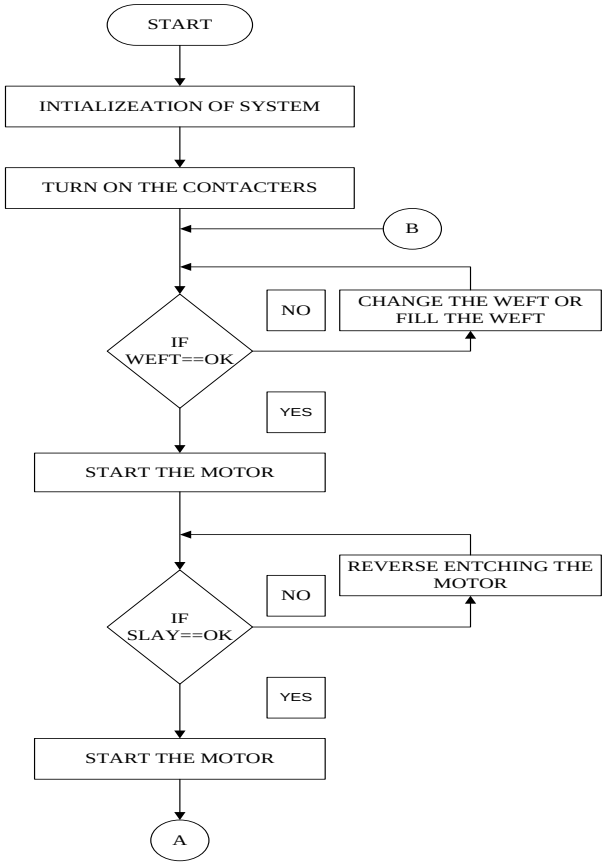


Fig. - 5: Flow Chart of system

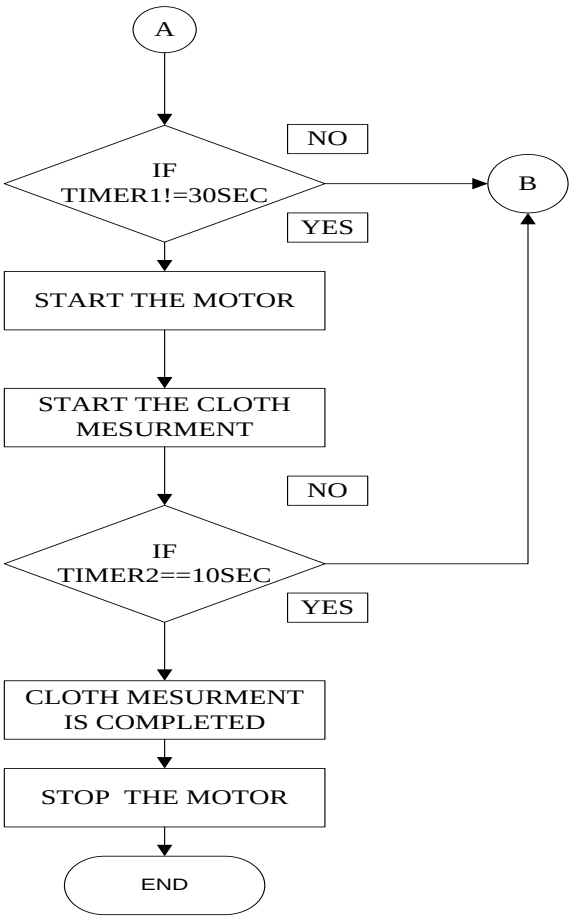
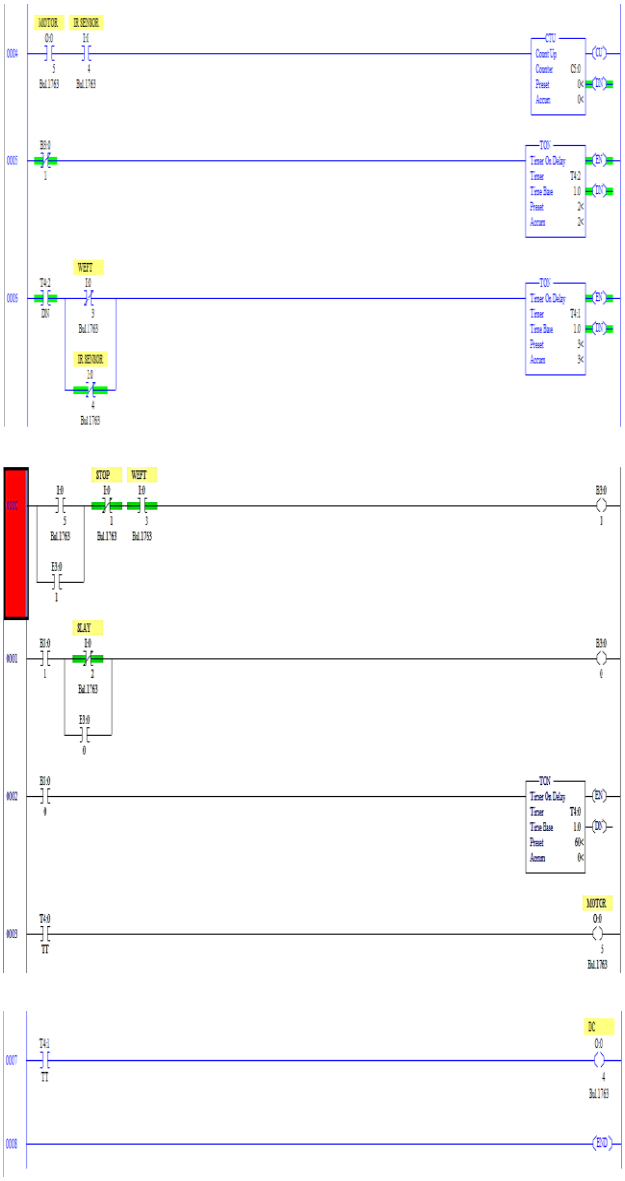


Fig. - 5: Flow Chart of system

At first turn ON the whole system. Then initialize it and run the program. After that turn ON the contactors and start the system. If sensor used for weft cutting and for back senter slay both are OK then start the motor. If weft is not OK then make it correct and check it again. If slay is not at back then do reverse etching of the motor. As the slay is at back, start the motor. After motor will start timer will also start for cloth measurement.IR sensor gives high pulse after completion of one rotation of wheel. As soon as timer will of motor will stop at that moment.

When motor is in running condition and if there is some fault is generated, for e.g. weft is break or slay is not at back, then motor will stop at the instant and DC link come into contact which is used for safety of the motor.

Ladder Programming:



Operation:

Programming of the PLC is called Ladder. Ladder diagram of proposed system is shown in above figure. Single line of the ladder is called "Rung" which is labelled from index 0000 to 0008. On first rung, PLC is checking weft is breaking or not. If it is ok, a binary bit is set. After, PLC check back centre slay using NC switch and set another binary bit if slay at back centre. If this two binary bits goes high motor coil goes high and start the loom motor using push button.

One timer is used to set the hours of loom. Using this timer, timing of loom can be set. The proposed system has also facility of cloth measurement and hence, for this purpose counter is used. When obstacle cut the IR sensor, it increase one count in counter.

The last operation is the DC injuction of the motor for smooth stop. Another timer is set to give some time for DC injunction. If one of the two proxy sensor change the state that means if fault is occur, PLC cut the AC connection from motor and give DC injunction to stop motor immediately.

5. CONCLUSION

Proposed system is based on programmable logic controller (PLC). Electronic weft stop sensor will help to detect the thread break, more accurately over traditional mechanical system. As it will detect the weft break on both side of the slay race .This will result in quality assurance of fabric. Direct measurement of fabric using .direct measurement of fabric using production sensor will surly reduces one labor per shed.

Proposed system can be used in small scale power looms where owner of small scale industry is cannot afford the cost of auto looms.

Future scope:

Proposed system can be modified to give advanced automation using specified and suitable sensor.

5. REFERENCES:

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