Design of PIC Microcontroller based Automatic Control System for Electronic Jacquard Mechanism

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Abstract

In India, very rarely one can find Computer controlled Power looms and Handlooms, because of the cost involved in the technology, death of indigenous manufacturers of electronic jacquards suited for Indian looms because of the complexity of the technologies involved - mechanical, electrical, electronics & computers. This paper proposes design and Implementation of Electronic Jacquard Controller and Design Partitioning, which provides some specific advantages over the existing EJCS, for Indian Handlooms & Power looms. It is too harder while using a conventional type of Jacquard Machine with serious punch cards. It will be better when the control of Jacquard becomes Electronic mode.

INTRODUCTION

Textile Industry of India produces immense business, just by Agriculture, with uniform spread both in Urban and Rural zones. It has a critical commitment to Indian economy both as far as GDP and all out Exports. Accessibility of substantial number of talented and untalented work, Supply of neighborhood developed and created crude material is the key for the maintainability of Indian textile industry. The persistent interest from both neighborhood and worldwide markets and the capacity of the material units to process and convey altered requests are one of the drivers of material industry. Over 97% of texture creation is taken up utilizing either handlooms or power looms spread crosswise over various locales of India (running from dress materials, rugs to sarees). By chance India has most elevated number of loom establishments, on the planet.

A weaving is a strategy, embraced in the weavers creating a texture in which two particular arrangements of a yarn and a string are interweaved at right edges to frame a texture or a material. A loom is a machine used to weave the material. In the loom, the longitudinal strings are called as a twist and the parallel strings are called as a weft. The motivation behind the loom is to hold the twist strings under pressure to encourage the intertwining of the weft strings.

Jacquards are the mechanical fittings to looms for the transfer of design to the cloth. Jacquard weaving makes possible in almost any loom the programmed raising of each warp thread independently of the others. This brings much greater versatility to the weaving process, and offers the highest level of warp yarn control.

This mechanism is probably one of the most important weaving inventions as Jacquard shedding made possible the automatic production of unlimited varieties of design weaving. In the conventional Mechanical jacquard looms, series of punched cards are used to weave the designs. Electronic Jacquards are the electronic version of widely prevalent mechanical jacquards, here the design stored in the pen drive / SD card can be transferred on to the cloth electronically. Electronic Jacquards additionally alluded as green machines, as it maintains a strategic distance from punched cards, henceforth sparing bunches of trees and decreasing pollution.

> ➢ **"Design of Novel Electronic Jacquard with Master Slave Architecture and Design Partitioning"**, International Journal of Innovative Technology and Research, June – July 2016. In this journal they built electronic jacquards using an array of electro-magnets/solenoids. The paper proposes the Design & Implementation of Hardware & Software of Electronic Jacquard Control System, based on Master-Slave Architecture and Design Partitioning, which provides some specific advantages over the existing Electronic Jacquard Control Systems for Indian Handlooms & Power looms.

> ➢ **"Research on the Needle Selecting Machine of Computerized Jacquard Circle Knitting Machine Based on Piezoelectric Ceramics"**, Journal on IITA International Conference on Services Science, Management and Engineering, July 2009. In this journal needle selecting machine of jacquard circle knitting machine based on piezoelectric ceramics is designed. This paper expands on the structure of needle selecting machine and its principle.

> ➢ **"Key technology in embedded control system of jacquard knitting"**, International Conference on Mechatronics and Automation, August 2010. In this paper the designing methodology of electronic jacquard machine using microcontroller was discussed to develop electronic control system.

> ➢ **"Research of Micro-Computer Control System of Electronic Jacquard Circular Knitting Machine"**, Journal on CJMM 2007, China. This Journal helps to design a Jacquard Controller with effective use of Microcontroller. This paper explains some theory and practical effect for the product development of Electronic Jacquard Control System.

➢ **"The working of Entrepreneurs in a competitive low technology Industry: The case of master weavers in the Handloom Industry",** International journal of mechanical Engineering and Computer Applications July-August 2013. This paper proposes Hardware & Software design and Implementation details of Electronic Jacquard Control System based on Slave Architecture and Design Partitioning, which provides some specific advantages over the existing EJCS systems, for Handlooms & Power looms.

➢ **"Design of Electronic Jacquard Controller based on MCU C8051F020**", Journal of Computer Engineering and Design, 2008, China. This journal paper help to technology to control the faucet (magnet implementing agency).It has the advantages of convenience in operation, higher reliability and lower cost when compared with the card control mechanical jacquard. An embedded design of electronic jacquard based on ARM.

➢ **"Research on Jacquard Control System for Three pile-height Carpet Tufting Machine"**, IITA International Conference on Control, Automation and Systems Engineering, Zhangjiajie, 2009.This journal paper help to find Computer controlled Power looms and Handlooms, because of cost involved in the technology, dearth of indigenous manufacturers of electronic jacquards suited for Indian looms because of the complexity of the technologies involved - mechanical, electrical, electronics & computers.

➢ **"Automation for Looms & Jacquards"**, the Indian Textile Journal, 2012. In this paper help to technology is benefiting users as well as machine manufacturers and with current infrastructure and viable alternative for imported weaving and jacquard machines. System and method for controlling a Jacquard mechanism, Jacquard mechanism and loom provided with such a system.

➢ **"Recent Developments in Rapier Weaving Machines in Textiles"**, American Journal of Systems Science, 2012. This paper reviews the recent developments in rapier weaving and addresses the challenges that face the weaving industry. The paper sheds the light on how the weaving machine manufacturers and woven fabric producers might strengthen the weaving industry by further advanced the rapier technology with the help of electro-mechanics, electronics, microprocessors, information technology and their application to the production of woven fabrics.

The conventional Jacquard machine operates based on the pattern of design which is printed on the punch cards. These punched cards are combined together in series manner and tied using thread. According to the design to be weaved, the number of required punch cards varied. The loom was controlled by chains of cards. These punch cards lead some operating troubles. The time span for pattern printing is large while using conventional looming jacquards. As the punch cards were made from the timbers, it leads to deforestation and pollution. These challenges can be wiped out by the cutting edge strategy for Electronic Jacquard Machine.

BLOCK DIAGRAM OF THE PROPOSED CONTROLLER

The schematic representation of the paper explains the sequential flow of control mechanism. The Optocoupler is fed with the PIC controller and controller is fed with power supply and the overall process controls the thread needles based on the program based on the design.
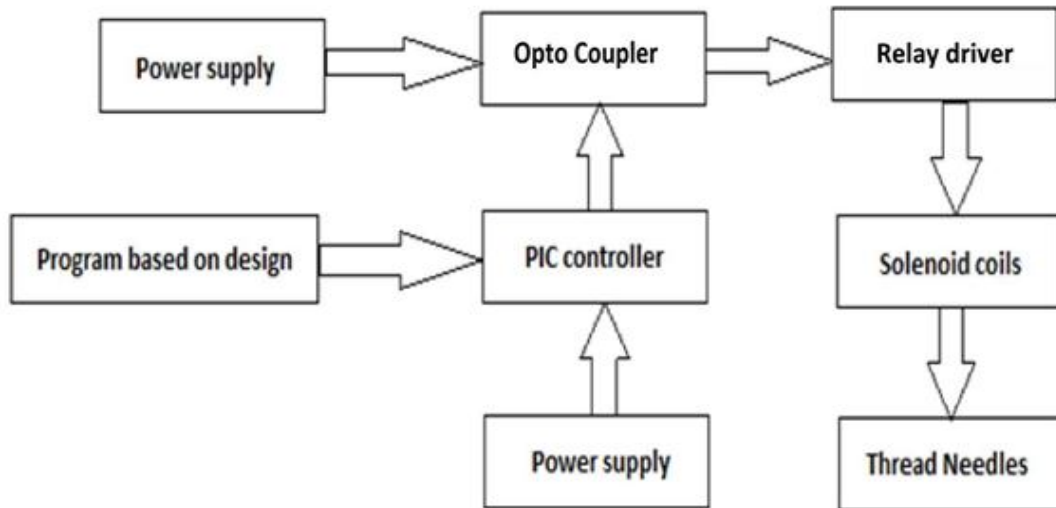
Figure 1. Block Diagram

CIRCUIT DIAGRAM

The working of Electronic Jacquard Controller is depending on the program of PIC controller. The program which is based on the required pattern of design is fed to the micro controller PIC16F877A. The PIC controller takes the power supply for its operation from the rectifier unit. The rectifier unit is moreover associated with voltage controller. The regulated 12V DC supply is sustained as power supply for the PIC controller. Likewise, the Optocoupler and Relay driver gets power supply from the rectifier unit.

According to the program which is fed to the PIC controller, it sends signal to the Optocoupler. At the point when the opto-coupler receives a signal the IR light starts glowing and Optocoupler switches the signal to the relay driver ULN2803.

Whenever the Relay driver gets input as high it provides low signal which acts as ground for the relay. The supply for the relay is already given and once the relay gets ground connection it starts operation. At the common pin of relay, the 230V AC is connected and whenever the relay operates the 230V AC is supplied to the solenoid coil.
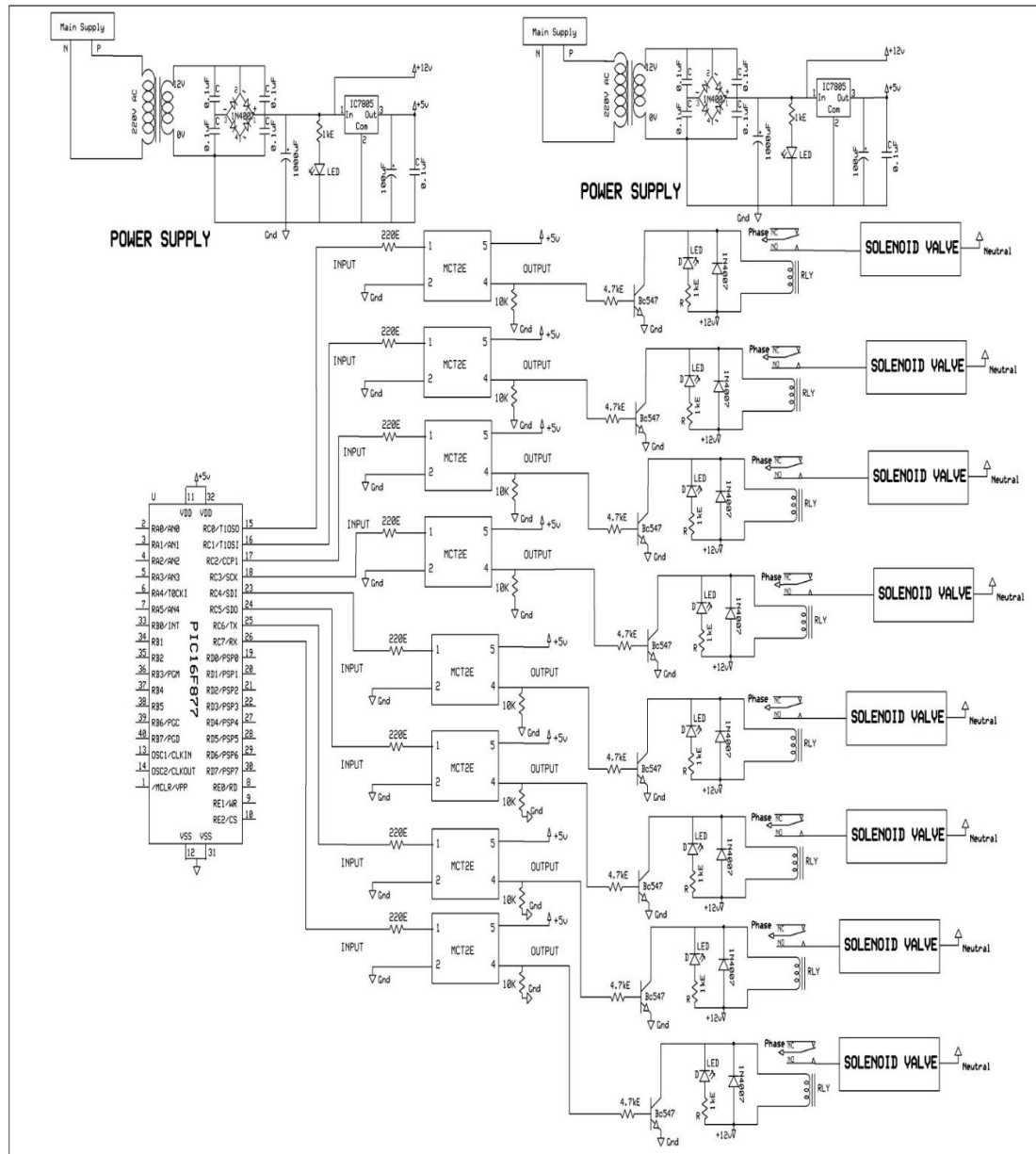
Figure 2. Circuit Diagram

The solenoid piston is coupled with the thread needles. Once the solenoid pulls the piston it carries up the thread according to the pattern of design. The diode which is connected across the relay acts as a freewheeling diode and prevents the discharging current conduction in the circuit.

The program for the PIC controller can be altered further as indicated by the adjustments in the pattern of design. This empowers the client to make changes in the plan design much of the time with no challenges.
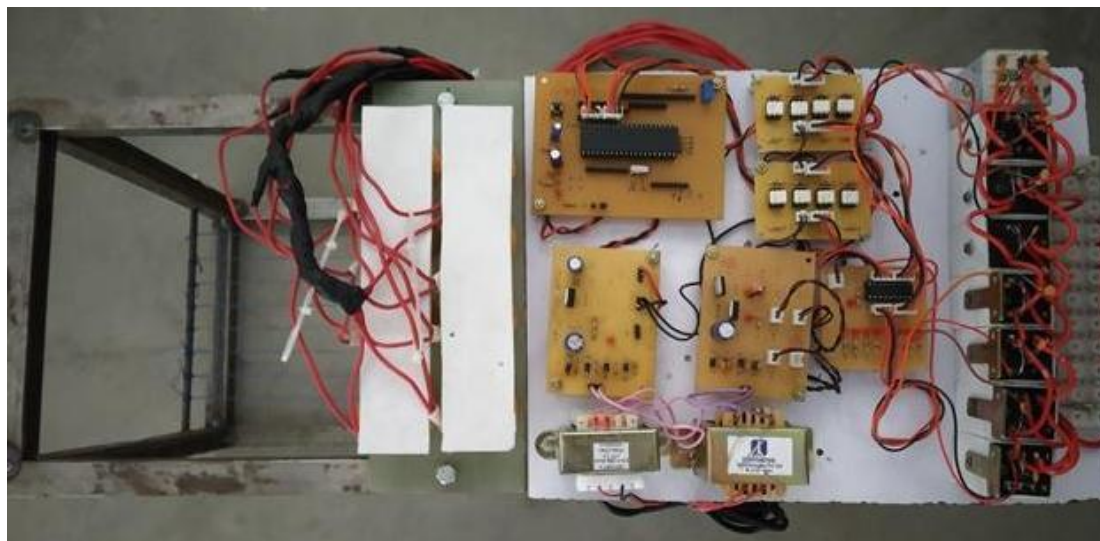
HARDWARE

Figure 3. Prototype Model

To achieve a simple structure, high reliability, and ease of installation and maintenance, the Micro-Controller Unit (MCU), jacquard driver circuit, DC supplies, and communication interfaces are all combined in this design. The design of the hardware structure, and printed circuit board (PCB) are described in this work to demonstrate the practicality of the method presented.

CONCLUSION

In this paper, we have built up a controller for Electronic Jacquard Machine which empowers the better control to the looming machine based on the program of PIC controller. This paper work on control of Electronic Jacquard Machine is of a practical significance to efficiently supporting the development of looming machinery to a high evaluation and extending the domestic and outside business sectors, and reinforce our aggressive capacity of controlling strategies over the looming machineries.

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