International Journal of Future Generation Communication and Networking
Vol. 13, No. 2s, (2020), pp. 118–126

Automation of Mechanical Press Machine Using Revolution Pi and PLC

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Abstract

The period of Industry 4.0 has arrived. Modern creating organizations face durable interest to broaden their efficiency by acknowledging great production lines and great delivering. Lately, the utilization of mechanical press machine has seen fast with computerization procedures. The procedures which are utilized to maintain a strategic distance from the wounds at creation destinations. This paper is going to utilize PLC to make press machine secure and safe.Furthermore interfacing ofRevolution Pi for controlling different methods of mechanical press utilizing various gadgets, for example, cell phone, ALEXA device and so on is done and hence the mechanical press is controlled even from remote location. Fundamentally, PLC is a Programmable Logic Controller. It has input lines, to which actuators are associated. It is programmable by functional block, ladder diagram and IEC programming. By utilizing PLC one can automate the mechanical press. The Revolution pi is interfaced with the mechanical press; it is an open source IoT door. It will furnish us with the greatest opportunity of associating mobiles and different gadgets.

Keywords**:** *Revolution Pi, PLC, Cloud, Mechanical Press*.

I. INTRODUCTION

Industry 4.0 is the subcategory of the fourth mechanical unrest that worries industry. The fourth mechanical unrest and industry 4.0 are regularly utilized conversely, industry 4.0 alludes to the idea of manufacturing plants wherein machines are increased with remote availability and sensors, associated with a framework that can picture the whole creation line, control and settle on choice all alone. Correspondence with one another, data on work pieces and self-association these are the most significant components that are important for the particular and decentralized structure of a brilliant production line.

Mechanical press is normally utilized in metal fashioning production and sheet metal working. The press shears, punches, frames or amasses metal or different materials by methods for apparatuses or dice joined to slides or inclines. Metal working happens by setting stock on a base kick the bucket and hitting in with a top pass on.

Press machine are utilized hugely in car metal working steel industry and so forth press computerization is normally used to build profitability of press. So as tofind out about press machine we visited barely any workshops where press

machine was introduced right now felt that press machine have a few wellbeing requests as there is chance related with press machine activity industry has seen numerous mishaps occurring while at the same time dealing with press machine .Subsequently to lessen them computerization as well as security automation is required in press machine. Security mechanization varies from standard automation on the premise that wellbeing automation parts are excess stage safe and have self-indicative.

ISSN: 2233-7857 IJFGCN

The modes of Mechanical press machine are being operated by the PLC and HMI is interfaced for performing control functions and receive feedback on those actions. It will provide us with the maximum freedom of connecting mobiles and other devices through which we will able to control mechanical press even from remote places.Those safety automation components are redundant phase safe and have self-diagnostic.

II. LITERATURE SURVEY

In a framework the quantity of transfers required for a specific activity is more than a PLC utilized for a similar activity. Practically used for controlling complex frameworks. It is adaptable and can be reapplied to control different frameworks rapidly with no issues at all. Computational capacities permit progressively advanced control. Convenienttroubleshooting helps make programming simpler and lessen downtime [1].A few enterprises use consecutive mechanical procedure which is individual in nature. For such procedures enterprises need to rely on utilization of transfers, venturing drum, clocks and controls, extensive challenges experienced in reconstructing required because of progress in the idea of creation. Regularly the entire framework must be rejected and an upgrading is required. To conquer these issues PLC control framework is presented. The PLC can be depicted as a control stepping tool involving a succession program. PLC grouping program comprises of regularly open and ordinarily shut contacts associated in equal or in series [2].A various leveled engineering of the savvy manufacturing plant was proposed to begin with, and afterward the key innovations were examined from the parts of the physical asset layer, the system layer, and the information application layer. What's more the significant issues and potential answers for key rising innovations, for example, Internet of Things (IoT), enormous information, and distributed computing, which are installed in the assembling process[3]. Industry 4.0 activity has gotten a wonderful consideration of the business and research network. In spite of the fact that the thought isn't new and was on the motivation of scholarly research in numerous years with various observations, the expression "Industry 4.0" is simply propelled and very much acknowledged to some broaden in scholastic life as well as in the modern culture too. While scholastic research centers around comprehension and characterizing the idea and attempting to create related frameworks, plan of action and particular approaches, industry, then again, concentrates on the difference in modern machine suits and smart items just as potential clients on this advancement. It is along these lines significant for the organizations to principally comprehend the highlights and substance of the Industry 4.0 for potential change from machine prevailing assembling to advance assembling. So as to accomplish a fruitful change, they ought to obviously audit their positions and particular possibilities against essential necessities put forth for Industry 4.0 standard. This will permit them to create a very much characterized guide. There have been a few methodologies and conversations going on along this line, a few guides are as of now proposed [4].Computerization framework comes in to presence through its different stages. Before, computerization is done through transfers and contactor rationales. Since the human mediation is more, the extent of blunders was likewise more. However, with the appearance of microchips and microcontrollers a few new instruments as Programmable Logic Controller (PLC) comein to utilization. These have decreased human mediation. It has expanded exactness, accuracy and efficiency [5].

III. PROPOSED WORK

i. Functional Block Diagram

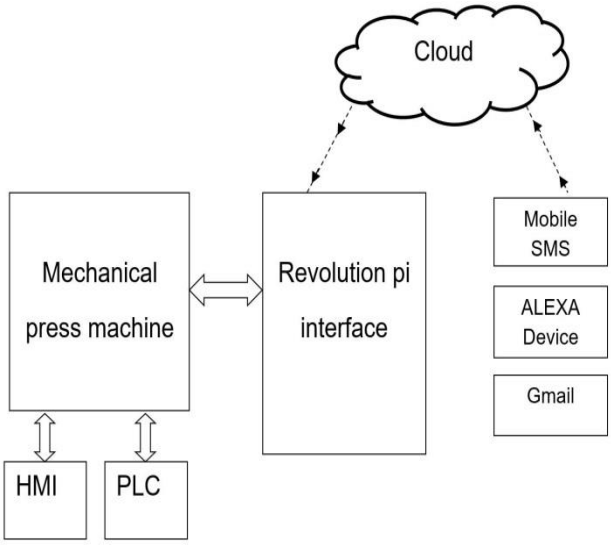

Fig1. Block Diagram of Automation of Mechanical Press Machine using Revolution Pi and PLC.

Fig.1 Represents block diagram representation of proposed system. The detailed function of each block is as discussed.

- **PLC** – A Programmable Logic Controller (PLC) is an industrial computer control system that continuously monitors state of input devices and make decisions based on custom program to control the state of output devices.
- **HMI –** It is Human Machine Interface used for handling human to machine and machine to human interactions.
- **Revolution pi –** Revolution pi is an open, modular and inexpensive industrial PC based on Raspberry pi and it can be used as a small controller unit.
- **Mobile (SMS) and ALEXA device –** It is used to give commands from remote places to the mechanical press machine

ii. Flow Chart

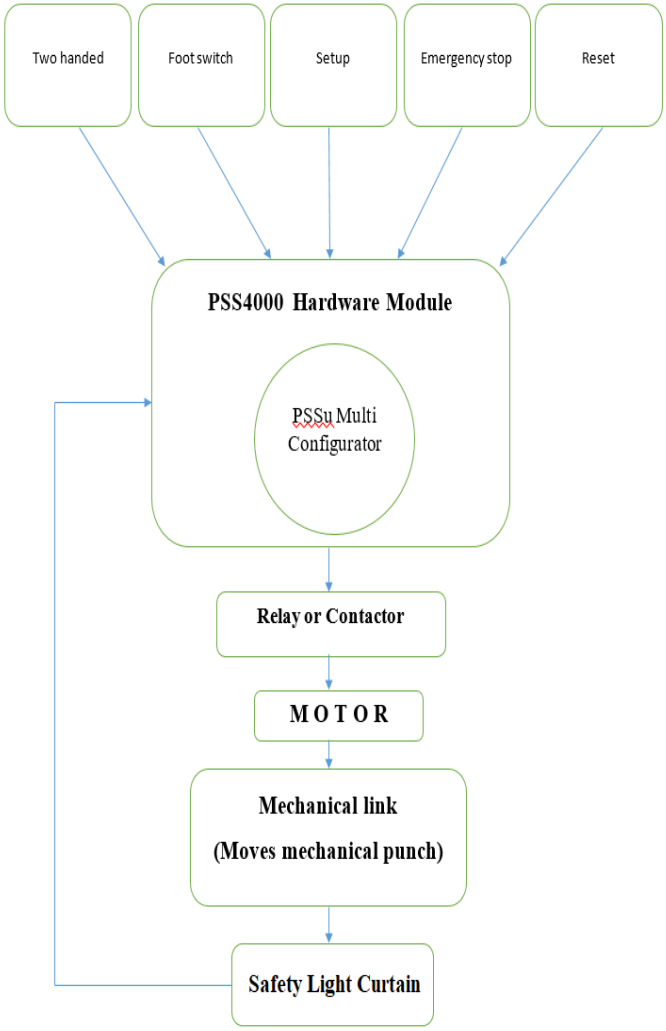

Fig 2.Flow Chart

The functionality of proposed system is designed with the help of fig.2.Here the PSS4000 softwaremodule consists of various inbuilt functions. Some of which has been used in this proposed system, namely two hand control switch, foot switch, setup mode, emergency stop and reset.

The logic of this entire module is developed in PSS4000 software. After development and dumping of the logic in the PLC the relay controls the electrical circuit of the machine and turns on the motor.

Once the motor starts the clutch and break in the machine starts operating simultaneously. Here after on selection of different modes the machine starts its operation. In case of any interruption while the piston is moving the light curtain will detect it and then immediately stops the operation.

IV. HARDWARE DESCRIPTION

i. PLC MODULE

Fig 3. PLC

A typical PLC is as shown in fig 3. In the automation framework PSS 4000, the protectedchecking capacity is perfectly incorporated inside the utilizer programming. Two distinctive evaluating standards, and therefore various capacities, can be actualized. For instance, screen up to 8 tomahawks for every control framework (PSS general PLC or PSS all-inclusive multi) up to PLC with a conservative module and relating programming squares and that is simply with one encoder.

We execute safe position observing in the mechanization framework PSS 4000. Counter modules with programming squares are accessible for this reason. Consequently, in merger with two encoders (non-security related).

The PSS all-inclusive PLC control frameworks are a reasonable answer for interlinked, complex plants. They can be utilized as a feature of a system or as an independent framework.

The PSS widespread multi control frameworks are reasonable for use on machines or in little plants. In blend with I/O modules, utilize these controllers to make control frameworks which are custom fitted to singular prerequisites

ii HUMAN MACHINE INTERFACE [HMI]

Fig 4. HMI Module

A Human Machine Interface (HMI) is shown in fig 4.HMI is a utilizer interface or dashboard that associates an individual to a machine, framework, or contraption. While the term can in fact be applied to any screen that authorizes a utilizer to associate with a contraption, HMI is most regularly used with regards to a modern procedure. HMIs speak with Programmable Logic Controllers (PLCs) and information/yield sensors to get and display data for clients to see. HMI screens can be used for a solitary capacity, such as observing and following, or for performing increasingly complex activities, such as turning machines off or augmenting engenderment scramble, contingent upon how they are actualized.

iii. REVOLUTION PI

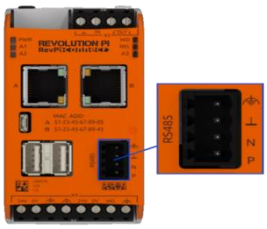

Fig 5. REVOLUTION PI MODULE

Fig 5 represents pictorial representation of RevPi.RevPiCore 3 is the most recent form of the RevPiCore, the base module of Transformation Pi. The quad-centerRevPiCore 3 comes furnished with theRaspberry Pi Figure Module 3 for a definitive in superior for complex undertakings, for example, picture handling. RevPiCore 3 comes outfitted with an adjusted Raspbian Jessie with a RT fix. Comprising of open equipment and programming, the [industrial PC] RevPiCore 3 fulfills the EN61131-2 guideline and, as a result of its particular structure, can be upgraded with advanced and simple I/O modules just as proper fieldbus gateways.

iv. ALEXA DEVICE

Alexa is a virtual advanced associate created by Amazon for its Amazon Echo and Echo Dot line of listing contraptions as shown in fig 6. Alexa's abilities imitate those of other canny helpers, for example, Apple Siri, Microsoft Cortana, Google Assistant and Samsung Bixby.

Fig 6. ALEXA DEVICE

Alexa reacts to voice control by returning data on items (on Amazon obviously), music, news, climate, sports and that's only the tip of the iceberg.

The back-end motor for Amazon's Alexa runs on Amazon Web Facilities in the cloud, empowering Alexa to get familiar with an individual or family's inclinations and grow its usefulness after some time. Alexa gets its name from the antiquated library of Alexandria, and it very well may be initiated by first saying a trigger word (either "Alexa" as a matter of course or "Echo," "Amazon" or "PC," in view of your inclinations), trailed by your inquiry or solicitation.Alexa utilizes characteristic language translation to process and follow up on demands.
Notwithstanding returning data, Alexa likewise empowers reverberation gadgets to work as brilliant home centers that can control Internet of Things associated gadgets like keen lights, indoor regulators and hardware.

V. SOFTWARE DESCRIPTION

The implementation of this project base on following software's:

- PSS4000
- PASVisu
- Node Red

➢ PSS4000

The controllers from the computerization framework PSS 4000 can be utilized as per the multi-ace standard. You can interface a few controllers with equivalent authorization basically through the constant Ethernet Safety Net. Safety NETtrades information and states between the controllers and synchronizes them. With the framework PSS 4000 you can actualize ventures for wellbeing and mechanization. The framework works without criticism to ensure the security of human and machine consistently. This guarantees changes or extensions in the control segment have no effect on wellbeing. The software is flexible for new developers.

VI. IMPLEMENTATION RESULT

The logic of all the eight modes of the press machine respectively 1.Press Off 2.Set-Up Without Motor 3.Set-Up 4.Two Hand Single Stroke 5.Foot Switch 6.Automatic Mode 7.Light Curtain I 8.Ligpht Curtain II have been successfully implemented using the PSS4000 software

➢ PASSVisu

With the electronic representation programming PASvisu you have an ideal perspective on the framework PSS 4000. You can connect the representation programming PASvisu straightforwardly to the control venture from the PSS4000 programming. It gives you full access to all procedure factors made in the undertaking just as to the whole namespace of the mechanization framework. Accordingly you can profit by shorter task run times, quicker building and a diminished potential for blunder. The machines information becomes noticeable on the Pilz Human Machine InterfaceusingPASvisu software.

➢ Node-Red

The flow based development tool Node-Red has been used for wiring the hardware devices together. JavaScript functions are created with help of this development tool. Node–Red flows are stored using JASON hence it can be easily imported and exported for sharing with other devices.

Fig7. Functional Logic of Press

Fig 8.Functional blocks of Node-Red

Fig.7 represents functional logic of press whereas fig.8 is representation of blocks of Node-Red.

VII. CONCLUSION

In automation industry, while dealing with machine presses, sometimes accidents may occurs and it may be dangerous for human life as well. In the proposed system, with the help of Revolution Pi and ALEXA, smart PLC

system is deployed so that wellbeing estimates should consistently be taken. Bi-manual (controls the utilization of which requires two hands to be on the pushbuttons to work) are a generally excellent approach to forestall mishaps, as are light sensors that shield the machine from working if the administrator is in scope of peril. The major advantage of proposed system over conventional system is, it may be controlled from any remote location. Thus avoiding direct human interference to the press machine and provides safety of life.

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