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# **Front Trailing Arm and Steering Column Press Machine Using PLC**

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**ABSTRACT:** In recent days FTA (front trailing arm) the cylindrical operation, which is vehicle suspension design with one or additional arms are connected between the axle and a pivot point. It's typically used on the rear axle of a motorized vehicle. The first arm connected between the axle and also the chassis. It is used on the front axle. A trailing arm design could also be utilized in an independent suspension arrangement. Some aircraft also use trailing arms in their undercarriage with oleo struts for shock absorption. It requires a many of sensors used as inputs and actuators used as outputs (various voltage supplies). The system is easy to create, facility, change and it provides reliable communication of sensors with reduced cost. The system HMI is programmable to satisfy demands, adding different sensors in an exceedingly short time advanced the whole hardware assembly and software algorithms. A PLC is an industrial computer that has been unevened and adapted for the control of build processes, such as assembly lines, machines, robotic devices, or any activity that requires high fidelity, ease of programming, and process fault detection[1].

**KEYWORDS:**PLC, HMI, FTA

## **I. INTRODUCTION**

A Trailing arm suspension, sometimes referred as vehicle suspension design in which one or additional arms are linked between the axle and a pivot point. It is generally used on the rear axle of a motor vehicle. A leading arm is used as the axle and the chassis. It is used on the front axle.

The powered steering column is a device intended essentially for connecting the steering mechanism. A steering control is a type of steering wheel in vehicles. Steering wheels are used in most modern land vehicles including automobiles, buses as well as tractors etc.

In the process of system design, PLC are controlled by the touch screen[1]. When the steering system is in the automatic driving mode[3][8], the controller updates the data of rotation angle and wheeling speed sent by the on-joining computer every 100ms. The encoder identifies the real-time position of the steering wheel and supply it return to the controller, when then processes the feedback value, and finally sends a series of real-time data such as the processed value to the on-board computer and touch the screen to realize the closed-loop control.

## **II. LITERATURE SURVEY**

Prof. Burali Y. N. suggested that a digital electronic device that uses a programmable memory to store instruction and to implement function such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes. The term logic is use primarily concerned with implementing logic and

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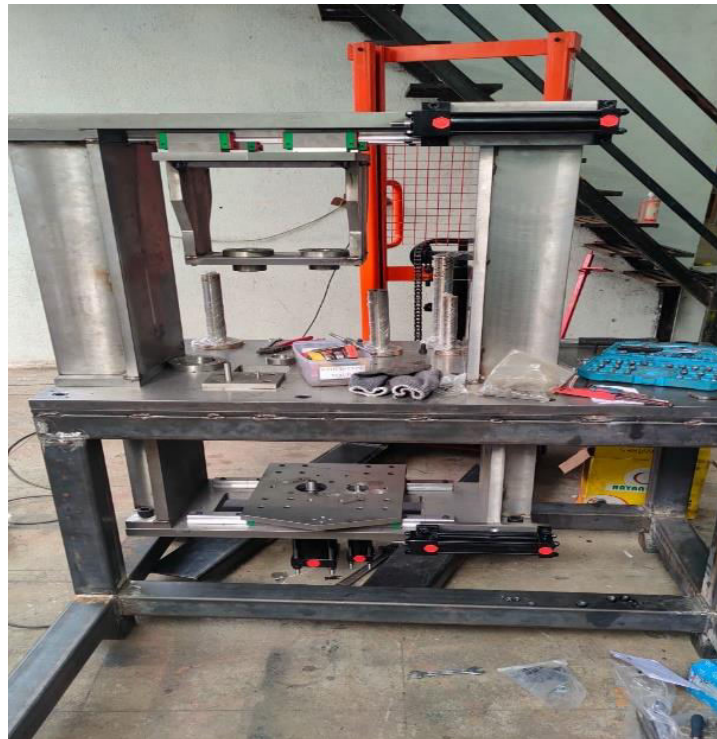
switching operations. Input devices e.g., switches, and output devices e.g., motors, being controlled are connected to the PLC and then the controller monitors the inputs and outputs according to this program stored in the PLC by the operator and so controls the machine or process. Originally, they were designed as a replacement for hard-wired relay and timer logic control systems. PLCs have the great advantage that it is possible to modify a control system without having to rewrite the connections to the input and output devices, the only requirement being that an operator has key in a different set of instruction. The result is a flexible system which can be used to control systems which vary quite widely in their nature and complexity.[3][8]

John Webb suggested that the development of low-cost computer has brought the most recent revolution, the Programmable Logic Controller (PLC). The advent of the PLC began in the 1970s, and has become the most common choice for manufacturing controls. The conventional methods need to be modernized and its various functions are required to be automated to achieve reduced cycle time, higher productivity[3][8], higher levels of accuracy and more reliability. The age of automation has brought a new meaning to electronics in industries; it means the complete automatic operation of the machines without human brain intervention, implying automatic inspection and electronics integration and control of various machine operations.[4]

### III. EXISTING METHOD

We have observed this project in universal automation(industry), we noticed that existing system is purely working on manual and operator dependent which is used for front trail arming and steering column press machine[3][8].

Hydraulic cylinder can happen if Proper bearing is pressed, two for indexing and one for pivot pin pressing, another for component pressing operation is totally operator dependent.



**Figure 1:**Existing Method of Steering Machine





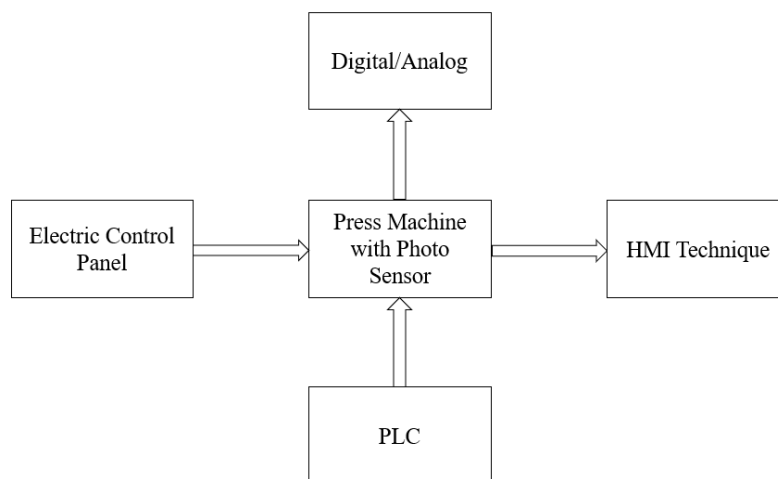
The above Electrical Drawing includes Analog and Digital, electrical control panel which is used electrical power to control the various mechanical functions of industrial equipment or machinery.

#### IV. PROPOSED METHOD

##### FRONT TRAILING ARM PRESS MACHINE USING PLC DESIGN (PROPOSED METHOD)

In the existing method, it had lot of disadvantages to overcome this method we have used photoelectric sensor with press machine [5]. They are provided to ensure the proper assembling of the parts and to avoid components missing. As we are in the digital world manually the conventional method needsto be modernized its various functions are required to be automated to achieve the higher productivity, reduced maximum level of accuracy and more reliability[3][8].

#### V. BLOCK DIAGRAM



**Figure 4:**Block Diagram of front trailing arm and steering column press machine using PLC

At first, input devices are designed electrical control panel Residual Control Circuit Breaker (RCCB), it has 25 Amps, 3 phase and 10 HP motor. Miniature Circuit Breaker (MCB) 6 Amps single pole single phase 230 Volt. Motor Protectional Circuit Breaker (MPCB), it has 13-18 Amps and 3 phase. Switch Mode Power Supply (SMPS), it is used to convert AC to DC. Transformer 440/230-Double phase for primary, single phase is used to secondary.

Photo Electric Sensor are designed using Programmable Logic Control to avoid human injuries in pressing machine and program loaded in Programmable Logic Controller by using LAN connection to Human Machine Interface. Finally, output is displayed on HMI Technique.

#### A. ELECTRIC CONTROL PANEL

Electric Control Panel is a combination of electrical devices which use electrical power to control the various mechanical function of industrial equipment of machinery. Electric Control Panel is used to give input to the PLC[1].

## **B. PRESS MACHINE WITH PHOTO SENSOR**

Photoelectric sensors [5], also known as photo eyes, emit a beam of light that is used to detect the presence or absence of items and equipment or changes in surface conditions. When the emitted light is interrupted or reflected by the object, the change in light patterns is measured by a receiver and the target object or surface is recognized. Photoelectric sensors are very common in industrial manufacturing fields such as material handling, packaging, food and beverage, medical, and many others.

There are two types of press brake guards, side guards, and rear press brake guards. Side guards are used to protect objects and hands from entering the work zone. Rear press brake guards offer protection by eliminating access to the back gauge and preventing the rear area of contact from being accessed.

## **C. HUMAN MACHINE INTERFACE (HMI) TECHNIQUE**

A Human-Machine Interface (HMI) may be a computer programme or dashboard that connects someone to a machine, system, or device. While the term can technically be applied to any screen that enables a user to interact with a tool, HMI is most ordinarily utilized in the context of an industrial process.

## **D. PROGRAMMABLE LOGIC CONTROLLER(PLC)**

A programmable logic controller could be a style of small pc which will receive information through its inputs and send manual through its outputs. essentially, a PLC's job is to regulate a system's functions victimization the inner logic programmed into it [1].

It is an industrial pc that has been ruggedized and custom-made for the management of producing processes, like assembly lines, machines, robotic devices, or any activity that needs high dependableness, simple programming, and method fault designation.

PLCs will vary from little standard devices with tens of inputs and outputs (I/O), in an exceedingly housing integral with the processor, to giant rack-mounted standard devices with thousands of I/O, and that square measure usually networked to alternative PLC and SCADA systems [1].

## **E. DIGITAL/ANALOG**

In this machine, it is used to control the pressure from the various cylinders from different side. Analog computer, any of a class of devices in which continuously variable physical quantities, such as electrical potential, fluid pressure, or mechanical motion, are represented in a way analogous to the corresponding quantities in the problem to be solved.

Digital systems that generate and process binary data. Computers are fundamentally digital machines because they process information that has been encoded as binary values either one that's positive (represented as 1) or one that's non-positive (represented as 0).

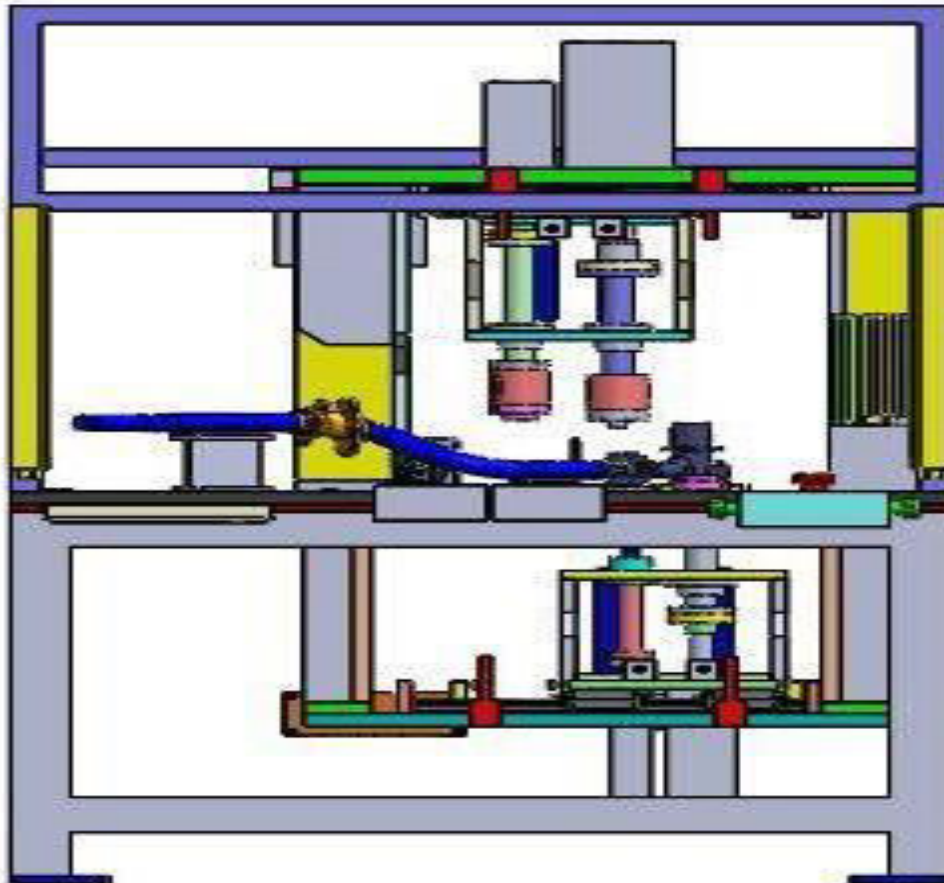
## **VI. DESCRIPTION OF MACHINE**

The press machine is used to assemble pivot pin and needle bearing with dust seal in FTA & Steering column at top and bottom. This machine consists of a locating fixture and hydraulic press cylinders to complete the proper assembly. The machine consists of 6 hydraulic cylinders in which two for bearing pressing, two for indexing, one for pivot pin pressing and another for component orientation. Pivot pin and needle bearing which helps to assemble the FTA and steering column allows free rotation of the steering column.

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**Figure 5:**FTA Machine Design

## VII. WORKING PRINCIPLE OF MACHINE

Load the Pivot pin, bearing and dust seal in their corresponding loading positions and place the Front Trailing Arm and Steering Column in locating fixture. Component presence sensors are provided to ensure the proper assembly of the parts and to avoid any part missing. Select AUTO Mode and switch ON the hydraulic motor, use the two-hand push button to start the autocycle process

All cylinders are operated by a hydraulic power pack system. The purpose of the component locating cylinder is to adjust orientation of the FTA and Steering Column so that the part damage can be avoided due to improper loading, followed by pivot pin is pressing then indexing will switch the pressing cylinder to press the bearings in top and bottom.

After that top and bottom bearing press cylinder actuated and presses the bearing. The cylinder goes to the home position with the help of indexing mechanism. After completion of the process, unload the assembled part and move to next stage.

### VIII. PLC LADDER

#### A. PLC LADDER DIAGRAM OF FTA

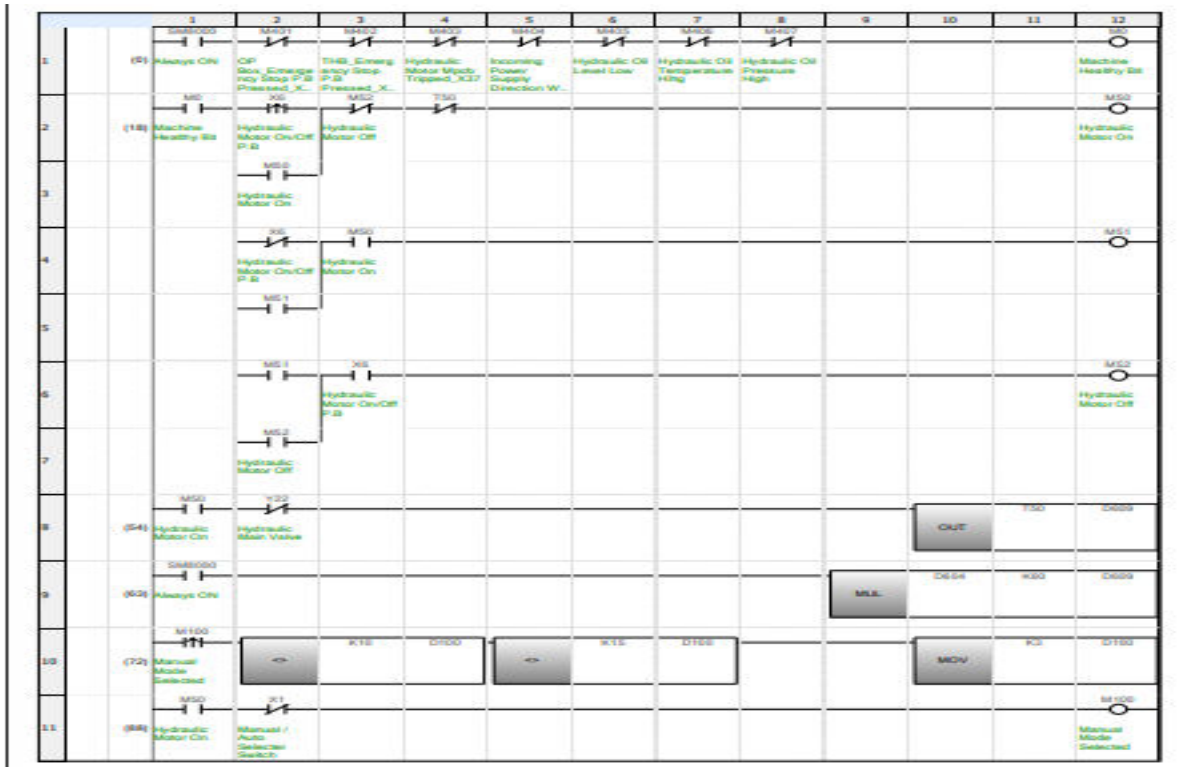


Figure 6: Programmable Logic Controller Ladder Diagram of FTA

The above figure of Ladder Logic is used to develop software for Programmable Logic Controllers (PLCs) used in industrial control application. The name is based on the observation that programs in this logic resemble ladders, with two vertical (Supply Power) and series of horizontal logic and technical values. Ladder diagrams are advanced schematics widely used to record logic structures for industrial controls.

#### B. PLC LADDER SPECIFICATIONS

NUMBER OF INPUTS	INPUTS SIGNALS THE PLC CAN ACCEPT
AC OUTPUT	Distinct AC voltage or current level
RELAY OUTPUT	Switch type output; contacts are unrolled or closed
ANALOG OUTPUT	Variable voltage or current, 0-10 volt, 4-20mA current loop

Table 1: PLC specification



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**Figure 7:**PLC System Operator

A Programmable Logic Controller is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon custom program control the state of output devices.

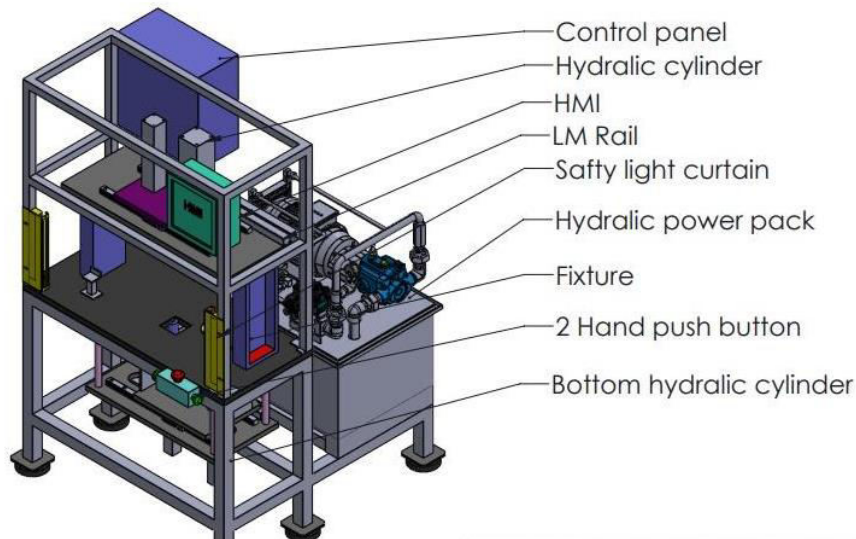
**IX. IMPLEMENTATION OF STEERING COLUMN PRESSING MACHINE**

HMI Technique



**Figure 8:**Front View of FTA & Steering Column Assembly

The implementation of Front Trailing Arm and Steering Column Pressing machine shows that sensors are designed for safety navigation and the status of input and output devices can be displayed in Human Machine Interface Technique, where the machines are expanded or retracted.



**Figure 9:**Overview of FTA & Steering Column Assembly

Overview of Steering column Assembly can be shown in this diagram, parts and types of a pressing machine specification, applications are designed to generate safety curtains, limited structures, manual control value, electrical control box and pressing machine.

## X. RESULTS AND DISCUSSION

After developing the necessary logic and making changes in the machine to suit the demands of plc and ladder logic developed testing was carried out. When the human parts were detected and respective sensors was glowing and indicates the machine to stop the immediate process. Thus, the serious injury on human problem was solved successfully.

## XI.CONCLUSION

It has been observed that Programmable Logic Controller is more convenient and this will remove any future hazards or failures that can occur due to the steering column press machine. By the logic developed in the project the process is being made more reliable, precise and accurate that will help in the improvement of productivity and speed of operation.

## REFERENCES

- [1] Hugh Jack, "Automatic Manufacturing Systems with PLC'S".
- [2] Mitsubishi User Manual FX1n Series.
- [3][8] Prof. Burali Y. N, "PLC Based Industrial Crane Automation & Monitoring. International Journal of Engineering And Science" ISSN: 2278-4721, Vol. 1, Issue 3 (Sept 2012), PP 01-04.
- [4] John Webb., "Programmable Logic Controller Principles and Applications".
- [5] Scott Juds , "Photoelectric Sensors And Controls".
- [6] R. S. Sharp, and D. A. Crolla, "Road Vehicle Suspension System Design- a Review," Vehicle System Dynamics: International Journal of Vehicle Mechanics and Mobility, 16 (1987), pp. 167-192

- [7] M. J. Burgess, N. P. Fleming M. Wootton and S. J. Williams, “A Tool for Rapid Vehicle Suspension Design”, SAE International , SAE Technical Paper Series, ISSN 0148-7191, 2004-01-3543.
- [8] Zhang Zhigang, Luo Xiwang, Li Junling . Automatic steering control system of wheeled model farming machinery [J].Transactions of the CSAE, 2005, 21( 11): 77- 80.
- [9] Ackermann J.,Brunte .T and Odenthal O., “Advantages of a drive steering for vehicle dynamics control,” in 32nd International Symposium of Automotive Technology andAutomation, no. 99ME013, pp. 263–270,Vienna, Italy, 1999.
- [10] Franke U., Mehring S., Suissa A. and Hahn S., “The daimler- benzsteering assistant- a spin-off from autonomous driving,” in Intelligent Vehicles '94 Symposium, pp. 120–124, Paris, France, October 1994.

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