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Predictive Maintenance of Pneumatic Cylinder

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ABSTRACT*:* Prevention is always better than cure; This not only holds good for humans but also or machines. There is always a need of preventing damages of machineries or at the minimum letting the user know that the part is going to get damaged. In the new industrial era there are very few machineries that work without pneumatic cylinders. These cylinders are very prone too failures. This project deals with the tracking pneumatic cylinders those are used for various applications. This project deals with the study of pneumatic cylinders at anIndian branded fabric and fashion retailer. This project deals with a solution to the production loss that happens at the factory production unit due to the failure of the pneumatic cylinders. This paper discusses about how to find prior to the cylinders failure to eliminate the stock unavailability and achieve a minimal production loss. This is carried out with the help of IR sensors that will scan the working of pneumatic cylinders.

KEYWORDS: Prediction, Pneumatic cylinders, IR sensors, Micro controllers.

I.INTRODUCTION

Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. [1] :85 Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage.

One major issue engineers come across working with pneumatic cylinders must do with the compressibility of a gas. Many studies have been completed on how the precision of a pneumatic cylinder can be affected as the load acting on the cylinder tries to further compress the gas used. Under a vertical load, a case where the cylinder takes on the full load, the precision of the cylinder is affected the most. A study at the National Cheng Kung University in Taiwan, concluded that the accuracy is about ± 30 nm, which is still within a satisfactory range but shows that the compressibility of air influences the system.[2]

Without proper maintenance and repeated usage, pneumatic cylinders are susceptible to damage in stressful environments. Some of the reasons that account for sudden failures are as follows:

1) Clogging of Contaminants – Your pneumatic system may fail if its parts are blocked with contaminates like solids, water, and oil. Prolonged exposure to industrial environments containing chemicals, paints, or weld splatters, results in damaging seals, plugged orifices, and decayed surface finishes. Clogging of water and oil content affects barrel or rod finish, and blocks orifice flow through. All these lead to unanticipated equipment failure, costly repairs, and expensive downtime.

2) Inadequate Lubrications – When cylinder seals have inadequate lubrication, it results in catastrophic failures. Ensure that the seals are provided with sufficient lubrication. Conducting periodic maintenance helps in understanding the lubricating condition of the seals.

Operating Over a Specified Pressure Range – Pneumatic cylinders are susceptible to damage when they operate over a specified pressure range and energy limit.

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II.NEED FOR THE SYSTEM

Operating above the specified operating limits will result in many problems like; Seals experiencing extreme stress rods ends bending or breaking, Extreme pressure spikes. By following the right operational and maintenance proceduresthe service life of the pneumatic cylinder can be enhanced.The right operation and maintenance procedures are always recommended. Formulate a pneumatic cylinder maintenance program, and execute the same in regular intervals. In this manner, there will be an up-to-date knowledge of the system's condition, which allows to take necessary measures accordingly. Follow the troubleshooting tips as suggested by the manufacturer. If you come across any major problem, take the unit to a credible repairing station. A reliable service centre can help bring the unit back to operating efficiency levels. For this there should be a continuous monitoring system which will be discussed in detail in this paper. Studies have shown that prior to the failure of pneumatic cylinder it slows down the thrusting movement considerably and using this as a tool cleaver algorithm has been applied to predict the failure of the pneumatic cylinder

III.INFRARED OBSTACLE SENSOR

Infrared Obstacle Sensor Module has builtin IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The module has on board potentiometer that lets user adjust detection range. The sensor has very good and stable response even in ambient light or in complete darkness. The system operates within the voltage limit 3.0V – 5.0V. It is capable of detecting obstacles in the range of 2cm and 30cm which is adjustable using potentiometer. Thecurrent consumption at 3.3V is approximately equal to 23 mA and at 5.0V is approximately equal to 43 mA. An obstacle avoidance sensor mainly consists of an infrared transmitter, an infrared receiver and a potentiometer. According to the reflecting character of an object, if there is no obstacle, the emitted infrared ray will weaken with the distance it spreads and finally disappear. If there is an obstacle, when the infrared ray encounters it, the ray will be reflected to the infrared receiver. Then the infrared receiver detects this signal and confirms that an obstacle is there in the front.

IV.WORKING OF THE SYSTEM

The Infrared Obstacle sensor must be adjusted at the maximum stroke point of the pneumatic cylinder.As prioritized from the above part change frequency list of differentpneumatic cylinders of different machines we will have to fit the sensor for the high functioning cylinders. Then the time of each between each thrust of the cylinder is noted down and then the programming is done accordingly. The sensor fit at the cylinder stroke point detects avoltage when the cylinder reaches the maximum point. And when it goes inside the IR sensor does not have any value. The micro controller that is attached to the IR sensor will have a track of the time in between each thrust (maximum point of the piston). The time is noted and if it matches with the time that has been entered then the piston works properly. In case the piston is going to fail the time between each thrust will vary from the normal value which can be found by the tracking system that has been programmed to the micro controller.

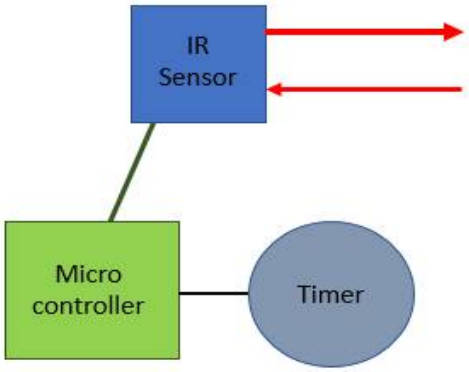

Fig. 1 Block Diagram of connection

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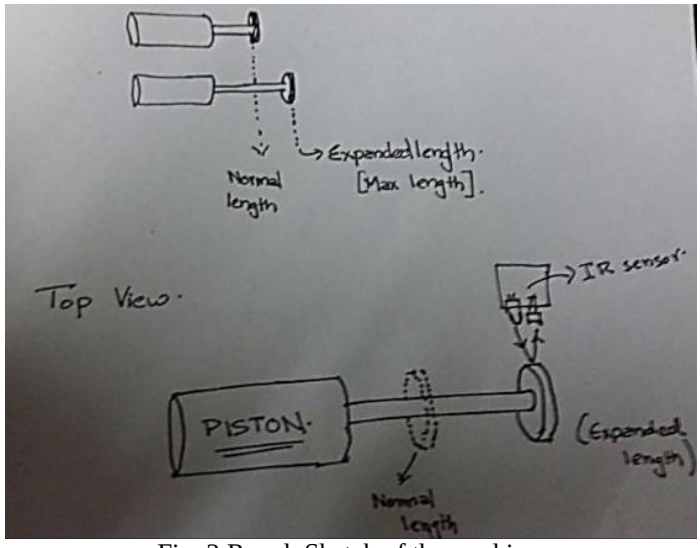

Fig. 2 Rough Sketch of the working

V. RESULT AND DISCUSSION

The testing was done with a working piston and the readings were taken. The Figure 3 shows that there is a voltage received from the IR Obstacle sensor in the interval of thirty seconds which is equal to the time interval between the normal working time of the pneumatic cylinder. If the time interval between each piston thrust increases or decreases the then the controller will give a notification by lighting a LED bulb and a buzzer which will help the worker understand that the piston is about to fail and the necessary actions could be taken.

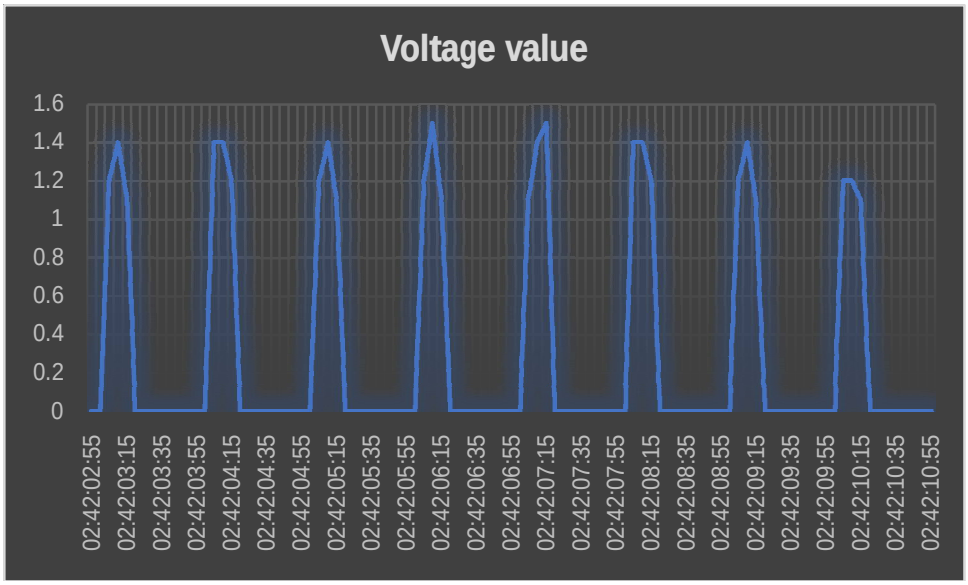

Fig. 3 Graph of 8 thrust of the piston

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VI.CONCLUSION

By this system the defective cylinders can be found out and can be replaced before it could destruct the working of the entire machine. The machine depreciation over the years might cause huge damage if not monitored by implementing this predictive maintenance. By this method we can overcome the lag time for receiving the new replacement cylinder as the failure is tracked prior. Stock keeping of the cylinders is also possible. Production loss due to machine breakdown will be drastically reduced if this method is used. There will be a huge reduction in the spare part inventory. Machine downtime will rarely occur and the maintenance cost can be drastically reduced. Reduction in unexpected failure in machine and increase in mean time between failures is also an advantage by this method. Along with all these positives there are some negatives for this method. Sensor might not function due to extreme external conditions. Proper installation of the sensors is required. Machine operators and mechanics must be aware of the setup.

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