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Laser Based Safety Mechanism for Tanning Industry

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ABSTRACT: The leather tanning industry is a vast sector which involves processing of leather for many hours along with tedious work of labours. Most of the work in the industry is done manually, like addition of appropriate ratio of chemicals and water. ^[3] The raw hide is washed, dried and tanned in huge drums. The workspace around the drum section is quite unsafe for the labours. Thus, the main objective is to provide an appropriate solution for the safety of workers. The proposed design is a boom barrier which is based on laser detection and preventing access beyond the safety limit. It is quite easy to operate and does not take up much of the workspace. A combination of electronics, electrical and mechanical systems makes the design efficient and suitable for industrial purposes.

KEYWORDS: tanning, boom barrier, safety, LASER, Arduino

I.INTRODUCTION

Leather is obtained by converting the animal's skin and hides by the process called as Tanning. The oldest system of tanning depends on the chemical action of vegetable material containing tanning. ^[3] The production is based on 4 stages: (1) Preparation of the hide (2) Tanning (3) Dyeing (4) Finished product. During dyeing, the operations are all performed in sequence in the same drum with intermediate steps of washing and drying. There are many hazards involved with the operating parts of the machines such that injuries caused by revolving drums, in-running rollers and knives. Efficient guarding should be provided. Considering the needs and requirements of the workers we have developed an appropriate system.

II.PROPOSED MODEL

The proposed model is a boom barrier which is based on laser detection and preventing access beyond the safety limit. It is quite easy to operate and does not take up much of the workspace. A combination of electronics, electrical and mechanical systems makes the design efficient and suitable for industrial purposes. ^[1] A boom barrier is a pole like structure in the workplace to block the workers access beyond a certain point to ensure safety. Our proposed model of boom barrier that is to be installed in the drum section will be around 1m-1.5m long. The boom barrier's internal circuit design is such that it doesn't require any separate switches for its operation, as it is electrically coupled to the main switches of the drum.

III.DESIGN METHODOLOGY

The safety system makes use of electrical equipment like contactor; relay etc., in order to interface the boom barrier directly to the drum's main switches. This facilitates to operate the boom barrier using the main switches of the main machinery. The safety standards can be further improved by interfacing sensors such as photo-resistor, proximity sensor and alarm system. The proximity sensor is used to detect the movement near the boom barrier. In case laser

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detection is installed photo-resistor and alarm will be used. The mechanical side of the design includes a light weight metallic rod to be used as a barrier. The barrier is opened and closed using a gear box to drive the DC motor. The safety system for the drum is designed in two phases:

➤ **Alarm system:**

The first phase of safety system includes 75% of mechanical work and 25% of electrical work. The plain includes setting up gate type mechanism to which laser and an alarm will be interfaced.

➤ **Drum cut-off:**

The second phase of safety system is used to stop the drum immediately when any incident occurs. The design comprise mainly of electrical of electrical work. The main objective is to control the motor of the durum which has to stop immediately before any incident happens. This is achieved by using a three phase normally closed relay and a connector circuit.

IV.MECHANISM OF THE SYSTEM

The safety system includes setting up of a boom barrier type mechanism to which a laser and an alarm will be interfaced. The Boom Barrier is a light weight metallic barrier that will be installed in front the drum which is controlled with a DC motor.

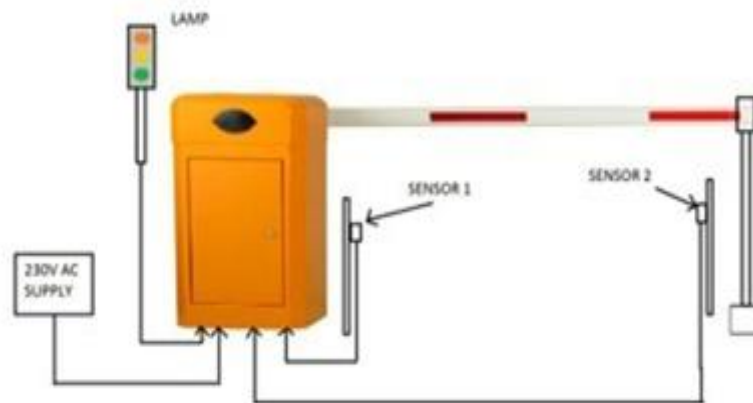


Fig.4.1 Boom Barrier

A laser light is placed diagonally on one end of the gate and a Photo-resistor on the other end. The alarm is interfaced to the mechanical design through electrical connectivity.

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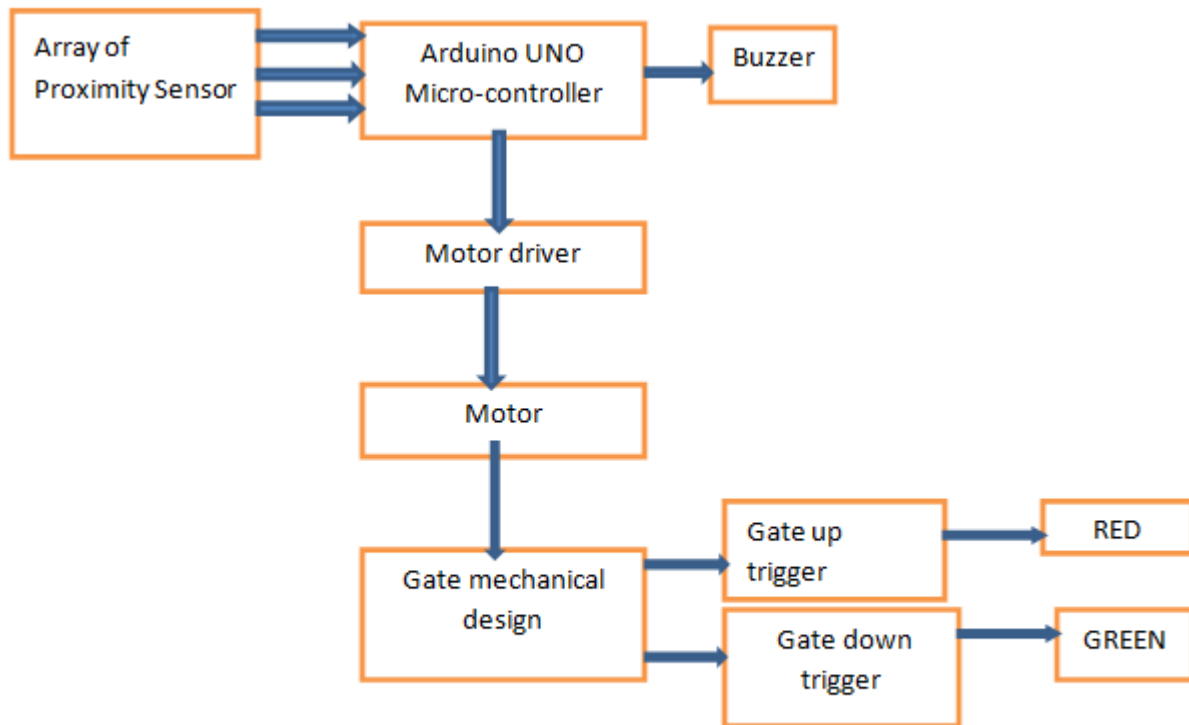


Fig4.2 Functional Block diagram

This system of boom barrier can be implemented with or without sensing modules. The efficiency of both the systems remains the same. An additional sensing module will only increase the reliability of the safety system. It depends upon the industrial requirements as to which type of design is to be implemented.

4.1 Without sensing module:

The movement of the drum is turned ON; the barrier will move vertically downward preventing the access for workers beyond the limit. When the drum is turned OFF, the barrier will move vertically upward allowing access for the workers beyond the controlled point to perform operations such as loading and unloading of materials in the drum. All these operations are controlled by a single controller which is programmed in such a way to facilitate easy operation for the workers. As this model does not require any separate switches for boom barrier operation, it facilitates simplicity of operation. The operating procedure is so simple in the sense that by just pressing the drum ON switch, the barrier closes automatically. And a single press on the drum OFF switch opens the boom barrier automatically by vertical upward movement.

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4.2 With sensing module:

The boom barrier integrated with sensor will be similar in operation to the boom barrier described above but will include an additional sensing module named proximity sensor. This added feature will detect any movement/presence of workers near the drum section for a certain range. [2] If anyone crosses the pre-set safety range the drum will immediately stop its rotation/operation. The safety limit will be set during installation by thorough checking and as per requirements of the workers. The boom barrier will work normally during ideal situations (i.e.) controlled by the switch of the drum. In abnormal situations, like sudden entry of workers in the range of area specified, the drum stops immediately irrespective of the drum ON/OFF switch state. Thus this model of boom barrier is simple to operate and also will add a higher level of security in workplace as it senses continuously for the workers presence in the limit specified.

V. CONCLUSION

The growth of an industry depends upon many factors and primarily upon the satisfaction of the workers. The safety of labours is an indispensable factor that every workspace should take into account. The safety system that we have developed is easy to operate and entirely reliable. The boom barrier operated using the main switches of the machinery prevents complexity and confusion in operation. It also provides a support to the falling victim to hold onto. The proximity sensor extends the operation and brings in automation into the simple design of the boom barrier.

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