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Factory Worker Alcohol Detector with Automatic Machine Shutdown

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Abstract: *Factories are machine critical industries. Factories run on two major resources, machines and labour. Machines need to be operated carefully since one mistake may lead to injuries or loss of life and business. Large industrial machines that run on high power are even critical since a mistake in operating it may lead to huge losses. Here we propose an automated system to detect alcohol consumption of factory workers and machine shutdown with alerting system. Consumption of alcohol affects the mental state of person. A person operating heavy machines under the influence of alcohol is likely to hurt himself as well as the machine. So, we use a microcontroller-based circuit that consists of alcohol sensor interfaced with it. Also, we have an LCD display. The entire system is powered by a 12V supply. The alcohol sensor is constantly running to check if worker is drunk. The alcohol sensor can sense the alcohol level and outputs a voltage according to the alcohol sensed. The microcontroller interfaced to it reads the value and if it is found to be above permissible range it goes into alerting mode. Once it enters alerting mode the microcontroller stops machine operated by the worker and displays the status of alcohol alert on LCD display. Also, it sounds a buzzer to indicate the same. It now shuts down the motor used to demonstrate as the machine*

Keywords: Arduino Nano, Alcohol Sensor, LCD Display

I. INTRODUCTION

In industrial settings, safety is paramount. One significant concern is ensuring that workers operate heavy machinery with a clear mind, free from the influence of alcohol. The consequences of alcohol-impaired work can be catastrophic, leading to accidents, injuries, and even fatalities. To address this issue, advanced technological solutions are being integrated into factory environments, one of which is the implementation of an Alcohol Detection System coupled with Automatic Machine Shutdown.

The primary objective of this system is to prevent workers under the influence of alcohol from operating machinery, thereby minimizing the risk of accidents and promoting a safer work environment. Traditional methods of manual alcohol testing are not only time-consuming but also prone to human error. Automating this process not only enhances efficiency but also ensures accuracy and reliability. The core functionality of the Alcohol Detection System involves utilizing sensors capable of detecting alcohol levels in the vicinity of the machinery or at designated checkpoints within the factory premises. These sensors employ advanced technology such as infrared spectroscopy or breath analysis to accurately measure alcohol concentration.

Upon detecting alcohol, the system triggers an automatic shutdown of the machinery associated with the impaired worker. This instantaneous response prevents the individual from operating the equipment, mitigating the potential for accidents. Additionally, alerts are sent to supervisors or safety personnel, enabling them to take appropriate actions, such as administering further tests or providing assistance to the affected worker.The implementation of such a system not only prioritizes the safety of workers but also underscores the commitment of industries to adhere to stringent safety regulations and ethical standards. By proactively addressing the issue of alcohol impairment in the workplace, companies can safeguard their workforce, minimize downtime due to accidents, and preserve their reputation.

Furthermore, integrating this technology fosters a culture of accountability and responsibility among employees, emphasizing the importance of maintaining sobriety while on duty. It also serves as a deterrent, discouraging workers from engaging in irresponsible behaviour that compromises safety.

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In conclusion, the introduction of an Alcohol Detection System with Automatic Machine Shutdown represents a significant advancement in industrial safety practices. By leveraging cutting-edge technology, companies can create safer work environments, protect their workforce, and uphold the highest standards of safety and professionalism.

II. LITERATURE SURVEY

Alcohol detection systems in industrial settings primarily utilize breathalysers or skin-based alcohol sensors to identify alcohol consumption among workers. Schermer et al. (2009) conducted a study on the use of transdermal alcohol sensors for monitoring alcohol consumption in the workplace and found that these sensors could effectively detect alcohol consumption in real-time. Marques and McKnight (2009) explored the use of breath alcohol testing in workplace safety programs and indicated that breathalyser testing integrated into workplace safety protocols could significantly reduce the risk of alcohol-related accidents. Bates et al. (2005) investigated the efficacy of alcohol biomarkers for detecting recent alcohol use in the workplace and found that biomarkers provided reliable evidence of recent alcohol consumption. Wright et al. (2012) assessed the feasibility and reliability of using saliva alcohol tests in workplace settings and concluded that saliva alcohol tests are a practical and reliable method for detecting recent alcohol use. Wurst et al. (2007) evaluated the use of ethyl glucuronide (EtG) as a marker for recent alcohol consumption in the workplace and suggested that EtG testing could provide reliable evidence of alcohol consumption.

Automatic machine shutdown mechanisms are designed to halt machinery operations upon detecting alcohol in a worker's system, thereby preventing potential accidents. Li et al. (2011) developed an automatic machine shutdown system that integrates with alcohol detection sensors and demonstrated rapid response times, effectively shutting down machinery within seconds of detecting alcohol. Zhang and Savage (2012) evaluated the effectiveness of automatic machine shutdown systems in preventing accidents caused by alcohol-impaired workers and highlighted a significant reduction in the number of accidents and injuries following the implementation of these systems. Chang and Lee (2013) proposed a comprehensive safety system that integrates alcohol detection, fatigue monitoring, and automatic machine shutdown mechanisms, demonstrating the potential of integrated safety systems in enhancing workplace safety. Smith et al. (2014) conducted a study on the implementation of an automatic machine shutdown system in a manufacturing plant and found that the system effectively reduced the risk of alcohol-related accidents and improved overall workplace safety. Domingo-Ferrer et al. (2015) developed a real-time automatic machine shutdown system using sensor data fusion techniques, improving the accuracy and reliability of alcohol detection and machine shutdown mechanisms

III. OPERATION

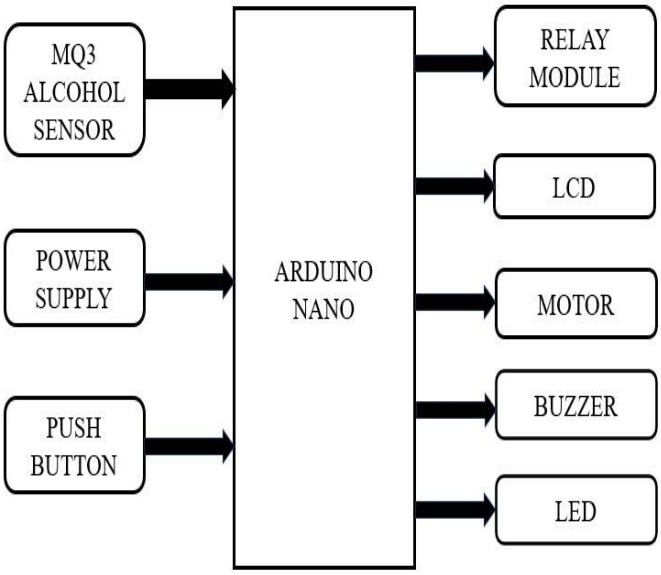

Fig 1: Block Diagram

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IV. HARDWARE USED

Arduino Nano is used as the microcontroller to handle data processing and control functions for alcohol consumption detection system.

A **Push Button** serves as a manual input device that allows workers or supervisors to initiate specific actions, such as system calibration or machine shutdown, as needed.

The **MQ-3** alcohol sensor is a gas sensor specifically designed to detect the presence of alcohol vapor in the air.

An **LCD** (Liquid Crystal Display) serves as a vital component for providing visual feedback and information to users, such as workers and supervisors.

A **Buzzer** serves as an audible alarm to alert workers and supervisors to potential hazards or critical events related to alcohol impairment detection.

Red and Green LEDs serve as visual indicators to convey important information about the system's status, alert users to potential risks, and provide feedback on detected alcohol impairment. The Red LED typically indicates an alarm or warning condition. The Green LED signifies a normal or safe operating condition

The **Relay Module** acts as a switch, controlling the power supply to machinery or equipment based on the detection of alcohol impairment in workers.

DC Motor in our project this motor work as machine as when the sensor detect the alcohol through relay module this machine gets shutdown.

V. SOFTWARE USED

Arduino IDE: The Integrated Development Environment (IDE) used for programming Arduino boards. It provides a user-friendly interface for writing, compiling, and uploading code to the Arduino platform.

VI. RESULTS AND DISCUSSIONS

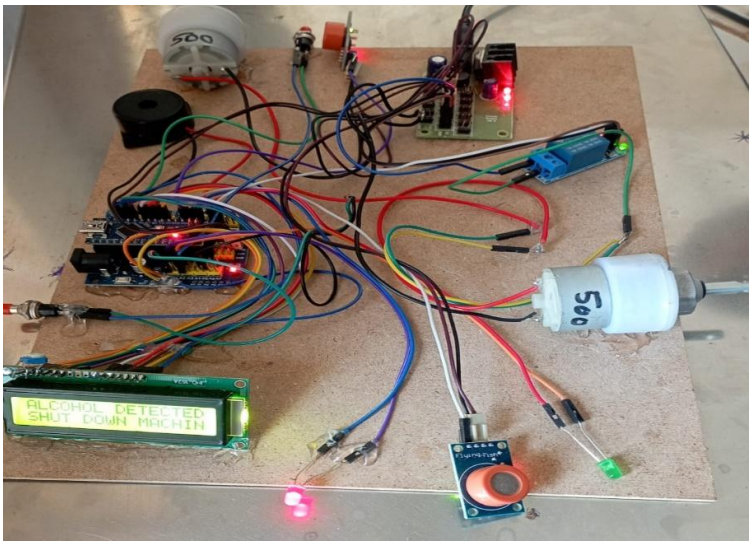

Figure 2: Factory worker Alcohol Detector with Automatic Machine Shutdown

When We Switch ON the kit shows the “NO ONE START WORK ON MACHINE” message

When We Press the push button it shows “MACHINE STARTED” message

When Alcohol is not detected the machine will work and Green Led glows

When the sensor senses the Alcohol, it shows “ALCOHOL DETECTED SHUT DOWN MACHINE” message and give a beep sound through buzzer and the RED led glows and machine stop working.

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VII. CONCLUSION

Alcohol detection and automatic machine shutdown systems are crucial components of modern industrial safety protocols. These systems, whether used individually or in combination, have proven to be effective in reducing the risk of alcohol-related accidents in factories and other industrial settings. Continued research and development in this field are essential to further enhance the accuracy and reliability of these systems, ensuring the safety and well-being of factory workers.

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