Design and Implementation of Cleaning Assistant for Metal Based Manufacturing Industry using Electromagnetic Coil

K.T.Anitha[1], G.Anbarasi[2]
[1]*Student, Electricals and Electronics Engineering, IFET College of Engineering, India*
[2]*Assistant Professor, Electricals and Electronics Engineering, IFET College of Engineering, India*

Abstract **- The paper presents the technical construction of a robot which is used in cleaning in metal-based manufacturing industries involving cutting, grinding and shaping of metals. The term "cleaning" sounds simple, yet we humans face a lot of problems with the disease-ridden workplace. The metal scrabs released by metal working in these industries can affect workers health since many of them are toxic where it is harmful for humans to work. And also, it may damage equipments and ignite explosions hence it is necessary to remove these dust particles immediately from the metalworking space from small workshop to large industries. Internet Of Things (IOT) is used to control the movement of robot and also the relay. The mechanical part is the base (rectangular wooden piece) with two DC motor and the four wheels (plastic wheels) in this case. The material used in mechanical part can be changed according to our prerequisite. The electronic part consisting of the ESP8266 wi-fi microchip, Atmega 328p, L239 motor drive, Relay, Electromagnet, 12V Battery and Power unit.**

Index Terms **- Cleaning, Metal working, IOT.**

INTRODUCTION

Workplace dust is indispensable in many occupations, it is necessary to remove the dust particles as long-term exposure to remove this dust may cause breathing problems, irritation of eyes, nose, throat and in some cases it may cause dermatitis. Because of these serious issues caused by the dust particles to humans and also to the environment it is a mandatory one to clean dust. In this proposal emphasis has been placed on strong metal dust such as iron, alloys of iron, nickel, cobalt etc… The iron is a reusable metal which can be re-melted and used for different puposes. Thus cleaning of metal dust particles not only for cleaning and to improve the air quality, it also involves in recollection of reusable particles. Breathing these metals can harm the lungs, nervous system and other organs such as liver and kidneys. Apart from this health issues, there are many other problems in handling metal dusts. As iron dusts are combustible, it may cause severe explosion when it is subjected to ignition. Hence accumulation of combustible dusts in the workplace can lead to far greater consequences. Metal dusts increase the severity of explosion and sensitivity because of their physical and chemical properties. Upon ignition in a contained enclosure volume and propagation to interconnected vessels, metal dusts exhibit augmented explosion severity and sensitivity because of their large heats of combustion, higher burning temperatures, radiative heat transfer effects and abnormally reactive interactions with water. These characteristics are specific to metal dust fuels and are not commonly demonstrated in organic combustion. It is not enough just to present the dangers of their working environment to the workers. It is necessary to take actions to get rid of the dangers, hence actions must be taken.

Block diagram

The block diagram of the hardware component

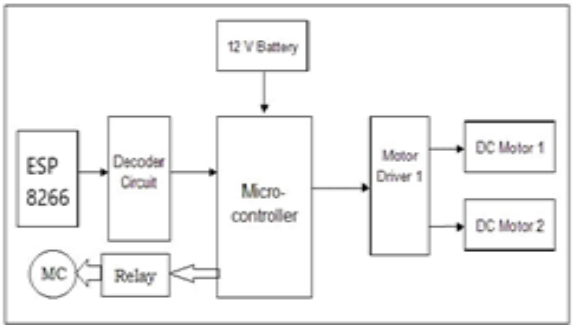


Fig.1 Block diagram of the hardware

ESP8266

The ESP8266 WiFi Module is a 32-bit tensilica processor and self-contained Security Operations Centre (SOC) with integrated TCP/IP protocol stack that can give any microcontroller access to the WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor. It is cost effective board.

Fig.2 Control buttons using IOT

Power supply

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage.

This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

12V 1.3AH Sealed Lead Acid Battery

The 'Online' range of sealed lead acid batteries are maintenance free, valve regulated, and leak proof ideally suited to all 'standby applications. There will be no loss in power output over the battery life. Low self-discharge of about 2-3% per month compared with 20-30% for more common battery systems. Quality construction with no compromise on materials to ensure a long service life. Low internal resistance means a high discharge rate. Wide operating temperature range operating between -15° C to +50 ° C when fully charged.

Microcontroller

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

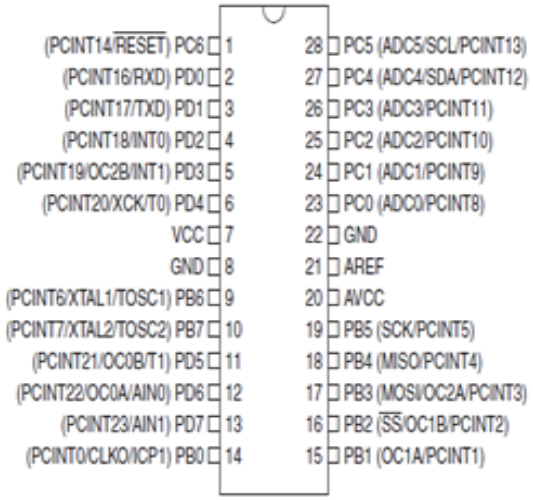


Fig.3 Pin diagram of Atmega 328p

L293 Motor Drive

The L293 is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. Small means small. The L293 is limited to 600 mA, but in reality, can only handle much small currents unless you have done some serious heat sinking to keep the case temperature down.

The pinout for the L293 in the 16-pin package is shown below in top view. Pin 1 is at the top left when the notch in the package faces up. Note that the names for pin functions may be slightly different than what is shown in the following diagrams.

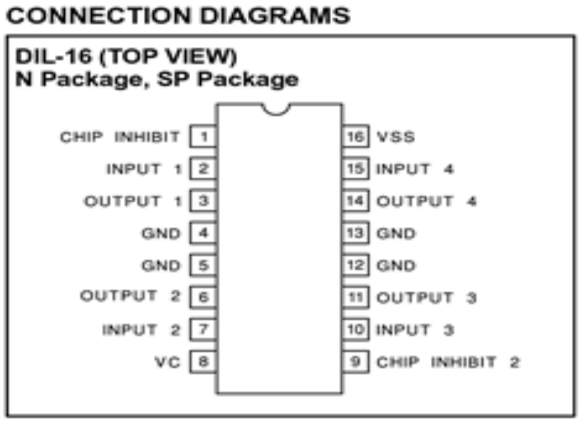


Fig.4.Connection diagram of L293 motor drived

12 V Dc motor

A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today.

Fig.5 DC motor

Relay

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it) Electromagnetic relays are those relays which are operated by electromagnetic action. Modern electrical protection relays are mainly microprocessor based, but still electromagnetic relay holds its place. It will take much longer time to be replaced all electromagnetic relays by microprocessor based static relays. So before going through detail of protection relay system we should review the various types of electromagnetic relay.

Magnetic coil

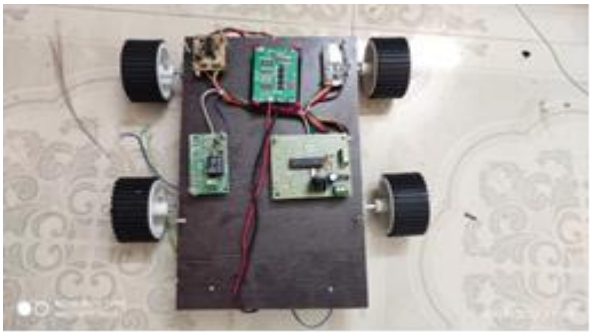
DC 12V KK-P25/20 8KG Lifting Solenoid Electromagnet consists of an iron core and a coil to attract magnetic substances, using the magnetic action induced by electric current, only while the current is applied. This compact functional device offers high power with high reliability. The structure and design to release the residual magnetism left after de-energization is also one of its unique features.

Fig.6 Magnetic coil

Working

The working of the proposed system is based on the user control. The user can control the movement of the robot through internet. The magnetization and demagnetization of magnet coil is controlled by the relay used. The relay is also operated through internet. Where there is a strong metal dust like iron steel etc it can attracted by the magnetic coil and thereby the dust is cleaned up from the workspace.

Hardware implementation



RESULT

The overall objective of the paper is design and implement a cleaning assistant for metal-based industry with effective performance.

CONCLUSION

In this paper represents the cleaning assistant for metal-based manufacturing industries and also for small workshops. This model improves the safety of the workers and also improving the quality of air.

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