FABRICATION OF AUTOMATIC BLACK BOARD CLEANING MACHINE

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Abstract : At recent years whiteboard/blackboard has become a crucial element at almost every educational institute. They are large in size, for that reason it is very time consuming and tedious process to erase the writings from the board with duster manually also chalk dust scatter can cause health issues like skin irritation and some lungs related problems. It even breaks the concentration of both lecturers and listeners.

We here propose an automated blackboard or whiteboard cleaning mechanism that cleans entire boards automatically with just a button click. Our system uses a aluminum frame, lead screw, arduino, two channel relay, Bluetooth module, motor driving chip, dc motor with 1000rpm, arduino app on mobile, end stoppers and a slider. When we give the command from the arduino app to Bluetooth module, it transfers command to the arduino. The arduino send voltage signals to the two channel relay module which provides power to 12V DC motor. The motor shaft welded to the lead screw starts rotating, as the lead screw rotates, the slider arranged over the lead screw starts moving either left or right. Whenever the slider comes in contact with the end stopper which are attached on either sides of the board, the end stopper sends signals to arduino and the arduino stops sending voltage signals to relay modul

IndexTerms - lead screw, dc motor, channel relay, Bluetooth module, arduino.

I. INTRODUCTION

Boards play a major role in both business and educational sector. It is known to be one of the major ways amongst many for teaching, presentation and display. Although it started out as the blackboard, it has emerged into enhanced technological boards such as the electronic board, interactive whiteboard and plain whiteboards. The whiteboard or blackboard which is commonly used in the educational sector is the basis of this project, aiming to ease lecturers, teachers as well as students of the work, time and effort it takes to clean the board. An Institution that adapts the appropriate technology can inspire and support teaching. In this technological age of continually evolving computers, laptop, video displays, interactive whiteboards, and internet access, it is shocking to realize that education was first influenced by introduction of chalkboard.

The magnetic whiteboard and blackboard has gone through numerous changes over the past decade, most of which are not easily noticeable. The cost of the Whiteboard or blackboard has gotten cheaper over time, the surface has become easier to wipe. The use of whiteboards or blackboards in learning environments can affect learning in many ways, including raising the level of interaction in a classroom, inspiring students and stimulating eagerness for learning. Whiteboards support many different learning styles and are used in different learning environments, including those with hearing impairments. Educators were the first people to recognize the blackboard's potential as a tool for collaboration, improving student learning outcomes and streamlining lesson plans. Unfortunately, most whiteboards and blackboard used by institutions are still erased by manual user action, which is tedious.

In this project, an automatic whiteboard or blackboard erasing system which consistently cleans boards with the push of a button is created. It is an electro-mechanical system that applies the use of combinational circuits and DC motor to automatically control the wiping of a board. It's a tool for teaching and a tool for learning. The two broad categories emerged in this project: the Automatic Whiteboard wiper as a tool to enhance teaching, and as a tool to support learning. Not just does it help teachers and lecturers but it supports students to also learn by its flexibility and versatility, interactivity of teachers with students.

2.LITERATURE SURVEY

S.Joshibaamali And K.Geetha Priya [1] has explained that the machine can operate in three selectable operatable modes. In the first mode, it cleans the left side of the board. In the second mode it cleans the right side of the board. In the third mode it cleans the whole area of the board.

Mr. Sunil R. Kewate, Mr Inzamam T. Mujawar, Mr. Akash D. Kewate, Mr.Hitesh R.[2] Pant has explained in their paper that the design and principles of sliding type wipe mechanism and also carried out the implementation and experimentation for motion analysis.

S.Nithyananth, A.Jagatheesh, K.Madan, B.Nirmalkumar [3] has explained about rack and pinion mechanism with the application of steering mechanism. This mechanism is used in automobiles to convert the rotation of steering wheels from left to right or right to left. A rack and pinion is generally used to convert the rotational motion into linear motion. Pinion engages teeth on rack. In the steering mechanism the author is trying to tell that the rotational motion applied to pinion will cause rack to slide upto the limit of its travel.

Dong Yeop Kim, Jae Min Lee, Jongsu Yoon, Tae-Keun Kim, Bong Seok Kim, and Chang-Woo Park [4] have researched a gondola typed robot system for wall shape recognition using limit switch. In this the author proposed a limit switch module as a mechanical sensor method. In this system there are two limit switches.

MojtabaKhaliliana,, Ali Abedi, Adel DerisZadeh [5] is explaning that in classical methods only average torque of the stepper motors is controlled which could causes high speed and torque ripple. To control the torque instantaneously and improve the performance of the hybrid stepper motor, direct torque control strategy is used in this paper.

DeepanjanMajumdar [6] Primitive blackboard erasers were at first wet materials or wood boards appended with eraser materials. They were compelling yet made the client open to the chalk dust which may not be deadly but rather could bring about hypersensitivities and issues to persons influenced by asthma or some other breathing issues. The fundamental construction modeling constantly incorporated the chalkboard itself as a critical part and additionally the duster put in diverse behavior yet with a solitary goal to delete the board.

Billie R. Crisp [7] proposed a framework in 1971, a programmed duster eradicating mechanical assembly for classroom use. The development of the pole altered with the eraser was fundamentally done by manual switches. Yet, the most particular piece of the component was the plural dusters installed on the pole in order to expand the duster reach and in addition cleaning the blackboard turned out to be much simpler. The electric engines compass the entire slate in order to move the duster along it. The rollers at top and base cross movement.

In 1993 Solomon Forst [8] planned a board deleting framework. The blackboard is mounted with the cleaning mechanical assembly fitted to the divider; it incorporates a different duster contraption instead of the cleaning material which was utilized as a part of the past models. They recommended that somewhat expanding the costs on an intricate component and in addition custom assembled vertical erasers we ought to utilize the typical dusters fitted on a different piece which then movers around the entire writing board deleting it.

In 2002 Chirag Shah [9] attempted to make the blackboard framework with Sensors to the engines to start engine development. The component control switches were with the client. The duster moved back and forth to eradicate the writing board. When the engine begins moving the apparatus and counter rigging associated with the strung pole which then moves the pole.

The most developed blackboard model was outlined by Jinzan Liu, ZhongZeng and Lang Xu [10] This blackboard deleting framework was the most progressive slate eradicating component which utilized cameras and advanced picture preparing to delete the erasable markings present on the blackboard. This was equipment and programming associated framework.

3. APPLICATIONS

1) Military and aerospace embedded software applications
2) Communication Applications
3) Industrial automation and process control software
4) Mastering the complexity of applications.
5) Reduction of product design time.
6) Real time processing of ever increasing amounts of data.
7) Intelligent, autonomous sensors.

4. CLASSIFICATION

- Real Time Systems.
- RTS is one which has to respond to events within a specified deadline.
- A right answer after the dead line is a wrong answer

4.1 RTS CLASSIFICATION

- Hard Real Time Systems
- Soft Real Time System

4.1.1 HARD REAL TIME SYSTEM

- "Hard" real-time systems have very narrow response time.
- Example: Nuclear power system, Cardiac pacemaker.

4.1.2 SOFT REAL TIME SYSTEM

- "Soft" real-time systems have reduced constrains on "lateness" but still must operate very quickly and repeatable.
- Example: Railway reservation system – takes a few extra seconds the data remains valid.

5. ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece
of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Fig – 5.1:ARDUINO UNO BOARD

The Arduino Uno is a microcontroller board based on the ATmega328. Itas 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a resetbutton. It contains everything needed to support the microcontroller; simply connect it to acomputer with a USB cable or power it with an AC-to-DC adapter or battery to get started

The Uno differs from all preceding boards in that it does not use the FTDIUSB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to versionR2) 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.

Revision 3 of the board has the following new features:

1. 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two othernew pins placed near to the RESET pin, the IOREF that allow the shields to adapt tothe voltage provided from the board. In future, shields will be compatible both withthe board that uses the AVR, which operate with 5V and with the ArduinoDue thatoperate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

2. Stronger RESET circuit.
3. Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. TheUno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno isthe latest in a series of USB Arduino boards, and the reference model for the Arduinoplatform; for a comparison with previous versions, see the index of Arduino boards.

5.1 POWER

The Arduino UNO can be powered via the UNO connection or with an external power supply. The power source is selected automatically.

External (NON- UNO) power can come either from an ac-to-de adapter(wall-wart) or battery. The adapter can be connected by plugging a 2.1mm centre-positiveplug into the board's power jack. Leads from a battery can be inserted in the gad and vin pinheaders of the power connector.The board can operate on an external supply of 6 to 20 volts. If suppliedwith less than 7v, however, the 5v pin may supply less than five volts and the board may beunstable, if using more than 12v, the voltage regulator may overheat and damage the board.The recommended range is 7 to 12 volts

The power pins are as follows:

- **VIN:** The input voltage to the Arduino board when it's using an external power source

  (as opposed to 5 volts from the USB connection or other regulated power source) You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: the regulated power supply used to power the microcontroller and other

  components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply
- **3V3**: A 3.3volt supply generated by the on-board regulator. Maximum current draw is

  50 mA.
- **GND**: Ground pins

5.2 MEMORY

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROMlibrary.

5.3 INPUT AND OUTPUT

Each of the 14 digital pins on the Uno can be used as an input or output, usingpin Mode, digital Write, and digital Read functions. They operate at S volts. Each pin canprovide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected bydefault) of 20-50 k Ohms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX), Used to receive (RX) and transmit (TX) TL serial data. Thesepins are connected to the corresponding pins of the ATmegaSU2 USB-to-TTIL Serial chip.

1. External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt ona low value, a rising or falling edge, or a change in value. See the attach Interruptfunction for details.

2. PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Writefunction.

3. SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPIcommunication using the SPI library

4. LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGHvalue, the LED is on, when the pin is LOW, it's off

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5volts, though is it possible to change the upper end of their range using the AREF pin and theanalog Reference function. Additionally, some pins have specialized functionality.

1. TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using theWire library.
2. There are a couple of other pins on the board:
3. AREF:Reference voltage for the analog inputs. Used with analog Reference.
4. Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

5.4 COMMUNICATION

The Arduino Uno has a number of facilities for communicating with acomputer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTLSV) serial communication, which is available on digital pins 0 (RX) and 1 (TX). AnATmcga16U2 on the board channels this serial communication over USB and appears as avirtual com port to software on the computer. The 16U2 firmware uses the standard USBCOM drivers, and no external driver is needed. However, on Windows, an .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the hoard will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (butnot for serial communication on pins 0 and 1).A Software Serial library allows for serial communication on any of the Uno's digital pins.

The ATmega328 also supports 12C (TWI) and SPI communication. TheArduino software includes a Wire library to simplify use of the 12C bus; see thedocumentation for details. For SPI communication, use the SPI library

5.6 USB OVER CURRENT PROTECTION

The Arduino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internalUSB protection, the fuse provides an extra layer of protection. If more than 500mA is applied tothe USB port, the fuse will automatically break the connection until the short or overloadremoved.

5.7 PHYSICAL CHARACTERISTICS

The maximum length and width of the Uno PCB are 2.7 and 2.1 inchesrespectively, with the USB connector and power jack extending beyond the formerdimension. Four screw holes allow the board to be attached to a surface or case. Note that thedistance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100milspacing of the other pins

5.8 WHAT DOES IT DO?

The Arduino hardware and software was designed for artists, designers, hobbyists,hackers,newbies, and anyone interested in creating interactive objects orenvironments, Arduino can interact with buttons, LEDs, motors, speakers, GPS units,cameras, the internet, and even your smart-phone or you're TV! This flexibility combinedwith the fact that the Arduino software is free, the hardware boards are pretty cheap, and boththe software and hardware are easy to learn has led to a large community of users who havecontributed code and released instructions for a huge variety of Arduino-based projects.

For everything from robots and a heating pad and warmingblanket to honest fortune-telling machines, and even a Dungeons and Dragons dice-throwinggauntlet, the Arduino can be used as the brains behind almost any electronics project.

5.9 WHAT'S ON THE BOARD?

There are many varieties of Arduino boards (explained on the next page) that can be used for different purposes. Some boards look a bit different from the one belowbut most Arduinos have the majority of these components in common.

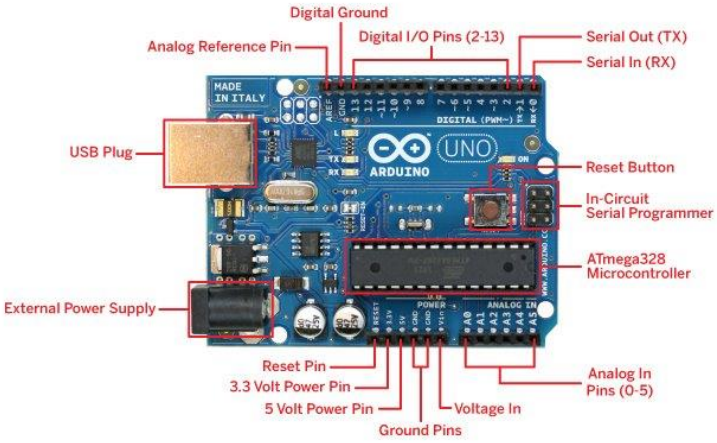

Fig – 5.2 :ARDUINO UNO BOARD PARTS

5.9.1 POWER (USB/BARREL JACK)

Every Arduino board needs a way to be connected to a power source. TheArduino UNO can be powered from a USB cable coming from your computer or a wallpower supply (like this) that is terminated in a barrel jack.

In the picture above the USB connection is labeled (1) and the barrel jack is labeled (2). The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial.

NOTE: Do NOT use a power supply greater than 20 Volts as you will overpower (and thereby destroy) you're Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts

5.9.2 PINS (5V, 3.3V, GND, ANALOG, DIGITAL, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit(probably in conjunction with a breadboard and some wire. They usually have black plasticheaders' that allow you to just plug a wire right into the board. The Arduino has severaldifferent kinds of pins, each of which is labeled on the board and used for different functions.

1. GND (3): Short for 'Ground . There are several GND pins on the Arduino, any of which can be used to ground your circuit.

2. 5V (4) & 3.3V (5): As you might guess, the SV pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.

3. Analog (6): The areas of pins under the Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read

4. Digital (7): Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).

5. PWM (8): You may have noticed the tilde () next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).

6. AREF (9): Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins

5.9.3 RESET BUTTON

Just like the original Nintendo, the Arduino has a reset button (10). Pushingit will temporarily connect the reset pin to ground and restart any code that is loaded on theArduino. This can be very useful if your code doesn't repeat, but you want to test it multipletimes. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix anyproblems.

5.9.4 POWER LED INDICATOR

Just beneath and to the right of the word "UNO on your circuit boardthere's a tiny LED next to the word 'ON' (11). This LED should light up whenever you plugyour Arduino into a power source. If this light doesn't turn on, there's a good chancesomething is wrong. Time to re-check your circuit!

5.9.5 TX RX LEDs

TX is short for transmit, Rx is short for receive. These markings appearquite a bit in electronics to indicate the pins responsible for serial communication. In ourcase, there are two places on the Arduino Uno where TX and Rx appear once by digital Pins 0 and I, and a second time next to the TX and rx indicator leds (12). These ledS will giveus some nice visual indications whenever our Arduino is receiving or transmitting data (likewhen we're loading a new program onto the board).

5.9.6 MAIN IC

The black thing with all the metal legs is an IC, or Integrated Circuit (13).Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the Atmega line of IC's from the ATMELCompany. This can be important, as you may need to know the IC type (along with yourboard type) before loading up a new program from the Arduino software. This informationcan usually be found in writing on the top side of the IC. If you want to know more about thedifference between various IC's, reading the datasheets is often a good idea.

5.9.7 VOLTAGE REGULATOR

The voltage regulator (14) is not actually something you can (or should)interact with on the Arduino. But it is potentially useful to know that it is there and what it'sfor. The voltage regulator does exactly what it says- it controls the amount of voltage that islet into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extravoltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduinoto anything greater than 20 volts

6. TECHNICAL SPECIFICATIONS

1. **Microcontroller**- ATmega328
2. **Operating Voltage**- 5V
3. **Input Voltage (recommended)** - 7to12V
4. **Input Voltage (limit)** -6to20v
5. **Digital I/O Pins**-14 (of which 6 provide PWM output)
6. **Analog Input Pins**-6
7. **DC Current per IO Pin**-40mA
8. **DC Current for 3.3V Pin**-50mA
9. **Flash Memory**-32 KB (ATmega328) of which 0.5 KB used by boot loader
10. **SRAM**-2 KB (ATmega328)
11. **EEPROM**-1 KB (ATmega328)
12. **Clock Speed**-16 MHz

7. ADVANTAGES

- In this project time requires to erase the blackboard is less as compared to hand erasing.
- Effective method for collecting the chalk¬ dust.
- By automation of erasing mechanism,¬ human energy can be saved.
- Blackboard can be erased according to the¬ requirement.
- Problem of dust can be reduced.
- Easy and fast operation with maximum wiping area
- It requires less or no maintenance.
- This project requires less money to fabricate
- This project is more useful in schools and colleges.

8.CONCLUSION

The objective of this work which is to fabricate an automated white or black board cleaner has been achieved to an extent. Blackboard will be erased automatically without any manual support. User has to only press appropriate key of mobile App to erase the blackboard in required manner. User can erase the required portion of the blackboard. No need to erase the whole blackboard. User has to take care that appropriate key assign for that direction of blackboard must be pressed. In this project, provision is provided for the¬ effective chalk dust collection. After cleaning the blackboard chalk dust will be automatically collected in the box placed below the board. Wireless system is provided to erase the¬ board from defined range of distance. Mobile App is provided to make the system user friendly. User has to press the appropriate key to erase the board from defined range distance.

Even though, automatic duster machine successfully fabricated but this machine needs some improvement to add to make this machine in high performance and comfortable to the user. Further research must be done in order to make the machine meet the specification and requirement for commercialized purpose. There are some ideas for the future development of Automatic Duster Machine. Redesign the mechanical structure -- in this project the design more like a prototype for this machine. To make it become reality this machine must be redesign to make it comfortable and able to apply in real world.

Eye of machine – we can make this machine operate with detection of dirty in whiteboard. Machine knows the location of dirty and erases it automatically.

Develop a liquid system for duster which could make it always in little wet condition while wipe-off the whiteboard.

Develop a timer on the system which it will be automatic submit a signal to eraser system to wipe-off the whiteboard after it was not used for certain time. This can prevent some remnants of the prior hand-written notations remain..

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