An Integrated Cleaning Approach of Automatic White Board

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Abstract--At present days, the white boards are widely used in almost every educational institute. In a research, it is found that more than 70% educational institutes around the world use white board as the writing medium in their class room. For the large size, it is so tough to erase the writings from the board with duster. It is really painful to invest our energy dependably for cleaning the white board. If a class continues about one hour, then about 8-10% time becomes waste because of cleaning the board using normal duster. Rather than this, the D.C engine is controlled so that the white board is to be cleaned very easily in a short time. This undoubtedly saves our profitable, valuable time. Considering this, "An Integrated Cleaning Approach of Automatic White Board", an automatic system can solve these problems. The board wiper will shorten the time and also the effort. It takes around 8 seconds to clear the board without destroying the quality. This system consists of microcontroller, motor driver, 12v transformer, IPS, wiper with two dusters and a wiper motor. Here, two dusters have been used in a wiper. Each duster can erase 50% of the whole white board. The whole board can also be erased in a time. Then, the two dusters will work in a same time. Where there is no electricity, then IPS (Instant Power Supply) is used for power. Solar cell can also be used in this system but it can be so expensive. Considering the cost, IPS has been used for the alternative of solar cell.

***Key Words:* Automation, IPS, Wiper, Wiper Motor, Microcontroller, 12v Transformer.**

1. INTRODUCTION

Our love is seen for the good old blackboard- those sweet smells of chalk that hissing sound for writing on the board. It can be written in bold by applying pressure and shaded different areas of a diagram by flipping the chalk sideways and wiping it across the blackboard surface. Students used to play "chalk-fights" between groups of them. Now, blackboard is not seen around anymore. The popularity of whiteboards increased rapidly in the mid–1980s and they have been used in many offices, meeting rooms, school classrooms and other work environments. The first whiteboard (also called marker boards) began to appear on the market in the mid–1960s. The first whiteboards which were very expensive were made of a melamine surface. It was really the "perfect" solution to the chalkboard, except that it ghosted in a short time and was not easy to keep clean. In our class or lecture rooms, the dire need for a duster that would be readily available at all times for cleaning the whiteboards has been a major concern, the height of some boards cleaners also affect the section of the board to be cleaned. Even when the board cleaners are available, it takes lecture time away from the lecturer to erase the board again and again. For this reason, its need for a faster, time saving and readily available cleaner has given birth to the design of an automated white board cleaner that can clean the board in a small amount of time as possible.

2. BACKGROUND

Man living in the cave early in the civilization used the wall of the cave as the writing medium. They used the wall to capture various memories or the story of their own culture and daily activities. As the time goes on and a civilized society was being formed the scenario begun to change. People began to use a big slice of the wood piece as the board and coal as the pen medium in the middle age. But it was not so comfortable and it became nasty. After that the black board had been introduced. It's nothing but a black canvas where a chalk is used as the pen medium. Chalk is a composite of calcium carbonate and it looks like a stick. It was comfortable but it creates dust during wiping the board using the duster. A duster is device which is used to wipe the writings from the board. Though the black board has not lost its popularity as in present time and it's being used widely across the world. But, it is a white board which is the modified version of the black board. Here, man uses a marker pen for writing and they use a piece of cloth or foam as a duster. Now, white board is the best writing medium during teaching across the world. At present, it is seen that almost everything is automated. The automation system has the capacity to reduce the human effort and to make any arrangement easier. So, those became possible for micro-controlling system. ATMEGA16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. It is an open-source hardware controller which is designed to ease any mechanism by using electronic commands.

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3. LITERATURE SURVEY

It is known that Deepanjan Majumdar primitive were at first wet materials or wood boards appended with eraser materials. They were constraining 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 that is harmful for persons. The fundamental construction modeling constantly incorporated the chalkboard itself as a critical part. Besides this, the duster put in diverse behavior yet with a solitary goal to delete the board [1]. Billie R. Crisp planned a framework in 1971, a programmed duster eradicating mechanical assembly for using in classroom. The development of the pole altered with the eraser which was performed by manual switches that was not comfortable. Yet, the most particular piece of the component was the plural dusters that were installed on the pole in order to expanding the duster reach and in addition cleaning the blackboard turned out to be much simpler. The rollers at top and base cross movement [2].
In 1993, Solomon Forst proposed a board deleting framework. In this 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 [3].

In 2002, Chirag Shah desired 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 so that it eradicates the writing board. When the engine begins, then this project can also be modified to clean board as present in schools, colleges, universities, conference and seminar hall which is a technical job for any human to perform moving the apparatus and counter rigging associated with the strung pole which then moves the pole.

It is known that Jinzan Liu, Zhong Zeng and LangX outlined the most developed model. 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 [4].Our proposed device is cost effective, reliable, time saving and easily transportable.

4. OBJECTIVES

To reduce the work and time required to erase the board so as to ease the problems of teachers as well as students. Here, it is modified into a gesture controlled eraser by using camera and DSP processors so as to identify the position or changing location of the users hand and make the duster do so.

5. METHODOLOGY

Motor driver along with microcontroller is used for rotating a motor both clockwise and anti-clockwise. The L293D chip is also used what's known as a type of H-Bridge. The H-Bridge is typically an electrical circuit that enables a voltage to be applied across a load in either direction to an output. This means that it is possible to reverse the direction of current and thus reverses the direction of the motor. In this circuit, capacitor is used to smooth out the power load to the motors as much as possible to help avoid any spikes and to stabilize the current.

6. HARDWARE IMPLEMENTATION

Automatic white board cleaning system is divided into two individual parts. One is to erase writing and another is to control, charging and backup the system automatically. The controlling unit contains the following components:

A. ATMEGA16:

ATMEGA16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. It is based on enhanced RISC (Reduced Instruction Set Computing, Know more about RISC and CISC Architecture) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. ATMEGA16 can work on a maximum frequency which range is about 16MHz. ATMEGA16 has 16 KB programmable flash memory, EEPROM of 512 Bytes. Its static RAM is 1KB. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000 respectively. ATMEGA16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATMEGA16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals [5].
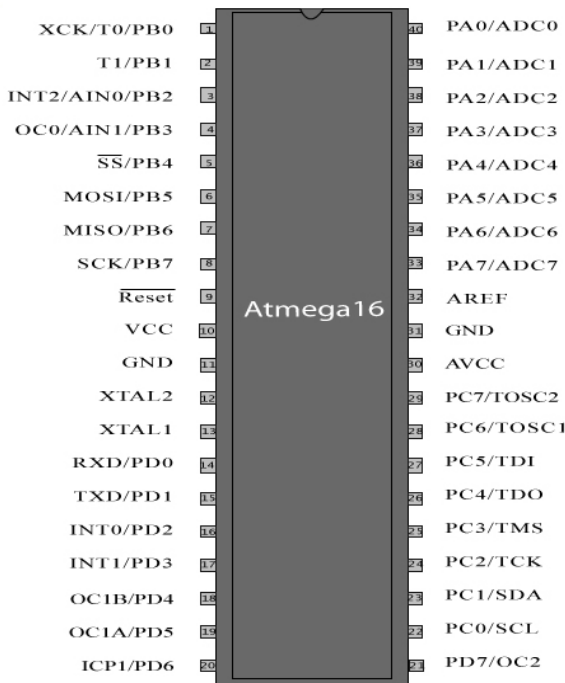
Figure 1: Atmega 16 [5].

B. Motor Driver: (L293D IC)

Motor driver L293D is a typical Motor Driver IC which allows DC motor to drive on either direction. It has 16-pins which can control a set of two DC motors simultaneously in any direction. It means that one can control two DC motor with a single L293D IC.
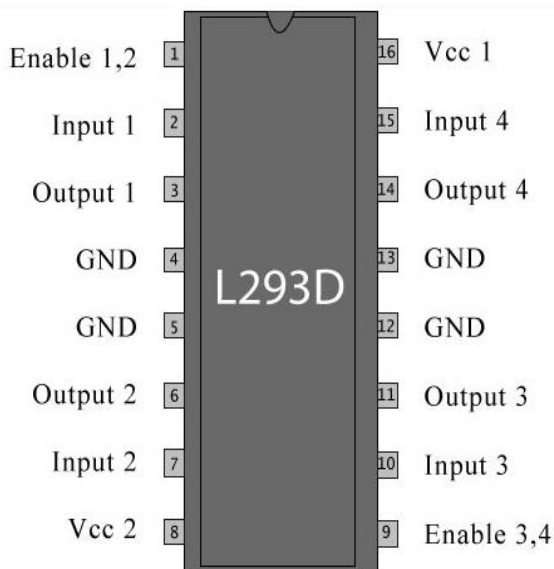
Figure 2: Motor Driver [6]

It fundamentally works on H-bridge concept that allows the voltage to be flown in either direction. As everybody knows that voltage needs to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor.

A single L293D consists of two h-Bridge circuit inside the IC which can rotate two dc motor independently. L293D is more effective. For its size, it is very much used in robotic application for controlling DC motors. The pin diagram of a L293D motor controller is showed in above. Actually, motor driver is an integrated circuit chip. The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE [7].

C. Wiper Motor

The mechanism behind wipers is the windshield wiper motor, which provides the power the wipers need. A linkage converts the rotational output of the windshield wiper motor into the back-and-forth motion of the wipers. The force that the windshield wiper motor delivers to the drive arm by slowing down the speed of the electric motor by 50 times while multiplying the torque by 50 times is controlled by a worm gear.

The parts of the wipers that are seen from the outside include a rubber blade, arms to hold the rubber blades and a spring linkage. There are usually two standard wipers; one is set in front of the driver and another is towards the middle which cleans the white board. The two wipers move in tandem to clean the board. The wipers, secured by pivots, are mounted on brackets at both ends of a connecting link, which is basically a long rod [8].Wiper motor is used for cleaning the board.

Figure 3: Wiper Motor [9]

D.　12 Volt Transformer

A Transformer is an electrical device that conveys electricity of one voltage and changes it into another voltage. In AC circuits, AC voltage, current and waveform can be transformed with the help of Transformers. It plays an important role in electronic equipment. AC and DC voltage in power supply equipment are almost achieved by transformer's transformation and commutation. Figure 4 shows the Transformer.

Basically, a Transformer changes electricity from high to low voltage or low to high voltage using two properties of electricity. In an electric circuit, there is magnetism around it. Secondly, whenever a magnetic field changes (by moving or by changing strength) a voltage is made.
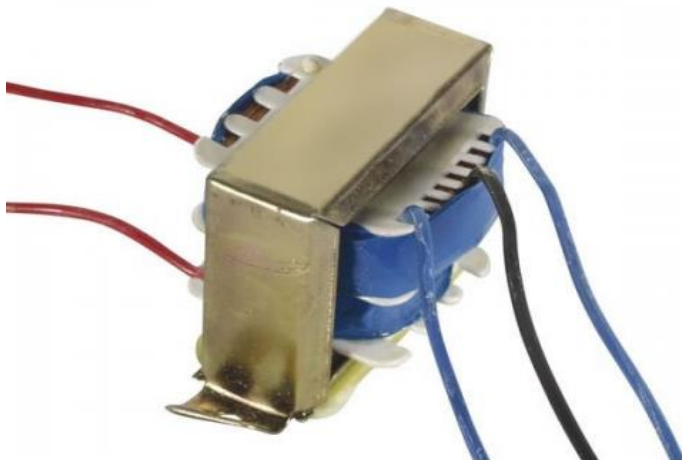
Figure 4: 12v Transformer [10]

A Transformer takes in electricity at a higher voltage and lets it run through lots of coils wound around an iron core. "When a voltage is applied to the primary winding, a single-phase Transformer can operate to either increase or decrease the voltage. Because of the alternating current, the magnetism in the core is also alternating. Also around the core is an output wire with fewer coils. The magnetism changing back and forth makes a current in the wire. Having fewer coils means less voltage. When it is used to "decrease" the voltage on the secondary winding with respect to the primary it is called a Step-down Transformer**. When a Transformer is used to "increase" the voltage on its secondary winding with respect to the primary, it is called a Step-up Transformer**.

However, a third condition exists in which a transformer produces the same voltage on its secondary as is applied to its primary winding. In other words, its output is identical with respect to input. This type of Transformer is called an "Impedance Transformer" and is mainly used for impedance matching or the isolation of adjoining electrical circuits.

The other components for control system are e-numerated below.

e. 10K Ohm resistor (Brown, Black, Orange, Gold)
f. 50V 10uF Capacitor.
g. A switch (push)
h. Jumper.

The elements that are used for building the wiping section consists of stainless steel, aluminum pipe, wood, pulleys ,foam, cord and cloth.

7.　MODELING

The circuit diagram is shown below. Two motors are connected through one motor driver. A switch is used as input. Current flows to the motor driver when switch becomes ON. Here, current is passed according to the program loaded in the microcontroller. Then, motor starts respectively for the microcontroller program.

Figure 5: Circuit diagram of the whole system for the board cleaner

The above figure illustrates the control system circuit diagram drawn by Proteus. The system is constructed according to this diagram. The corresponding pin numbers are exactly connected to the motors through motor drivers. The logical expression for the system is shown below as a flow diagram in the following figure

Figure 6: Block diagram of control system

8. BUILT IN CONTROL UNIT IPS SYSTEM

To overcome above shortcomings an initiative was taken to design such an IPS that will give a stable output and its battery will serve for a long time compared to the conventional IPS. It will also be available at comparatively low cost

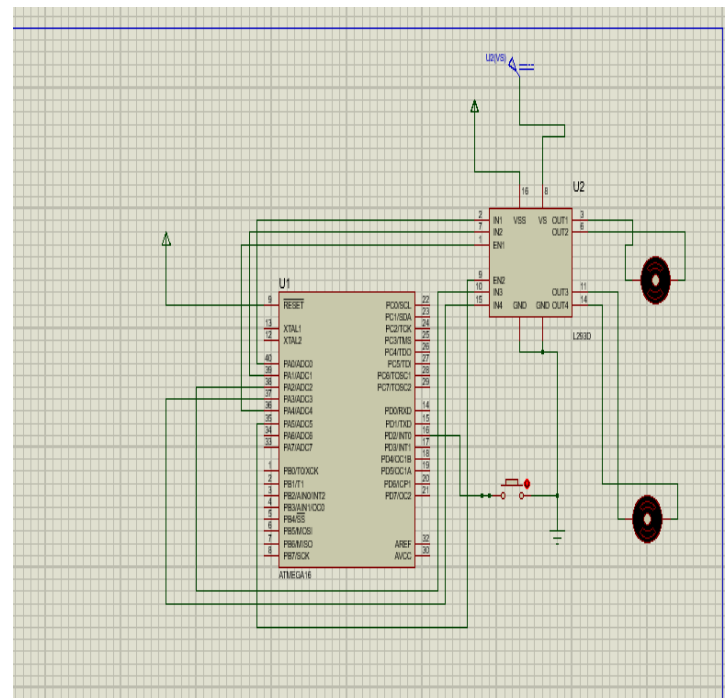| Serial Number	Features	Specification
1	Main Voltage	220v,50Hz
2	Low Voltage Power Supply	12v
3	Temperature Range	$(0\text{-}30)^0$ C
4	Output Range	12v
5	Voltage Regulator	7805
6	Power	90w
7	Backup Time	Battery Dependent

Table 1: The specification of the designed IPS [11].

Here, IPS is used for the alternative of electricity. When there is no electricity, then it also can be used by using IPS. Here, solar cell can also be used but solar cell is more costlier than the built in control unit IPS system [11].

9. DISCUSSION AND CONCLUSION

It is observed that the time requires for complete cleaning the whole board using this machine is average 8 sec. On the other hand, while using the manual process the time is about 25 sec which is nearly about three times of the machine time. Though there have some lagging in to start the motor, but averagely it is optimum. The machine is reducing both time and human effort. It also maintains the visual quality of the board. This construction consists of AVR microcontroller. But it is possible to fabricate the circuit using Atmega16, Atmega-128 and other chip. For that reason, it is very easy to crest the controlling circuit which enables us to create the machine easily. Besides this, to construct the main structure very simple tool work is needed and the materials used in this is not very costly and available in market. So, it is not complicated to construct this machine and it will help to introduce an automation system. The system can be further developed by integrating a Bluetooth remote for controlling the switch. Infrared sensors can be used to convert this system to a smart white board.

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