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AUTOMATIC CLOTH DRYER

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Abstract - *Development of Clothes Dryer Machine is a project that was inspired by real life problem faced by housewives during rainy season .This project focusing in designing and including to develop the system and also its body structure. The objective of the project is to develop and improve the Clothes Dryer Machine. The current clothes dryer machine also known as tumble machine is used to dry a loads of textiles have many types that have been released in the market. Most of them use Spinning and Heating concept as a way to remove moisture from the clothes. It comes with many shapes and sizes according to amount of load that can be filled in the machine. Basically, the machine is unmovable and it is also difficult to replace the equipment during break down and most importantly present dryers uses tumbling and heating together which can curl and shrink clothes. Our aim is to develop a machine that can fulfill those criteria.*

Keywords **- Low-cost solution, Power efficient, High Speed, compact in size, Easy to repair, Simple to use and User friendly, Humidity based approach, Cloth friendly Solution.**

1. INTRODUCTION

The first electric dryer was invented in the early 20th century. Inventor J. Ross Moore was tired of hanging his clothing outside, especially during the winter. To help keep his wardrobe out of the freezing weather, he built a shed to house his clothes while they dried. In addition, he added a stove. The clothing would hang on the line in front of the fire and dry. This was the beginning of the development of electric dryers. For the next three decades, Moore worked to eventually build a gas and electric unit, but couldn't find anyone to help him get his idea manufactured. The drum-type model was built and eventually picked up by Hamilton Manufacturing in Wisconsin. The new dryers were sold under the name June Day beginning in 1938. A clothes dryer, also known as tumble dryer, is a powered household appliance that is used to remove moisture from a load of clothing, bedding and other textiles, usually shortly after they are washed in a washing machine. Otherwise, clothes may also be dried by natural evaporation and, if available, sunlight, on an outdoor or indoor clothes line or clothes horse which also cause fading of colour of cloth.

2. LITERATURE SURVEY

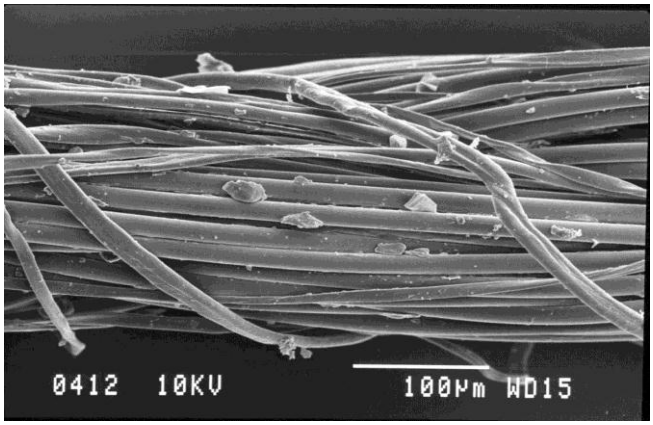

Fig 1: Cotton thread under a microscope (SEM). Image from UWBL.

Most dryers consist of a rotating drum called a tumbler through which heated air is circulated to evaporate the moisture from the load. The clothes dryer also known as tumble machine is used to dry loads of textiles has many types that have been released in the market. Most of them use spinning concept as a way to remove moisture from the clothes. Besides that, there are many shapes and sizes that come with amount of load that can be filled in the machine. Due to Heating and rotating action clothes can curl and shrink too.

3. PROPOSED SYSTEM

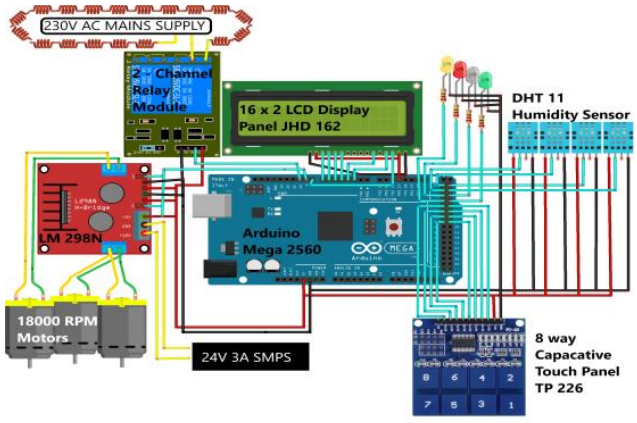

Fig 2: Proposed System.

Our system consists of heater to dry the clothes. Our System has capability to select type of fabric and accordingly plan efficient way to dry that particular fabric. It's purely based

on predefined algorithms which are based on humidity of fabric. According to humidity fan air flow and heat provided are adjusted according to fabric. The Circuitry consists of Arduino Mega 2560 which does the work of controlling fan speed with the help of motor driver (L298N) and provide heat with the help of relay by connecting to the Heating element (nichrome coil) to 230V AC Mains by using the feedback provided by the Humidity sensors (DHT 11) and does the work of displaying completeness of drying on LCD panel. Mega is also provided inputs through 8-way Capacitive Touch Sensor (TTP 226), The motors are provided 24V by 24V, 3A SMPS which is connected to L298N. LEDs are use to show status of system i.e. process Started, Error present, on Hold or completed.

3.1 DATA FLOW GRAPH

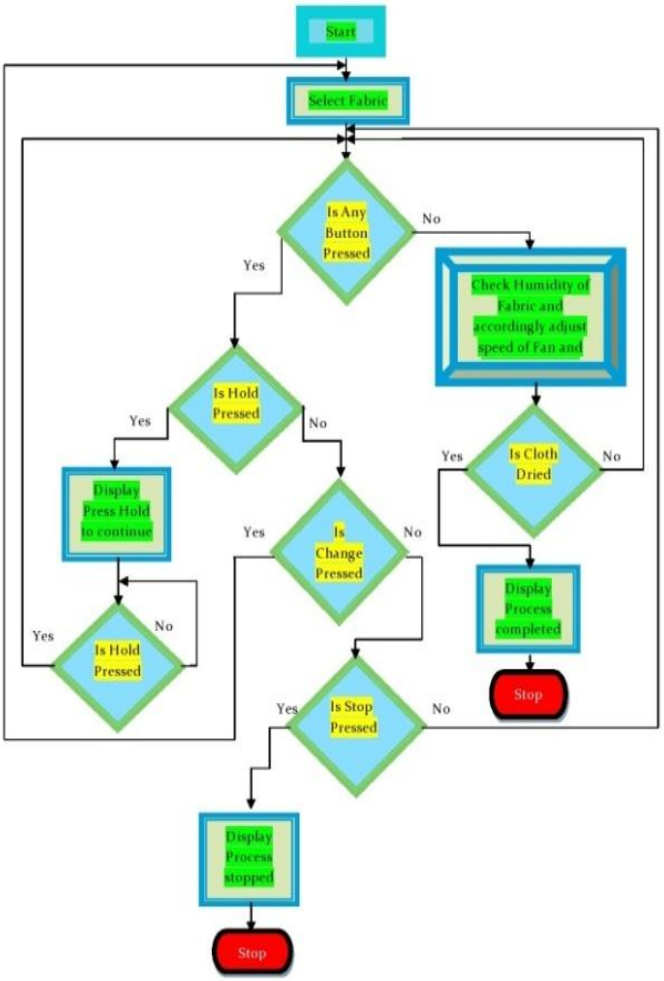

Fig 3: Data Flow Graph.

3.2 WORKING

The system takes fabric input once user presses START button. The user has four choices that are COTTON, NYLON, SILK and CLOTH INDEPENDENT. Once the user selects fabric the machine starts drying that particular fabric by adjusting fan speed and heat based on that fabric type and Humidity of the fabric. The adjustments are based on algorithms which were generated by testing the fabric by providing it that fan speed and heat. User can stop the process by pressing STOP button and process can be completely stopped. The user can pause the process by pressing HOLD and everything stops, to continue the process user to press HOLD again. The System has CHANGE button which can change fabric type if the user wishes to change fabric type. It is allocated by considering the possibility of pressing of wrong button. Once CHANGE button is pressed user can again select Fabric type. Once the Cloth is Dried user is notified by the tune.

4. REQUIREMENTS

4.1 HARDWARE REQUIREMENTS

ARDUINO MEGA

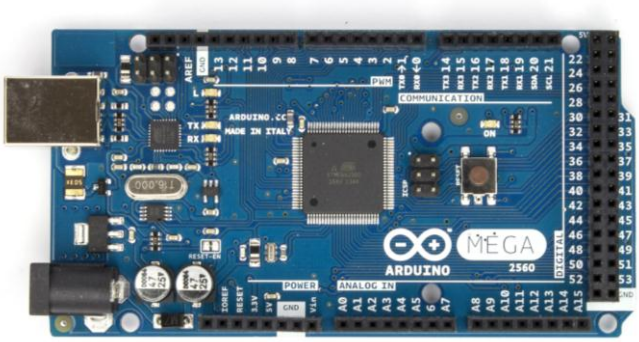

Fig 4: Arduino Mega

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs) and DC Current for each input/output pin is 40 mA, 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The operating voltage of this microcontroller is 5volts and the recommended Input Voltage will range from 7volts to 12volts. The USB host chip used in this is MAX3421E. Flash Memory like 256 KB where 8 KB of flash memory is used with the help of bootloader. The static random access memory (SRAM) is 8 KB. The electrically erasable programmable read-only memory (EEPROM) is 4 KB. The dimensions of this board is 101.52 mm x 53.3 mm and weight of this board is 36 g.

Mega takes feedback from 4 DHT-11s and from which it controls fan speed using L298N and heating element is switched on and off with the help of relay. Mega displays information using 16x2 LCD panel and uses TTP 226 to take inputs from user.
16x2 LCD Display Panel

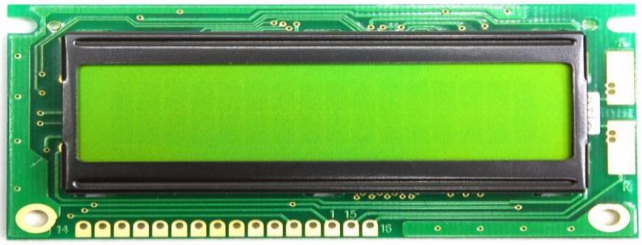

Fig 5: 16x2 LCD Display Panel

16×2 LCD is named so because; it has 16 Columns and 2 Rows. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots. Now, we know that each character has (5×8=40) 40 Pixels and for 32 Characters we will have (32×40) 1280 Pixels. Operating Voltage is 4.7V to 5.3V. Current consumption is 1mA without backlight. Alphanumeric LCD display module, meaning can display alphabets and numbers Consists of two rows and each row can print 16 characters. It can also display any custom generated characters Available in Green and Blue Backlight. It is used for displaying information for user according to user's selection. It also displays errors, process completion status, temperature and humidity.

DHT 11

Fig 6: DHT11(Digital Humidity and Temperature Sensor)

The DHT11 is a commonly used Temperature and humidity sensor and comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. Data given by four DHT-11s is processed by Arduino Mega and on the basis of data heating is controlled or fan speed is increased by Mega using Relays and LM298N.

2- WAY RELAY MODULE

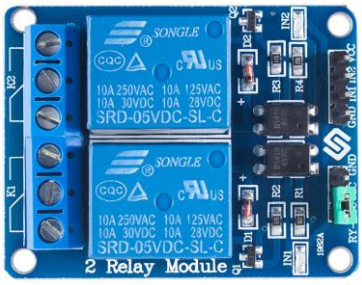

Fig 7: 2- WAY RELAY MODULE

This is a LOW Level 5V 2-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. Features:

- Relay Maximum output: DC 30V/10A, AC 250V/10A
- 2 Channel Relay Module with Optocoupler LOW Level Trigger expansion board, which is compatible with Arduino.
- Standard interface that can be controlled directly by microcontroller (8051, AVR, *PIC, DSP, ARM, ARM, MSP430, TTL logic)
- Relay of high-quality loose music relays SPDT. A common terminal, a normally open, one normally closed terminal
- optocoupler isolation, good anti-jamming

LM298N MOTOR DRIVER

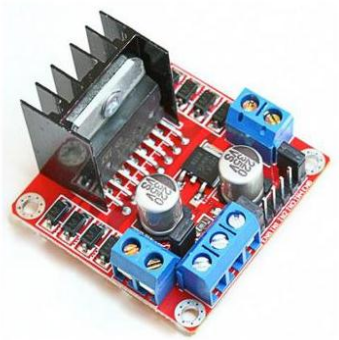

Fig 8: LM298N MOTOR DRIVER

The motor driver is a little current amplifier. It takes a low current signal and gives out a high current signal which can drive a motor. It can also control the direction of the motor. Its basic features are:

- Maximum supply voltage 46V
- Maximum output DC current 4A
- Low saturation voltage
- Over-temperature protection
- Logical "0" Input Voltage up to 1.5 V

There are four outputs. The output for motor A is obtained from out1 out2 pins and similarly for motor B output is obtained from out3 out4 pins. L298N does not have built in protection diodes we use external diodes to prevent the IC from getting damaged. The +12V pin is where the motor power is attached. This pin can accept voltages from +7VDC to +46VDC. Speed control is also possible with the L298N motor driver by feeding PWM signals to the motor enable pins. The speed of the motor will vary according to the

width of the pulses. The wider the pulses, the faster the motor rotates.

8-WAY CAPACITIVE BUTTONS

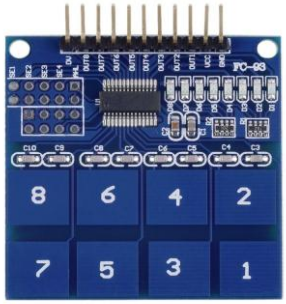

Fig 9: TTP-226 Capacitive panel

TTP226 8-Way Capacitive Touch Sensor / Switch Module is based on a touch-sensing IC enabling capacitive touch switch mode. Capacitive touch allows electronics to sense when your finger is within a few millimetres of a surface to simulate a button "press" just like how the pushbutton works. It is used in any place where low to no force human touch sensing is desirable. In the normal state, the module output is low, low power consumption. When a finger touches the corresponding position, the module output high, if not touched for 12 seconds, switch to low-power mode.

HEATING ELEMENT

Fig 10: Nichrome Wire

The best materials for electric heater coils are dictated by the purpose of the heater and the medium being heated. Two of the most popular choices are Nickel-based materials and Iron-based materials. The most common Nickel-based coil material is nichrome. Nichrome is an alloy containing 80% Nickel and 20% Chrome. Nichrome is predominantly used in high-temperature applications up to 1250°C. This mixture has a number of advantages including:

- Oxidation Resistant
- Reliable Resistance
- High Melting Point
- Minimal Expansion When Heated

A coil is a heating element attached to the heating unit itself. The heater generates the electric current which flows into the coil. The heating coil transfers the electric energy into heat energy. It may be directly immersed in the medium to heat it up or radiate heat through an open space.

Motors RS 385

Fig 11: RS 385 Motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. The motors which we are using can operate on constant 24V DC Supply and will consume less power than 70W. The Motors have 19600 rpm at no load condition and has torque of 13.1 mN-m. At no load condition motor draws 0.22A and at maximum efficiency the current drawn is 1.35A and has a stall current of 8.3A.

4.2 SOFTWARE REQUIREMENTS

1. AURDINO IDE
2. FRITZING
3. EAGLE

OPERATING SYSTEM: WINDOWS 10

5. RESULT

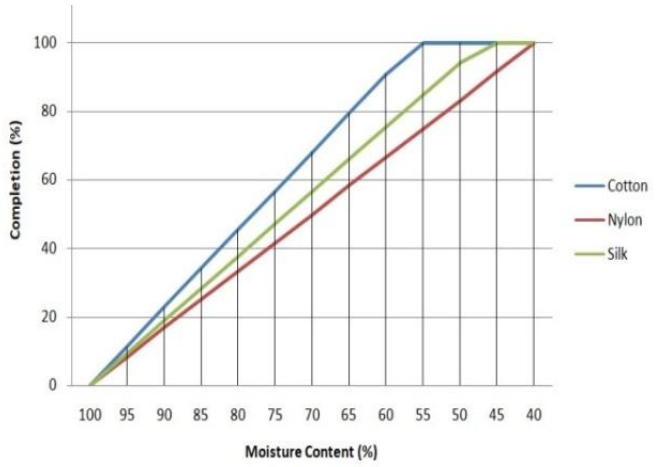

Fig 12: Result

The above graph gives relation of humidity and completion of drying process. We found out that when clothes are dried contain particular amount of moisture in them and they are not completely moisture free. We have found out that cotton contains 56% Humidity at completely dry condition as it is made from cellulose and it is hydrophilic in nature and Nylon & Silk contains 40% & 47% Humidity respectively.

Table 1: Observations

Moisture Present (%)	Fan Speed Control using PWM (%)	Cloth Drying Completion (%)		
		Cotton	Nylon	Silk
100	50	0	0	0
95	50	11.363	8.333	9.434
90	50	22.727	16.666	18.868
85	70	34.091	25	28.302
80	70	45.455	33.333	37.736
75	70	56.818	41.667	47.170
70	70	68.182	50	56.604
65	100	79.545	58.333	66.038
60	100	90.909	66.667	75.477
55	0% if Drying is Completed or 100% if Drying depending on cloth type	100	75	84.906
50		100	83.333	94.34
45		100	91.667	100
40	0	100	100	100

As clothes are drying the humidity present keeps on reducing till a particular point as the clothes absorbs moisture it is not possible to remove the moisture and keep the clothes moisture free. But we can dry it by knowing how much actual moisture the cloth will contain when it is completely dry. By knowing it for all fabrics we can dry clothes by drying the clothes till moisture reaches the given value for dry cloth. As moisture and Humidity are related we can do it by using humidity sensor.

6. CONCLUSION

Our Project highlights the issue of drying clothes during rainy season and potentially gives a solution for this problem. Our project gives a low cost, energy efficient compactness and swift approach towards this problem. Our project fulfills the aim of reducing efforts of the people by drying clothes instantly. Our project can be implemented by integrating all the components together and further reducing power consumption.

The notable features of this project:

1. **Low cost solution**
2. **Power efficient**
3. **Speed**
4. **Compact**

7. FUTURE SCOPE

We are providing fabric type to the machine for adjusting Heat & fan speed according to Fabric requirements. We are taking feedback from Humidity Sensor to determine whether cloths dried or not. This thing can be implemented by Image Processing and further training machine by using machine learning. This can also be done by using many other sensors which will determine Fabric, so Fabric selection can be removed on further advancements. Also AI could be implemented in it so that it takes inputs from sensors and then algorithm will be improved and we get more efficient way to dry clothes within less time by adjusting Fan speed & heat.

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