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PWM Based Rpm Controlled Spin Coating System

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Abstract - In this project describes, building and working of more efficient and compactable spin layer apparatus with a low power consumption comparing to that of current spin layer machine available in the market. The spin layer machine consists of stepper motor, syringe system, Dc brushless motor and PIC16F877P processor. The machine will coat thin film in a micro level thickness and its spinning speed and flow rate of the liquid has been controlled by the processor. Thickness of the film is determined by the flow rate and layer time of the spinning machine. Films with good uniformity for various thicknesses have been successfully prepared by using above spin layer machine, a capacitor sensor has been fabricated the above spin layer techniques and studied their physical properties

1. INTRODUCTION

Nowadays thin film manufacture improves to develop all the applications and in all the fields, which makes up of thin film technology. All the micro level devices, ICs and sensor are fabricated by thin film technology, which is very less in spacious and lower in power consumption of devices. Thin film has been fabricated by many no., of systems like Liquid-Phase Chemical Technique and Chemical Vapors Admission procedure which is the most common method for fabricating thin film. Classification of the systems contains some electro processes such as Mechanical Techniques Electroplating Spray pyrolysis Electroless plating Spray-on techniques Electrolytic anodization Spin-on techniques Chemical reduction plating Chemical displacement plating Electrophoresis deposition Liquid phase epitaxy. The spin covering apparatus was first labeled by Emslie et al. (1958) and Meyerhof et al. (1978) using numerous simplifications. In this research work building and design for spin covering apparatus using ARM processor has been designed, it is one of the unique methods compare to that of other methods, these benefits include more uniform layer thickness, decreased layer consumption, increased yield, and low cost. A more uniform layer depth result in reduced layer consumption, greater reproducibility in performance, and interference fringes those are less visible. For spin layer, these interference fringes are less visible since they are in a symmetrical pattern of a few smooth, concentric circles.

2. ABOUT EMBEDDED SYSTEM

An embedded system is practically any totaling system other than a desktop processer. An embedded system is a keen system which performs the desired function upon power up, repeatedly. Embedded systems are found in a variety of public electronic devices such as consumer electronics ex. Cell phones, digital cameras, portable Video games, etc., embedded systems are found in a variety of communal electronic devices,

A) The processing units of the embedded system

A.1 Processor in an Embedded System A processor is an important unit in the embedded system hardware. A microcontroller is an integrated chip that has the supercomputer, memory and numerous other hardware units in it; these form the palmtop part of the embedded system. An embedded workstation is a processor with special features that allow it to be embedded into a system. A digital signal processor (DSP) is a workstation meant for application that process digital signals.

A.2. A newly introduced technology that moreover unites the application-specific system processors (ASSPs) in the embedded systems.

A.3. Multiple processors in a system.

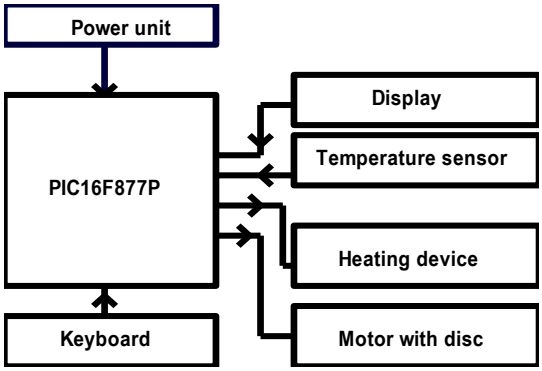
Embedded systems are a combination of hardware and software as well as other components that we bring together into products such as cell phones, music player, a network router, or an aircraft guidance system. They are a system within another system

3. FILM PREPARATION

The step-by-step research of a PVA thin film and the process is initiated by making a colloidal suspension, preparing substrates, and spin covering to make a pattern. The design and cleaning of substrates to prepare them for deposition are also described in, including details of the deposition procedure. The problems and results of depositing PVA under different conditions deals with the formation of samples and the device designed. The structure of a spin coated the colloidal patterns (at different speeds) by spin covering an interruption (prepared in different solvents) is described in terms of depth variation studies at different speeds. The device designed. The structure of a spin coated the colloidal patterns (at different speeds) by spin covering an interruption (prepared in different solvents) is described in terms of depth variation studies at different speeds.

4. BLOCK DIAGRAM

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is rising companionable with the PIC16C5x, PIC12Cxxx and PIC16C7x plans. It facial appearance 200 ns order carrying out, 256 bytes of EEPROM figures memory, self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.



Microchip PIC16F877A Microcontroller Features

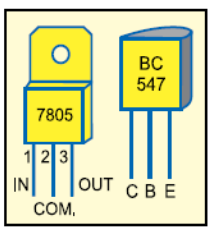


Fig.1 : Pin details of 7805 and BC547

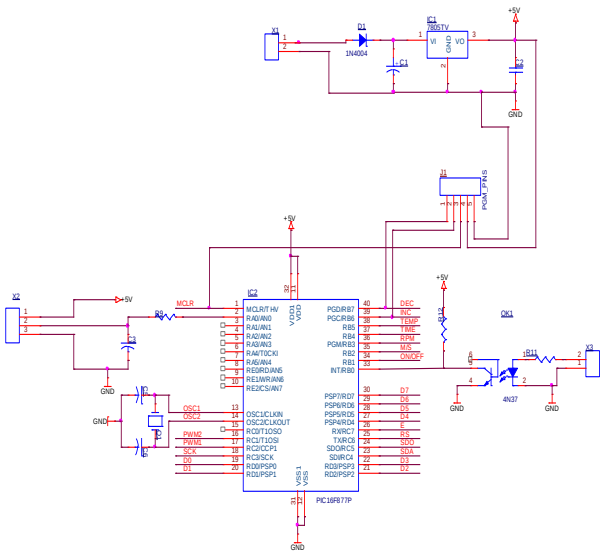
i. High-Performance RISC CPU

- Lead-free; RoHS-compliant
- working rate: 20 MHz, 200 ns order cycle
- working voltage: 4.0-5.5V
- developed enthusiasm range (-40° to +85°C)
- 15 Interrupt Sources
- 35 single-word information
- All single-cycle information except for course branches (two-cycle)

ii. Special Microcontroller Features

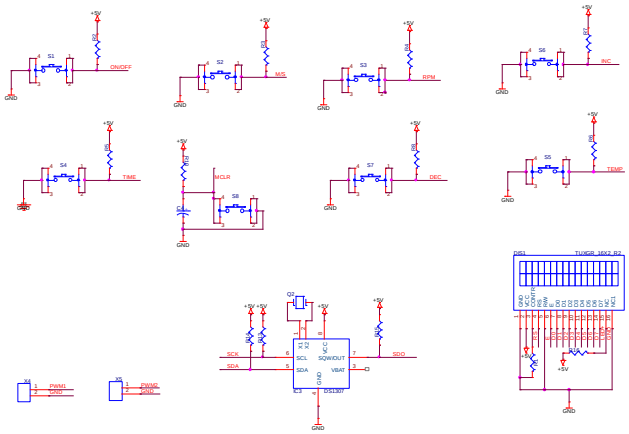
- Flash Memory: 14.3 Kbytes (8192 words)
- Data SRAM: 368 bytes
- Data EEPROM: 256 bytes
- Self-reprogrammable less than software control
- In-Circuit Serial Programming via two pins (5V)
- Watchdog Timer with on-chip RC oscillator
- Programmable code protection
- Power-saving Sleep mode
- Selectable oscillator options
- In-Circuit Debug via two pins

5. CIRCUIT DIAGRAM



6. CIRCUIT EXPLANATION

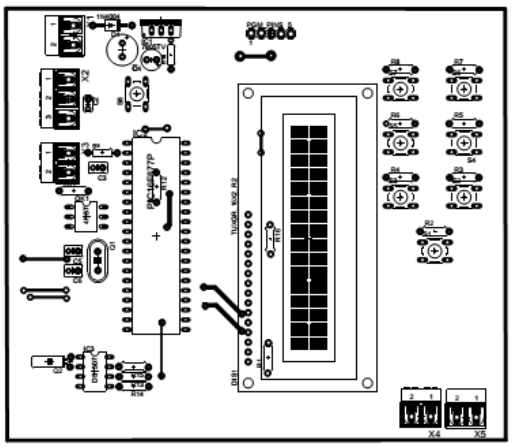
This circuit of the PWM based RPM controlled spin coating system. It comprises PIC16F877P, regulator 7805 (IC2), stepper motor, syringe system, DC brushless motor and LCD display and a few discrete components.



PIC16F877P is the heart of the circuit. It is an 8-bit PIC16F877P processer with five I/O Ports on it starting from Port A to Port E. out of 40 pins there are 33 I/O pins and rest are used for powering it up & for transmitting & receiving signal.PIC16F877P is connected to switches S1 through S8 that are used for inputting the various commands. Preset Switch S1 is connected with 34 pin to ON/OFF function. Switch S2 is connected with 35 pin to M\S (manually reset/set) function. Switch S3 is connected with 36 pin to RPM function. Switch S4 is connected with 37 pin to Time function. Switch S5 is connected with 38 pin to temperature function. Switch S6 is connected with 39 pin to increment function. Switch S7 is connected with 40 pin to decrement function. Switch S8 is connected with 1 pin to MCLR (reset) function. The above function is set by manually for RPM, time; temperature will be set by using the key increment, decrement after setting all the value, once we press the set the function will start. Power-on reset is provided by the combination of resistor 10 and capacitor C4. Switch S8 is used for manual reset. Data pins D0 through D7 of the LCD are connected to port pins 19-22 & 27-30 of the PIC16F877P. The control pins register select (RS) and enable (E) are connected to port pins Port C 25&26, respectively. A 12MHz crystal along with two 33pF capacitors provides the basic clock frequency. To derive the power supply for the circuit, the 230V AC mains are stepped down by transformer X2 to deliver a secondary output of 5V, 500mA. The transformer output is rectified by a full-wave rectifier comprising diodes D1. The full-wave rectified output is smooth-ended by capacitor C1 and regulated by voltage regulator IC 7805 (IC1). Capacitor C2 bypasses the ripples present in the regulated supply. Fig. 1 shows pin details of voltage regulator IC 7805 and transistor BC547.Assemble the circuit on a PCB to minimize time and assembly errors. An actual-size, single-side PCB for the PIC16F877P based PWM based RPM controlled spin coating system. When the set switch is ON the process starts & the temperature will vary from 10°C to 80°C with 100 RPM to 5000 RPM maximum depending on the function of thin film.

PRINTER CIRCUIT BOARD

Top Side



Printed circuit board is electrically form of electronic component or electrical component using connection tracks, pads and other features etched. In PCB two different type of called electrical & non electrical layer. In electrical layer copper shape or trace is used, but in non-electrical layer paste, mask, silk and other layer. Trace is connecting the two points or group components in a board. Shapes are used as flood or plan in copper shape. In silk layer have only text or logo of the costumer. Paste layer is used for place the component in board.

7. CONCLUSION

The spin coating machine has been constructed using PIC Processor PIC16F877P and controlling using motor driver L293. The mechanical setup with chuck is designed and tested which holds the rotor axle of the motor. The speed is monitored and controlled by the PIC processor controlling section. The design of spin coating using the PIC Processor gives more precise controlling signals for uniform various controlling speeds from 1000 rpm to 5000 rpm.The samples were organized by varying two constraints the flow of spin coating solvent and controlling the speed of the substrate. Both flow of spin coating solvent and the spin speed have an influence on the symmetry present in the structure of the spin coated colloidal sample. Hence the created spin coating mechanism can be used to form the thin films with uniformly coated area in low depth.

This spin coating mechanism is more efficient for different attentiveness of the explanation which can produce good in reproducible, easy to handle and fully mechanical

and lower price of films.The limitation of this machine is that we can't increase the rpm more than 5000 because of controlling signal, motor driver and because of motor. The PVA solution of different concentrations has been prepared and the PVA thin films are coated over the Al substrate using the above spin coating machine.

Then Al/PVA/Al structure is used for dielectric characteristics. The structural area of the film is 1cm x 1cm, which is used for dielectric studies. The LCR meter (TH2826) is used for measuring the capacitance of dielectric film and SEM images of PVA films have been taken, studied and analyzed. XRD shows crystalline nature of the PVA films and SEM shows the cubic nature of the above film. In the dielectric studies the capacitance of the PVA film increases with increase of frequency (1MHz-5MHz) at room temperature.

After reaching the 4MHz the capacitance suddenly decreases. The increase of capacitance with increase of frequency up to 3MHz occurs due to the orientation of dipoles. The sudden decrease of capacitance above 3MHz is due to non-orientation of dipoles occurs in the high frequency range in the polymer film

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