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**ACCREDITED BY NAAC WITH "A" GRADE**

**DEPARTMENT OF**
Electronics and Communication Engineering

A REPORT

ON

# "TEMPERATURE CONTROLLED FAN"

**T.E. (ECE)**

*SUBMITTED BY*

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**(Academic Year: 2020-2021)**

**AMRITA Vishwa Vidyapeetham University**
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(DEPARTMENT OF Electronics and Communication Engineering )

# *Certificate*

This is to certify that project has been completed by

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**Abstract**

In today's world, every enterprise needs automation. Industrial automation system has become popular in many industries and play a crucial role in controlling several processes related operations. Industrial automation and process control greatly reduce the need for human sensory and mental requirements. The main aim of this project is to calculate and monitor the surrounding temperature and change the speed of the fan as temperature changes. Here we use an ADC converter which is inbuilt in LPC2148 in order to read the temperature values in Celcius from the LM35 sensor and check it for threshold limits set for Fan control. The speed should increase with a rise in temperature and should decrease with a drop in temperature. The FAN is controlled by an output given to it by the LPC2148 microcontroller, the power is given to the fan is lesser in low temperature and greater in high temperature. This application can be used and deployed easily in any public sector.

**Keywords-** ***ARM (LPC2148)Microcontroller, LM35 Temperature Sensor, DC Motor(12volt), 2N2222( NPN transistor), LM016L LCD Display, ADC(Analog to Digital Converter).***

# Chapter 1

# INTRODUCTION

## 1.1 Introduction

Sensors are devices which detect and measure the non-electrical parameters such as temperature, pressure, speed, distance, weight, they do this by converting these physical parameters into signals which can be measured electrically. Sensors have become the part and parcel of our day to day life. From big industries to small households, sensors are being utilized by everyone. In most of the industries maintaining exact temperature and other environmental conditions are one of the top priorities.So, we are designing a Temperature Based-sensor system to control a Fan(DC Motor) which can be used by these industries to overcome these problems and provide a better, reliable, accurate and cost effective solution. For this purpose we are interfacing sensors such as temperature sensor with the help of a microcontroller (LPC2148). Since, the outputs of the sensors are analog in nature, so, after signal conditioning, they are connected to the ADC pins of the microcontroller.This is done by reading the temperature in LPC2148 from temperature sensor LM35. The ARM7 LPC2148 uses the ADC pin for reading temperature from temperature sensor LM35 The reading output is displayed through LM016L LCD Display. The 10 bit ADC used for reading the temperature from LM35 Basic clocking for the A/D converters is provided by the VPB clock . A programmable divider is included in each converter to scale this clock to the 4.5 MHz (max) clock needed by the successive approximation process A fully accurate conversion requires 11 of these clocks. As this is a simple speed control of the DC motor, we can connect the motor with a transistor provided the transistor can handle current requirements of the motor. Hence, we chose 2N2222 transistor.Now according to the temperature we are going to control speed of the dc fan(12Volt Dc motor) which depends on the technique by checking the preset threshold values from the output of LM35 and Turning the Fan(Dc motor) On/OFF.

## 1.2 Motivation

Our motivation is to make a simple device which can automatically save a lot of power

# Chapter 2

# COMPONENTS REQUIRED

1. LPC21148 MCU Based Development Board
2. 12V DC Motor
3. 2N2222 NPN Transistor
4. LM35 Temperature sensor
5. LM016L LCD Display
6. 1K, 10K Ohm Resistor
7. Two 33pF and one 100nF Capacitor
8. 12MHz Crystal Oscillator
9. Power Supply – Two 3.3V for MCU, LCD and Reset Circuit, 12V for Motor and 5V for LM35
10. Connecting wires
11. Button

# Chapter 3

# INTRODUCTION TO LPC2148

## 3.1 Introduction

This study adopts ARM7 LPC2148, which is a cost-effective and high performance and very low power consumption 32-bit microcontroller for the development of the system. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, the users can take the advantage of the rich and open programming platform resources, to develop different applications. It is based on a 32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combines the microcontroller with 32 kB, and 512 kB of embedded high-speed flash memory. A128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications.

## 3.2 Key Features of LPC2148

1. 32-bit ARM7TDMI-S microcontroller a tiny LQFP64 or HVQFN64 package.
2. 32 kB of on-chip static RAM and 512 KB of on-chip flash program memory.
3. 128-bit wide interface/accelerator enables high speed of 60 MHz operations.
4. In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms, programming of 256 B in 1 ms.
5. Two 8-channel 10-bit ADCs provide a total of up to 16 analog inputs, with conversion times as low as 2.44 µs per channel.
6. Single 10-bit DAC provides a variable analog output (LPC2132/34/36/38).
7. Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
8. Low power Real-time clock with independent power and dedicated 32 kHz clock input.
9. Up to forty-seven 5 V tolerant general purpose I/O pins in a tiny LQFP64 package.
10. On-chip integrated oscillator operates with external crystal in a range of 1 MHz to 30 MHz and with external oscillator up to 50 MHz
11. Power saving modes include idle and power-down.

12. CPU operating voltage range of 3.0 V to 3.6 V

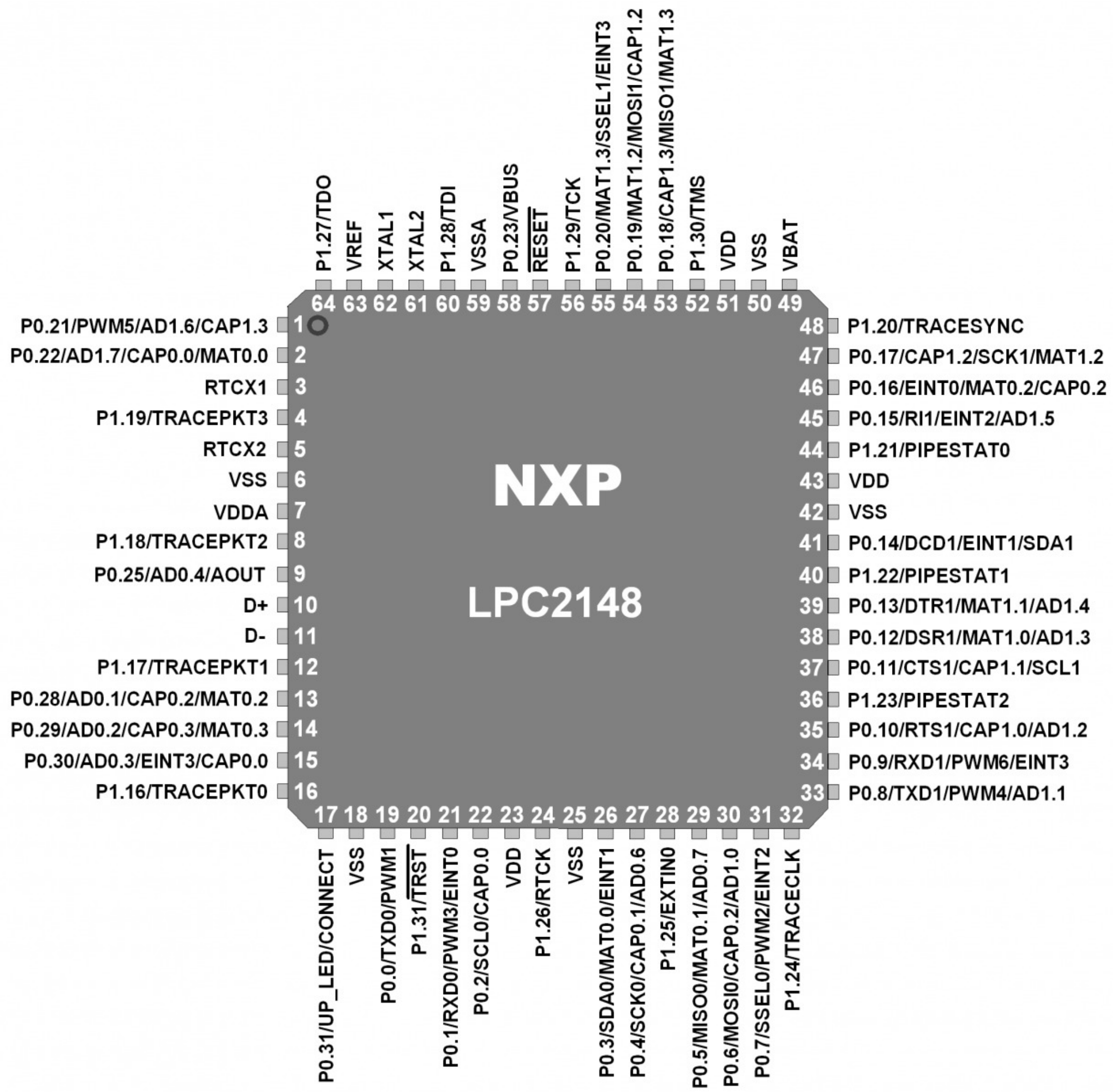



Figure 3.1: Pin configuration of LPC2148

# Chapter 4

# LCD INTERFACING

We always use devices made up of Liquid Crystal Displays (LCDs) like computers, digital watches, and also DVD and CD players. They have become very common and have taken a giant leap in the screen industry by clearly replacing the use of Cathode Ray Tubes (CRT). CRT draws more power than LCD and is also bigger and heavier.

Here we are using alphanumeric LCD 16×2. A 16×2 LCD display is a very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special and even custom characters (unlike in seven segments), animations.

A 16×2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in the 5×7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

## 4.1 Pin Description

1) Ground (0V) - Ground
2) Supply voltage 5V (4.7V – 5.3V)- Vcc
3)Contrast adjustment; through a variable resistor- VEE
4)Selects command register when low; and data register when high- Register Select
5)Low to write to the register; High to read from the register- read/write
6)Sends data to data pins when a high to low pulse is given- Enable
7) 8-bit data pins: DB0, DB1, DB2, DB3, DB4, DB5, DB6, DB7
8) Backlight VCC (5V)- Led+
9) Backlight Ground (0V)- Led-

The LCD display module requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus. If a 4-bit data bus is used the LCD will require a total of

7 data lines (3 control lines plus the 4 lines for the data bus). If an 8-bit data bus is used the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data bus). The three control lines are referred to as EN, RS, and RW.

The EN line is called “Enable.” This control line is used to tell the LCD that you are sending it data. To send data to the LCD, your program should make sure this line is low (0) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

The RS line is the “Register Select” line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor). When RS is high (1), the data being sent is text data which should be displayed on the screen. For example, to display the letter “T” on the screen you would set RS high.

The RW line is the “Read/Write” control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction (“Get LCD status”) is a read command. All others are writing commands–so RW will almost always below.

Finally, the data bus consists of 4 or 8 lines (depending on the mode of operation selected by the user). In the case of an 8-bit data bus, the lines are referred to as DB0, DB1, DB2, DB3, DB4, DB5, DB6, and DB7.

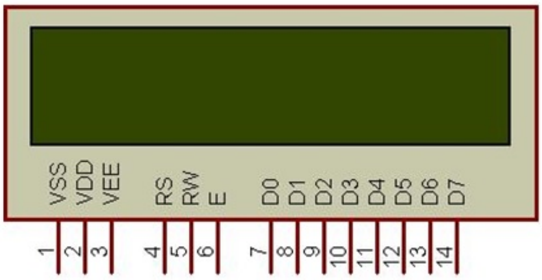



Figure 4.1: Pin configuration of LCD Display

| Code (Hex) | Command to LCD Instruction Register |
|---|---|
| 1 | Clear Display screen |
| 2 | Return home |
| 4 | Decrement cursor (Shift cursor to left) |
| 6 | Increment cursor (Shift cursor to Right) |
| 5 | Shift display right |
| 7 | Shift display left |
| 8 | Display off, cursor off |
| A | Display on, cursor off |
| C | Display on, cursor off |
| E | Display on, cursor blinking |
| F | Display on, cursor blinking |
| 10 | Shift cursor position to left |
| 14 | Shift cursor position to right |
| 18 | Shift the entire display to the left |
| 1C | Shift the entire display to the right |
| 80 | Force cursor to beginning of 1st line |
| 0C0 | Force cursor to beginning of 2nd line |
| 38 | 2 lines and 5x7 Matrix www.embetronicx.com |

Figure 4.2: LCD Commands

# Chapter 5

# INTRODUCTION TO GPIO

## 5.1 PINSEL Register

A 32-bit register is used to select the function of the pins in which the user needs it to operate. There are four functions for each pin of the controller, in which the first function one is GPIO ( General Purpose Input Output ). It means that the pin can either act as an Input or Output with no specific functions. There is totally three PINSEL register in LPC2148 Controller in order to control the functions of the Pins in the respective ports. The classification is given below PINSEL0 – Controls functions of Port0.0 – Port0.15 PINSEL1 – Controls functions of Port0.16-Port0.31 PINSEL2 – Controls functions of Port1.16-Port1.31

## 5.2 I/O PORT

LPC2141/2/4/6/8 has two 32-bit General Purpose I/O ports. A total of 30 input/output and a single output only pin out of 32 pins are available on PORT0. PORT1 has up to 16 pins available for GPIO functions. PORT0 and PORT1 are controlled via two groups of 4 registers.

### 5.2.1 IOPIN

This register provides the value of port pins that are configured to perform only digital functions. The register will give the logic value of the pin regardless of whether the pin is configured for input or output, or as GPIO or an alternate digital function. As an example, a particular port pin may have GPIO input, GPIO output, UART receive, and PWM output as selectable functions. Any configuration of that pin will allow its current logic state to be read from the IOPIN register.

If a pin has an analog function as one of its options, the pin state cannot be read if the analog configuration is selected. Selecting the pin as an A/D input disconnects the digital features of the pin. In that case, the pin value read in the IOPIN register is not valid. Writing to the IOPIN register stores the value in the port output register, bypassing the need to use both the IOSET and IOCLR registers to obtain the entire written value. This feature should be used carefully in an application since it affects the entire port.

### 5.2.2 IOSET

This register is used to produce a HIGH-level output at the port pins configured as GPIO in an OUTPUT mode. Writing 1 produces a HIGH level at the corresponding port pins. Writing 0 has no effect. If any pin is configured as an input or a secondary function, writing 1 to the corresponding bit in the IOSET has no effect. Reading the IOSET register returns the value of this register, as determined by previous writes to IOSET and IOCLR (or IOPIN as noted above). This value does not reflect the effect of any outside world influence on the I/O pins.

### 5.2.3 IODIR

This word accessible register is used to control the direction of the pins when they are configured as GPIO port pins. The direction bit for any pin must be set according to the pin functionality.

### 5.2.4 IOCLR

This register is used to produce a LOW-level output at port pins configured as GPIO in an OUTPUT mode. Writing 1 produces a LOW level at the corresponding port pin and clears the corresponding bit in the IOSET register. Writing 0 has no effect. If any pin is configured as an input or a secondary function, writing to IOCLR has no effect.

# Chapter 6

# INTRODUCTION TO LM35 SENSOR

## 6.1 Introduction

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

## 6.2 Features of LM35

1. Calibrated directly in ° Celsius (Centigrade)
2. Linear + 10.0 mV/°C scale factor
3. 0.5°C accuracy guaranteeable (at +25°C)
4. Rated for full -55° to +150°C range
5. Suitable for remote applications
6. Low cost due to wafer-level trimming
7. Operates from 4 to 30 volts
8. Less than 60 µA current drain
9. Low self-heating, 0.08°C in still air
10. Nonlinearity only ±1/4°C typical
11. Low impedance output, 0.1 W for 1 mA load.

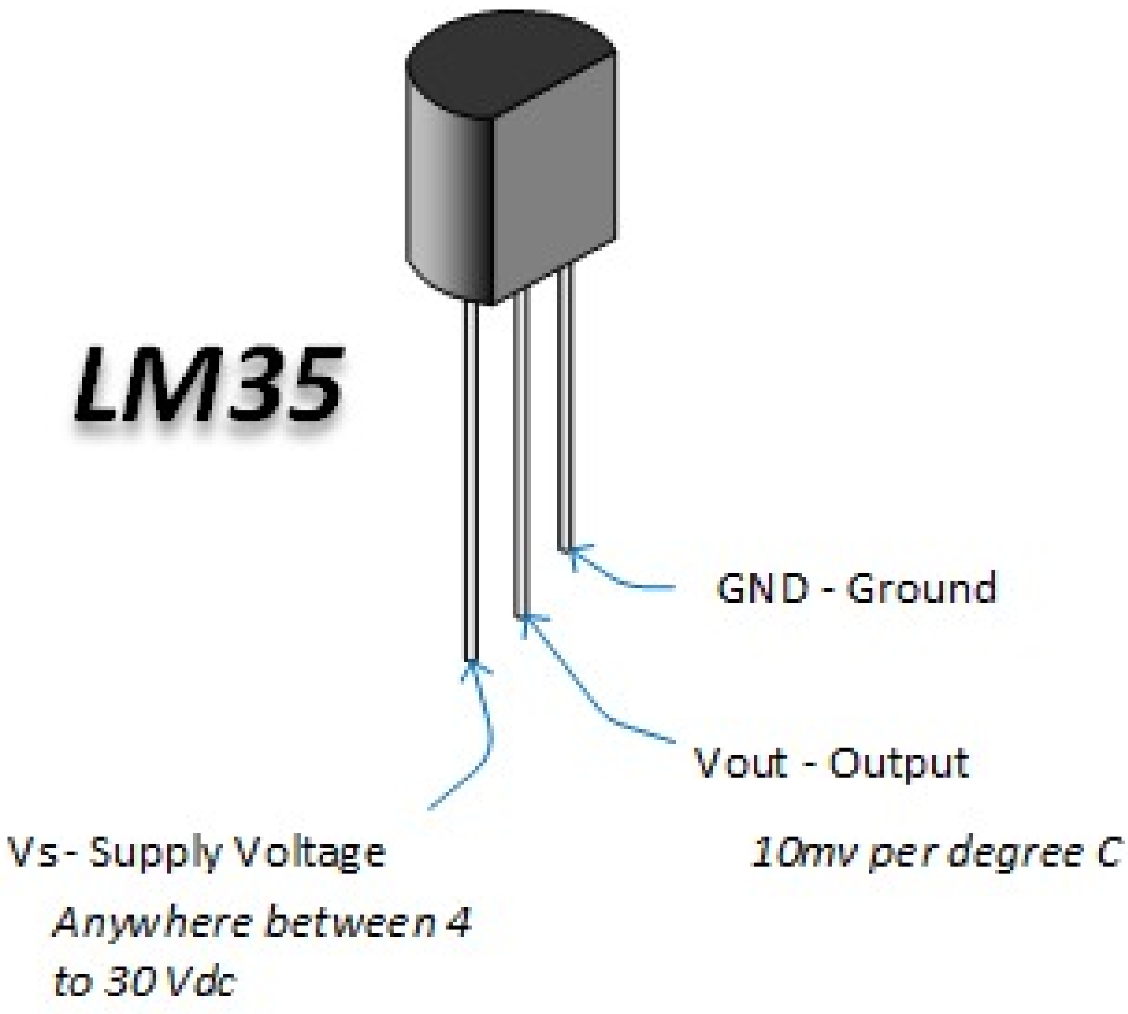



Figure 6.1: Pin configuration of LM35 Temperature Sensor

# Chapter 7

# INTRODUCTION TO ADC

## 7.1 Introduction

Microcontrollers are very useful especially when it comes to communicating with other devices, such as sensors, motors, switches, memory, and even other microcontrollers. As we all know many interface methods have been developed over years to solve the complex problem of balancing the needs of features, cost, size, power consumption, reliability. But ADC Analog-to-Digital converter remains famous among all. Using this ADC we can connect any type of Analog sensor.

LPC2148 has two inbuilt 10-bit Successive Approximation ADC. ADC0 has six channels (AD0.1-AD0.6). ADC1 has 8-Channels (AD1.0-AD1.7). ADC operating frequency is 4.5 MHz (max.), operating frequency decides the conversion time. The ADC reference voltage is measured across GND to VREF, meaning it can do the conversion within this range. Usually, the VREFPis connected to VDD.

## 7.2 Features

1) 10-bit successive approximation analog to digital converter (one in LPC2141/2 and two in LPC2144/6/8).
2) Input multiplexing among 6 or 8 pins (ADC0 and ADC1).
3) Power-down mode.
4) Measurement range 0 V to VREF (typically 3 V; not to exceed VDDA voltage level).
5)10 bit conversion time  2.44µs.
6) Burst conversion mode for single or multiple inputs.
7)Optional conversion on transition on input pin or Timer Match signal.
8) Global Start command for both converters (LPC2144/6/8 only).
9)As LPC2148 works on 3.3 volts, this will be the ADC reference voltage.
10) Now the Resolution of ADC = 3.3/(2**10) = 3.3/1024 =0.003222 = 3.2mV

In our case we use the following Channel: ADC 0.2 P0.29 GPIO, AD0.2, CAP0.3, MAT0.3 26,27 bits of PINSEL1

Registers Used For ADC: There are several registers that will be used to set up and configure the ADC feature in LPC2148. The two registers we will be concerned about:

ADCR (A/D Control Register) and ADGDR (A/D Global Data register). AD0CR – A/D Control Register This is the main control register for AD0. Used for Configuring the ADC0.

| Bit | Symbol | Value | Description | Reset value |
|---|---|---|---|---|
| 7:0 | SEL | | Selects which of the AD0.7:0/AD1.7:0 pins is (are) to be sampled and converted. For AD0, bit 0 selects Pin AD0.0, and bit 7 selects pin AD0.7. In software-controlled mode, only one of these bits should be 1. In hardware scan mode, any value containing 1 to 8 ones. All zeroes is equivalent to 0x01. | 0x01 |
| 15:8 | CLKDIV | | The APB clock (PCLK) is divided by (this value plus one) to produce the clock for the A/D converter, which should be less than or equal to 4.5 MHz. Typically, software should program the smallest value in this field that yields a clock of 4.5 MHz or slightly less, but in certain cases (such as a high-impedance analog source) a slower clock may be desirable. | 0 |
| 16 | BURST | 1 | The AD converter does repeated conversions at the rate selected by the CLKS field, scanning (if necessary) through the pins selected by 1s in the SEL field. The first conversion after the start corresponds to the least-significant 1 in the SEL field, then higher numbered 1-bits (pins) if applicable. Repeated conversions can be terminated by clearing this bit, but the conversion that's in progress when this bit is cleared will be completed.<br>**Remark:** START bits must be 000 when BURST = 1 or conversions will not start. | 0 |
| | | 0 | Conversions are software controlled and require 11 clocks. | |
| 19:17 | CLKS | | This field selects the number of clocks used for each conversion in Burst mode, and the number of bits of accuracy of the result in the RESULT bits of ADDR, between 11 clocks (10 bits) and 4 clocks (3 bits). | 000 |
| | | 000 | 11 clocks / 10 bits | |
| | | 001 | 10 clocks / 9bits | |
| | | 010 | 9 clocks / 8 bits | |
| | | 011 | 8 clocks / 7 bits | |
| | | 100 | 7 clocks / 6 bits | |
| | | 101 | 6 clocks / 5 bits | |
| | | 110 | 5 clocks / 4 bits | |
| | | 111 | 4 clocks / 3 bits | |
| 20 | - | | Reserved, user software should not write ones to reserved bits. The value read from a reserved bit is not defined. | NA |
| 21 | PDN | 1 | The A/D converter is operational. | 0 |
| | | 0 | The A/D converter is in power-down mode. | |
| 23:22 | - | | Reserved, user software should not write ones to reserved bits. The value read from a reserved bit is not defined. | NA |
| 26:24 | START | | When the BURST bit is 0, these bits control whether and when an A/D conversion is started: | 0 |
| | | 000 | No start (this value should be used when clearing PDN to 0). | |
| | | 001 | Start conversion now. | |
| | | 010 | Start conversion when the edge selected by bit 27 occurs on P0.16/EINT0/MAT0.2/CAP0.2 pin. | |
| | | 011 | Start conversion when the edge selected by bit 27 occurs on P0.22/CAP0.0/MAT0.0 pin. | |
| | | 100 | Start conversion when the edge selected by bit 27 occurs on MAT0.1. | |
| | | 101 | Start conversion when the edge selected by bit 27 occurs on MAT0.3. | |
| | | 110 | Start conversion when the edge selected by bit 27 occurs on MAT1.0. | |
| | | 111 | Start conversion when the edge selected by bit 27 occurs on MAT1.1. | |
| 27 | EDGE | | This bit is significant only when the START field contains 010-111. In these cases: | 0 |
| | | 1 | Start conversion on a falling edge on the selected CAP/MAT signal. | |
| | | 0 | Start conversion on a rising edge on the selected CAP/MAT signal. | |
| 31:28 | - | | Reserved, user software should not write ones to reserved bits. The value read from a reserved bit is not defined. | NA |



Figure 7.1: AD0CR – A/D Control Register

AD0GDR – A/D Global Data Register This is the global data register for the corresponding ADC module. It contains the ADC's DONE bit and the result of the most recent A/D conversion.

| Bit | Symbol | Description | Reset value |
|---|---|---|---|
| 5:0 | - | Reserved, user software should not write ones to reserved bits. The value read from a reserved bit is not defined. | NA |
| 15:6 | RESULT | When DONE is 1, this field contains a binary fraction representing the voltage on the Ain pin selected by the SEL field, divided by the voltage on the $V_{DDA}$ pin ($V/V_{REF}$). Zero in the field indicates that the voltage on the Ain pin was less than, equal to, or close to that on $V_{SSA}$, while 0x3FF indicates that the voltage on Ain was close to, equal to, or greater than that on $V_{REF}$. | NA |
| 23:16 | - | Reserved, user software should not write ones to reserved bits. The value read from a reserved bit is not defined. | NA |
| 26:24 | CHN | These bits contain the channel from which the RESULT bits were converted (e.g. 000 identifies channel 0, 001 channel 1...). | NA |
| 29:27 | - | Reserved, user software should not write ones to reserved bits. The value read from a reserved bit is not defined. | NA |
| 30 | OVERUN | This bit is 1 in burst mode if the results of one or more conversions was (were) lost and overwritten before the conversion that produced the result in the RESULT bits. This bit is cleared by reading this register. | 0 |
| 31 | DONE | This bit is set to 1 when an A/D conversion completes. It is cleared when this register is read and when the ADCR is written. If the ADCR is written while a conversion is still in progress, this bit is set and a new conversion is started. | 0 |



Figure 7.2: AD0GDR – A/D Global Data Register

# Chapter 8

# INTRODUCTION TO 2N2222

## 8.1 Working of 2N2222

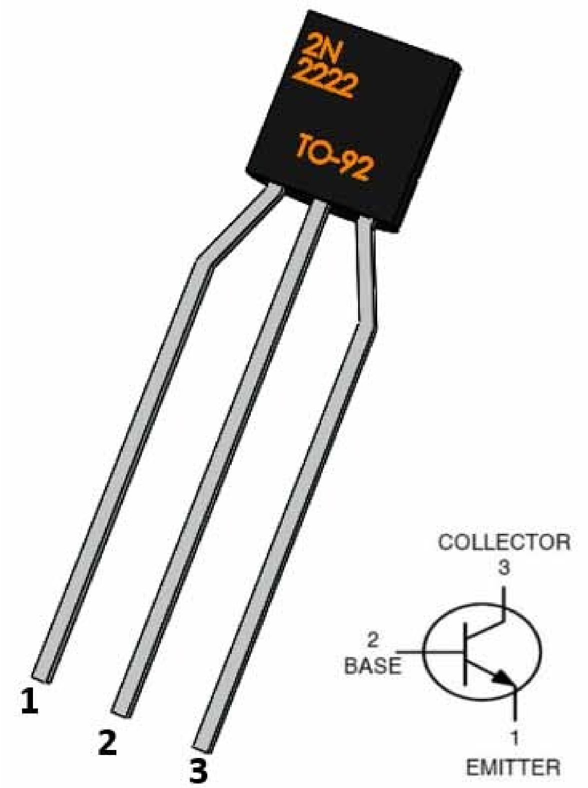
It's a current-controlled transistor. So, a small current at the base terminal is used to drive a high current between the other two terminals. It is used for switching purposes because of its fast response time.

## 8.2 Features of 2n2222

1) 2N2222 is an NPN transistor, which means it has a single P doped layer embedded between two N doped layers.
2)It's a Bipolar junction transistor abbreviated as BJT.
3)It has three terminals named as:1) Emitter 2) Collector 3)Base.
4) It's a current-controlled transistor. It has a Collector current of 800 mA.
5) Power Dissipation of 2N2222 is 500mW.
6) It can operate between -65 C to 200 C temperature.
7) Collector base voltage of 2n2222 is 60.
8) Collector-Emitter Voltage of 2n2222 is 30.
9) Emitter Base voltage of 2n2222 is 5.

## 8.3 Applications of 2N2222

1) It is used for current amplification.
2) It is also used as a switch to turn ON or OFF any appliances automatically.
3) Because of its fast response time, it can be used for pulse width modulation.
4) It is mostly used in embedded and automation projects.




| 2N2222A | |
|---|---|
| 1 | Emitter |
| 2 | Base |
| 3 | Collector |

Figure 8.1: Pin Configuration of 2N2222 NPN-Transistor

# Chapter 9

# INTRODUCTION TO DC MOTOR

## 9.1 Dc Motor Interfacing with LPC2148 :

After connecting the LM35 temperature sensor, we need to connect the motor to the MCU. Since we cannot connect the motor directly to the LPC2148 (as a matter of fact to any microcontroller), we need to use a driver circuit. The maximum output current of the microcontroller pin is 15mA at 3.3V. But the power requirements of most DC motors are out of reach of the microcontroller and what is produced by the motor may damage the microcontroller. As this is simple control of the DC motor, Hence, we choose the 2N2222 transistor. It is an NPN transistor with a maximum collector–to–emitter voltage of 30V and a maximum collector current of 800mA.

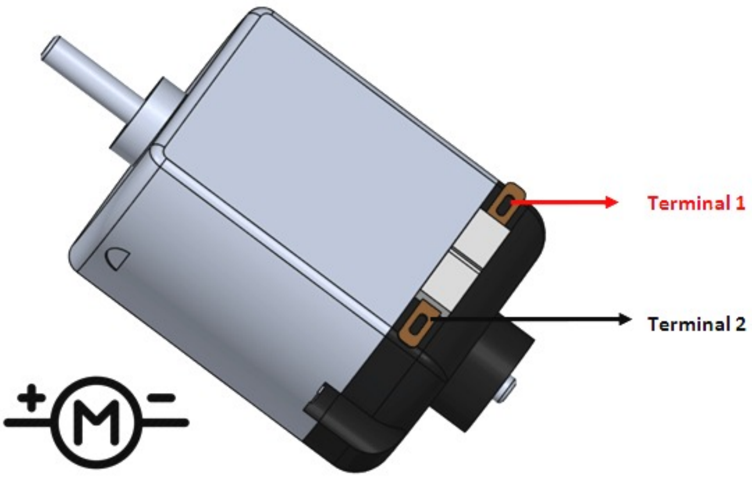



Figure 9.1: Pin configuration of DC Motor

# Chapter 10

# SOFTWARE REQUIREMENT SPECIFICATION

## 10.1 Software Requirement

1. Keil Uvision4
2. Proteus 8 Professional

### 10.1.1 Description

Keil UVision4 is used for Embedded C programming. Proteus 8 Professional is used for circuit design and simulation.

# Chapter 11

# IMPLEMENTATION OF PROJECT

## 11.1 Algorithm for Temperature Controlled Motor

1. Start
2. Initialize ADC.
3. Initialize LCD.
4. Get feedback from Temperature sensor.
5. If temperature ¿ Set temperature then turn ON the Cooler(FAN)
6. If temperature ¡ Set temperature then turn OFF the Fan(Dc motor)

## 11.2 Circuit Diagram

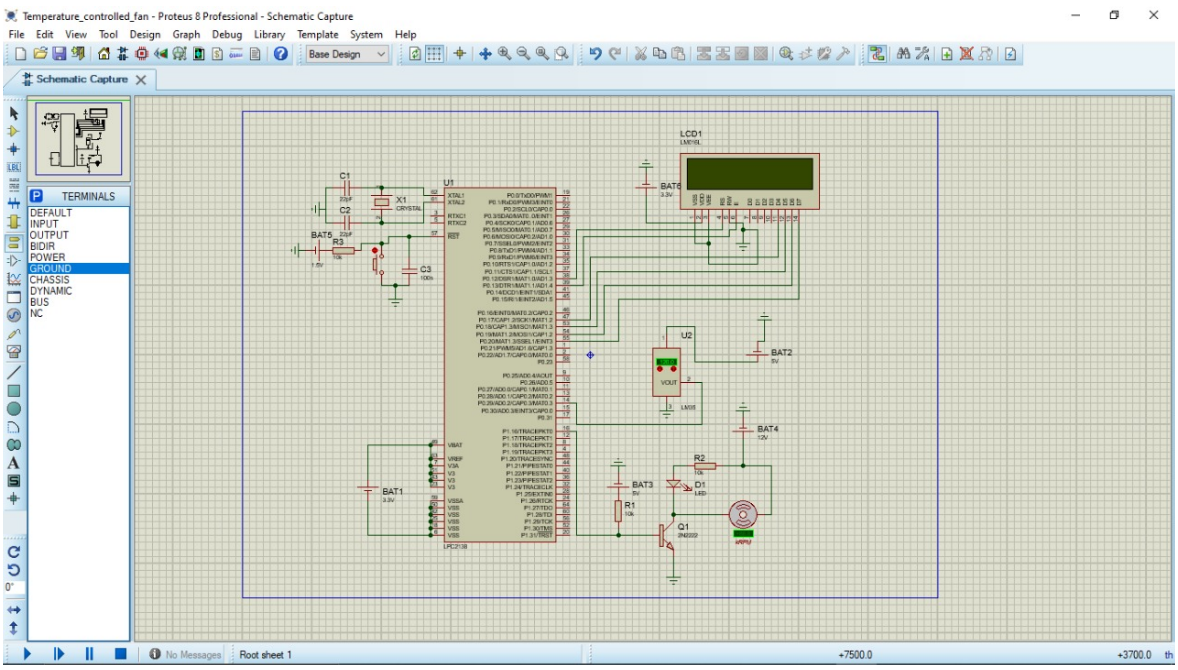



Figure 11.1: Circuit Diagram

## 11.3 Block Diagram

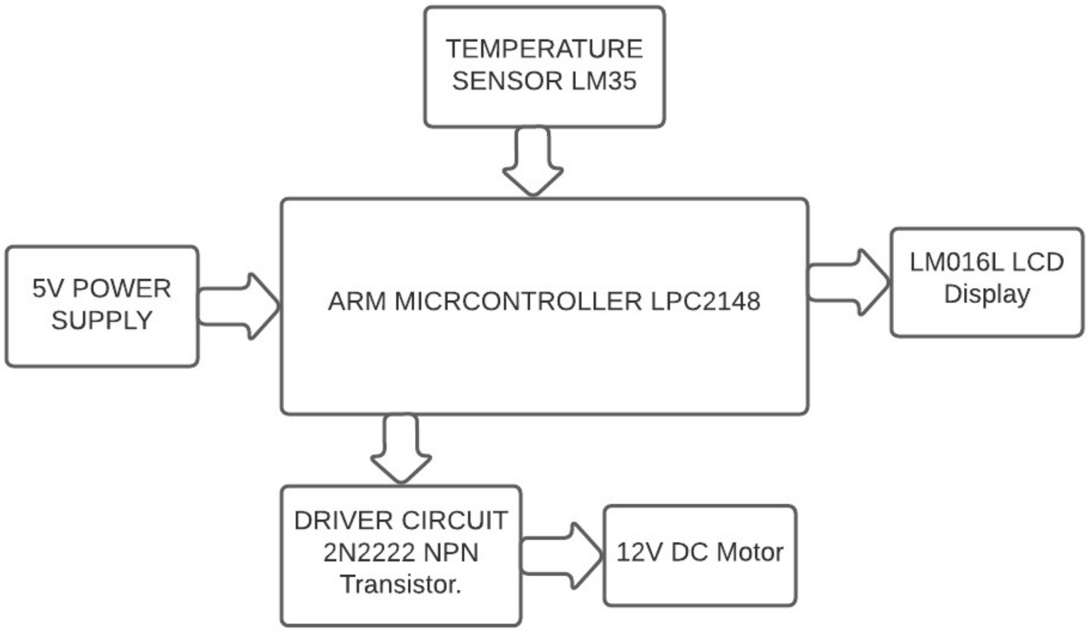



Figure 11.2: Block Diagram

## 11.4 CIRCUIT CONNECTIONS :

LCD: CONTROLS
RS: P0.12
RW: GND
EN: P0.13
DATA LINES
D4: P0.17
D5: P0.18
D6: P0.19
D7: P0.20
ADC :
P0.29/AD0.2 : LM35 SENSOR OUTPUT PIN 2
LM35 TEMPERATURE SENSOR:
Pin1: 5 Volt supply
PIN 2 : P0.29/AD0.2 of LPC2148
Pin3: GND
MOTOR:
One terminal of motor is supplied with 12Volt Supply. Other to the collector of 2N2222 NPN transistor.(along with some load of 10KOhm and an LED ) P1.16 : To the Base of 2N2222 NPN transistor for voltage amplification to DC motor( along with 5 Volt supply and a load of 10KOhm)
2N2222 NPN Transistor:

Base: P0.16
Collector: DC Motor
Emitter: GND
CRYSTAL OSCILLATOR:
It is connected to the XTAL1, XTAL2 pins of LPC2148 (along with two 22pF Capacitor)
XTAL1: Input to the oscillator circuit and internal clock generator circuits.
XTAL2: Output from the oscillator amplifier.
Reset Circuitry:
It is connected to the RST(with bar over it) pin.
It is supplied with 3.3Volt cell along with a 100nF Capacitor and a load of 10KOhm and a switch to Reset it.
Power Supply:
3.3volt
Here +ve terminal is connected to (VBAT, VREF, V3A,V3,V3,V3)
-ve terminal is connected to (VSSA,VSS,VSS,VSS,VSS,VSS)
VSS: (Ground) 0 V reference
VSSA: (Analog Ground) 0 V reference. This should technically be the same voltage as VSS, but should be separated to minimize noise and error. This pin must be grounded if the ADC/DAC are not used.
VDD: 3.3 V Power Supply: This is the power supply voltage for the core and I/O ports.
VDDA: Analog 3.3 V Power Supply: This should technically be the same voltage as VDD, but should be separated to minimize noise and error.
This voltage is used to power the ADC(s) and DAC (where available).
This pin must be tied to VDD when the ADC/DAC is not used.
VREF: A/D Converter Reference: This should technically be the same voltage as VDD, but should be separated to minimize noise and error. Level on this pin is used as a reference for A/D convertor and DAC (where available). This pin must be tied to VDD when the ADC/DAC are
not used.
VBAT: RTC Power Supply: A 3.3 V on this pin supplies the power to the RTC.

# Chapter 12

# REFERENCES

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# Chapter 13

# FUTURE WORK

So we want to improve our work by changing the aim of our project to increase and decrease speed according to temperature instead of directly turning On/Off. So we want to use PWM and also PLL Techniques to solve this issue changing and speed and direction for Controlling DC Motor. And also make it deploy easily in any kind of places.

## 13.1 Applications:

Since every sensor gives some special or specific information, each and every sensor can be used for a specific purpose. The temperature sensor can be used for critical industrial applications such as detecting and controlling the temperature of the Blast furnace and boiler and providing this information to the control room by buzzer, alarm, or some other effective way.

# Chapter 14

# APPENDIX

The code is attached as.pdf file with this project presentation. titled "TEMPERATURE CONTROLLED FAN"

# Chapter 15

# CONCLUSION

The project ”Temperature Controlled Fan” is successfully completed and presented. It has passed all the objectives and requirements.