3.1 Design Description:

One of important part of the research is this chapter because it is design of hardware. Although the design has a lot of components connected together, the drawing is clear, see figure (3.1).

Figure (3.1)  Block Diagram of the system
3.2 Components of Circuit:

1- Microcontroller (atmage32).
2- Publicity Display Unit (LCD's).
3- GSM modem.
4- Control Center.
   i. PC center.
   ii. GSM modem.
   iii. Interface.
5- Power supply

3.2.1 Microcontroller

ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The ATmega32 provides the following features:

1. 32kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities.
2. 1024bytes EEPROM, 2Kbyte SRAM.
3. 32 general purpose I/O lines.
4. 32 general purpose working registers.
5. A JTAG interface for Boundaryscan.
6. On-chip Debugging support and programming.
7. Three flexible Timer/Counters with compare modes.
8. Internal and External Interrupts.
9. A serial programmable USART.
10. A byte oriented Two-wire Serial Interface.
11. An 8-channel.
12. 10-bit ADC with optional differential input stage with programmable gain (TQFP package only).
13. A programmable Watchdog Timer with Internal Oscillator.
14. An SPI serial port and six software selectable power saving modes.

The idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.[5-1].
Figure (3.2) Pin Out Microcontroller ATmega32
3.2.2 Publicity Display Unit (LCD's)

Computers, TVs, electronics presentation and commercial advertising; all these purposes have a very important component that used to show the needs of the monitor. So needs to know about it, often referred to as a display screen, a video display terminal (VDT) or a visual display unit (VDU).

There are several types of publicity displays:

1. Cathode Ray Tube (CRT).
2. Liquid crystal Displays (LCDs).
4. Light Emitting Diode display (LED).
5. Organic LED display (O'LED).

In this project Liquid crystal Displays (LCD) are used, so need to know about this display.

Portable computers were originally designed to be compact versions of their bigger brothers. They crammed all the components of big desktop computer into a small, suitcase-like box called (laughably) a portable computer. No matter what the designers do to reduce the size of the computer, the display remained as large as the desktop version’s that is, unit an inventor found that when he passed an electric current through a semi crystalline liquid, the crystals aligned them self with the current. It was found that by combining transistors with these liquidly crystals, patterns could be formed. These patterns could represent numbers or letters.
The first application of these liquid crystal displays (LCDs) was the (LCD) watch. It was rather bulky, but it was cool.

As (LCD) elements got smaller, the detail of the patterns became greater, until one day someone thought to make a computer screen put of several of these elements. This screen was very light compared to computer monitors of the day, and it consumed little power. It could easily be added to a portable computer to reduce the weight by as much as 30 pounds. As the components got smaller, so did the computer, and the laptop computer was born.

LCDs are not just limited to laptops; desktop versions of LCD displays are available as well. They use the same technology as their laptop counterparts but on a much larger scale. Plus, these LCDs are available in either analog or digital interfaces for the desktop computer. The Analog interface is exactly the same as the digital signal from the computer is converted into analog signal by the video card, which is then sent along the same 15-pin connector as a monitor. Digital LCDs, on the other hand, are directly driven by the video card’s internal circuitry. They require the video card to be able to support digital output (through the use of a digital are generally sharper than their analog counter parts.

Two major types of LCD displays are used today: active matrix screen and passive matrix screen. The main difference lie in the quality of the image however, both types use lighting behind the LCD panel to make the screen easier to view.

**Active matrix:** An active matrix screen works in a similar manner to the LCD watch. The screen is made up of a several individual LCD pixels, when switched on, activities two electrodes that align the crystals of display in very crisp and easy to look at. The major disadvantage of an
active matrix screen is that it requires large amount of power to operate all the transistors. Even with the backlight turned off, the screen can still consume battery power at an alarming rate. Most laptops with active matrix screen can’t operate on a battery for more than two hours.

**Passive matrix:** Within the passive matrix screen are two rows of transistors; one at the top, another at the side. When the computer’s video circuit wants to turn on a particular pixel (turn it black), it sends a signal to the x- and y- coordinate transistors for that pixel thus turning them on.

Then cause’s voltage lines from each axis to intersect at the desired coordinates, turning the desired pixel black.

![Diagram of how passive matrix LCDs work](image.png)

Figure (3.3): How Passive matrix LCDs work
The main difference between active matrix and passive matrix is image quality. Because the computer takes a millisecond or two to light the coordinates for a pixel in passive matrix displays, the response of the screen to rapid changes is poor, causing, for example, an effect known as submarine. On a computer with a passive matrix display, if you move the mouse pointer rapidly from one location to another, it will disappear from the first location to another, it will disappear in the first location and reappear in the new location without appearing anywhere in between.

To keep the quality of the image on an LCD the best, the screen must be caned often. Liquid crystal displays are typically coated with a clear plastic covering. This covering commonly gets dirtied by fingerprints as well as generous coating of dust. The best way to clean the LCD lens coating is to wipe it off occasionally with a damp cloth. Doing so will ensure that the images stay crisp and clear.

The LCD 40x4 is used in the system design. Table3.1 shows the terminal functions of LCD 40x2.
Table (3.1) The Terminal Functions of (40x2) LCD

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>Description</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>VSS</td>
<td>1</td>
</tr>
<tr>
<td>Positive power supply</td>
<td>VDD</td>
<td>2</td>
</tr>
<tr>
<td>LCD contrast reference supply</td>
<td>Vo</td>
<td>3</td>
</tr>
<tr>
<td>Register Select RS = High: Transferring Display Data RS = Low: Transferring Instruction Data</td>
<td>RS</td>
<td>4</td>
</tr>
<tr>
<td>Read/Write control Bus R/W = High:</td>
<td>R/W</td>
<td>5</td>
</tr>
<tr>
<td>Data Enable</td>
<td>E1</td>
<td>6</td>
</tr>
<tr>
<td>Data Enable</td>
<td>E2</td>
<td>7</td>
</tr>
<tr>
<td>Bi- directional Tri- state Data Bus</td>
<td>DB)</td>
<td>8</td>
</tr>
<tr>
<td>. .</td>
<td>. .</td>
<td></td>
</tr>
<tr>
<td>DB7</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>No connection</td>
<td>NC</td>
<td>16</td>
</tr>
<tr>
<td>LED Backlight Positive Power supply</td>
<td>BLA</td>
<td>17</td>
</tr>
<tr>
<td>LED Backlight Negative Power supplies</td>
<td>BLK</td>
<td>18</td>
</tr>
</tbody>
</table>
3.2.3 Global System Mobile (GSM)

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM implies worldwide framework for versatile correspondence. GSM is a global advanced cell telecommunication. It was standard proposed by ETSI (European Telecommunications Standard Institute) in 1989. The primary business administration's were launched in 1991 and after its initial presentation in Europe; the standard went worldwide in 1992. From that point forward GSM has turned into the most broadly embraced and quickly developing advanced standard, and it is situated to turn into the world's overwhelming cell standard.

Today's third era GSM systems convey excellent and secure versatile voice and information administrations with full abilities over the world. GSM is a massively fruitful engineering and as uncommon story of worldwide accomplishment. Since the first GSM system was industrially launched, it turned into, the world's heading and fastest developing portable standard. The GSM Association evaluates that advances characterized in the GSM standard serve 80% of the worldwide portable business, including more than 5 billion individuals crosswise over more than 212 nations and domains, making GSM the most omnipresent of the numerous guidelines for cell systems.

Today's GSM stage is living, developing and advancing and as of now offers an extended and characteristic-rich "family" of voice and empowering administrations. The Global System for Mobile Communication (GSM) system is cell telecommunication system with an adaptable structural planning following the ETSI Gsm900/GSM 1800 standard. Seamen's usage is the advanced cell versatile correspondence
framework D900/1800/1900 that uses the precise most recent innovation to meet each prerequisite of the standard.

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, Pico, and femto and umbrella cells. [4-2]

3.2.4 Control Center

3.2.4.1 Subscriber Identity Module (SIM):

GSM is the Subscriber Identity Module; it's one of the key features. Commonly known as a SIM card.

The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets

3.2.4.2 GSM Module (SIM 900 GSM)

Figure (3.4) GSM Module SIM 900
GSM module SIM 900 is being used in the project here. It is just like a cell phone with all the facilities of sending and receiving a message, sending and receiving calls. It has a communication that can be programmed using AT commands.

GSM Modem is built with SIMCOM Make SIM900 Quad-band. GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz it is very compact in size and easy to use as plug in GSM Modem. The Modem is designed to interface PC Serial port through max circuit. The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. It is suitable for SMS as well as DATA transfer application in M2M interface. The modem needed only 3 wires (TX, Rx and GND) except Power supply to interface with microcontroller/Host PC. Using this modem, allows sending & Reading SMS through simple AT commands. [5-8]

3.2.4.3 Serial Communication

The RS-232 interface is the Electronic Industries Association (EIA) standard for the interchange of serial binary data between two devices. It was initially developed by the EIA to standardize the connection of computers with telephone.

Line modems. The standard allows as many as 20 signals to be defined, but gives complete freedom to the user. Three wires are sufficient: send data, receive data, and signal ground. The remaining lines can be
hardwired on or off permanently. The signal transmission is bipolar, requiring two voltages, from 5 to 25 volts, of opposite polarity.

Figure (3-7) illustrates the pin numbering used in the original DB-9 connector normally used in modern computers.

![DB-9 connector diagram]

Figure(3.5): DB-9 connector

The RS-232C standard specifies that the maximum length of cable between the transmitter and receiver should not exceed 100 feet.

In theory, a wire cable could be used to connect the Data Terminal Equipment (DTE) to the Data Communication Equipment (DCE). The DTE is a device that is acting as a data source, data sink, or both, e.g. a terminal, peripheral or computer. The DCE is a device that provides the functions required to establish, maintain, and terminate a data-transmission connecting, as well as the signal conversion, and coding required for communication between data terminal equipment and data circuit; e.g. a modem.

The RS-232C specifies the signaling rate between the DTE and DCE, and a digital signal is used on all interchange circuits. The RS-232 standard specifies that logic "1" is to be sent as a voltage in the range -15 to -5 V and that logic "0" is to sent as a voltage in the range +5 to +15 V. The standard specifies that voltages of at least 3 V in amplitude will
always be recognized correctly at the receiver according to their polarity,
so that appreciable attenuation along the line can be tolerated. The
transfer rate is rated > 20 kbps and a distance of < 15m. Greater distance
and data rates are possible with good design.

3.2.5 Power Supply

Basically any electronic circuit runs with a power supply. Here,
gives a 5v supply to the various IC’s used in the design presented here.
We get a 240V supply at any instant. So in order to provide our circuit
appropriate supply voltage a different power circuit is to be made based
on our requirement. The various steps included in the circuit are
explained below stepwise. And also various precautions are to be taken
for the safety of the electronic circuit designed. The different stages of
the design of the circuit are given below:

1. Transformer.
2. Bridge rectifier.
3. Filter circuit.
4. Voltage regulator.
3.3 System Design:

As mentioned before the design of the system consist of two separate units, control center and control unit. Control center with Microcontroller controlled by switches in Control Room with an administrator for monitoring the system so we can said operation indoors, the indoors electronic devices are within the temperature and humidity limits for proper operation of the hardware whereas the control unit operates outdoors. The outdoor units with the publicity side. Microcontrollers and display Unit ( LCD's ), fan, heater, temperature finally control switches with LED's indicator.
Control Center

The control center contents of Microcontroller to remotely control the publicity is to be displayed, in the other side monitor and control the temperature of publicity devices by switches. LCD is used to display the temperature.