Sudan University of science and technology

College Of Graduate Studies

Automatic Control of Irrigation System Using GSM Technique

التحكم الآلي في منظومة رى باستخدام تقنية نظام الإتصال المحمول

A Thesis submitted in partial

Fulfillment of the requirement for the award of the

Degree of Master of Mechatronic Engineering

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I would like to express my gratitude and sincere thanks to my respected supervisor

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Finally, I express my gratitude to my Family& Friends who are involved either directly or indirectly for the completion of this project.

ABSTRACT

With the rapid growth in global population, agriculture becomes more important to meet the needs of the human race. Agriculture requires irrigation, and every year we have more water consumption than rainfall. At the present era, farmers use irrigation technique through the manual control in which they irrigate land at regular intervals. Beside the increase workload of this manual technique, it consumes more water or sometimes the water reaches late due to which the crops get dried.

The aim of this research is to develop an automatic irrigation system using microcontroller. The system uses several sensors output to monitor different soil conditions and compares them against a set of threshold values. Accordingly, it may run one or more actuator in order to maintain optimum soil condition. The system can also be run in manual mode regardless of the sensors signals. The system can be remotely controlled using dual tone multi frequency (DTMF) technique and connect from any phone to farms phone. The system has Global System for Mobile Communication (GSM), so that it has the ability to dial a predefined number as an alert to inform about abnormal events for seeking human interventions. Before the hardwire implementation, a simulation for the proposed system is done with Proteus program, Then the proposed system had been implemented and a number of testing scenarios under different environment conditions had been carried. Both of simulation and the hardwired prototype results demonstrated a perfect operation of the system. The benefits of such system are of great significance if implemented in agriculture.

المستخلص

مع النمو السريع لعدد السكان في العالم أصبحت الزراعة أكثر أهمية لتلبية إحتياجاتهم.الزراعة تحتاج للري وفي كل عام نجد أن إستهلاك المياه أكبر من المتوفر بالأمطار،حيث أصبح المزارعون يستخدمون تقنية الري التقليدي أو اليدوي وذلك بري الأراضي علي فترات منتظمة.

بجانب زيادة عدد العاملين في هذه التقنية فانها قد تستهلك كمية اكبر من المياه يفوق حوجة المحصول أو قد تصله المياه متاخرة مما يسبب جفافه.

يهدف هذا البحث لتطوير نظام ري تلقائي باستخدام المتحكمات الدقيقة حيث يستخدم النظام عدة أجهزة استشعار لمراقبة ظروف التربة المختلفة ومقارنتها بمجموعة من القيم المرجعيه. وفقًا لذلك ، قد يتم تشغيل محرك واحد أو أكثر من أجل الحفاظ على حالة التربة المثلى. يمكن أيضًا تشغيل النظام في الوضع اليدوي بغض النظر عن إشارات المستشعرات. كما يمكن التحكم في النظام عن بُعد باستخدام تقنية التردد المزدوج للنغمة (DTMF) والاتصال من أي هاتف بهاتف المزرعة. يحتوي النظام كذلك على النظام العالمي للاتصالات المتنقلة (GSM) ، بحيث يكون لديه القدرة على طلب رقم محدد مسبقًا كتنبيه للإبلاغ عن الأحداث غير الطبيعية للبحث عن التدخلات البشرية.

قبل تنفيذ النظام فعليا ، تم إجراء عمل محاكاة للنظام المقترح بواسطة أحد أنظمة المحاكاة الفعالة (Proteus).

بعد ذلك تم تنفيذ النظام المقترح وتم تنفيذ عدد من سيناريوهات الاختبار في ظل ظروف بيئية مختلفة. أثبتت كل من نتائج المحاكاة ونسخة النموذج الأولي الثابت تشغيلًا مثاليًا للنظام.

فوائد هذا النظام كبيرة جدا وعظيمة إذا تم تنفيذها علي أرض الواقع في مجال الزراعة

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Chapter One

Introduction

1.1 Introduction:

Irrigation is a scientific process of artificially supplying water to the land or soil that is being cultivated. Traditionally in dry regions having no or little rainfall water had to be supplied to the fields either through canals, hand pumps or tube wells. However, this method had severe problems such as increase in workload of farm labor and often it lead to problem such as over irrigation or under-irrigation, and leaching of soil. Further, there were issues like weeding, lesser yield of crop as an effect of above mentioned problems. Hence, there was a need for a way to test the soil condition before supplying water to the fields. This mechanism would reduce the workload of the farmer and help maintain proper soil conditions for improved and better crop production. Hence, with the advance of technology it was possible to design systems that eliminate the direct involvement of farmers with respect to irrigation of their fields.

Agriculture is the backbone of economy. In today's world, as we see the rapid growth in global population, agriculture becomes more important to meet the needs of the human race. Since agriculture requires irrigation, and every year we have more water consumption than rainfall, it becomes critical for growers to find ways to conserve water while still achieving the highest yield. But at the present era, the farmers have been using irrigation technique through the manual control in which they irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Over the past 200 years, farmers developed simple irrigation systems based on diversion of water from seasonal or permanent streams and rivers. The systems

were referred to as farmer-managed irrigation systems (FMIS). This sort of manual irrigation system provide variable amount of water that is sometimes excess or sometimes insufficient than that required for the suitable growth of crops .Thus, the farmer has to toil himself all day and night to monitor the moisture content in the soil.

The advances in the technologies related to wireless communication has led to the emergence of several engineering designs to aid the human requirements. As we all know Agriculture plays a significant role in developing country Therefor, implementation of mobile communication in facilitating farmers becoming a hot research area.

1.2 Problem Statement:

With the rapid growth in global population, agriculture becomes more important to meet the needs of the human race.

Agriculture requires irrigation, and every year we have more water consumption than rainfall. At the present era, farmers use irrigation technique through the manual control in which they irrigate land at regular intervals.

Beside the increase workload of this manual technique, it consumes more water or sometimes the water reaches late due to which the crops get dried. Hence, it becomes critical for growers to find ways to conserve water and decrease workload while still achieving the highest yield by automatically monitor and test soil condition before supplying water to fields.

1.3 Aim and Objectives:

This research aims to:

- Automate irrigation process to conserve and adjust water supplies in farm to achieve highest yield with lowest farmers' workload.
- Design irrigation system using Bascom & Proteus Simulink
- Develop a real model of automatic irrigation system that could be access remotely.

1.4 Methodology:

The system continuously monitors the soil moisture, , temperature, and light luminescence and provides this information to user though SMS. The system consists of a centralized unit having a subscriber number which forms a link between user and device and acts as a primary node for sending and receiving the data though SMSs by the user.

The centralized unit communicates with the system through SMSs which will be received by GSM with the help of SIM card; the GSM sends this data to ATMEGA Controller, after processing it displays it on the LCD. The activation command is given to start the motor and indirectly activate the transistorized relay circuit to constantly monitor the environmental factors and once the required level is reached the motor is turned off and the message is sent to the farmer.

The heart of the automatic irrigation system is the microcontroller. These devices are very low-cost and can be used very easily in digital control applications.

1.5 Thesis outlines:

The rest of this thesis is organized as follows:-

Chapter 2 (Literature Review):

This chapter reviews back ground literature related to automatic irrigation systems, tools and general approaches that are used in these systems. Besides, it summarizes related previous studies of researches in the field of automatic irrigation and highlights deficiencies and problems they faced.

Chapter 3 (Methodology):

This chapter describes, discusses and justifies the research approach, methods and techniques used in this research work. General methodology frameworks followed by specific sub frameworks of all phases and way forward to achieve research objective are presented and explained.

Chapter 4 (Results and Discussions):

In this chapter, the results will be displayed and analyzed, and an evaluation of performance of developed system is provided.

Chapter 5 (Conclusions and Recommendations):

This chapter concludes the overall research work gives recommendations for future work

Chapter Two

Literature Review

2.1 Over view:

This chapter reviews background literature related to automatic irrigation systems, tools and general approaches that are used in these systems. Besides, it summarizes related previous studies.

The chapter includes a discussion of automation, automation in irrigation, automating irrigation process and summarizes related previous studies.

2.2 Automation:

Automation is a set of technologies that results in operation of machines and systems without significant human intervention and achieves performance superior to manual operation. Automation therefore is the mechanism for systems that "move by itself" However, apart from this original sense of the word, automated systems also achieve significantly superior performance than what is possible with manual systems, in terms of power, precision and the speed of operation.

Although the term mechanization is often used to refer to the simple replacement of human labor by machines, automation generally implies the integration of machines into a self-governing system.

2.3 Automation in Irrigation:

After research in the agricultural field, researchers have found that the yield of agriculture is declining day by day. The use of technology in the field of agriculture plays an important role in increasing the production while concurrently reducing the extra man power efforts, water requirement and fertilizer requirement.

Some of the researchers tried for the betterment of farmers and provides the systems that use technologies which are helpful for increasing the agricultural yield.

Efficient water management plays an important role in the irrigated agricultural cropping systems. In order to produce more crops per drop, growers in arid regions are currently exploring irrigation techniques in the range from using less fresh water to …. One of them is making agriculture in a manner of sense, which uses a different type of sensors

A site-specific sensor-based irrigation control system is a potential solution to optimize yields and maximize water use efficiency for fields with variation in water availability due to different soil characteristics or crop water needs

Temporal monitoring of soil moisture at different growth stages of the crop could prevent water stress and improve the crop yield.

In the last two decades, with the development of technologies, several researches focused on autonomous irrigation with sensors in agricultural systems. Amongst these works, micro sprinkler system has a different place, and it was designed for latching the controlled solenoid valves in a citrus orchard with sensors afterwards, soil moisture sensors and sprinkler valve controllers are being used for site-specific irrigation automation.

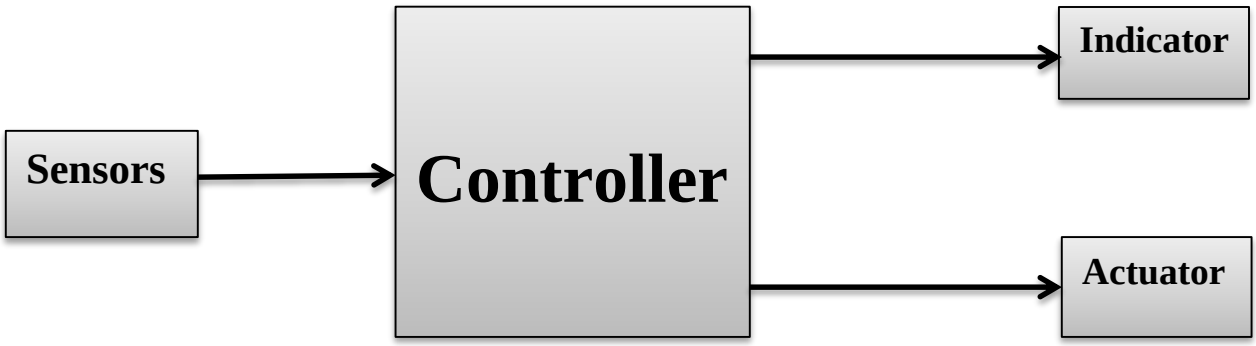
The advantages of using sensors are having the reduced time waste, costs, and easier installation and maintenance in large areas. After the usage of sensor technology began in agricultural irrigation, a trial was made to involve different types of equipment in such instrumentations.

Many of the commercially available sensors, valves and modules assembled for irrigation system networks are too complex and/or costly to be feasible for site-

specific management of fixed irrigation systems. The adoption of them by producers has been limited due to cost, installation time, maintenance, and complexity of systems.

The literature review shows that, with the wide spread use of cellular networks, automatic irrigation systems have been applied through wireless technology at the farm area incorporating GSM technology with mobile phone through the mobile network. The technology is one of the factors which limit the implementation of some of the automated irrigation system in developing countries.

2.4 Automating Irrigation Process:



2.4.1 Sensors:

A sensor is the device that provides a usable output in response to a specified measure.

A sensor acquires a physical quantity and converts it into a signal suitable for processing (e.g. optical, electrical, mechanical).

Common sensors convert measurement of physical phenomena into an electrical signal; and the active element of it is called a transducer.

Transducer is the device that converts one form of energy to another.

Sensors are pervasive. They are embedded in our bodies, automobiles, airplanes, cellular telephones, radios, chemical plants, industrial plants and countless other applications.

2.4.1.1 Criteria to choose a Sensor:

There are certain features which have to be considered when we choose a sensor. They are as given below:

1. Accuracy
2. Environmental condition - usually has limits for temperature/ humidity
3. Range - Measurement limit of sensor
4. Calibration - Essential for most of the measuring devices as the readings changes with time
5. Resolution - Smallest increment detected by the sensor
6. Cost

7. Repeatability - The reading that varies is repeatedly measured under the same environment.

2.4.1.2 Classification of Sensors:

Sensors can be classified to many types according to the principle of operation, application and other properties.

Classification based on property is as given below:

- Temperature - Thermistors, thermocouples, RTD's, IC and many more.
- Pressure – vacuum, elastic liquid based manometers, LVDT, electronic.
- Flow - Electromagnetic, differential pressure, positional displacement, thermal mass, etc.
- Level Sensors - Differential pressure, ultrasonic radio frequency, radar, thermal displacement, etc.
- Proximity and displacement - LVDT, photoelectric, capacitive, magnetic, ultrasonic.
- Biosensors - Resonant mirror, electrochemical, surface Plasmon resonance, Light addressable potentio-metric.
- Image - Charge coupled devices, CMOS
- Gas and chemical - Semiconductor, Infrared, Conductance, Electrochemical.
- Acceleration - Gyroscopes, Accelerometers.
- Others - Moisture, humidity sensor, Speed sensor, mass, Tilt sensor, force, viscosity.

2.4.2 Actuator:

An actuator is the device that enable aprocess variable to be manipulated. It is the device that brings about the mechanical movements required for any physical process in the factory. Internally, actuators can be broken down into two separate modules: the signal amplifier and the transducer.

The amplifier converts a low power control signal into a high power signal that is fed into the transducer; the transducer converts the energy of the amplified control signal into work. This process usually involves converting one form of energy into another, e.g. electrical motors convert electrical energy into kinetic energy.

An actuator is closely related to motion or position control. In aircraft system, actuators are used in many speed, flow and position control for sue in flight control system.

Typical actuators are:

- Electric Motors: - AC motor- DC motor- stepper motor- servo motor.
- Hydraulic Actuators: - Hydraulic actuators may be linear or rotary for example
  Hydraulic Servo Valves- pump
- Pneumatic actuators.

2.4.3User Interface:

The user interface (UI), in the industrial design field of human–computer interaction, is the space where interactions between humans and machines occur. The goal of this interaction is to allow effective operation and control of the machine from the human end, whilst the machine simultaneously feeds back information that aids the operators' decision-making process.

Generally, the goal of user interface design is to produce a user interface which makes it easy, efficient, and enjoyable to operate a machine in the way that produces the desired result. This generally means that the operator needs to provide minimal input to achieve the desired output, and also that the machine minimizes undesired outputs to the human.

2.4.3.1User Interface Tools:

There are many tools use to interface between user and controller (computer microcontroller plc.) from these tools:

1. **ZigBee Module:**

ZigBee Module is a low-cost, low-power, wireless mesh networking standard.

This module can achieve transparent data transmission between many devices, and it can form a MESH network. This device has the characteristics of small volume, ultra-low power consumption and low-cost. It can be either as an independent data transmission termination or be easily embedded into a variety of products to form a short-range wireless data transmission solution.

2. **GSM Module:**

A GSM Modem is a wireless modem that works with a GSM wireless network. Like a GSM Mobile Phone, a GSM Modem requires a SIM card from a wireless carrier in order to operate. Once a GSM Modem is placed and powered it is ready to function as a receiver and transmitter GSM Modem supports a set of AT commands.

3. Tele Phone and DTMF:

Telephone one of the tools that is use for interface between the controller and user, but need to convert the decimal number to binary number for that using the DTMF with it.

DTMF (dual tone multi frequency) is the signal to the phone company that you generate when you press an ordinary telephone's touch keys.

2.4.4 Controller:

For each system the control unit causes the system to go through a sequence of control steps;

In each control step the control unit issues a set of signals which cause the corresponding program to be executed.

The signals to be generated at a certain moment depend on:

- The actual step to be executed.
- The condition and status of the inputs (sensors).
- The actual instruction executed.
- External signals received.

There are many type of control unit can be used to control l the system, from these control units:

1. Programmable Logic Controller (PLC):

A programmable logic controller (PLC) is an industrially hardened computer- based unit that performs discrete or continuous control functions in a variety of Processing, plant and factory environment.

The PLC is very expensive and not the best chooses for small project where the microcontroller or microcomputer can replace it.

2. Microcontroller:

You can find microcontrollers in all kinds of electronic devices these days. Any device that measures, stores, controls, calculates, or displays information must have a microcontroller chip inside.

A microcontroller is basically a PLC on a single chip. It contains on one chip a processor and all the supporting circuits to enable it to communicate and interface with external equipment.

Unlike a microprocessor a microcontroller does not require any external interfacing of support devices. Intel 8051 is the most popular microcontroller ever produced in the world market.

3. Microcomputer:

A microcomputer is a complete computer on a smaller scale and is generally a synonym for the more common term, personal computer or PC, a computer designed for an individual. A microcomputer contains a microprocessor (a central processing unit on a microchip), memory in the form of read-only memory and random access memory, I/O ports and a bus or system of interconnecting wires, housed in a unit that is usually called a motherboard.

2.4.5 Indicator:

Indictor is display tool indicate the statues of sensors and actuator, the indicator can be:

1. LCD (Liquid Crystal Display):

LCD (Liquid Crystal Display) is an electronic display module commonly used in various devices and circuits.

2. Light Emitting Diode:

   The light emitting diode use for indicate to statues of sensor, actuator and mode of operation

Chapter Three

Research Methodology

3.1 Introduction:

This chapter describes, discusses and justifies the research approach, methods and techniques used in this research work. General methodology frameworks followed by specific sub frameworks of all phases and way forward to achieve research objective are presented and explained.

The chapter contains research activities, system overview, simulation tools and flow chart.

3.2 Research Activities:

The research activities are presented in Figure 3.1.

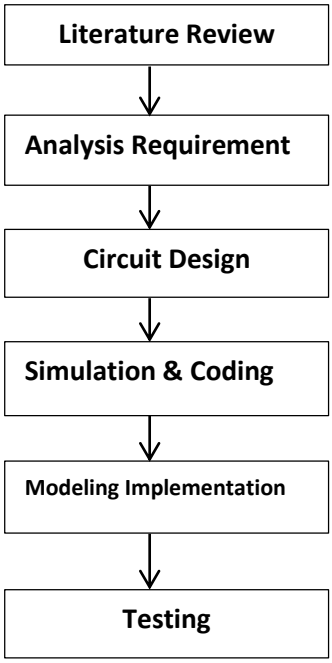


Figure 3.1: Research activities

Research activities began with a comprehensive literature review that shows how research related to previous studies and compares and contrasts different authors'

views on the issue. Analyses requirement that is followed by studying and analyze the theoretical and practical requirements needed to complete the search. The next step was a phase of circuit design where an outline of the components of the circuit is drawn and linked. Then, a simulation of the designed circuit is done with a test code. This is followed by implementing the practical hardwiring of circuit components and burning the application code on its memory. Finally comes to the step of testing the practical circuit and recording the results.

3.3 system overview:

The system overview begin with block diagram of irrigation system "Figure 3.2 describe the system components and how connected" which include the sensor as input of system, the sensor connect to the controller, the controller process the input value and give the output to the actuator.

The block diagram contains interface tools for user in input and output.

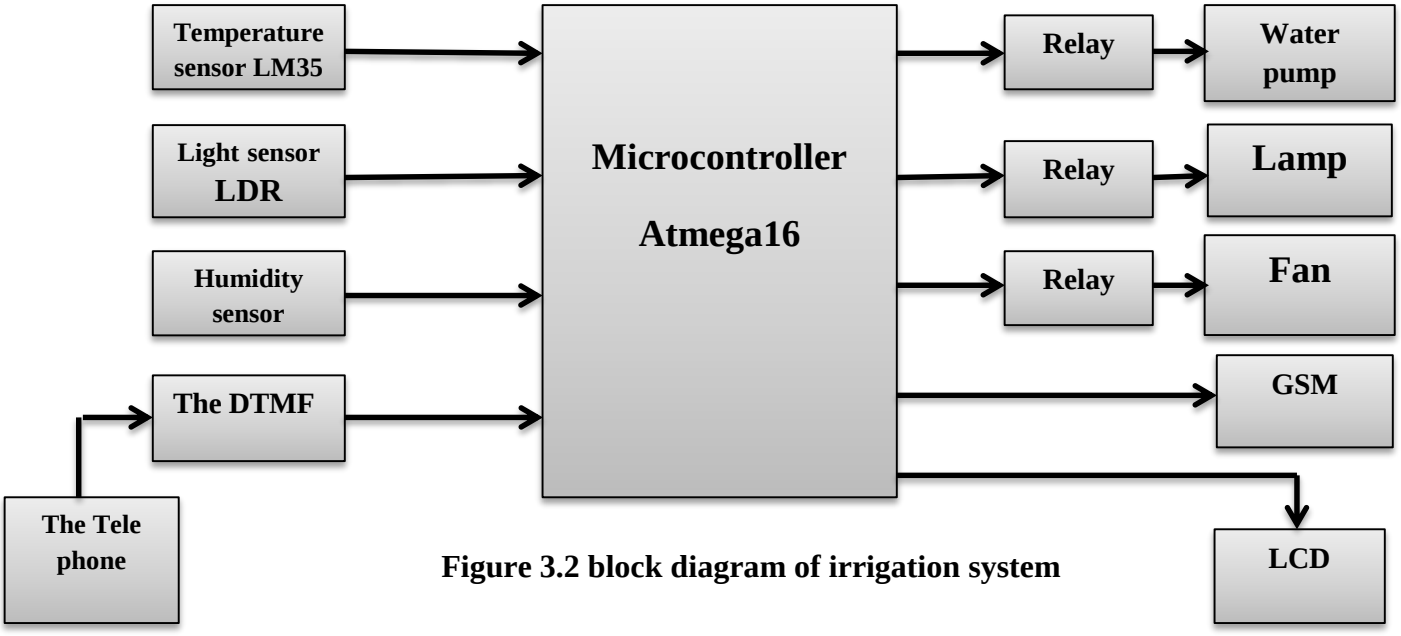


Figure 3.2 block diagram of irrigation system

The telephone use as interface tool between microcontroller and the user throw DTMF, when user press any number in telephone the microcontroller gives

command to actuator (on/off) according to number has been pressed, and display the states on LCD.

The DTMF use to convert the decimal number from telephone to binary number for microcontroller.

GSM modules send the status of sensor and actuator from microcontroller to the user phone.

3.4 Circuit diagram of the proposed irrigation system:

The circuit diagram illustrate all components used and how connected, the temperature sensor LM35 is first input, give analog signal to microcontroller and according to that digital signal out to fan which represent first actuator, the second input is the light sensor (LDR) give analog signal and microcontroller give digital signal to the second actuator (the lamp), the third input signal is the digital signal come from soil humidity sensor to the third actuator (water pump).

The DTMF and telephone use as input where send command to microcontroller to operate system in auto or manual mode, and give command to all actuator in manual.

Liquid Crystal Display (LCD) is other output that displays the status of sensor and actuator" Figure 3.3 describe the circuit diagram of irrigation system"

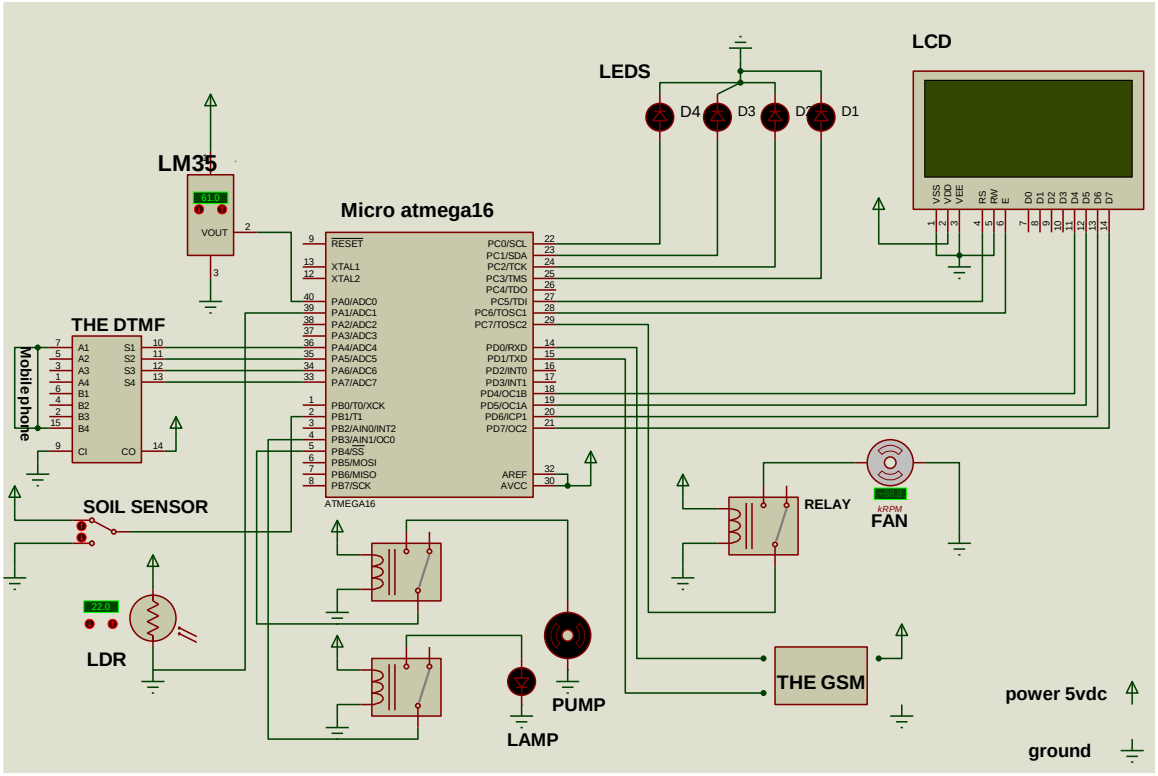


Figure 3.3 Circuit diagram of the proposed irrigation system

3.5 Circuit Components:

The components include sensors, actuator, control unit, communication units and other components.

1. Microcontroller:

It is a highly integrated chip that contains all the components comprising a controller Microcontrollers are sometimes called Embedded Microcontrollers, which just means that they are part of a larger device or system.

There are many type of microcontroller, atmega16 suitable for this research because it is high performance, low power consumption m fully static operation and 32programable I/O lines.

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle

2. Liquid Crystal Display (LCD):

LCD (Liquid Crystal Display) is an electronic display module commonly used in various devices and circuits. LCDs are economical, easily programmable, have no limitation of displaying special and even custom characters and so on. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage.

There are many types of LCD according to the number of line and number of character in line, LCD16*4 where 4 is number of line and 16 is number of character in line is used in the research.

The LCD display the states of the sensor, temperature value, light density value and the soil humidity statues ok or not ok. Also display the states of actuators (fan, lamp, pump) run or stop and display the mode of operation manual or automatic.

3. Temperature sensor:

Temperature sensor senses the information about temperature in the soil or atmospheres in this project temperature sensor senses the values and gives to the processor, the processor process the values with a model of program based and this value can be takes by actuators are connected to output port of the microcontroller

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature" Figure 3-4 shows temperature sensor LM35".

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

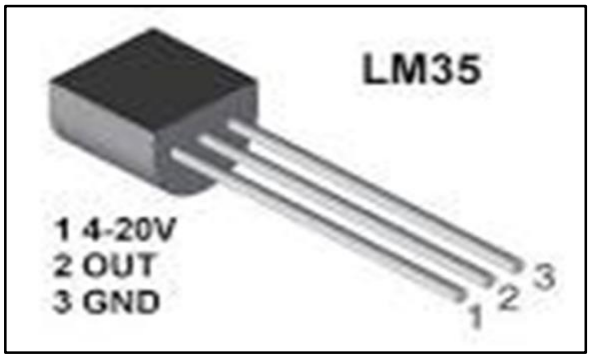


Figure (3-4): temperature sensor LM35

4. Soil Sensor:

Soil sensor is used to calculate soil moisture values in the land crops soil sensor can be placed in the root zone of the plants for automated irrigation purpose.

We use the grove soil moisture, this moisture Sensor can be utilized to recognize the dampness of soil or judge if there is water around the sensor, let the plants connect for human help. They can be exceptionally to utilize, simply embed it into the dirt and after that read it. With help of this sensor, it will be feasible to make the plant remind thirsty now, need some water.

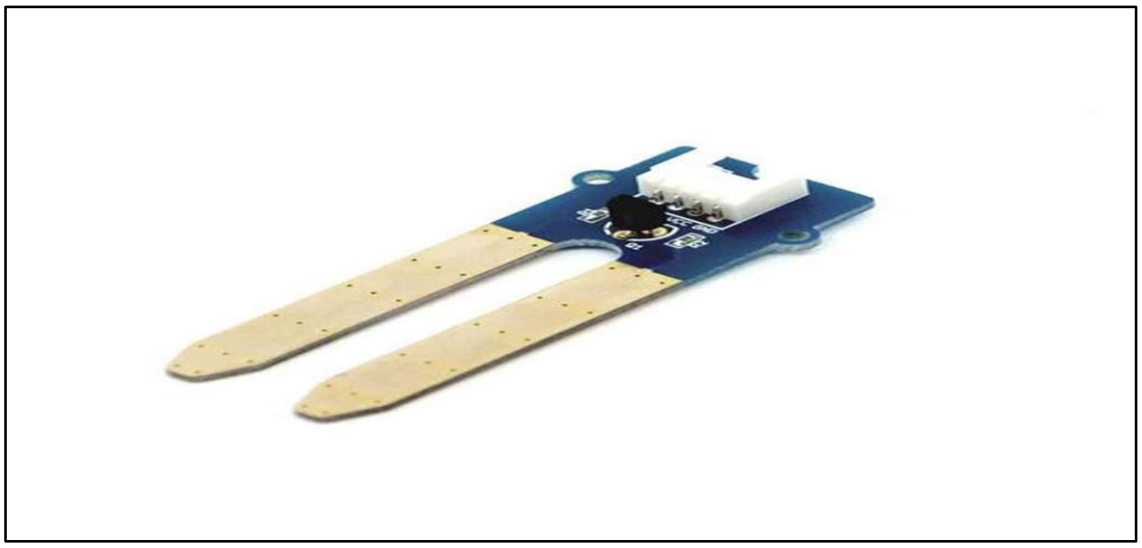


Figure (3-5): soil sensor

5. Light Dependent Resistor

A light dependent resistor also known as a LDR, photo resistor, Photo conductor or photocell, is a resistor whose resistance increases or decreases depending on the amount of light intensity. LDR are a very useful tool in a light/dark circuits.

LDR's are light subordinate devices whose resistance diminishes when light falls on them and increments oblivious. At the point when a light ward resistor is kept in dull, its resistance is high. This resistance is called as dull resistance. It can be as high as 1012 Ω. What's more, if the implement is permitted to retain light its resistance will diminish radically. In the event that a consistent voltage is connected to it and force of light is expanded the current begins expanding.

LDR's have minimal effort and straightforward structure. They are frequently utilized as light sensors. They are utilized when there is a need to recognize absences or habitations of light like in a cam light meter. Used in street lamps, alarm clock, burglar alarm circuits, light intensity meters, for counting the packages moving on a conveyor belt, etc

.

Figure (3-6):LDR Sensor

6. Global System for Mobile Communication (GSM):

GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA).

Listed below are the features of GSM that account for its popularity and wide acceptance

- International roaming
- Improved spectrum efficiency
- Low-cost mobile sets and base stations (BSs)
- High-quality speech
- Compatibility with Integrated Services Digital Network (ISDN) and other telephone company services
- Support for new services.

GSM Modem:

Modem stands for modulator-demodulator. It is a communication device that can modulate an analog carrier signal with digital data and transmit, while it also demodulates the incoming modulated signal to extract the analog information. There can be wired as well as wireless modems.

GSM SIM900 used in this research " Figure (3-7) show GSM Modem SIM900", The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications.

Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.

Figure (3-7): GSM Modem SIM900

7. DTMF (dual tone multi frequency):

DTMF (dual tone multi frequency) is the signal to the phone company that you generate when you press an ordinary telephone's touch keys, each key you press on your phone generates two tones of specific frequencies. So that a voice can't imitate the tones, one tone is generated from a high-frequency group of tones and the other

from a low frequency group (show in fig 3-6). Here are the signals you send when you press your Touch tone phone keys.

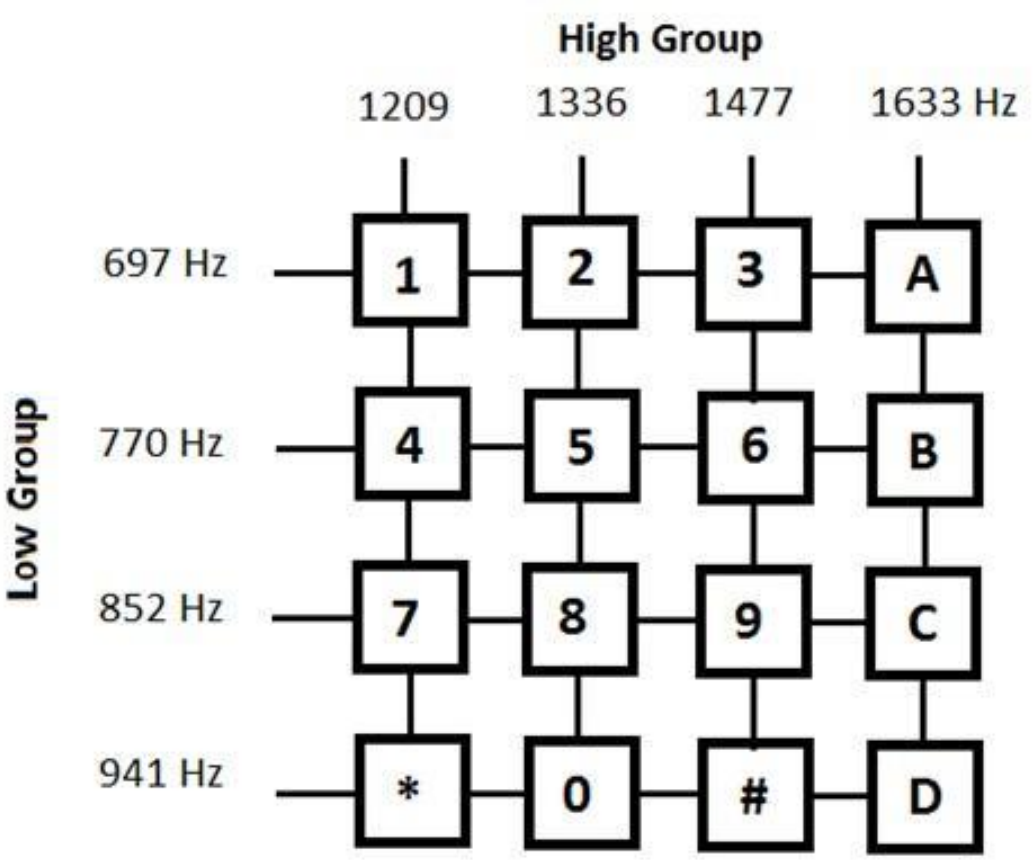


Figure 3-8 High and Low frequency group

high and low frequency group conver to binary code as shown in table below

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

Table 3-1 illustrate conver low and high frequency to binary code

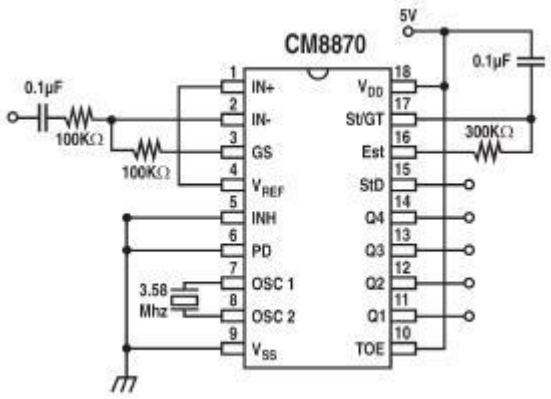


Figure (3-9): The DTMF

9. Other components:

ULN2003: there are many type of ULN, ULN2003, ULN2003A, ULN2004 and ULN2803.

The ULN2003 is known for its high-current, high-voltage capacity. The drivers can be paralleled for even higher current output. Even further, stacking one chip on top of another, both electrically and physically, has been done. Generally it can also be used for interfacing with a stepper motor, where the motor requires high ratings which cannot be provided by other interfacing devices.

3.6 Simulation Tools:

The simulation tools that tools used to simulate the circuit as software.

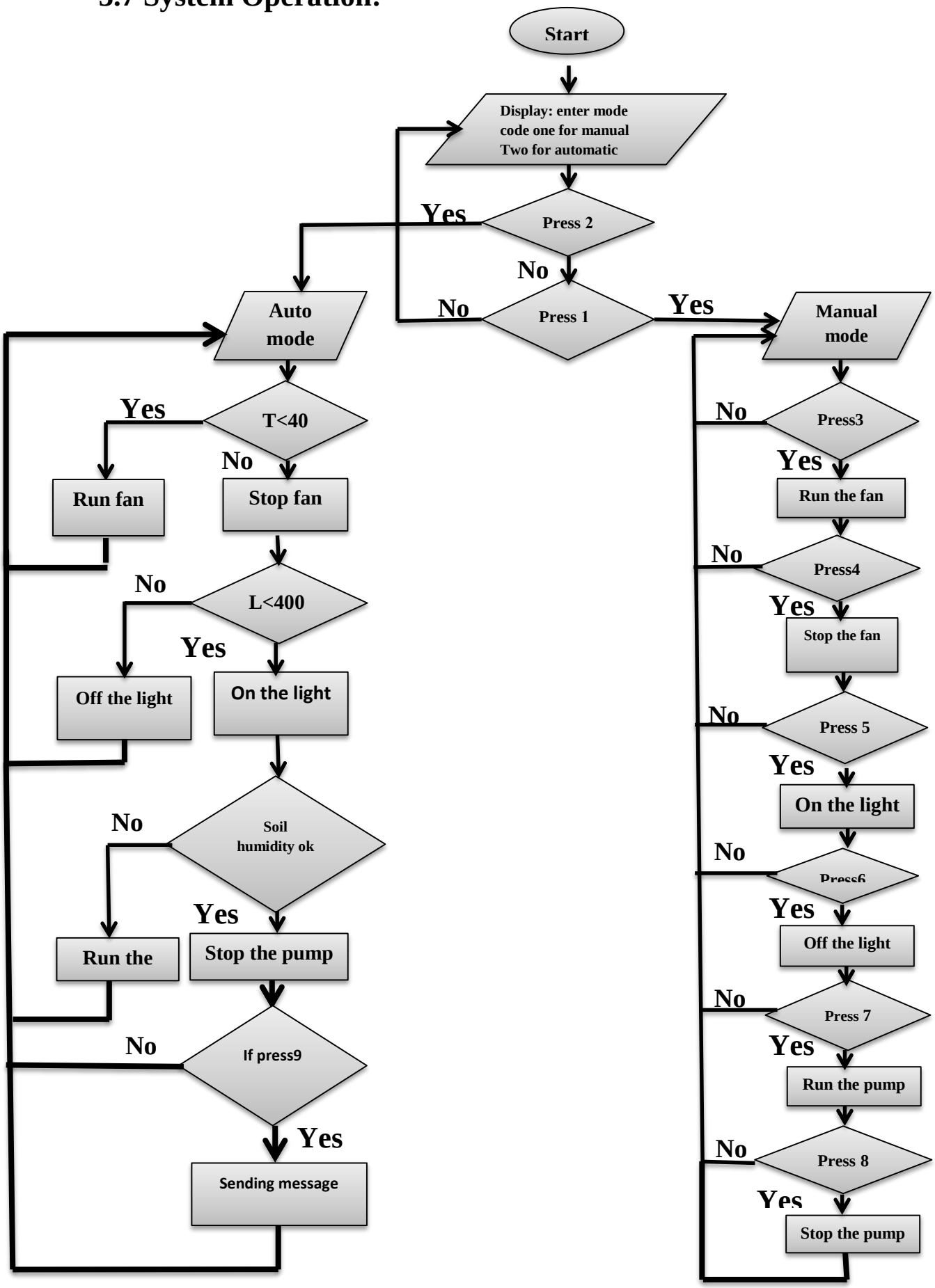
Bascom & AVR BASCOM-AVR is four programs in one package, it is known as an IDE (integrated development environment) it includes the Program Editor, the Compiler, the Programmer and the Simulator all together.

The Bascom used to write the program code, writing the code in program editor and then compiler it from high level language to machine code and if no error we can program it to microcontroller.

Proteus ISIS:

Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design, this program includes most components sensor and actuator, used to design the circuit and test it after loaded the program code.

3.7 System Operation:



Micro controller programming into two mode of operation automatic mode and manual mode control by the user wants to, and has programming on the basis of signals (DTMF) and referring light, temperature and soil moisture sensitive income (INPUT) for Micro controller according to the conditions of work required of them

Automatic mode is the main mode of operation and this is done by clicking two on the phone and in this case, the sensors are controlling the operation and suspension.

Manual mode is the auxiliary mode and done by pressing the number one and it will be operating and suspended by pressing the buttons without taking into account the states of the sensors.

3.7.1-Automatic mode

In this mode, the control automatically by pressing the button (2) ,is automatically controlled in the irrigation process where control through phone contact with the sender in the future by clicking on the button (2), whereupon (DTMF) converts the received signal into binary signal (0,1) and then converted as a matter of Micro controller which display the statues of sensor in LCD and irrigation process after checking the sensor signals soil moisture, light and temperature and also display the statues of actuator (fan, led and pump).

- When give start LCD will display inter mode code.
- If press two and select auto mode LCD will display status sensor and actuator.
- If temperature is higher than set point the micro controller run the fan and LCD will display temperature is hot and the fan running in auto mode.
- If temperature is lower than set point the micro controller stop the fan and LCD will display temperature is cold and the fan stopped in auto mode.

- If Light Intensity is higher than set point the micro controller Shut down the lighting system and LCD will display Light Intensity and the lamp stopped in auto mode.

- If Light Intensity is higher than set point the micro controller run the lighting system and LCD will display Light Intensity and the lamp run in auto mode.

- If Soil moisture is low the micro controller run the pump and LCD will display humidity not ok and pump run in auto.

- If Soil moisture is ok the micro controller stop the pump and LCD will display humidity ok and pump stop in auto.

- if press 9the GSM module send SMS with detail condition of field to the master SIM or owner of the field, and if he want to change the mode and run the system in manual mode he can call the number of phone (not GSM) and select the mode code from phone keypad, and he can run and stopped the actuator (lamp fan pump) according to manual mode.

Condition	Action
Temperature>40	Fan run
	Display: temp hot fan run in auto in line one
Temperature<40	Fan stopped
	Display: temp normal fan stop in auto in line one
Light density > 400	The light off
	Display: lamp off in auto in line two after delay 500 mS
Light density < 400	The light on
	Display: lamp on in auto in line two after delay 500 ms
Soil humidity ok	The pump stop
	Display: pump off in line three and soil humidity ok in line four
Soil humidity Not ok	The pump run
	Display: pump run in line three and soil humidity low in line four.

Table 3.2 illustrate the auto mode conditions and actions

3.7.2-Manual mode:

In this mode control be manually by the user , regardless of the sensor signals and has programmable micro controller in this research that the manual operating system starts by clicking on the button (1) to be automated system to stop and switch to a manual system .

whereupon (DTMF) converts the received signal into binary signal (0,1) and then converted as a matter of Micro controller which display the statues of sensor in

LCD and irrigation process after the user selects any of the actuator wants to run and any wants to stop it.

- When give start LCD will display inter mode code.
- If press two and select manual mode LCD will display status sensor and actuator.
- If the user wants to run the fan must be pressing the number three.
- If the user wants to stop the fan must be pressing the number four.
- If the user wants to run the lamp must be pressing the number five.
- If the user wants to stop the lamp must be pressing the number six.
- If the user wants to run the pump must be pressing the number seven.
- If the user wants to stop the pump must be pressing the number eight.

The GSM module send SMS with detail condition of field to the master SIM or owner of the field, and if he want to change the mode and run the system in manual mode he can call the number of phone (not GSM) and select the mode code from phone keypad, and he can run and stopped the actuator (lamp fan pump) according to manual mode.

Condition	Action
Press three	Fan run
	Display: fan run in manual in line two
Press four	Fan stopped
	Display: fan stop in manual in line two
Press five	The light on
	Display: lamp on in manual in line three
Press six	The light off
	Display: lamp off in manual in line three
Press seven	The pump run
	pump run in manual in line four
Press eight	The pump run
	pump stop in manual in line four

Table 3.3 illustrate the manual mode conditions and actions

Chapter Four

System Implementation and Testing

4.1 System Implementation

There are five steps to connected microcontroller with components of circuit. They are:

4.1.1 Step one

In this step connected the sensors with the microcontroller through pins (40, 39, 37, VCC and ground), as shown in Figure 4.1.

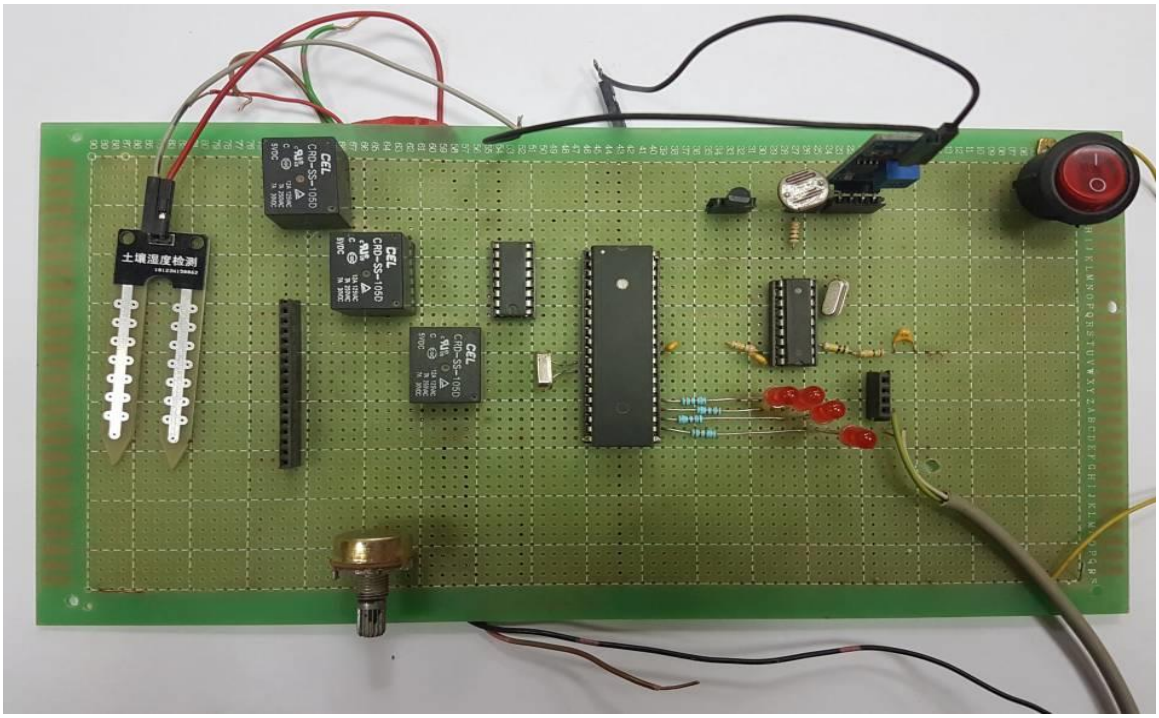


Figure 4.1 Connecting sensors with the controller

4.1.2 Step two

In this step connected the LCD with the microcontroller through pins (16, 17, 18, 19, 20and 21) as shown in Figure 4.2.

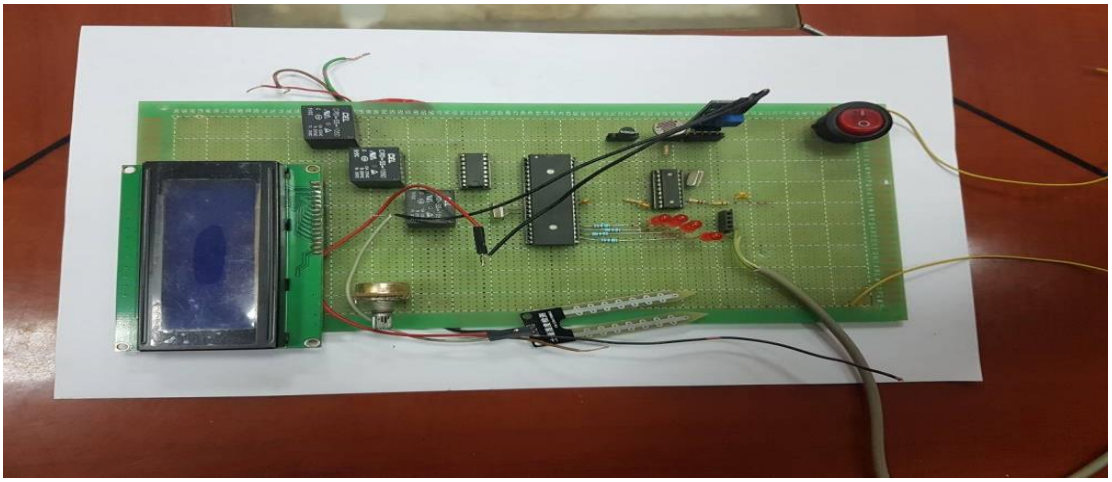


Figure 4.2 Connecting LCD with the controller

4.1.3 Step three

In this step connected the DTMF and telephone with the microcontroller through pins (33, 34, 35, 36, VCC and ground) as shown in Figure 4.3.

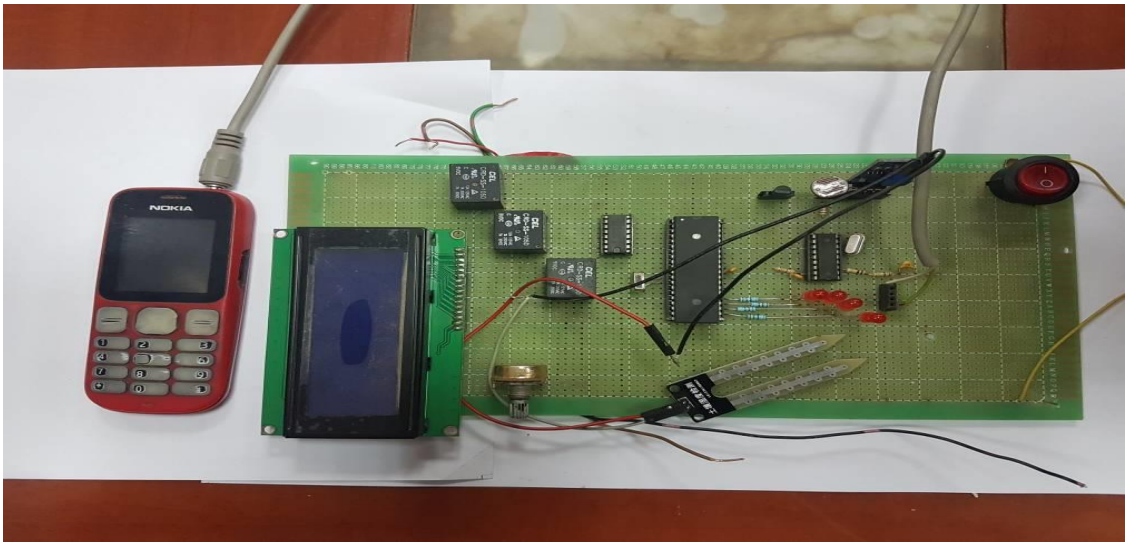


Figure 4.3 Connecting the DTMF and telephone with the microcontroller

4.1.4 Step four

Connected the actuator with the microcontroller through pins (4, 5, 6, VCC and ground) as shown in Figure 4.4.

Figure 4.4 connected the actuator with the microcontroller

4.1.5 Step five

In this step connected the GSM with the microcontroller through pin 15.VCC and ground as shown in Figure 4.5

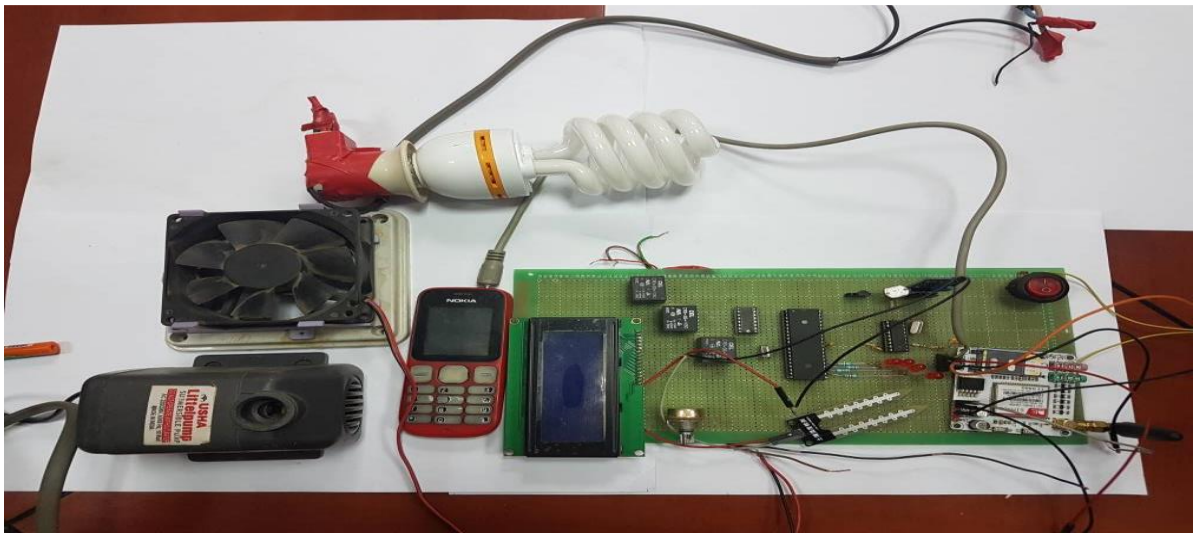


Figure 4.5 connected the GSM with the microcontroller

4.2 system testing:

After our simulation and the module, we find out that we can save temperature light density and humidity of the irrigation system according to set point in the program and we can operate the system manual at any time and from anywhere, also the GSM sending statues of system when we need. So we take some cases about our research:

4.2.1 Simulation testing:

When powered the system the LCD will display the message “enter mode code one for manual two for automatic" as shown in Figure 4.6

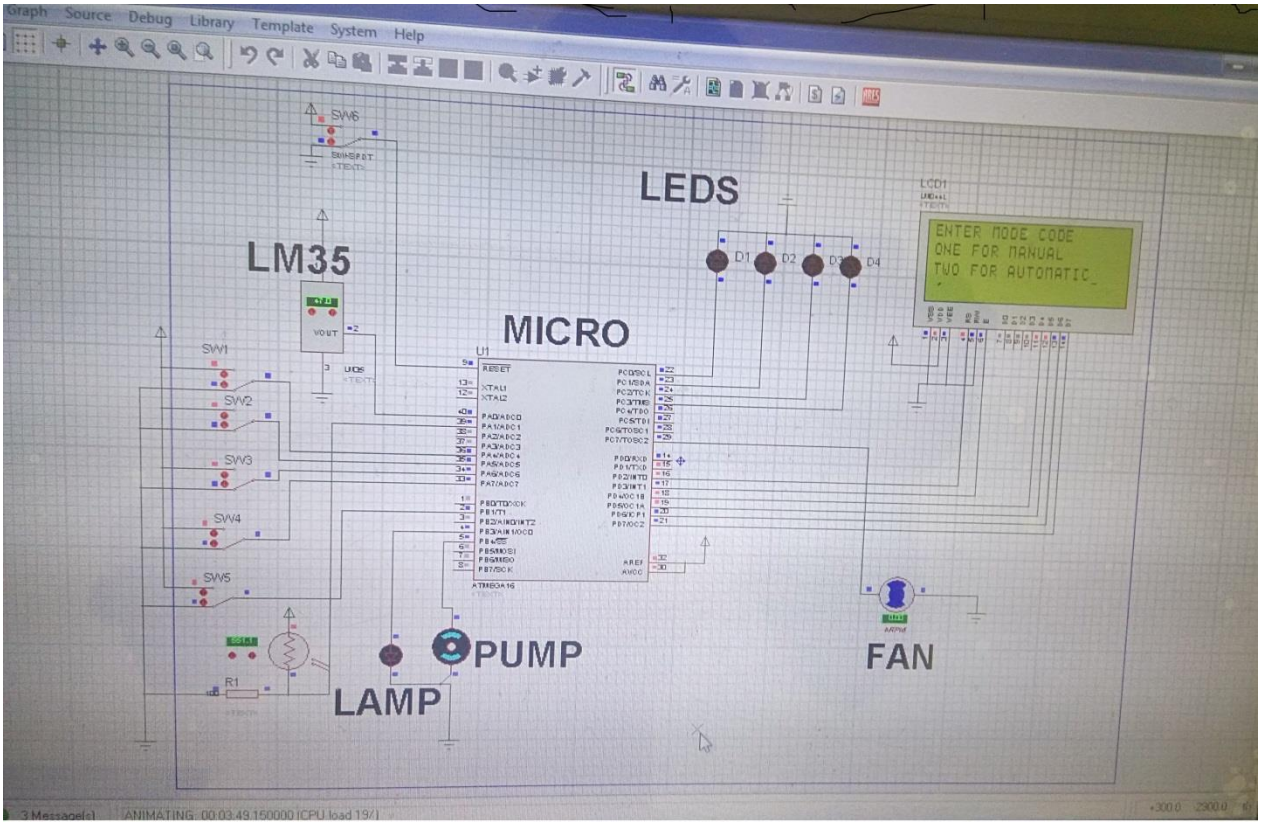


Figure 4.6 the message after powering the system in simulation

Case1:-when press 3, 5 and 7 LCD display (fan run in manual – lamp on in manual – pump run in manual) and actuator run as shown in Figure 4.7

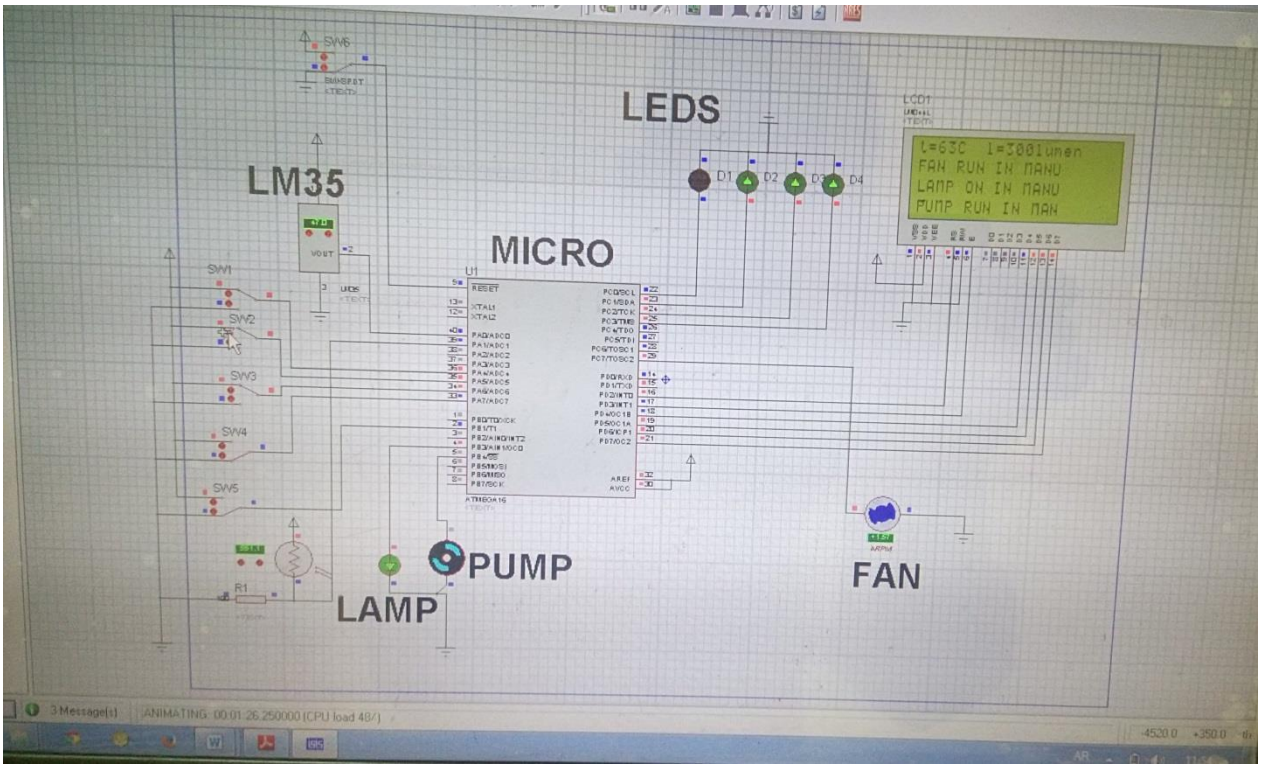


Figure 4.7 Fan, Lamp, Pump run in manual, actuator run

Case2:-when press 4, 6 and 8 LCD (fan off in manual – lamp off in manual – pump off in manual) and actuator stop as shown in Figure 4.8

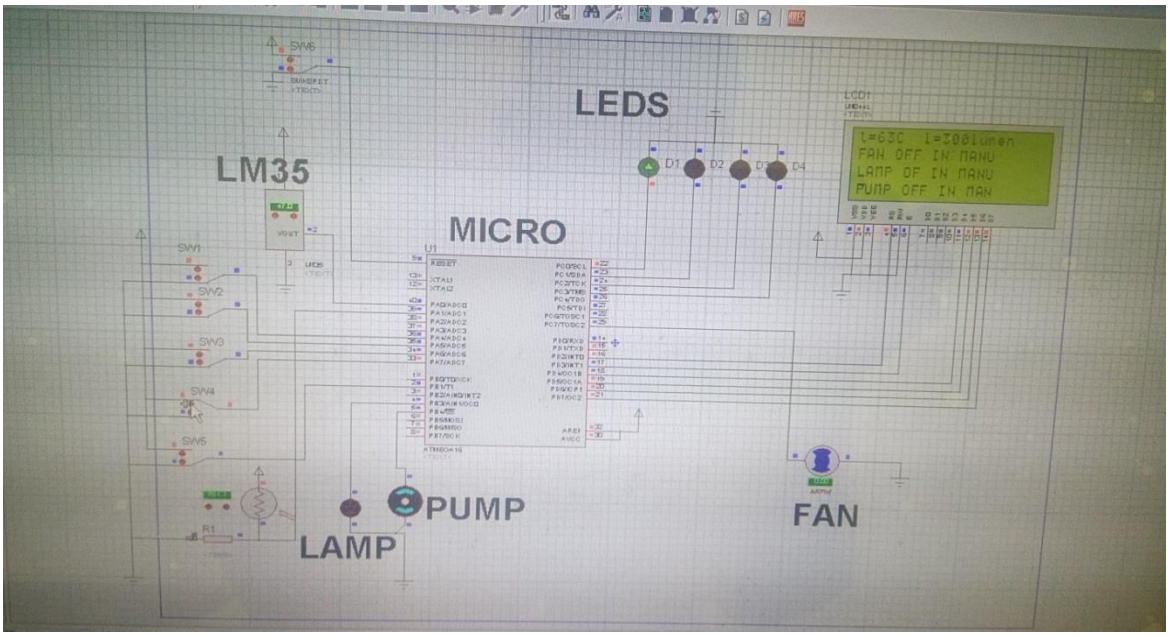


Figure 4.8 Fan, Lamp, Pump off in manual, actuator stop

Case3 :-when temperature less than 40C and light density less than 400lumen and soil humidity = 0 the LCD display the value of sensors and after a few seconds display (fan stop auto mode – lamp on auto mode – pump run soil hum low) as shown in Figure 4.9

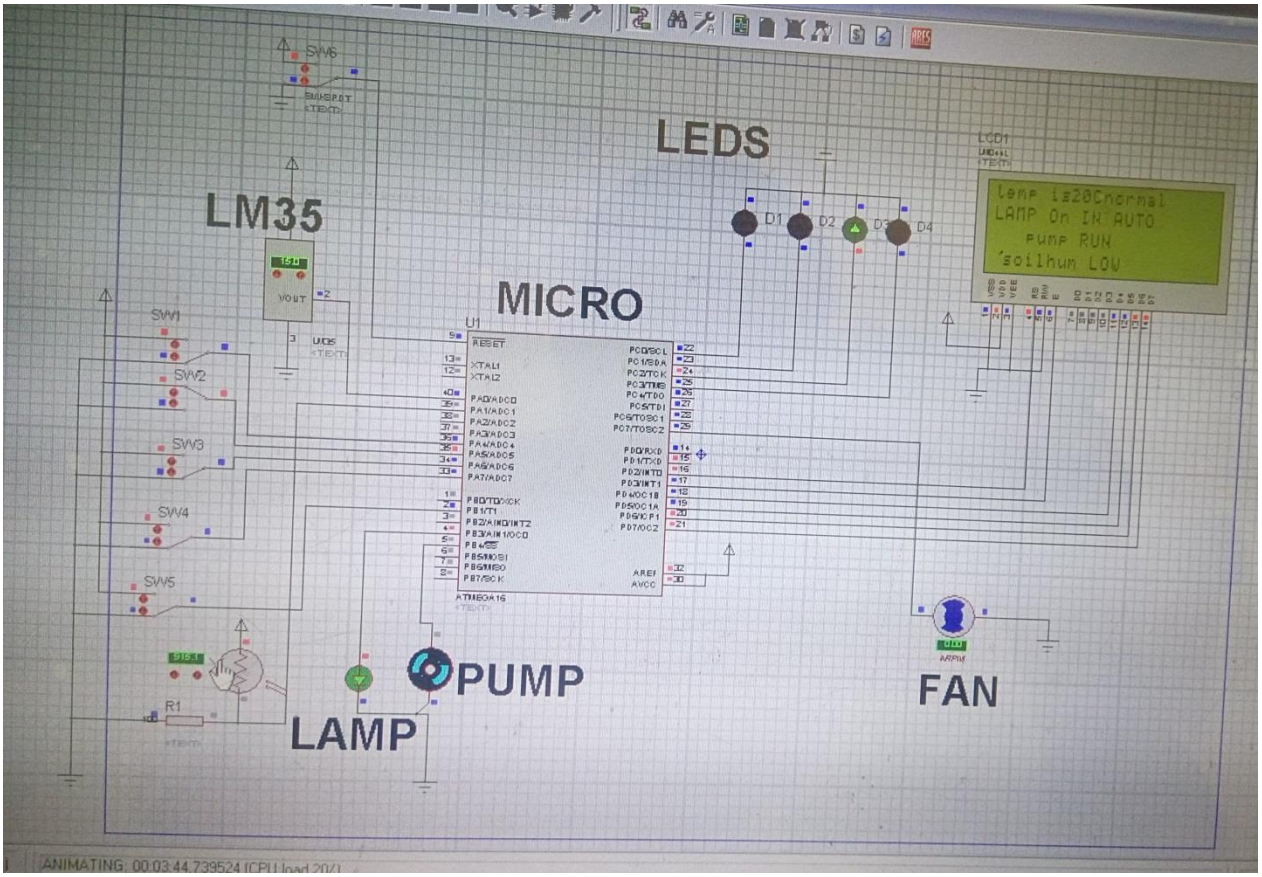


Figure 4.9 fan stop auto mode – lamp on auto mode – pump run soil hum low

4.2.2 Real mode testing:

When powered the system the LCD will display the message “enter mode code one for manual two for automatic" as shown in Figure 4.10

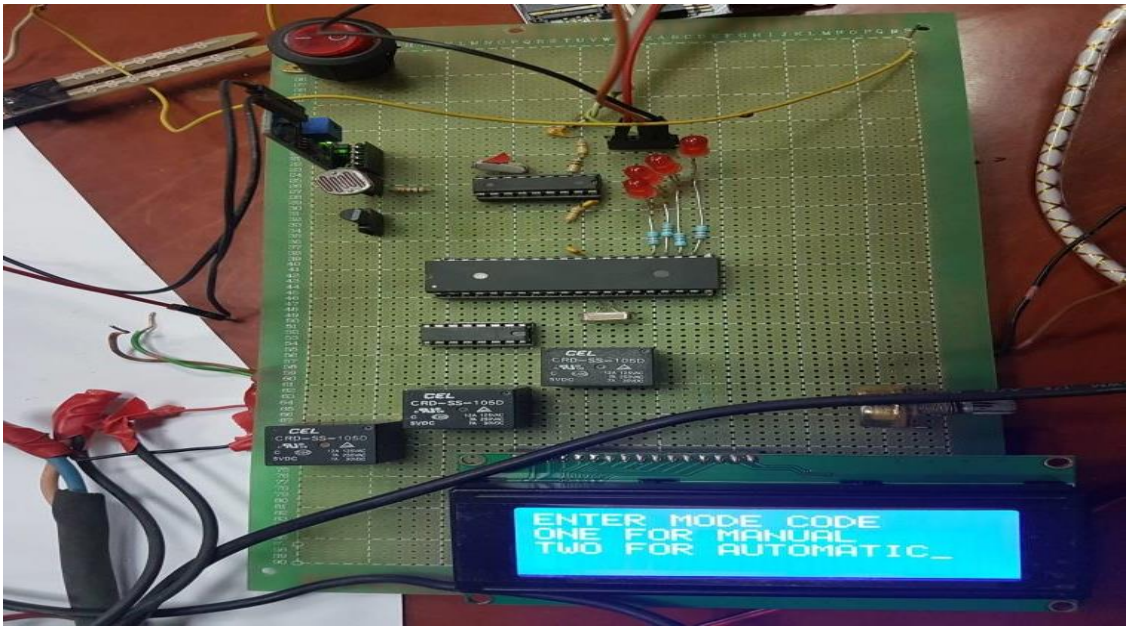


Figure 4.10 the message after powering the system

Then if press one and select manual mode the system display the message "manual mode run" on the LCD, after a few seconds the LCD display the value of temperature and light sensors as shown in Figure 4.11

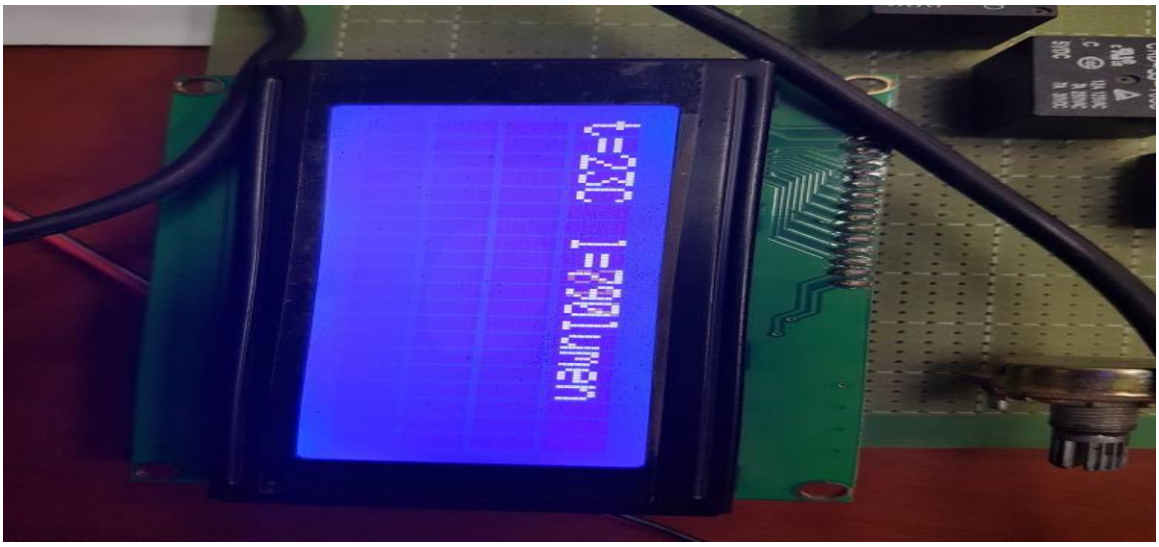


Figure 4.11 Temperature and light values in manual mode

Case1:-when press 3, 5 and 7 LCD display (fan run in manual – lamp on in manual – pump run in manual) and actuator run as shown in Figure 4.12.

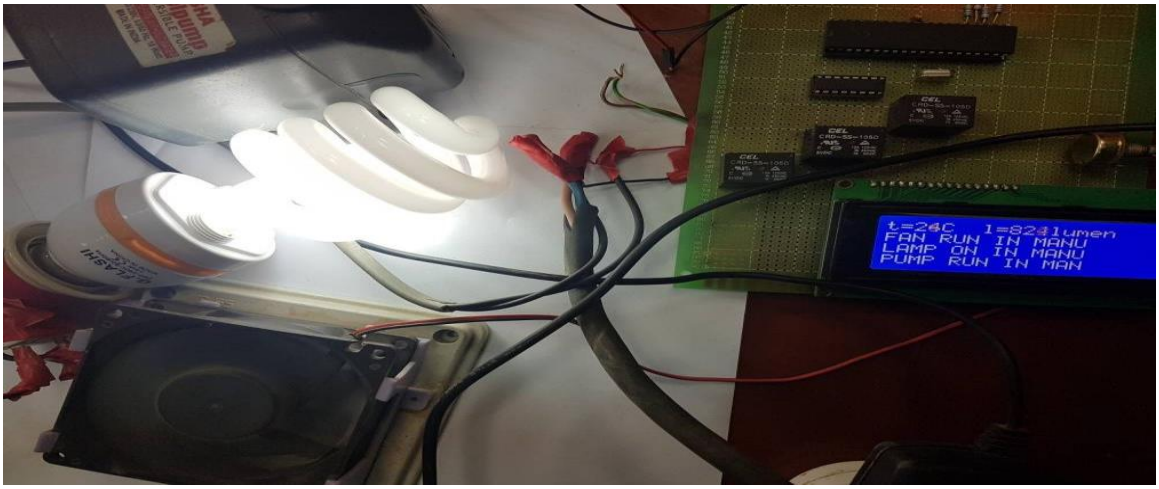


Figure 4.12 Fan, Lamp, Pump run in manual, actuator run

Case2:-when press 4, 6 and 8 LCD (fan off in manual – lamp off in manual – pump off in manual) and actuator stop as shown in Figure 4.13

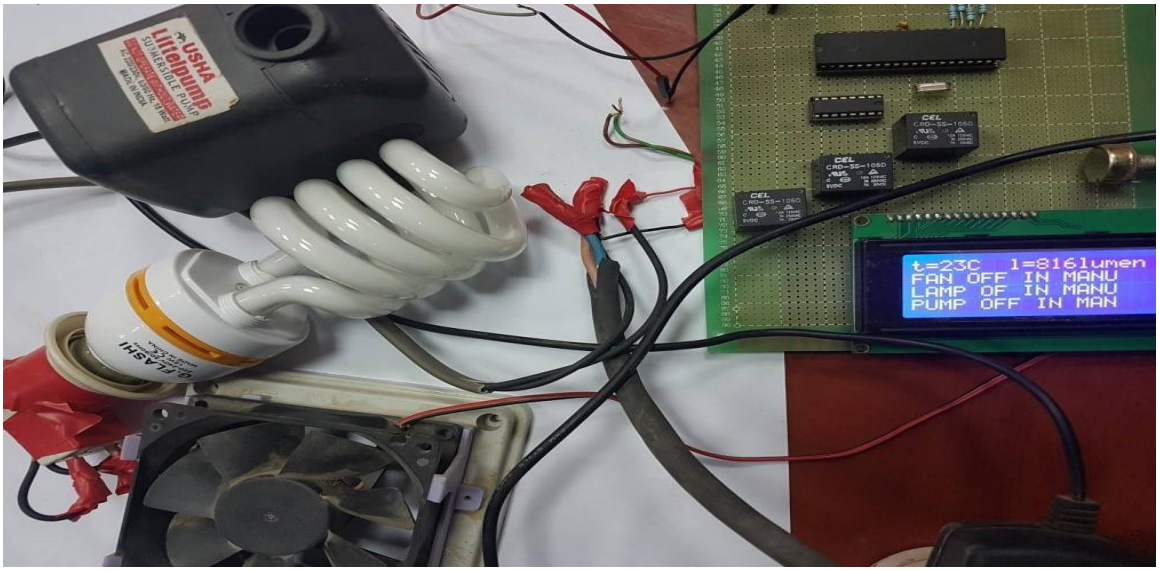


Figure 4.13 Fan, Lamp, Pump off in manual, actuator stop

Case3:-when press 3, 5 and 8 LCD display (fan run in manual – lamp on in manual – pump off in manual) fan and lamp run but pump off as shown in Figure 4.14

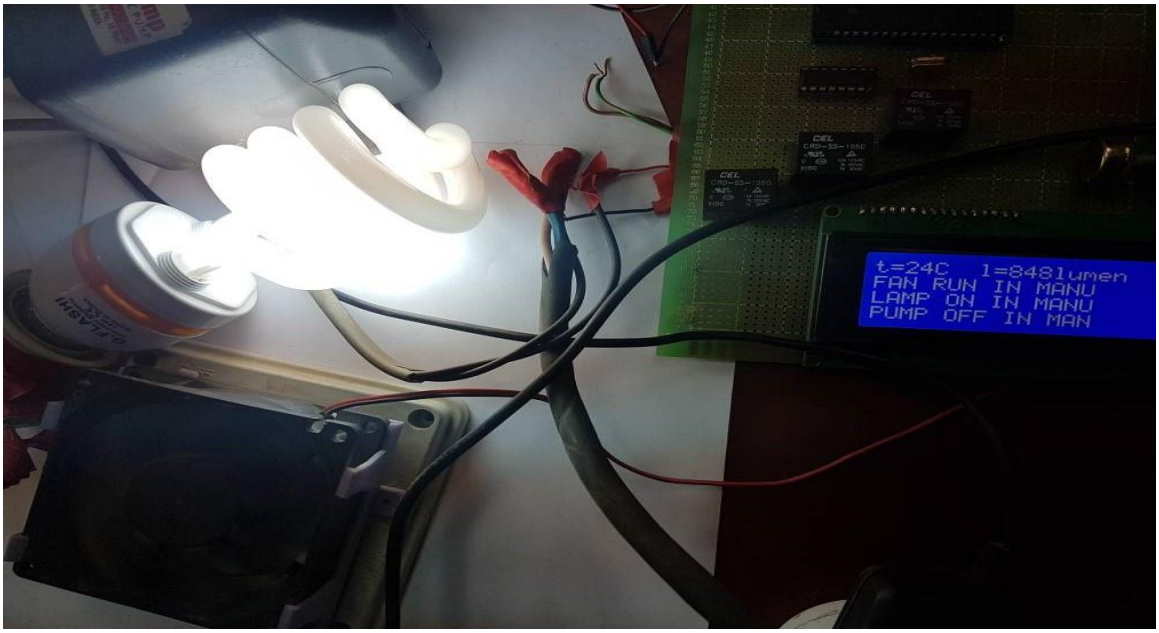


Figure 4.14 fan and lamp run but pump off

If press two and selected automatic mode the system work automatically according to sensors value.

Case 1:-when temperature less than 40C and light density more than 400lumen and soil humidity = 1 the LCD display the value of sensors and after a few seconds display (fan off auto mode – lamp off auto mode – pump off soil hum ok) as shown in Figure 4.15.

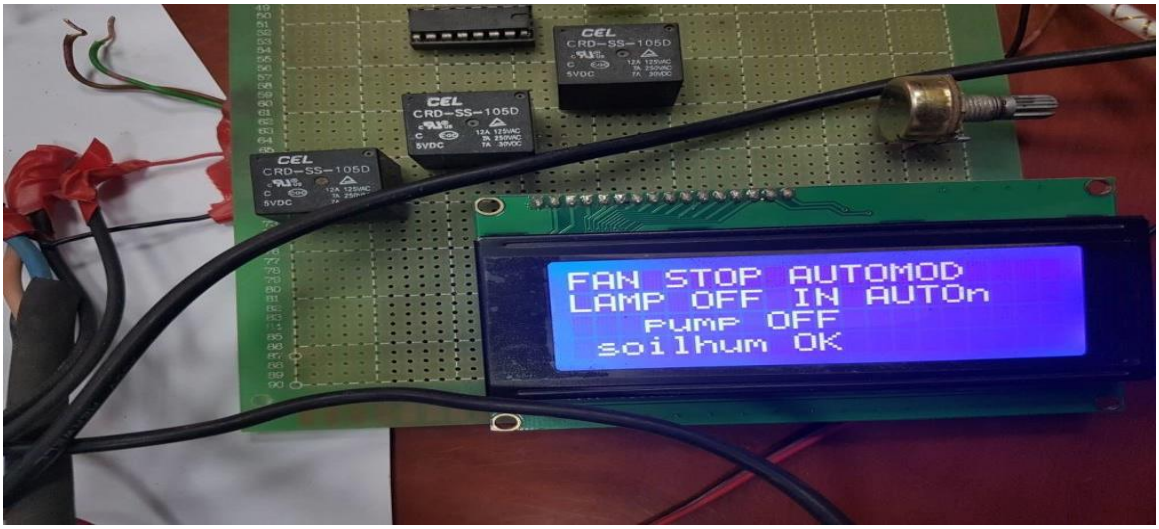


Figure 4.15 fan off auto mode – lamp off auto mode – pump off soil hum ok

Case 2:-when temperature more than 40C and light density more than 400lumen and soil humidity = 1 the LCD display the value of sensors and after a few seconds display (fan run auto mode – lamp off auto mode – pump off soil hum ok) as shown in Figure 4.16

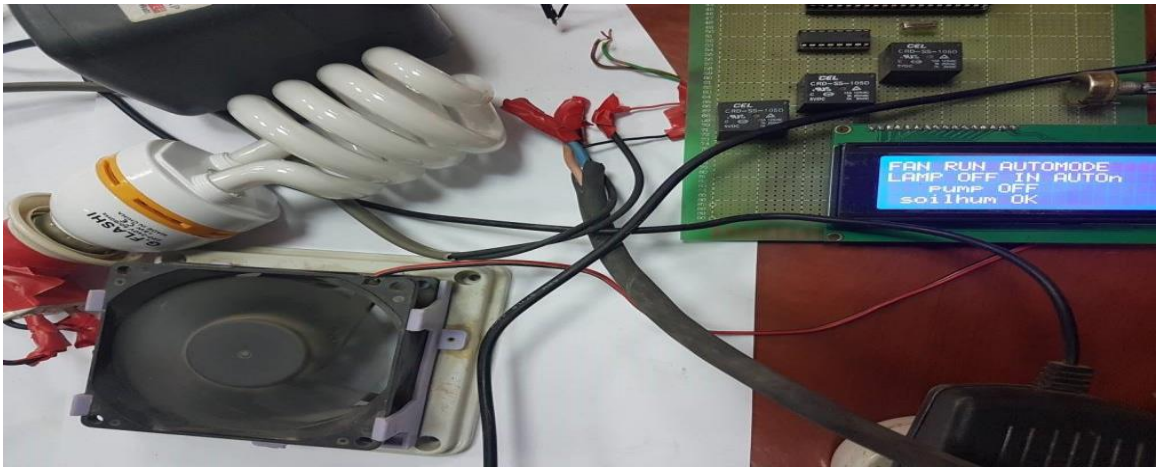


Figure 4.16 fan run auto mode – lamp off auto mode – pump off soil hum ok

Case3 :-when temperature less than 40C and light density less than 400lumen and soil humidity = 1 the LCD display the value of sensors and after a few seconds

display (fan stop auto mode – lamp on auto mode – pump off soil hum ok) as shown in Figure 4.17

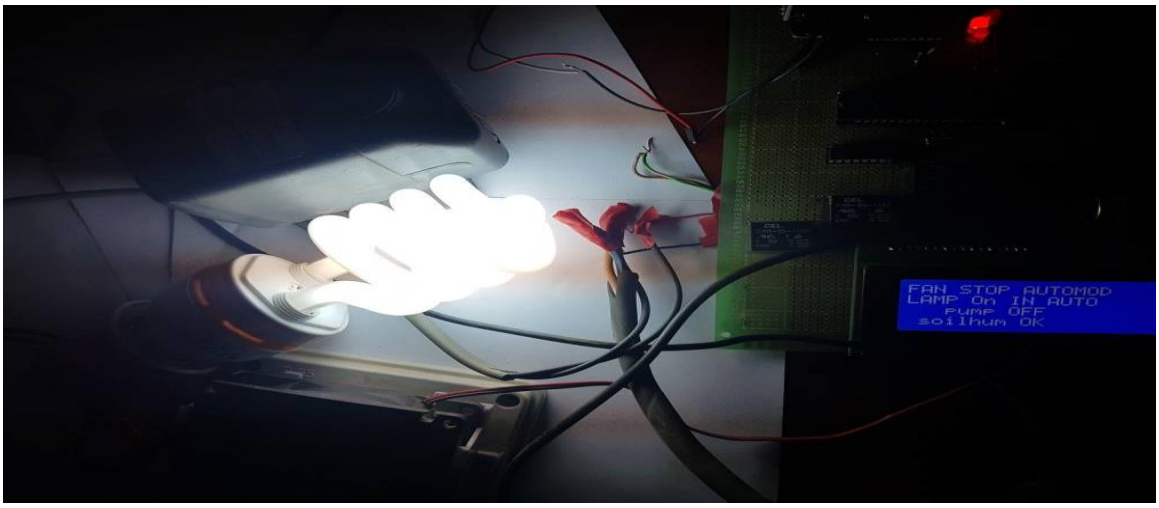


Figure 4.17 fan stop auto mode – lamp on auto mode – pump off soil hum ok

If press nine the LCD display sending message and the GSM sending message include statues of sensor and actuator as shown in Figure 4.18

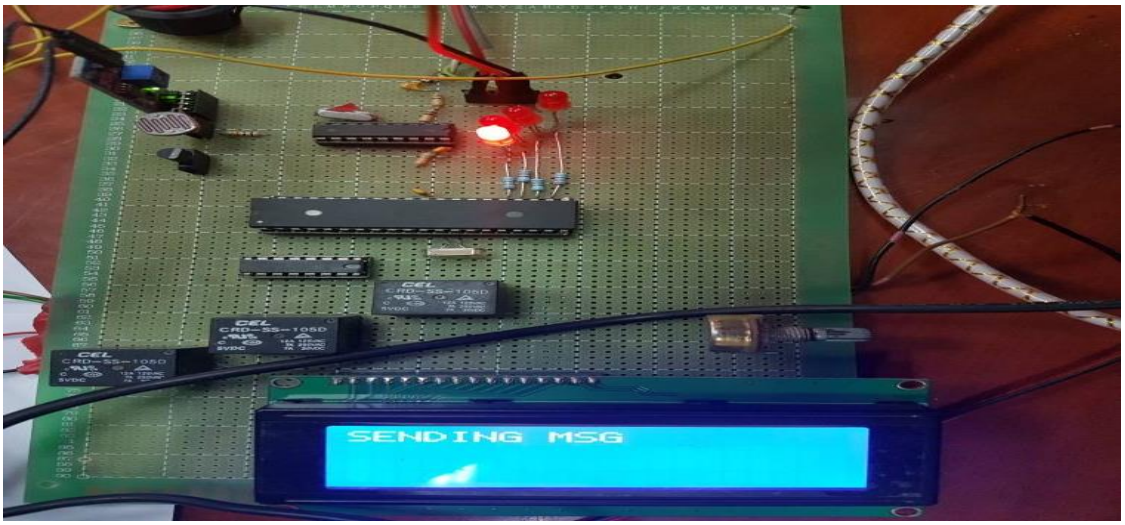


Figure 4.18LCD sends message when we press 9

Discussion:

Firstly the user must be select mode for equipment, when the user press 2 on the phone , the irrigation system run with auto-mode , when he press 1, the irrigation system run manual-mode.

In auto mode when the temperature on green House more than or equal to 40℃ , the fan will run and the LCD will display “temp hot and fan run in auto in line one”.

The Microcontroller will check the status of LDR, When the Light density more than or equal to 400 lumen, the lighting system is off and the LCD will show “lamp off in auto in line two” after delay 500 ms.

The controller also check the humidity soil by humidity sensor, when the relay of humidity is opened contact, the soil is wet and the water Pump is off, the LCD will show “pump off in line three and soil humidity ok in line four”.

When the user press 1 on the phone, the irrigation system run with manual-mode. In this mode all actuator is run manually by using phone. When the users press 3 on the phone, the fan will run and the LCD will view “fan run in manual in line two”. When the user press 4, the fan will stop and LCD will show” fan stop in manual in line two”. When the user press 6, the lighting system will shut off and LCD will display “lamp off in manual in line three”. When the user press 7, the water pump is run and LCD will view “pump run in manual in line four”. When the user press 8, the water pump will stop and LCD will show” pump stop in manual in line four”.

When we press 9 the microcontroller will send a message through GSM to the project owner.

Chapter five

Conclusion & Recommendations

5.1 Conclusion:

By using Hardware and software knowledge we built the “GSM Based Automatic Irrigation System”. We became successful to receive the message about the state of the field that is whether the land is dry or wet through the GSM interfacing. The result of our design has met our expectation, in which every component is working well. Our irrigation system is easy to use, comparatively cheap in that case that by just giving a miscall we can received the state of the field, Moisture sensor interfacing helps to detect the moisture content of the fields and comparing the value predefine in the buffer helps to automatically to turn on/off the pump easily, low power consumption and highly reliable. The LCD also offer great interface and user can be familiar with the system and know the state of the field by just reading the message displayed on the LCD. Also the temperature sensor and light sensor monitor the status of temperature and light, and on/off the fan and lamp according to set point. The system we had design is also secure because the master SIM only can only receive the message of the state of the field. This system saves the valuable time of the farmers and free from worrying about the field and helps to increase the production of the crops because this system provides the defined amount of water to the particular fields, also we can control in the system from anywhere by using DTMF (dual tone multi frequency) technique and connect from any phone to farms phone.

6.2 Recommendations:

- Increase the number of moisture sensor to cover the field.
- Uses an analog moisture sensor instead of the digital moisture sensor for accurate humidity value.
- Uses wireless sensors.
- Run the field by GSM module with short massage.

.

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Appendix:

```
  $regfile = "m16def.dat"

$crystal = 8000000

Baud = 9600



'-----------------------

'-----------------------[LCD Configurations]

Config Lcdpin = Pin , Db4 = Portd.4 , Db5 = Portd.5 , Db6 = Portd.6 , Db7 =
Portd.7 , E = Portd.3 , Rs = Portd.2

Config Lcd = 20 * 4

Config Portc = Output

Config Portd = Output

Config Pina.0 = Input

Config Pina.1 = Input

Config Pina.3 = Input

Config Portb.5 = Output : Relay Alias Portb.5

Config Portb.3 = Output : Led Alias Portb.3

Config Portb.4 = Output : Pump Alias Portb.4

Config Portc.0 = Output
```

```
Config Portc.1 = Output

Config Portc.2 = Output

Config Portc.3 = Output

Config Pina.4 = Input

Config Pina.5 = Input

Config Pina.6 = Input

Config Pina.7 = Input

Config Portc.0 = Output

Config Portc.1 = Output

Config Portc.2 = Output

Config Portc.3 = Output

Config Adc = Single , Prescaler = Auto , Reference = Internal

    '

  [Variables]

Dim Co As Bit

Dim Mn As Word

Dim Au As Word

Dim A As Word

Dim B As Word
```

```
Dim C As Word

Dim Lm35 As Word

Dim Lightsen As Word

Dim Soilsens As Word

Declare Sub Pwd

Declare Sub Snd

Declare Sub Man

Declare Sub Auto

Declare Sub Light

Declare Sub Humidty

Declare Sub Temp


Sub Pwd:

  Cls

Locate 1 , 1

Lcd "ENTER MODE CODE"

Locate 2 , 1

Lcd "ONE FOR MANUAL"

Locate 3 , 1
```

```
Lcd "TWO FOR AUTOMATIC"
Do
        If Pina.7 = 1 And Pina.6 = 1 And Pina.5 = 0 And Pina.4 = 0 And Co = 1 Then
    Co = 0
    Gosub Pwd
        Else
   If Pina.7 = 0 And Pina.6 = 0 And Pina.5 = 0 And Pina.4 = 1 Then
    Co = 0
    Gosub Man
        Else
  If Pina.7 = 0 And Pina.6 = 0 And Pina.5 = 1 And Pina.4 = 0 Then
    Co = 0
    Gosub Auto
        Else
  If Pina.7 = 1 And Pina.6 = 0 And Pina.5 = 0 And Pina.4 = 1 And Co = 0 Then
    Co = 1
    Gosub Snd
 End If
```

```
    End If
    End If
    End If
Loop
      End Sub


Sub Snd:
'If Co > 0 Then
'Return
'Goto Pwd
'Else
'Co = Co + 1
Cls
Locate 1 , 1
Lcd "SENDING MSG"
Waitms 500
    Portc.0 = 1
Portc.1 = 0
```

```
Portc.2 = 0

Portc.3 = 1


  Start Adc

   Lm35 = Getadc(0)

  A = Lm35 / 2

   Lightsen = Getadc(1)

   B = Lightsen

If Pinb.5 = 0 And Pinb.3 = 0 And Pinb.4 = 0 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "MAN MODE ,T =  A C , L = Blumen  , FAN = OFF , LIGHTING = OFF ,
BUMP = OFF" ; Chr(26)


Else
```

```
If Pinb.5 = 0 And Pinb.3 = 0 And Pinb.4 = 1 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "MAN MODE ,  ,T =  A C , L = Blumen  , FAN = OFF , LIGHTING = OFF , BUMP = ON" ; Chr(26)


Else

If Pinb.5 = 0 And Pinb.3 = 1 And Pinb.4 = 0 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "MAN MODE ,T =  A C , L = Blumen , FAN = OFF , LIGHTING = ON , BUMP = OFF" ; Chr(26)
```

```
Else

If Pinb.5 = 0 And Pinb.3 = 1 And Pinb.4 = 1 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "MAN MODE ,T =  A C , L = Blumen ,  FAN = OFF , LIGHTING = ON , BUMP = ON" ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 0 And Pinb.4 = 0 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)
```

```
Waitms 500

Print "MAN MODE ,T =  A C , L = Blumen ,  FAN = ON , LIGHTING = OFF , BUMP = OFF" ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 0 And Pinb.4 = 1 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "MAN MODE , T =  A C , L = Blumen , FAN = ON , LIGHTING = OFF , BUMP = ON" ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 1 And Pinb.4 = 0 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"
```

```
Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "MAN MODE , T =  A C , L = Blumen , FAN = ON , LIGHTING = ON , BUMP = OFF" ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 1 And Pinb.4 = 1 And Mn = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500


Print "MAN MODE , T =  A C , L = Blumen , FAN = ON , LIGHTING = ON , BUMP = ON" ; Chr(26)


'***.*

Else
```

```
If Pinb.5 = 0 And Pinb.3 = 0 And Pinb.4 = 0 And Au = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "Auto MODE , T =  A C , L = Blumen , FAN = OFF , LIGHTING = OFF , BUMP = OFF" ; Chr(26)


Else

If Pinb.5 = 0 And Pinb.3 = 0 And Pinb.4 = 1 And Au = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500
```

```
Print "Auto MODE , T =  A C , L = Blumen , FAN = OFF , LIGHTING = OFF , BUMP = ON" ; Chr(26)


Else

If Pinb.5 = 0 And Pinb.3 = 1 And Pinb.4 = 0 And Au = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "Auto MODE , T =  A C , L = Blumen , FAN = OFF , LIGHTING = ON , BUMP = OFF" ; Chr(26)


Else

If Pinb.5 = 0 And Pinb.3 = 1 And Pinb.4 = 1 And Au = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500
```

```
Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "Auto MODE , T =  A C , L = Blumen , FAN = OFF , LIGHTING = ON , BUMP = ON" ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 0 And Pinb.4 = 0 And Au = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "Auto MODE , T =  A C , L = Blumen , FAN = ON , LIGHTING = OFF , BUMP = OFF" ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 0 And Pinb.4 = 1 And Au = 1 Then

Print "ATE0"

Waitms 500
```

```
Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "AUTO MODE ,T =  A C , L = Blumen ,  FAN = ON , LIGHTING = OFF ,
BUMP = ON " ; Chr(26)


Else

If Pinb.5 = 1 And Pinb.3 = 1 And Pinb.4 = 0 And Au = 1 Then

Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500

Print "AUTO MODE , T =  A C , L = Blumen , FAN = ON , LIGHTING = ON ,
BUMP = OFF" ; Chr(26)


Else

If Portb.5 = 1 And Pinb.3 = 1 And Pinb.4 = 1 And Au = 1 Then
```

```
Print "ATE0"

Waitms 500

Print "AT+CMGF=1"

Waitms 500

Print "AT+CMGS=" ; Chr(34) ; "0912164512" ; Chr(34) ; Chr(13)

Waitms 500


Print "AUTO MODE ,T =  A C , L = Blumen , FAN = ON , LIGHTING = ON ,
BUMP = ON" ; Chr(26)


 Waitms 6000

 If Pina.7 = 1 And Pina.6 = 1 And Pina.5 = 0 And Pina.4 = 0 Then

    Gosub Pwd

    End If

      End If

      End If

End If

End If

End If
```

```
End If

End If

End If

End If

End If

End If

End If

End If

End If

End If

End If

'End If


'Co = Co + 1




'Gosub Pwd
```

```
End Sub


Sub Man:

Mn = 1

Au = 0

'If Pina.7 = 0 And Pina.6 = 0 And Pina.5 = 0 And Pina.4 = 1 Then

Portc.0 = 1

Portc.1 = 1

Portc.2 = 1

Portc.3 = 1

Waitms 700

Portc.0 = 0

Portc.1 = 0

Portc.2 = 0

Portc.3 = 0

Waitms 700

Portc.0 = 1

Portc.1 = 1

Portc.2 = 1
```

```
Portc.3 = 1
Waitms 700
Portc.0 = 0
Portc.1 = 0
Portc.2 = 0
Portc.3 = 0
Waitms 700
Portc.0 = 1
Portc.1 = 1
Portc.2 = 1
Portc.3 = 1
Waitms 700
Portc.0 = 0
Portc.1 = 0
Portc.2 = 0
Portc.3 = 1

    Cls
    Locate 1 , 1 : Lcd "MANUAL MODE RUN"
```

```
        Waitms 500

Start Adc

      Lm35 = Getadc(0)

        A = Lm35 / 2



     Cls

      Locate 1 , 1 : Lcd "t="

      Lcd A

      Locate 1 , 5 : Lcd "C"



     Lightsen = Getadc(1)

     B = Lightsen

      Locate 1 , 8
```

```
      Lcd "l="
      Lcd B
      Locate 1 , 13 : Lcd "lumen"
      Waitms 500
Cursor Off
Home Upper
      'End If
      Do
       Start Adc
       Lm35 = Getadc(0)
     A = Lm35 / 2
   'Cls

       Locate 1 , 1 : Lcd "t="
       Locate 1 , 3 : Lcd "  "
       Locate 1 , 3 : Lcd A
       Locate 1 , 5 : Lcd "C"
```

```
    Lightsen = Getadc(1)
    B = Lightsen
     Locate 1 , 8
     Lcd "l="
     Locate 1 , 10 : Lcd "   "
     Locate 1 , 10 : Lcd B
     Locate 1 , 13 : Lcd "lumen"
     Waitms 500
If Pina.7 = 0 And Pina.6 = 0 And Pina.5 = 1 And Pina.4 = 1 Then
Portc.0 = 0
Portc.1 = 0
Portc.2 = 1
Portc.3 = 1
   Portb.5 = 1

   Locate 2 , 1 : Lcd "FAN RUN IN MANU"
   End If
```

```
If Pina.7 = 0 And Pina.6 = 1 And Pina.5 = 0 And Pina.4 = 0 Then
Portc.0 = 0
Portc.1 = 1
Portc.2 = 0
Portc.3 = 0
    Portb.5 = 0
    Locate 2 , 1 : Lcd "FAN OFF IN MANU"
    End If
If Pina.7 = 0 And Pina.6 = 1 And Pina.5 = 0 And Pina.4 = 1 Then
Portc.0 = 0
Portc.1 = 1
Portc.2 = 0
Portc.3 = 1
   Portb.3 = 1
   Locate 3 , 1 : Lcd "LAMP ON IN MANU"
   End If
If Pina.7 = 0 And Pina.6 = 1 And Pina.5 = 1 And Pina.4 = 0 Then
Portc.0 = 0
Portc.1 = 1
```

```
Portc.2 = 1

Portc.3 = 0

   Portb.3 = 0

   Locate 3 , 1 : Lcd "LAMP OF IN MANU "

   End If


If Pina.7 = 0 And Pina.6 = 1 And Pina.5 = 1 And Pina.4 = 1 Then

Portc.0 = 0

Portc.1 = 1

Portc.2 = 1

Portc.3 = 1

   Portb.4 = 1

   Locate 4 , 1 : Lcd "PUMP RUN IN MAN"

   End If

If Pina.7 = 1 And Pina.6 = 0 And Pina.5 = 0 And Pina.4 = 0 Then

Portc.0 = 1

Portc.1 = 0

Portc.2 = 0

Portc.3 = 0
```

```
   Portb.4 = 0
   Locate 4 , 1 : Lcd "PUMP OFF IN MAN"
End If
     If Pina.7 = 1 And Pina.6 = 1 And Pina.5 = 0 And Pina.4 = 0 Then
    Gosub Pwd
      Else
      If Pina.7 = 1 And Pina.6 = 0 And Pina.5 = 0 And Pina.4 = 1 Then
            Gosub Snd
             End If
             End If
       Loop
End Sub


Sub Auto:
Mn = 0
Au = 1
If Pina.7 = 0 And Pina.6 = 0 And Pina.5 = 1 And Pina.4 = 0 Then
Portc.0 = 1
Portc.1 = 1
```

```
Portc.2 = 1

Portc.3 = 1

Waitms 700

Portc.0 = 0

Portc.1 = 0

Portc.2 = 0

Portc.3 = 0

Waitms 700

Portc.0 = 1

Portc.1 = 1

Portc.2 = 1

Portc.3 = 1

Waitms 700

Portc.0 = 0

Portc.1 = 0

Portc.2 = 0

Portc.3 = 0

Waitms 700

Portc.0 = 1
```

```
Portc.1 = 1

Portc.2 = 1

Portc.3 = 1

Waitms 700

Portc.0 = 0

Portc.1 = 0

Portc.2 = 1

Portc.3 = 0

  Cls

 Do


  Gosub Temp

  Waitms 1000

  Gosub Light

  Waitms 1000

  Gosub Humidty

  Waitms 1000

    If Pina.7 = 1 And Pina.6 = 1 And Pina.5 = 0 And Pina.4 = 0 Then

  Gosub Pwd
```

```
    End If
      If Pina.7 = 1 And Pina.6 = 0 And Pina.5 = 0 And Pina.4 = 1 Then
           Gosub Snd
            End If
       Loop
       End If
  'Goto Main
End Sub
Sub Temp:

   Start Adc
     Lm35 = Getadc(0)

        A = Lm35 / 2

       If A < 40 Then

       Locate 1 , 1 : Lcd "temp is"
              Lcd A
```

```
        Locate 1 , 10 : Lcd "C"
        Lcd "normal"

          Reset Relay
        Waitms 5000
 Locate 1 , 1 : Lcd "FAN STOP AUTOMOD"
 Waitms 5000

Else
Waitms 5000

Locate 1 , 1 : Lcd "temp is "
        Lcd A
        Locate 1 , 12 : Lcd "C"
        Lcd "hot   "

            Set Relay
          Waitms 5000
Locate 1 , 1 : Lcd "FAN RUN AUTOMODE"
```

```
      Waitms 5000
            End If
          End Sub
Sub Light:
   Lightsen = Getadc(1)
   B = Lightsen
   If B > 400 Then
    Reset Led
    Locate 2 , 1
Lcd "light is"
Lcd B
Locate 2 , 13 : Lcd "lumen "
  Waitms 5000

      Locate 2 , 1 : Lcd "LAMP OFF IN AUTO"
      Waitms 5000

Else
   Set Led
```

```
    Locate 2 , 1
Lcd "light is"
Lcd B
Locate 2 , 13 : Lcd "lumen"
  Waitms 5000


     Locate 2 , 1 : Lcd "LAMP On IN AUTO  "
     Waitms 5000
     End If
 ' Goto Main
End Sub
Sub Humidty:


  If Pina.3 = 0 Then
  Reset Pump
  Locate 3 , 2 : Lcd "  pump RUN      "
  Locate 4 , 2 : Lcd "soilhum LOW"
  Else
  Set Pump
```

```
    Locate 3 , 2 : Lcd "  pump OFF      "
    Locate 4 , 2 : Lcd "soilhum OK "
    End If
Cursor Off
 Home Upper

End Sub
```