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Belgaum, Karnataka-590 018

A Project Report on

"SMART IRRIGATION USING GSM TECHNOLOGY"

Project Report submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering
In
Electrical & Electronics Engineering

Submitted by

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Certificate

Certified that the project work entitled **"Smart Irrigation Using GSM Technology"** carried out by **Ms. NIKITHA N (1CR16EE051)**, **Mr. RAJESH V (1CR16EE051)**, **Ms. S PAVITHRA(1CR16EE062)**, **Ms. MAMATHA M(1CR17EE404)** are bonafied students of CMR Institute of Technology, Bengaluru, in partial fulfillment for the award of Bachelor of Engineering in Electrical & Electronics Engineering of the Visvesvaraya Technological University, Belgaum, during the year 2019-2020. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

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DECLARATION

We, [Ms. **NIKITHA N (1CR16EE051),** Mr**. RAJESH V (1CR16EE056),** Ms.**S PAVITHRA (ICR16EE062),** Ms.**MAMATHA M (1CR17EE404)],** hereby declare that thereport entitled **"Smart irrigation using GSM technology"** has been carried out by us under the guidance of **Dr. RUMA DEBNATH,** Associate Professor, Department of Electrical & Electronics Engineering, CMR Institute of Technology, Bengaluru, in partial fulfillment of the requirement for the degree of **BACHELOR OF ENGINEERING in ELECTRICAL & ELECTRONICS ENGINEERING**, of Visveswaraya Technological University, Belagaum during the academic year 2019-20.The work done in this report is original and it has not been submitted for any other degree in any university.

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ABSTRACT

With the water requirements in irrigation being large, there is a need for a smart irrigation system that can save about 80% of the water. This prototype aims at saving time and avoiding problems like constant vigilance. It also helps in water conservation by automatically providing water to the plants/gardens depending on their water requirements. Circuit construction was done on a Vero board.

Simulation is done using Proteus™ circuit simulation software. This prototype has many advantages which make it a good alternative to the current approaches since it facilitates the farmers to assist them in daily needs of the monitoring and controlling the field environmental parameters with minimum cost and user friendliness.

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CHAPTER 1

INTRODUCTION

1.1 Background

Agriculture is the backbone of Indian 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. However, agriculture requires irrigation, and with 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. 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 play a significant role in developing country like India and implementing mobile communication for facilitating farmers is the basic idea of our project. SMART IRRIGATION BASED ON GSM TECHNOLOGY is a simpler, multipurpose, cost-effective design to control the on-off mechanism of an electric motor for irrigation in the field via Short Message Service (SMS). This tends to utilize the availability of GSM network, mobile phones and electronic circuits to achieve an automated system which is programmed to work as a thinking device to accomplish this purpose. Besides self-monitoring the moisture content of the soil, this system will also give auxiliary control to the user to enable him/her to irrigate the field from a remote place In this system, the motor work on its own with the help of inputs received from the sensors which is measuring the moisture content of agricultural land and farmer can monitor whether everything is going normal or some action is needed to be taken. The entire process is controlled and monitored. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability

of labour to turn motors on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed.

In this project there are soil moisture sensors for monitoring the moisture content of soil which continuously inform about the moisture present in the soil. Including the water sensors for the water level indication if farmers using the storage system .We also have voltage and current sensors to detect any faults in the voltage or current and keep updating the farmers. There is provision of selecting the amount of moisture content required for different crops. Whether we have to irrigate the rice field that requires more water or some other crops that require less amount of moisture content, this system provides suitable moisture for various types of crops. Use of GSM network can work out irrigation system with low cost. This system monitors land owner's soil moisture, water level voltage and current and send message to the land owner about the status of field and irrigates the field if there is need of irrigation and the motor is switched off automatically after the necessary condition is met.

1.2 OVERVIEW

A. The History Of Irrigation

Archaeological investigation has found evidence of irrigation where the natural rainfall was insufficient to support crops for rain fed agriculture. Perennial irrigation was practiced in the Mesopotamian plain whereby crops were regularly watered throughout the growing season by coaxing water through a matrix of small channels formed in the field. Ancient Egyptians practiced Basin irrigation using the flooding of the Nile to inundate land plots which had been surrounded by dykes. The flood water was held until the fertile sediment had settled before the surplus was returned to the watercourse. There is evidence of the ancient Egyptian pharaoh Amenemhet III in the twelfth dynasty (about 1800 BCE) using the natural lake of the Faiyum Oasis as a reservoir to store surpluses of water for use during the dry seasons, the lake swelled annually from flooding of the Nile. Sophisticated irrigation and storage systems were developed by the Indus Valley Civilization in present-day Pakistan and North India, including the reservoirs at Girnar in

3000 BCE and an early canal irrigation system from circa 2600 BC. Large scale agriculture was practiced and an extensive network of canals was used for the purpose of irrigation.

B. Present Extent of Irrigation

In the mid-20th century, the advent of diesel and electric motors led to systems that could pump groundwater out of major aquifers faster than drainage basins could refill them. This can lead to permanent loss of aquifer capacity, decreased water quality, ground subsidence, and other problems. The future of food production in such areas as the North China Plain, the Punjab, and the Great Plains of the US is threatened by this phenomenon. At the global scale, 2,788,000 km² (689 million acres) of fertile land was equipped with irrigation infrastructure around the year 2000. About 68% of the area equipped for irrigation is located in Asia, 17% in the Americas, 9% in Europe, 5% in Africa and 1% in Oceania. The largest contiguous areas of high irrigation density are found:

- In Northern India and Pakistan along the Ganges and Indus rivers
- In the Hai He, Huang He and Yangtze basins in China
- Along the Nile river in Egypt and Sudan
- In the Mississippi-Missouri river basin and in parts of California

C. Smart Irrigation

SMART Irrigation is Sustainably Managed, Accountable, Responsible and Trusted irrigation. SMART irrigators aim to minimize their environmental footprint through efficient water use, and must also run a profitable business. This allows them to reinvest in new and improved technologies which ensure sustainable and responsible irrigation over time. New irrigation technologies and decision support tools are continually being innovated in New Zealand and globally. Water use efficiency and energy use efficiency are the main focuses of these innovations. Fortunately, efficiency is linked to better quality production and improved profitability. Over the last two decades there has been a major change in the irrigation technology used in New Zealand. There has been a general move from manual flood irrigation to remotely controlled spray irrigation such as centre pivots, drip line and micro sprinklers.

1.3 Objectives

The main the objective of the project will be concentrated towards the development of the system that works on SMS feature of the mobile phone. The objectives of our system can be divided into two categories which are as follows.

1.3.1 General objectives

To develop effective and convenient automatic irrigation system to increase the productivity of crops .

1.3.2 Specific objectives

The secondary objectives of this study are as follows:

1. To develop system that automatically regulates the moisture of the soil.
2. To minimize human labor used in irrigation.
3. To provide convenience in accessing the system from anywhere at any time.
4. To save the time of the owner for the large fields.

CHAPTER 2

LITERATURE REVIEW

Many research have been done in the agriculture field, most of them are concentrating on sensors parameters and automatic switching mechanisms of pumps based on sensor's signals. 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.

2.1 Global System for Mobile Communication (GSM)

GSM is the most popular and widely used digital mobile telephony system in the world. According to GSM world, it is now used by over 1.5 billion people all over the world. Hence the Ubiquity of GSM enables international roaming arrangements between mobile phone operators and provides their subscribers the use of the phone in many parts of the world. Besides that, GSM is considered a second generation (2G) cell phone system as both the signalling and speech channels are digital which differs from the previous technology.

Figure 2.1 GSM logo

Table 2.1: History of GSM

Year	**GSM Development**
1982	European Conference of Postal and Telecommunications Administrations (CEPT) created the Group Special Mobile (GSM) to develop a standard for mobile telephone system in Europe.
1987	Memorandum of understanding was signed by 13 countries in Europe to develop a common cell phone system.
1989	GSM responsibility was transferred to ETSI
1990	Phase I of GSM specifications was published.
1991	The first GSM network was launched in Finland
1993	Over 1 million subscribers were using GSM phone network.

GSM also found a low-cost implementation of the SMS, short message service, which has since been supported on other cellular phone standards as well. For example, the worldwide emergency telephone number feature (112) is included. GSM uses narrowband Time Division Multiple Access (TDMA) for voice and Short Messaging Service (SMS). TDMA is a technology used in digital mobile phone communication that divides each cellular channel into 3 time slots to increase the amount of data that can be carried. GSM digitizes and compresses data, then sends it down a channel with 2 other user data in its own time slot.

2.2 Short Message Service (SMS)

SMS stands for Short Message Service. It is a technology that enables the sending and receiving of message between mobile phones. SMS first appeared in Europe in 1992. It was included in the GSM (Global System for Mobile Communication) standards right at the beginning. Later it was ported to wireless technologies like CDMA and TDMA. The GSM and SMS standards were originally developed by ETSI. ETSI is the abbreviation for European Telecommunication Standard Institute. Now the 3GPP (Third Generation Partnership Project) is responsible for the development and maintenance of the GSM and SMS standards. One SMS message can contain at most 140 bytes (1120 bits) of data, so one SMS message can contain up to:

1. 160 characters if 7-bit character encoding is used. (7-bit character encoding is suitable for encoding Latin characters like English alphabets.)
2. 70 characters if 16-bit Unicode UCS2 character encoding is used. (SMS text messages containing non-Latin characters like Chinese character should use 16-bit character encoding.)

Once the message is sent the message is received by SMSC, which must then get it to the appropriate mobile device. To do this the SMSC sends a SMS request to Home Location Register (HLR) to find the roaming customer. Once HLR receives the request, it responds to the SMSC with the subscriber's status i.e. Inactive or active subscriber is roaming.

If the response is "inactive", then the SMSC will hold onto the message for a period of time. When the subscriber access his device, the HLR sends a SMS notification to the SMSC and the SMSC will attempt delivery.

The SMSC transfer the message in a Short Message Delivery Point to Point format to the serving system. The system pages the device, and if it responds, the message gets delivered. The SMSC receives verification that the message was received by the end user then categorizes the message a "sent" and will not attempt to send again. SMS provides a mechanism for transmitting short message to and from wireless devices. The service makes a use of a SMSC, which acts as a store and forward system for short messages.

CHAPTER 3

COMPONENTS REQUIRED

3.1 Moisture sensor

This Moisture Sensor can be used to detect the moisture of soil or judge if there is water around the sensor, let the plants in your garden reach out for human help. They can be very easy to use, just insert it into the soil and then read it. With the help of this sensor, it will be realizable to make the plant remind you hey I am thirsty now, please give me some water. The moisture sensor which can be used to detect the moisture of the soil. When the soil moisture deficits, the sensor output value will decrease. You can know whether a plant needs water or not by observing the results that the sensor outputs. Soil moisture sensor based on soil resistivity measurement. It is a transducer which measures the moisture contains in the soil and convert it into electrical form. Thus observed value is in analog form and further more processing it is converted into digital form. This moisture sensor is easily available in the local market and easy to use. In this sensor there are three pins one for ground, next for supply and next for signal.

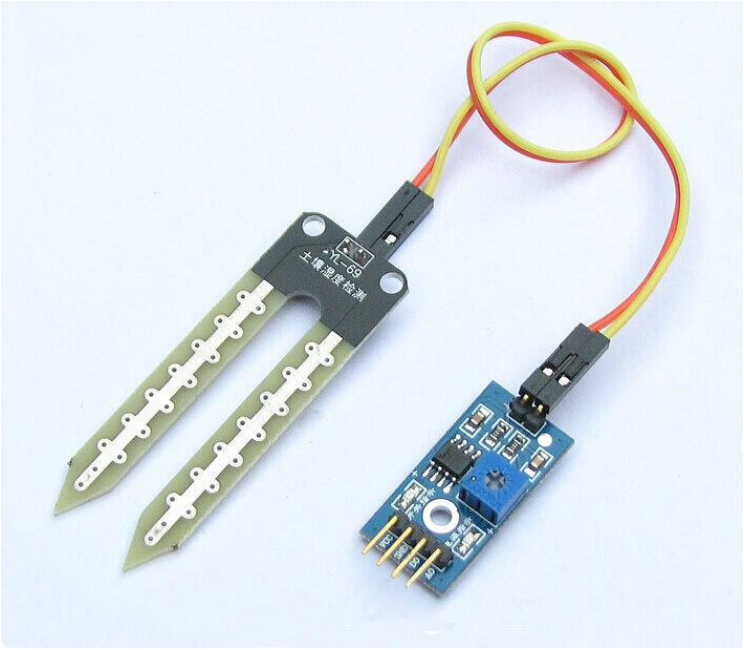


Figure 3.1: Moisture Sensor

3.2 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. We are using the later one where in the modem captures the modulated carrier signal with an antenna connected to it. 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. Our project focuses on reading, writing, sending, receiving and deleting SMS messages via AT commands. The GSM we used is SIM 900 and its works on 9600 bps.

Figure 3.2:Sim 900 GSM

3.3 Gsm Moblie Set

A mobile set or phone is a compatible device that can be moved while we are talking. They work on cellular networks and offer different services. To get a mobile phone service, one must subscribe to a GSM service provider. For GSM phones one has to get a SIM card which contains a unique authentication and subscription programs into the chip. Once the SIM card is into the mobile set, one can make connection anywhere within the coverage of the GSM network.

Figure 3.3: GSM mobile set

3.4 Venturi Setup

This is very simple and low cost device. A partial vacuum is created in the system which allows suction of the fertilizers into the irrigation system through venturi action. Fertilizer injectors are devices used to apply water-soluble fertilizers, pesticides, plant growth regulators, wetting agents and mineral acids during crop production.

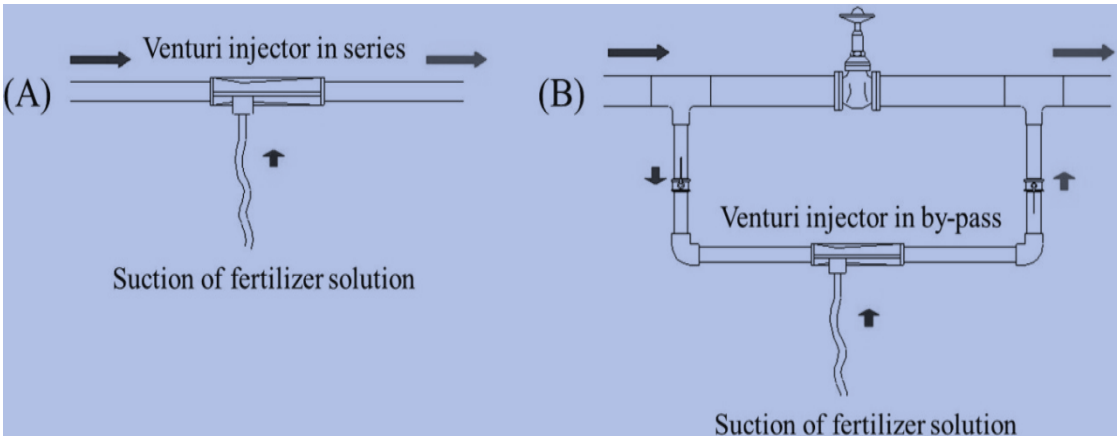


Figure 3.4: Venturi Setup

Injectors take a small portion of concentrated fertilizer solution from a stock tank and inject it into the water line. For every part of stock solution, there are x parts of water, where "x" is determined by the injector ratio. For example, with a 1:100 ratio 1 part of stock solution is mixed with 99 parts of water, for a total of 100 parts of final solution. The size of the stock tank varies and it could be as small as 5 gallons or as large as 2,000 gallons

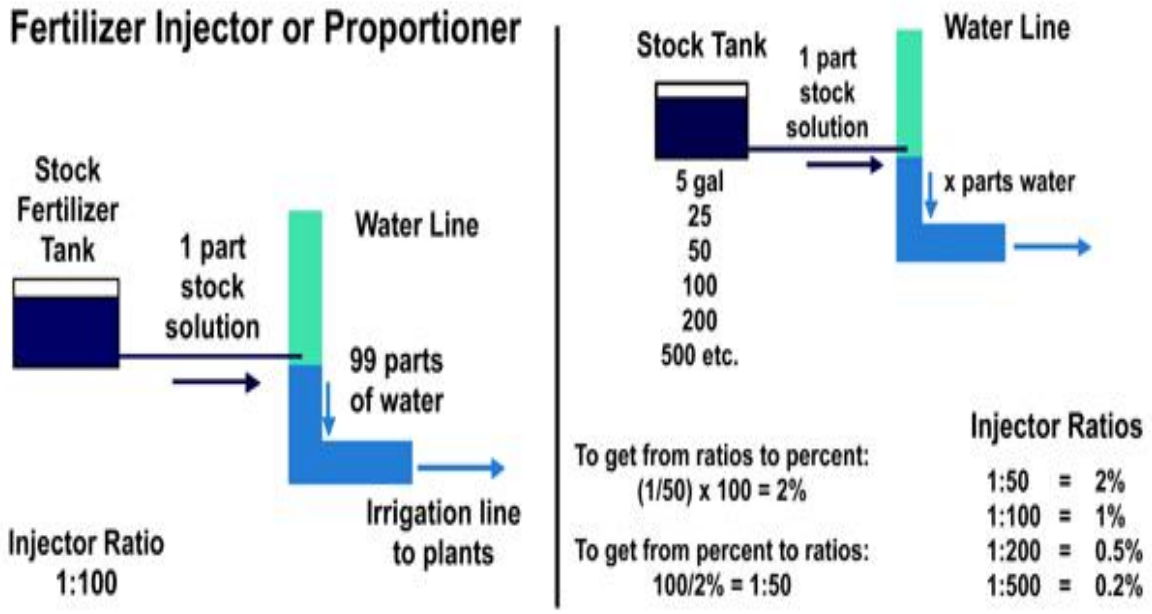


Figure 3.5: Fertilizer injector

Venturi-type injectors, such as Hozon and Syphonex (Figure 1) use a pressure difference between the water line and the stock tank to draw a concentrated solution into a faucet connect valve and mix it with water in the hose. These inexpensive injectors can be easily attached to any faucet but do not allow precise control over concentration. Because of water pressure fluctuations variable amount(s) of chemical may be injected into the hose. In addition, the injection ratios are low (typically 1:16) and therefore require a large stock tank, thus limiting the use of Venturi-type injectors to small growing areas. The Hozon requires very little maintenance; check the screen on the suction line for clogs and periodically remove salt deposits from the mixing valve.

3.4 Arduino Nano

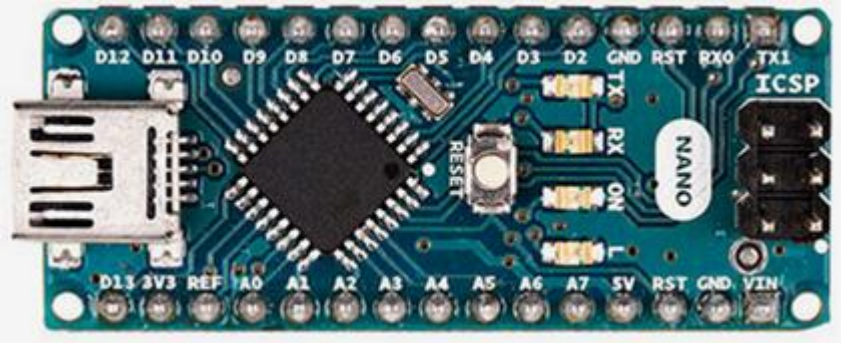


Figure 3.6 arduino nano

Overview:

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of standard one. The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

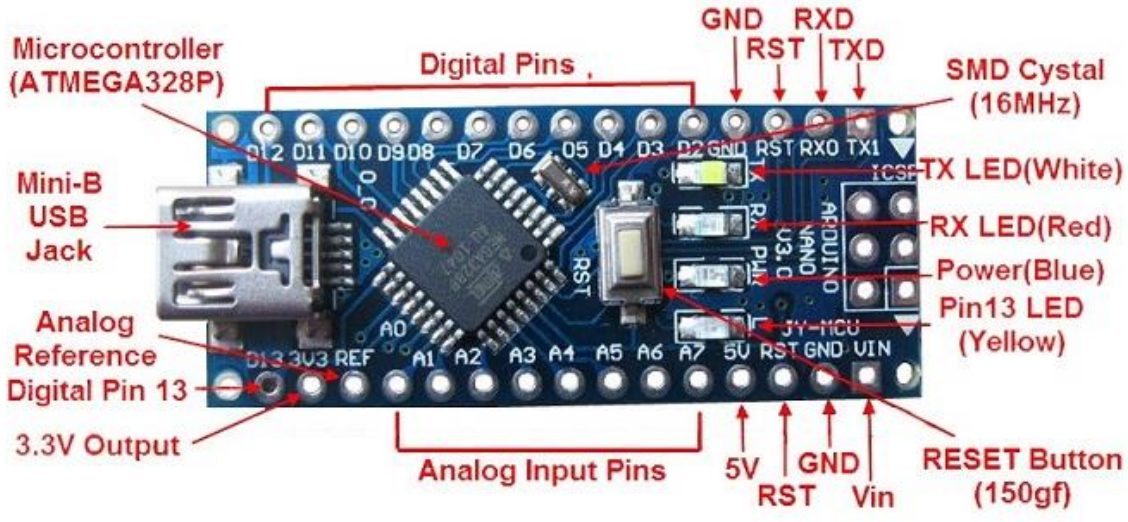


Figure 3.7 Arduino Nano Pin description

Table 3.1: Technical Specifications

Microcontroller	Atmel ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (of which 2KB used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Dimensions	0.70” x 1.70

Input and Output

Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Nano has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the analogReference() function. Analog pins 6 and 7 cannot be used as digital pins.

3.6 AT Commands, GSM AT command set

AT commands are instructions used to control a modem. AT is the abbreviation of Attention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones. Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

AT commands with a GSM/GPRS MODEM or mobile phone can be used to access following information and services:

1. Information and configuration pertaining to mobile device or MODEM and SIM card.
2. SMS services.
3. MMS services.
4. Fax services.
5. Data and Voice link over mobile network.

The Hayes subset commands are called the basic commands and the commands specific to a GSM network are called extended AT commands.

TYPES OF AT COMMANDS:

There are four types of AT commands

1) Test commands – used to check whether a command is supported or not by the MODEM.

SYNTAX: AT<command name>=?
For example: ATD=?

2) Read command – used to get mobile phone or MODEM settings for an operation.

SYNTAX: AT<command name>?
For example: AT+CBC?

3) Set commands – used to modify mobile phone or MODEM settings for an operation.

SYNTAX: AT<command name>=value1, value2, …, valueN

Some values in set commands can be optional.

For example: AT+CSCA=”+9876543210”, 120

4) Execution commands – used to carry out an operation.

SYNTAX: AT<command name>=parameter1, parameter2, …, parameterN

The read commands are not available to get value of last parameter assigned in execution commands because parameters of execution commands are not stored.

For example: AT+CMSS=1,”+ 9876543210”, 120

3.7 Voltage Sensor

A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage or DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal, etc.

Sensors are basically a device which can sense or identify and react to certain types of electrical or some optical signals. Implementation of **voltage sensor** and current sensor techniques have become an excellent choice to the conventional current and voltage measurement methods.

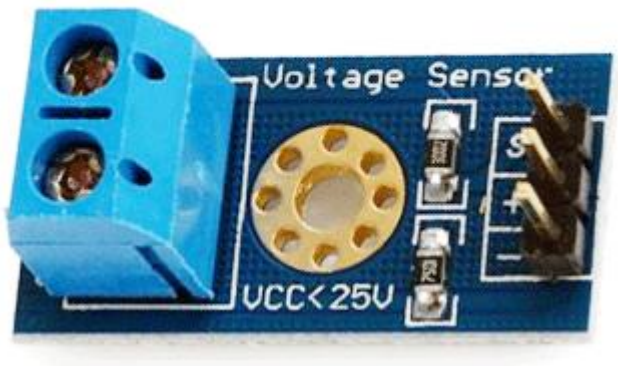


Figure 3.8: voltage sensor

3.8 Current Sensor

A **current sensor** is a device that detects electric current in a wire and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control. More information on current sensors can be found here.

The sensed current and the output signal can be:

- Alternating current input,
  - analog output, which duplicates the wave shape of the sensed current.

- bipolar output, which duplicates the wave shape of the sensed current.
- unipolar output, which is proportional to the average or RMS value of the sensed current.

- Direct current input,
  - unipolar, with a unipolar output, which duplicates the wave shape of the sensed current
  - digital output, which switches when the sensed current exceeds a certain threshold

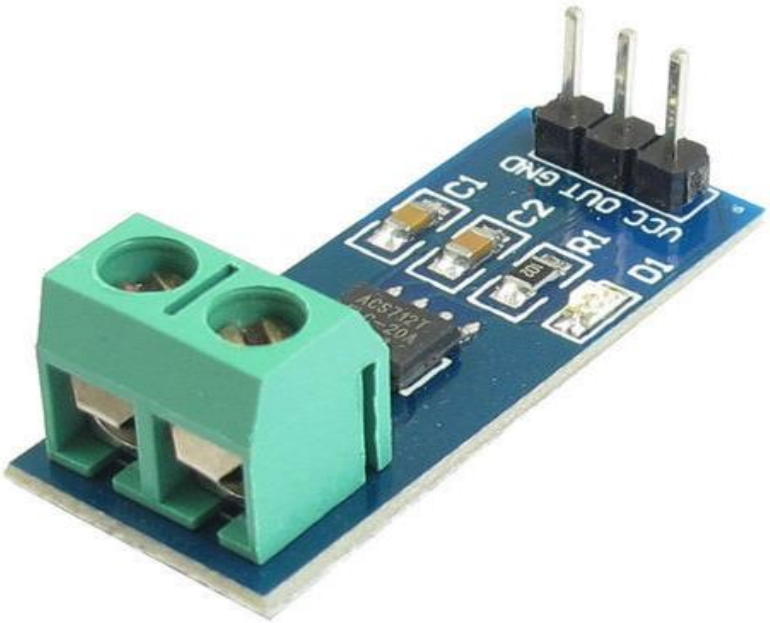


Figure3.9current sensor

3.9 SMPS (Switched -Mode Power Supply)

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such personal computer, while converting voltage and current characteristics Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy This higher power conversion efficiency is an important advantage of a switched-mode

power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.

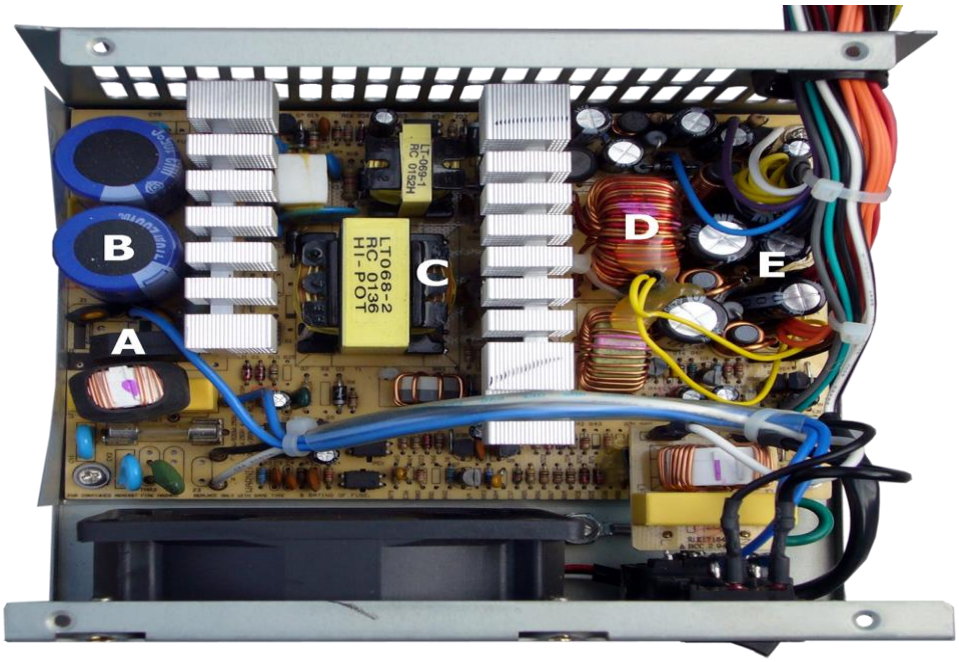


Figure 3.10: Parts in SMPS

A: input EMI filtering and bridge rectifier;

B: input filter capacitors;

"Between" B and C: primary side heat sink;

C: transformer;

Between C and D: secondary side heat sink;

D: output filter coil;

E: output filter capacitors.

3.10 LCD (liquid crystal display)

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. 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 etc. 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.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots

Figure 3.11: LCD display.

3.11 Relay Module

The relay module is an electrically operated switch that allows you to turn ON or OFF a circuit using voltage and/or current much higher than a Microcontroller could handle. There is no connection between the low voltage circuit operated by the Microcontroller and the high power circuit. The relay protects each circuit from the other. Each channel in the module has three connections named NC, COM, and NO. Depending on the input signal trigger mode, the jumper cap can be placed at high level effective mode which 'closes' the normally open (NO) switch at high level input and at low level effective mode which operates the same but at low level input.

A **relay** is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break

contacts, or combinations thereof. Microcontroller then gives a signal to the called mobile, by pressing call receiving button microcontroller get signal to turn on the valve. When the moisture content becomes sufficient, the sensor senses this and gives back the signal to the Microcontroller. **Relay** gets open and the water pump become turn off

The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called *protective relays*.

Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

Figure 3.12: relay module

CHAPTER 4

DESIGN OF THE SYSYTEM

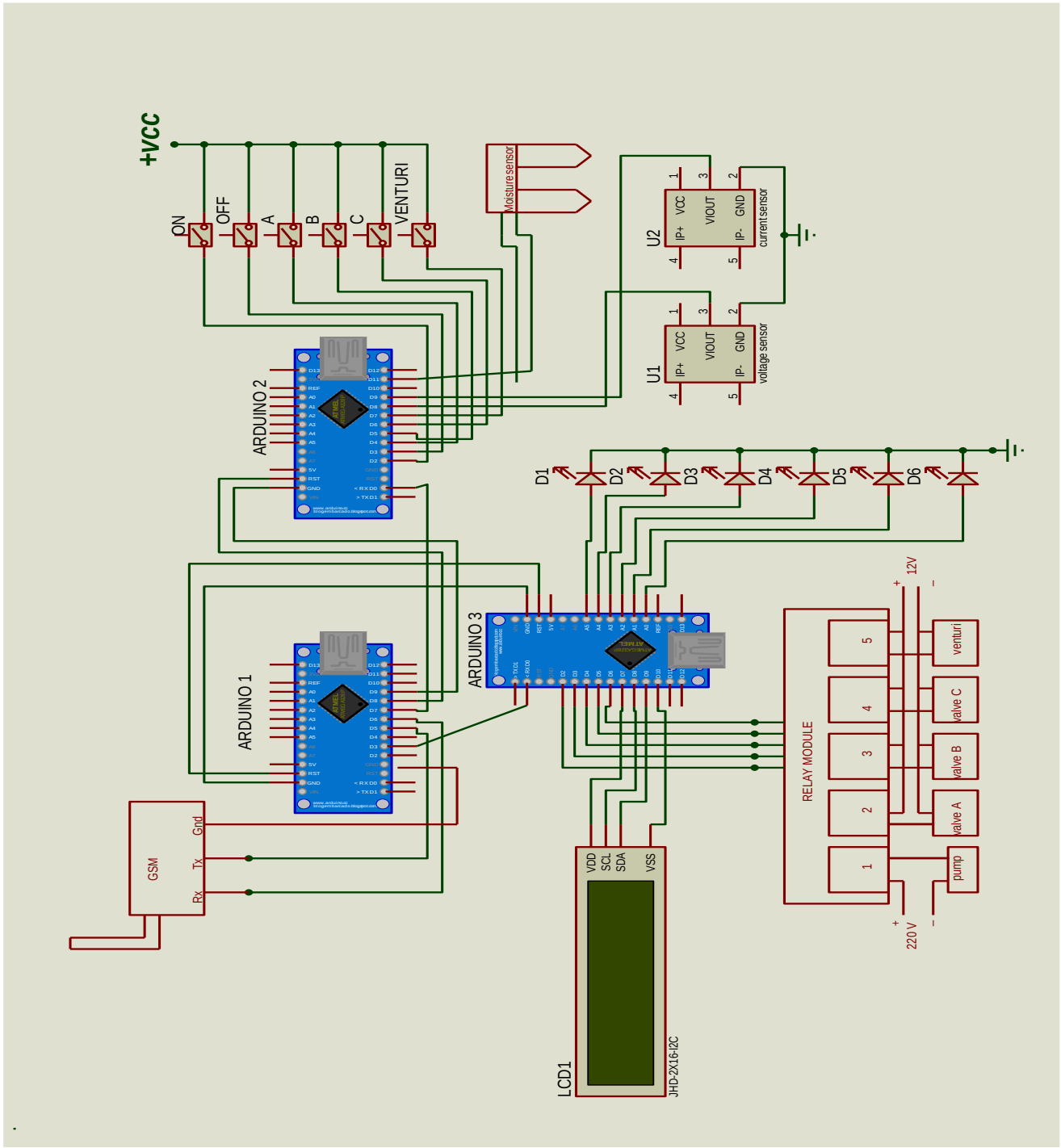


Figure 4.1: Circuit diagram

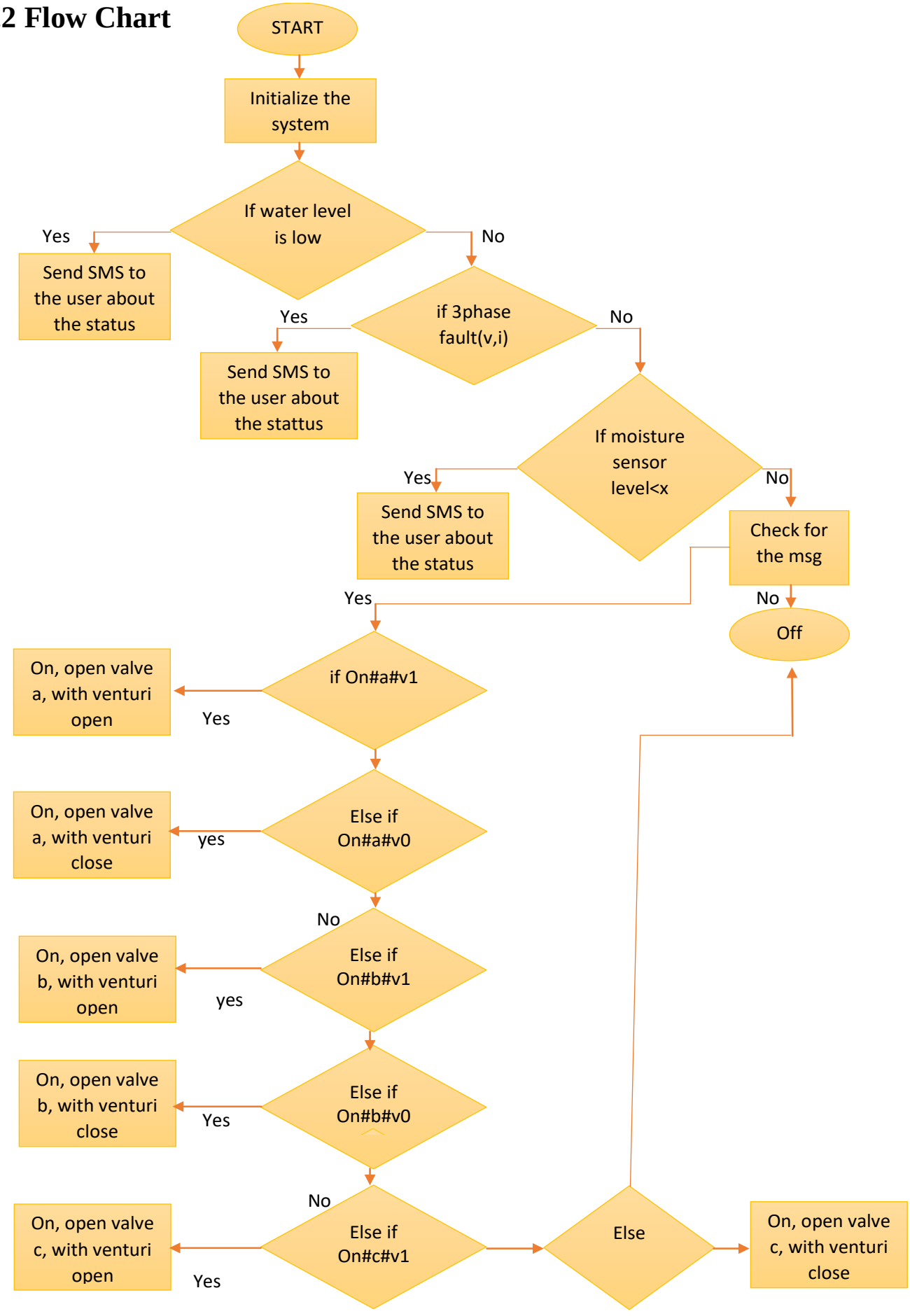
4.1 Circuit diagram explanation

The circuit diagram is shown in previous page. This simulation diagram shows the simulation circuit diagram for our project. This circuit is constructed in PROTEUS software.

The LCD of 16X2 displays with 4 bits mode is interfaced with the Arduino3. These interfaced pins are digital pin which are D7, D8, D9, D10. The Pump, valve A, valve B, valve C, and venturi set up is interfaced with Arduino3 pin of D2, D3, D4, D5, D6 respectively via five relay modules 1, 2, 3, 4, 5. Notifications of the apparatus is indicated by LED's which is interfaced with Arduino3 pin of A0, A1, A2, A3, A4, A5.

Arduino1 is interfacing Arduino3, Arduino2 and GSM module. The three pins of GSM module Rx, Tx, and ground is connected to D6, D5, ground pin of arduino1. Ground, reset, Rx pin of Arduino3 is interfaced with ground, reset, and D3 pins of arduino1 respectively. Voltage and current sensor are connected to arduino2 of D8, D9 pins. Arduino2 pins of reset, ground, Rx is connected to arduino1 via D8, D9, and D7 respectively. All the pins of switch which is necessary for closing and opening of valves are connected to digital pins of arduino2 via D2, D3, D4, D5, D6, and D7.

4.2 Flow Chart



4.3 Proposed Model

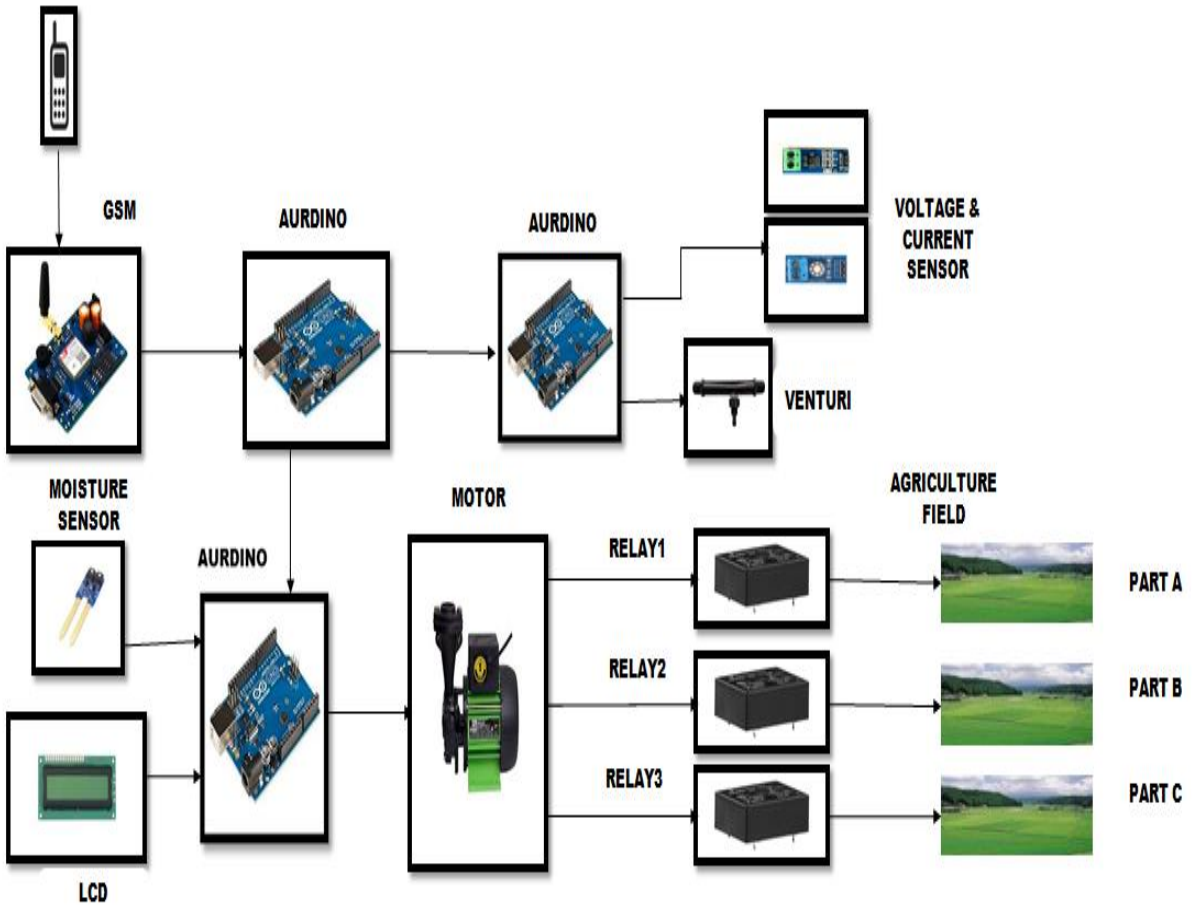


Figure:4.2 Proposed model of smart irrigation using gsm thechnology

The automatic irrigation system was designed to continuously sense the moisture level of the soil ,water level in the tank and three phase faults like(current , voltage). The system responds appropriately by watering the soil with the exact required amount of water and then shuts down the water supply when the required level of soil moisture is achieved and if there is any faults in voltage or current or if the water level is two low in storage system. This system consists of three arduinos having control over the entire process. When the power supply is given to the circuit, the display will show the title of the project. After the power supply is turned ON, the display shows that to enter the mobile number for receiving information from the field side. The display shows the registered mobile number. After the mobile are registered, the display will shows whether the mobile number is stored or not. The display shows the land condition, motor condition, water level in the well and any three phase faults. And the information is passed to the registered mobile number via GSM module. The SMS is sent by registered

number to the GSM module, it check and operates according to the command. The SMS are send to the GSM module, if it received it shows in the display. The wrong command are send to the GSM module, the display shows that as invalid format. The command is correct to turn ON the motor, it will be displayed in display unit.

First process is to initialize the system. Initialization takes when all the electrical component meet the set frequency set by the programmer. Transmitting and receiving the information by the system has to be the set frequency. Once the set frequency is achieved by the system it will check with the water level in the tank. Suppose the water level is below than the minimum level then user receives the message stating that the water level is low and it will terminate the process. If the water level is more than the minimum then it will check for the next condition which is 3 phase fault. This fault can be either due to voltage or current supplied to the motor. If their is a fluctuation in the voltage or current then the user receives the message stating that some fault in the supply. The moisture sensor measures the resistivity of the soil. Moisture sensor is a transducer which converts the value of moisture contained in soil into electrical form. The output of moisture sensor is analog in nature. The inbuilt ADC in ATmega16 converts analog input data into 10-bit digital data. Thus obtained data is further processed by the processor and displayed in LCD. Every crop is defined with the lower and higher defined value which is needed for proper growth. If the value sensed by the moisture sensor is below the lower defined value, motor automatically ON and pump the water in the field. If higher defined value is met, motor is OFF again automatically. The state of motor is also displayed in LCD.

Once every condition is satisfied the GSM module waits for user command to turn on the motor and irrigate which part of the land. Once the command is given that particular value get opened. In our project we have consider a relay module which have control over motor and three valves. The three valve are used to choose a particular land where irrigation has to be done .Once the user choose a land to be irrigated the relay module opens that particular valve for irrigation the system also aids in fertilization of the crop by opening up the venture valve. The opening and closing of the valve is controlled using the relay module based on commands it can be done on user requirement. On deciding these factors the particular land with or without fertilizer. Once the land get irrigated or if the moisture level is reached the motor turns off automatically and the status of the motor is sent as an SMS to the user.

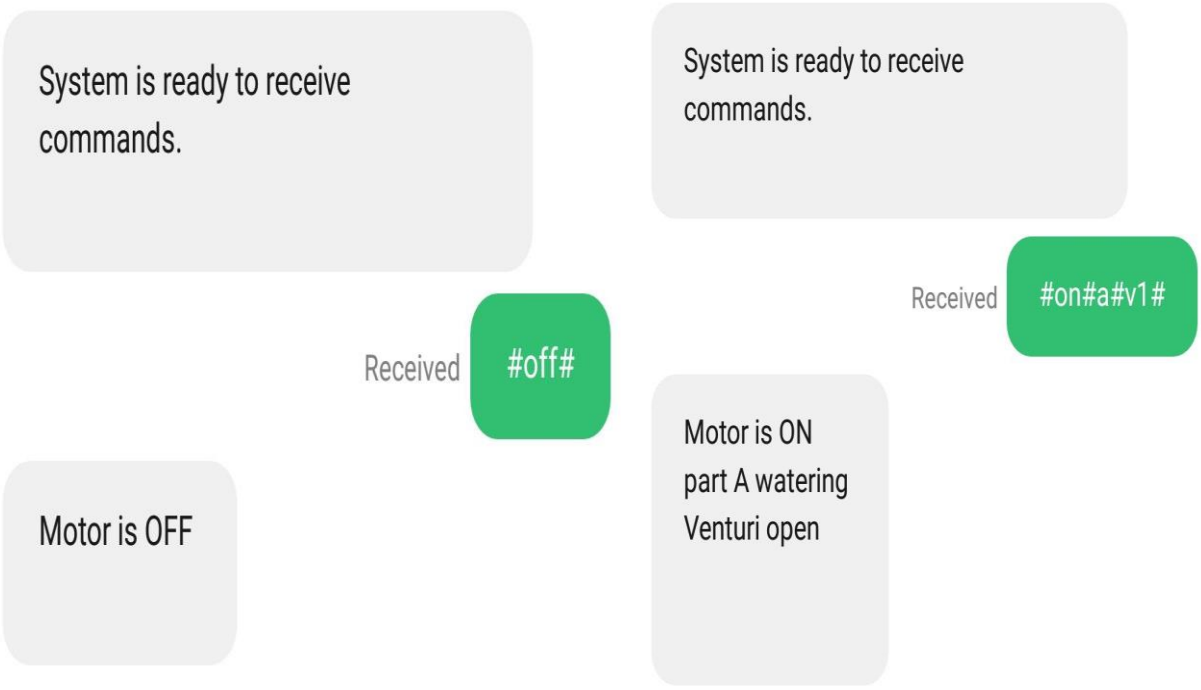
CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 RESULTS

Below is the output of the code.

This is the SMS received by the user on working of GSM module



Connection is established between GSM and user.

Figure 5.1: SMS output

5.2 ADVANTAGES

- **Smart Agriculture**: Smart irrigation system allows farmers to use water efficiently, which increases the crop productivity and reduces farmer's workload.

- **Saves Time:** The time taken for irrigation of the land is less compared to the conventional irrigation methods.

- This system controls the growth of weeds and delivers high quality of crop productivity.

- **Avoids Soil Erosion:** They can avoid over-watering, excessive runoff and soil erosion by scheduling the amount of irrigation according to soil characteristics, crop types, weather conditions and field geometries.

- **Lowered Operation Costs:** Automating processes in irrigation can reduce resources consumption, human error and overall cost.

- **Easy Access:** GSM(Global System for Mobile communication)technology has less signal deterioration making it better for sending control signals and receiving updates over long distances. Using Cellular phones adds up for better communication.

- **Works as Reminder for the farmers:** In case if the farmer forgets to off the motor, he gets a message which reminds him about this.

- **Reduces Manpower:** As the system takes care of the entire irrigation process, the labors required in the field is reduced which in turn reduces the labor cost.

- Smart irrigation system is safe for the farmers to use.

- **Access to Real Time data:** Farmers can visualize water levels and soil moisture in real time and remotely do accelerate decision making process.

5.3 APPLICATIONS

- Main application of the system is that it can be used in areas where the crops are changed according to the seasons, soil conditions etc.
- This system can be used in farms located in remote areas where transportation is not frequent.
- With adding more sensors to this system it monitors more parameters like Humidity, PH of soil, pressure, which makes the system more advanced.
- This irrigation system allows cultivation in places with water scarcity thereby improving sustainability.
- This system can be implemented for large fields. And because of this system the owner of the field can grow different crops in a single field by dividing the fields into sections of land.

5.4 FUTURE SCOPE

- This project can be used as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization etc.
- The project itself can be modified to achieve a complete home automation.
- Human computer interface using AI can be another field for future scope.
- Further, the venture setup can be made automatic so that it can automatically monitor the fertilizer level and give corresponding message to the farmer.
- This system can be made fully automatic, that is from deciding which valve to be opened, whether fertilizer is necessary.

CHAPTER 6

CONCLUSION

By using Hardware and software knowledge we built the “Smart Irrigation using GSM technology”. 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 components 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 motor 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. The three valves are corresponding used for three different sections of the land along with the venturi setup so that this somewhat meet the requirement of farmer and farmer are free from the fact of irrigation overflow or underflow problems for growing the crop.

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.

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