

SMART FARMING SYSTEME USING MACHINE LEARNING

Submitted in partial fulfillment of the requirements for the award of Bachelor of
Engineering degree in Electronics and Communication Engineering
by

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SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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APRIL-2021



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of SATYANARAYANA DANDAMUDI (37130362) and SAI VENKATA MANISH LINGAMALLU (37130352) Who carried out the project entitled "**SMART FARMING SYSTEM USING MACHINE LEARNING**" under my supervision from September 2020 to April 2021.

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DECLARATION

We, SATYANARAYANA DANDAMUDI (37130362) and SAI VENKATA MANISH LINGAMALLU (37130352) here by declare that the Project Report entitled “**SMART FARMING SYSTEM USING MACHINE LEARNING**” is done by us under the guidance of Mr. K.T.ILAYARAJAA,M.E.,(Ph.D)and at SATHYABAMAINSTITUTE OF SCIENCE AND TECHNOLOGY is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

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ABSTRACT

Smart framing is an emerging concept, because IOT sensors are capable of providing information about agriculture fields and then act upon based on the user input. The feature of this paper includes development of a system which can monitor temperature, level of water, moisture and even the movement if any happens in the field which may destroy the crops in agricultural field through sensors using nodemcu board. Smart framing is an emerging concept, because IOT sensors are capable of providing information about agriculture fields and then act upon based on the user input. The project aims at making use of evolving technology i.e. IOT and smart agriculture using automation. Once hardware has been developed depending on the change in requirements and technology the software needs the updating. The updated hardware is called new version of the software. This new version is required to be tested in order to ensure changes that are made in the old version work correctly and it will not bring bugs in other part of the software. This is necessary because updating in one part of the hardware may bring some undesirable effects in other part of the hardware.

Key Words: Internet of Things (IOT), Smart framing using IOT, node mcu, Soil Moisture Sensor, ,ir sensor.

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
	Abstract	V
	List of abbreviations	lx
	List of Figures	x
1	Introduction	1
2	2.1 Literature Review	2
	2.2 Existing Survey	3
3	Block Diagram Explanation	5
	3.1 Hardware Requirement	5
	3.2 Software Requirement	5
	3.3 Introduction of Embedded System	6
	3.3.1 Overview of Embedded System	6
	3.3.1.1 Block diagram of Embedded System	7
	3.3.1.2 Characteristic of Embedded System	8
	3.3.2 Applications Specific System	8
	3.3.3 Reactive System	8
	3.3.4 Distributed System	9
	3.3.5 Heterogeneous System	9
	3.3.6 Harsh Environment	9
	3.3.7 System safety and reliability	9
	3.3.8 Control of Physical system	10
	3.3.9 Small and Low weight	10
	3.3.10 Cost Sensitivity	10
	3.3.11 Power Management	11
4	ARDUINO AND COMPONENTS	12
	4. Basic Arduino	12
	4.1 Wi-fi	14

4.1.1 Digital	17
4.1.2 Analog	18
4.1.3 Output Signal	20
4.1.4 Input signal	21
4.2 Software tips	25
4.3 ESP8266 node MCUWi-fi	27
4.3.1 Specifications	27
4.3.2Pin diagram Description of node MCU	28
4.4 ArduinoIDE	28
4.4.1Uploading Blink	29
4.5 Temperature & Humidity sensor	31
4.5.1 Working principal of DHT11 sensor	31
4.5.2 Applications o fDHT11 sensor	32
4.6 Gas Sensor	32
4.6.1 Gas Sensor construction	32
4.6.2The Purpose of each of this elements	33
4.6.3 Gas sensor working	34
4.7 Soil Moisture sensor	35
4.7.1 Working of Sensor	36
4.7.2 Working principal	37
4.7.3 Specifications	38
4.7.4 Soil Moisture Sensor Applications	39

CHAPTER 5	
5.1 Thing Speak	40
5.1.1 What is IOT?	40
5.1.2Thing speak key features	41
5.1.3Creating a Channel	41
5.2FutureScope	44
5.3Types of precious Agriculture	44
6. CONCLUSION	46
REFERENCES	48

LIST OF ABBREVIATIONS

PWM - Pulse Width Modulation

IOT - Internet Of Things

LIST OF FIGURES

FIGURE NO	FIGURENAME	PAGE NO.
3.1	Block diagram of Embedded System	7
3.2	Embedded System having Heterogeneous Architecture	9
4.1	Wi-fisensor	13
4.2	Pin diagram of Wi-fi sensor	13
4.3	Internal picture of Wi-fisensor	22
4.4	ESP8266 node MCU Wi-fi sensor	27
4.5	Pin diagram of node MCU	28
4.6	Loading Blink Picture	29
4.7	Uploading Blink Picture	30
4.8	Gas Sensor	32
4.9	Soil Moisture Sensor	38
4.10	Connecting of Soil Moisture Sensor	39
5.1	ThingSpeak	40
5.2	Creating Channel	42
5.3	Entering Field Name	42
5.4	Output Graph picture	43

CHAPTER - 1

1.1 INTRODUCTION

In India, agriculture is the need of most of the Indians livelihood and it is one of the main sources of livelihood. Agriculture also has a major impact on economy of the country. The consumption of water increases day by day that may leads to the problem of water scarcity. Now a day not only for crops outdoor plants in home becoming quite difficult for them. A The regular water system techniques like overhead sprinklers, flood type taking care of frameworks typically wet the lower leaves and stem of the plants. The whole soil surfaces soaked and regularly remains wet long after water system is finished. Such condition advances contaminations by leaf form organisms. the opposite the dribble or stream water system is a kind of present day water system strategy that gradually applies limited quantities of water to some portion of plant root zone. Water is provided habitually, regularly day by day to keep up great soil dampness condition and forestall dampness stress in the plant with appropriate utilization of water assets. Trickle water system saves water in light of the fact that lone the plant's root zone gets dampness. Little water is lost to profound permeation if the legitimate sum is applied. Trickle water system is mainstream since it can expand yields and decline both water prerequisites and work .Drip water system needs about portion of the water required by sprinkler or surface water system. Lower working pressing factors and stream rates bring about decreased energy costs. A more significant level of water control is achievable. Plants can be supplied with more precise amounts of water. Disease and insect damage is reduced because plant foliage stays dry. Operating cost is typically diminished. Leagues may keep during the water system measure since columns between plants stay dry. An issue in Traditional System For the situation of conventional water system framework water system is done physically by ranchers. Since, he water is inundated straightforwardly in the land, plants under go high pressure from variety in soil dampness, consequently plant appearance is decreased. The short fall of programmed controlling of the frame work bring about inappropriate water control framework. The significant justification these limits are the

development of populace which is expanding at a quicker rate. At present there is arising worldwide water emergency where overseeing shortage of water has become a genuine work.

CHAPTER - 2

2.1 LITERATUREREVIEW

Agriculture is the backbone of all developed countries. It utilizes 85% of accessible new water assets worldwide and this rate keeps on being prevailing in water utilization in light of populace development and expanded food interest. Because of this, effective water the board is the significant worry in many editing framework in bone-dry and semi-dry territories. A robotized water system framework is expected to streamline water use for farming harvests. The need of mechanized water system framework is to defeated over water system and under water system.

An automated irrigation system for efficient water management and intruder detection system has been proposed. Soil Parameters like soil dampness, pH, Humidity are estimated and the Pressure sensor and the detected qualities are shown in LCD. The gatecrasher identification framework is finished with the assistance of PIR sensor where the birds are repulsed from going into the field. The GSM module has been utilized to set up a correspondence connect between the rancher and the field. The current field status will be suggested to the rancher through SMS and furthermore refreshed in the page. The rancher can get to the worker about the field condition whenever, anyplace consequently lessening the labor and time.

Archana and Priya (2016) proposed a paper in which the humidity and soil moisture sensors are placed in the root zone of the plant. Based on the sensed values the microcontroller is used to control the supply of water to the field. This system doesn't intimate the farmer about the field status. Sonali D. Gainwar and Dinesh V. Rojatkhar (2015) proposed a paper in Which soil parameters such as pH, humidity, moisture and temperature are Pump ON/OFF as per the level of moisture in the soil. The current field status is not intimated to the farmer[2].

V. R. Balaji and M. Sudha (2016) proposed a paper in which the system derives power from sunlight through photo-voltaic cells. This system doesn't depend on electricity. The soil moisture sensor has been used and based on the sensed values PIC microcontroller is used to ON/OFF the motor pump. Weather forecasting is not included in this system[3].

R. Subalakshmi (2016) proposed a paper to make irrigation system simpler, the complexities involved in irrigation is tackled with automation system using microcontroller and GSM. Based on the sensed values from soil moisture, temperature and humidity sensors, the GSM sends message to the farmer when the parameters exceed the threshold value set in the program. The nutrient content in the soil is not determined by this system[4].

Karan kansara (2015) proposed an automated irrigation system where the humidity and temperature sensors are used to sense the soil conditions and based on that microcontroller will control the water flow. Farmer will be intimated through GSM. This system doesn't monitor the nutrient content in the soil[5].

Prof C.H.Chavan and P.V.Karnade (2014) proposed a smart wireless sensor network for monitoring environmental parameters using Zigbee. These nodes send data wirelessly to a central server, which collects data, stores it and allows it to be analyzed then displayed as needed and also be sent to the client mobile. Weather forecasting and nutrient determined in this system[6].

G.Parameswaran and K.Sivaprasath (2016) proposed a smart drip irrigation system using IOT in which humidity, temperature and pH sensors are used irrigation status is updated to the server or local host using personal computer. The farmer can't access about the field condition without internet[7].

S.Reshma and B.A.Sarath (2016) proposed an IOT based automatic irrigation system using wireless sensor networks in which various sensors are used to measure the soil parameters. This system provides a web interface to the user to monitor and control the system remotely. Weather monitoring is not done in this system [8].

Joaquin Gutierrez (2013) proposed a gateway unit which handles sensor information, triggers actuators, and transmits data to a web application. It is

powered by photovoltaic panels and has duplex communication link based on cellular internet interface that allows for data inspection and irrigation scheduling to be programmed through web page[9].

Yunseopkim (2008) proposed a paper in which the field conditions were site-specifically monitored by six in-field sensor stations distributed across the field. The GPS and wireless communication has been used to intimate the farmer. Without internet the farmer cannot access the information about the current field status[10].

2.2 EXISTING SYSTEM

Issues in Traditional System For the situation of customary water system framework water system is done physically by ranchers. Since, the water is flooded straightforwardly in the land, plants under go high pressure from variety in soil dampness, in this way plant appearance is diminished. The shortfalls of programmed controlling of the framework bring about inappropriate water control framework. The significant justification these limits is the development of populace which is expanding at a quicker rate. At present there is arising worldwide water emergency where overseeing shortage of water has become a genuine work. This development can be found in nations which have lack of water assets and are monetarily poor. So this is the difficult issue in Traditional Irrigation System. Limitation so existing system:

- Physical work of farmer to control
- [• drip irrigation Wastage of water
- [• wastage of time

CHAPTER - 3

3. BLOCK DIAGRAM EXPLANATION

In this project we can do smart irrigation system using IOT technology now a days everywhere we are using IOT technology to do a particular task in a smarter way, so first we collect the information from the nature such as temperature, humidity ,gas and soil moisture for weather monitoring When soil becomes dry motor will automatically turn ON and using IR sensors motion is detected and buzzer will turn ON is detected . All the data is sent to cloud and is monitored

3.1 Hardware requirement:

- IR sensor
- Temperature sensor
- Gas sensor
- Buzzer
- Soil moisture sensor.
- Motor
- NODE MCU.

3.2 Software requirement:

- Thing speak cloud.
- Embedded C
- Arduino IDE

3.3 INTRODUCTION TO EMBEDDED SYSTEMS

3.3.1 Overview of embedded systems

An installed framework is a unique reason PC framework intended to perform one or a couple of committed capacities, frequently with ongoing processing requirements. It is generally installed as a component of a total gadget including equipment and mechanical parts. Interestingly, a broadly useful PC, like a PC, can do various undertakings relying upon programming. Inserted frameworks have become vital today as they control large numbers of the normal gadgets we use.

Since the inserted framework is devoted to explicit errands, plan designers can streamline it, diminishing the size and cost of the item, or expanding the dependability and execution. Some implanted frameworks are mass-delivered, profiting by economies of scale.

Genuinely, inserted frameworks range from compact gadgets like computerized watches and MP3 players, to huge fixed establishments like traffic signals, processing plant regulators, or the frameworks controlling thermal energy stations. Intricacy shifts from low, with a solitary microcontroller chip, to extremely high with different units, peripherals and organizations mounted inside an enormous frame or fenced in area.

As a rule, "installed framework" is definitely not a precisely characterized term, as numerous frameworks have some component of programmability. For instance, Handheld PCs share a few components with inserted frameworks —, for example, the working frameworks and microchips which power them — yet are not really installed frameworks, since they permit various applications to be stacked and peripherals to be associated.

Implanted frameworks give a few capacities.

- Monitor the climate; implanted frameworks read information from input sensors. This information is then handled and the outcomes showed in some configuration to a client or clients
- Control the climate; inserted frameworks create and communicate order for actuators.
- Transform the data; inserted frameworks change the information gathered in some significant manner, like information pressure.

Despite the fact that communication with the outside world through sensors and actuators is a significant part of inserted frameworks, these frameworks likewise give usefulness explicit to their applications. Implanted frameworks regularly execute applications, for example, control laws, limited state machines, and sign handling calculations. These systems must also identify and respond to issues in both the interior processing climate just as the encompassing electro mechanical systems.

There are many categories of embedded systems, from communication devices to home appliances control systems. Examples include;

- Communication devices e.g. cellular phones.
- Home Appliances e.g.:CDplayer , VCR,microwave oven
- Control Systems
e.g.: Automobile anti-lock braking systems, robotics, satellite control

3.3.1.1 Block diagram of an embedded system:

An embedded system usually contains an embedded processor. Many appliances that have a digital interface -- microwaves, VCRs, cars -- utilize embedded systems. Some embedded systems include an operating system. Others are very specialized resulting in the entire logic being implemented as a single program. These systems are embedded into some device for some specific purpose other than to provide general purpose computing. A typical embedded system is shown in Fig 1.1

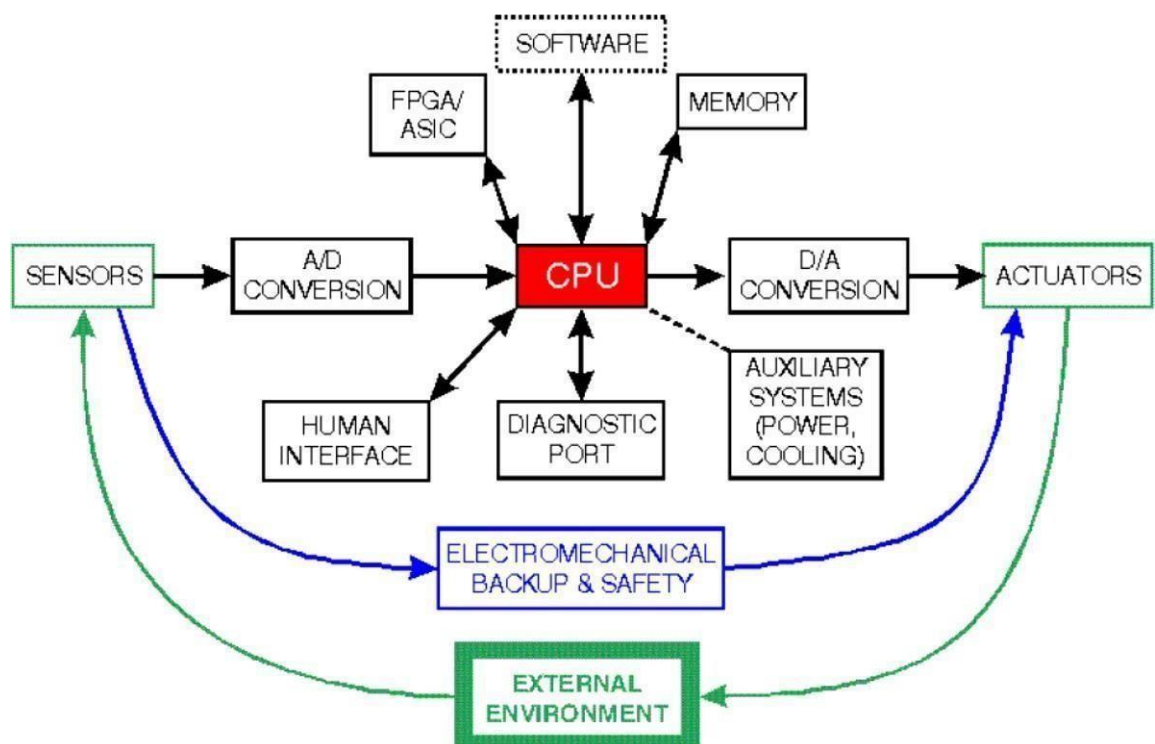


Fig: 3.1:Block diagram of a typical embedded system

3.3.1.2 Characteristics of embedded systems

Embedded systems are characterized by a unique set of characteristics. Each of these characteristics imposed a specific set of design constraints on embedded systems designers. The challenge to designing embedded systems is to conform to the specific set of constraints for the application.

3.3.2 Application Specific Systems:

Embedded systems are not general-purpose computers. Implanted framework plans are streamlined for a particular application. A large number of the work attributes are known before the equipment is planned. This permits the originator to zero in on the particular plan limitations of a very much characterized application. All things considered, there is restricted client program ability. Some implanted frameworks, be that as it may, require the adaptability of reprogram ability. Programmable DSPs are regular for such applications.

3.3.3 Reactive Systems

As referenced before, a run of the mill implanted frameworks model reacts to the climate by means of sensors and control the climate utilizing actuators. This requires inserted frameworks to run at the speed of the climate. This quality of installed framework is classified "responsive". Receptive calculation implies that the framework (principally the product segment) executes in light of outer occasions. Outer occasions can be either intermittent or aperiodic. Intermittent occasions make it simpler to plan handling to ensure execution. Aperiodic events are harder to schedule. The maximum event arrival rate must be estimated in order to accommodate worst case situations. Most implanted frameworks have a huge responsive segment. Perhaps the greatest test for inserted framework fashioners is playing out a precise most pessimistic scenario plan examination on frameworks with measurable execution attributes (e.g., store memory on a DSP or other implanted processor). Ongoing framework activity implies that the rightness of a calculation depends, partially, on the time at which it is conveyed. Frameworks with this necessity should frequently configuration to most pessimistic scenario execution. Be that as it may, precisely foreseeing the most pessimistic scenario might be troublesome on convoluted designs. This regularly prompts excessively critical assessments deciding in favor alert. Many implanted frameworks have a huge prerequisite for continuous activity to meet outside I/O and control dependability necessities. Some constant frameworks are additionally responsive frameworks.

3.3.4 Distributed Systems

A common characteristic of an embedded system is one that consists of communicating processes executing on several CPUs or ASICs which are connected by communication links. There as on for this is economy. Economical 48-bit microcontrollers may be cheaper than a 32-bit processors. Even after adding the cost of the communication links, this approach may be preferable. In this methodology, various processors are typically needed to deal with numerous time-basic undertakings. Gadgets leveled out of installed frameworks may likewise be truly disseminated.

3.3.5 Heterogeneous Architectures

Embedded systems often are composed of heterogeneous architectures (Fig 1.2). They may contain different processors in the same system solution. They may also mixed signal systems. The combination of I/O interfaces, local and remote memories, and sensors and actuators makes embedded system design truly unique. Embedded systems also have tight design constraints, and heterogeneity provides better design flexibility.



Fig: 3.2: Embedded Systems having Heterogeneous Architectures

3.3.6 Harsh environment

Many implanted frameworks don't work in a controlled climate. Unnecessary warmth is frequently an issue, particularly in applications including ignition (e.g., numerous transportation applications). Extra issues can be caused for inserted registering by a requirement for assurance from vibration, stun, lightning, power supply variances, water, consumption, fire, and general actual maltreatment.

3.3.7 System safety and reliability

As embedded system complexity and computing power continue to grow, they are starting to control more and more of the safety aspects of the overall system. These safety measures may be as programming just as equipment control. Mechanical security reinforcements are ordinarily

initiated when the PC framework lets completely go to securely close down framework activity. Programming wellbeing and unwavering quality is a greater issue. Programming doesn't ordinarily "break" in the feeling of equipment. Anyway programming might be intricate to the point that a bunch of surprising conditions can cause programming disappointments prompting perilous circumstances. Conversation of this theme is outside the extent of this book, however the difficulties for implanted originators incorporate planning solid programming and building modest, accessible frameworks utilizing inconsistent parts. The main challenge for installed framework planners is to obtain low-cost reliability with minimal redundancy.

3.3.8 Control of physical systems

One of the main reasons for inserting a comp PC is to communicate with the climate. This is regularly done by observing and controlling outer hardware. Embedded computers transform the analog signals from sensors into digital form for processing. Inserted framework architects should cautiously adjust framework tradeoffs among simple parts, power, mechanical, organization, and advanced equipment with relating programming.

3.3.9 Little and low weight

Many installed PCs are actually situated inside some bigger framework. The structure factor for the implanted framework might be directed by style. For instance, the structure factor for a rocket may need to fit inside the nose of the rocket. One of the difficulties for inserted frameworks architects is to create non-rectangular calculations for specific arrangements. Weight can also be a critical constraint. Embedded automobile control systems, for example, must be light weight for fuel economy. Portable CDplayers must be light weight for portability purposes.

3.3.10 Cost sensitivity

Cost is an issue in most systems, but the sensitivity to cost changes can vary dramatically in embedded systems. This is mainly due to the effect of computer cost shave on profitability and is more function of the proportion of cost changes compared to the total system cost.

3.3.11 Power management

Inserted frameworks have severe imperatives on power. Given the Convey ability

necessities of many installed frameworks, the need to monitor power is critical to keep up battery life as far as might be feasible. Minimization of warmth creation is another undeniable worry for inserted frameworks.

CHAPTER-4

ARDUINO AND COMPONENT

4 BASIC ARDUINO:

setup(): A function present in every Arduino sketch. Run once before the loop()function. Often used to set pin mode to input or output. The setup()function looks like:

loop(): A function present in every single Arduinosketch. This code happens over and over again.

The loop() is where (almost) everything happens. The one exception to this is setup() and variable declaration. Mod Kit uses another type of loop called “forever()”which executes over Serial.

The loop() function looks like:

Input: A pin mode that admissions data.

Output: A pin mode that ends data.

High: Electrical sign present (5V for Uno). Likewise ON or True in boolean rationale.

Low: No electrical sign present (0V). Likewise OFF or False in boolean rationale.

Digital Read : Get a HIGH or LOW perusing from a pin previously proclaimed as an information.

Digital Write Assign a HIGH or LOW worth to a pin previously proclaimed as a yield.

analog Read: Get a worth between or including 0 (LOW) and 1023 (HIGH). This permits you to get readings from simple sensors or interfaces that have multiple states.

Analog Write: Assign a worth between or including 0 (LOW) and 255 (HIGH). This permits you to a PWM esteem rather than simply HIGH or LOW..

PWM: Stands for Pulse-Width Modulation, a technique for imitating a simple sign through an advanced pin. A worth between or including 0 and 255. Utilized with analog Write.

4.1 Wi-Fi

The SDK gives a bunch of interfaces to information get and send capacities over the Wi-Fi and TCP/IP layer so software engineers can zero in on application advancement on the undeniable level. Clients can without much of a stretch utilize the relating interfaces to acknowledge information get and send. All systems administration capacities on the ESP8266 IoT stage are acknowledged in the library, and are not straightforward to clients. All things being equal, clients can introduce the interface in user main. `c void us re_init(void)` is the default strategy gave. Clients can add capacities like firmware introduction, network boundaries setting, and clock instatement in the interface. The SDK gives an API to deal with json, and clients can likewise utilize self-characterized information types to deal with the them.

ESP8266 offers a total and independent Wi-Fi organizing arrangement, permitting it to either have the application or to offload all Wi-Fi organizing capacities from another application processor. At the point when ESP8266 has the application, and when it is the lone application processor in the gadget, it can boot up straightforwardly from an outside streak. It has incorporated reserve to improve the exhibition of the framework in such applications, and to limit the memory necessities.

The ESP8266EX offers a total and independent Wi-Fi network arrangement. It tends to be utilized to have the applications or to offload Wi-Fi network capacities from other application processors. At the point when the ESP8266 has an application as the lone processor in the gadget, it boots up straightforwardly from an outer glimmer. It has an in-fabricated, rapid store to improve the exhibition of the framework and lessen the memory occupation. On the other hand, when the ESP8266 is utilized as a Wi-Fi connector, remote web access can be added to any miniature regulator based gadget through the UART interface or the CPU AHB connect interface, and subsequently give the clients a basic Wi-Fi arrangement. ESP8266EX appreciates significant degree of on-chip mix. It coordinates the receiving wire switch, RF balun, power speaker, low clamor get enhancer, channels, and force the executives modules. It

requires insignificant outside hardware, and the whole arrangement, including the front-end module, is intended to consume negligible PCB space. The ESP8266EX likewise incorporates an improved form of the 32-bit processor of Tensilica's L106 Diamond arrangement, with on-chip SRAM. The ESP8266EX is frequently incorporated with outside sensors and other application explicit gadgets through its records give instances of the virtual products of the connected applications. The ESP8266EX framework has many bleeding edge benefits, including energy-effective VoIP that can switch quickly among rest and wake modes, versatile radio predisposition for low-power tasks, frontend signal preparing limit, issue shooting limit, and the radio framework concurrence highlight to eliminate cell, bluetooth, DDR, LVDS and LCD impedance. SDK dependent on the ESP8266 IoT stage offers clients a straightforward, high velocity and productive programming stage for IoT gadget improvement. This programming guide gives an outline of the SDK just as subtleties of the APIs. The objective per users are inserted programming designers who utilize the ESP8266 IoT stage for programming advancement.

Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface other CPU AHB bridge interface. ESP8266 on-board processing and storage capability allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

With its high degree of on-chip integration, which includes the antenna switch balun, power management converters, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

Sophisticated system-level features include fast sleep/wake context switching for energy efficient VoIP, adaptive radio biasing for low-power operation, advance signal processing, and spur cancellation and radio coexistence features for common cellular ,Bluetooth DDR, LVDS ,LCD interference mitigation.

- 802.11b/g/n protocol
- Wi-Fi Direct(P2P),soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Support antenna diversity
- Power down leakage current of<10uA Integrated low power 32-bit.
- SDIO2.0,SPI,UARTSTBC,1×1MIMO,2×1MIMO A-M PDU &A-MSDU aggregation &guard interval
- 0.4 Wake up and transmit packets in <2ms Stand by power consumption of<1.0mW(DTIM3)

These boards below use the same micro-controller, just in a different package. The Lily pad is designed for use with conductive thread instead of wire and the Arduino Mini is simply a smaller package without the USB, Barrel Jack and Power Outs.

It depends on what you want to do with it really. There are two different purposes outlined and over for the voltage divider, we will go after both.

If you wish to use the voltage divider as a sensor reading device first you need to know the maximum voltage allowed by the analog inputs you are using to read the signal. On an Arduino this is 5V. So, already we know the maximum value we need for V_{out} . The V_{in} is simply the amount of voltage already present on the circuit before it reaches the first resistor. You should be able to find the maximum voltage your sensor outputs by looking on the Datasheet, this is the maximum amount of voltage your sensor will let through given the voltage in of your circuit. Now we have

exactly one variable left, the value of the second resistor. Solve for R2 and you will have all the components of your voltage divider figured out! We solve for R1's highest value because a smaller resistor will simply give us a smaller signal which will be readable by our analog inputs. Powering an analog Reference is exactly the same as reading a sensor. Except you have to calculate for the voltage out value you want to use as the analog Reference. All of the electrical signals that the Arduino works with are either Analog or Digital. It is extremely important to understand the difference between these two types of signal and how to manipulate the information these signals represent.

4.1.1 DIGITAL

An electronic signal sent as twofold code that can be either the presence or nonattendance of current, high and low voltages or short heartbeats at a specific recurrence.

People see the world in simple, however robots, PCs and circuits utilize Digital. A computerized signal is a signal that has just two states. These states can differ contingent upon the signal, yet just characterized the states are ON or OFF, never in the middle.

In the realm of Arduino, Digital signals are utilized for everything except for Analog Input. Contingent upon the voltage of the Arduino the ON or HIGH of the Digital signal will be equivalent to the framework voltage, while the OFF or LOW signal will consistently approach 0V. This is an extravagant method of saying that on a 5V Arduino the HIGH signals will be a little under 5V and on a 3.3V Arduino the HIGH signals will be somewhat under 3.3V.

To receive or send Digital signals the Arduino uses Digital pins # 0 - # 13. You may also setup your Analog Input pins to go about as Digital pins. To setup Analog Input pins as Digital pins utilize the order

Pin Mode (pin Number, value);

Where pin Number is an Analog pin (A0–A5) and value is either INPUT or OUTPUT. To arrangement Digital pins utilize a similar order yet

reference a Digital pin for pinNumber rather than an Analog In pin. Advanced pins default as information, so truly you just need to set them to OUTPUT in pin Mode. To peruse these pins utilize the order:

Digital Read (pinNumber);

Where pin Number is the Digital pin to which the Digital segment is associated. The digital Read order will return either a HIGH or a LOW sign. To convey a Digitalmessage to a pin utilize the order:

Digital Write(pin Number ,value); where in Number is the quantity of the pin conveying the message and worth is either HIGH or LOW.

The Arduino additionally has the capacity to yield a Digital sign that goes about as an Analog sign, this sign is called Pulse Width Modulation (PWM). Advanced Pins # 3, #5, # 6, # 9, # 10 and #11 have PWM capacities. To yield a PWM signal utilize the order:

Analog Write(pin Number, value);

where pin Number is a Digital Pin with PWM abilities and worth is a number between 0 (0%) and 255 (100%). For more data on PWM see the PWM worksheets or S.I.K. circuit 12.

THINGSTOREMEMBERABOUTDIGITAL:

- Digital Input /Output uses the Digital pins ,but Analog In pins can be used asdigital
- To receive a digital signal use: *digital Read(pinNumber);*
- To send a digital signal use: *digital Write(pinNumber,value);*
- Digital Input and Output are always either HIGH or LOW

4.1.2 ANALOG

The entirety of the electrical signs that the Arduino works with are either Analog or Digital. It is critical to comprehend the contrast between

these two sorts of sign and how to control the data these signs address. (And if they are out of our range of acceptable temperatures then what are we doing there?) This continuous stream is what defines analog data. Digital information, the complementary concept to Analog, estimates analog data using only one and zeros.

In the realm of Arduino an Analog sign is essentially a sign that can be HIGH (on), LOW (off) or anything in the middle of these two states. This means an Analog signal has a voltage value that can be anything between 0V and 5V (unless you mess with the Analog Reference pin). Analog allows you to send output or receive input about devices that run at percentages as well as on and off.

To receive Analog Input the Arduino uses Analog pins # 0 - # 5. These pins are designed for use with components that output Analog information and can be used for Analog Input. There is no set up necessary, and to read them use the command:

XC analog Read (pinNumber); GC

Where pin Number is the Analog In pin to which the Analog component is connected. The analog Read command will return a number including or between 0 and 1023.

The Arduino also has the capability to output a digital signal that acts as an Analog signal, this signal is called Pulse Width Modulation (PWM). Digital Pins #3, #5, #6, #9, #10 and #11 have PWM capabilities. To output a PWM signal use the command:

Analog Write(pinNumber,value);

Where pin Number is a Digital Pin with PWM capabilities and value is a number between 0 (0%) and 255 (100%). On the Arduino UNO PWM pins are signified by a ~ sign. For more information on PWM see the PWM worksheets or S.I.K.circuit12.

THINGS TO REMEMBER ABOUT ANALOG:

- Simple Input utilizes the Analog In pins, Analog Output utilizes the PWM pins

- To get an Analog sign use: *analog Read(pin Number);*
- To send a PWM signal use: *analog Write(pin Number,value);*
- Simple Input esteems range from 0 to 1023 (1024 qualities since itutilizes 10 pieces, 210)
- PWM Output esteems range from 0 to 255 (256 qualities since itutilizes 8 pieces, 28)The entirety of the electrical signs that the Arduino works with are either information or yield. It is critical to comprehend the distinction between these twosorts of sign and how to control the data these signs address.

4.1.3 OUTPUTSIGNALS

Output to the Arduino pins is always Digital, however there are two extraordinary types of Digital Output; regular Digital Output and Pulse Width Modulation Output(PWM). Output is only possible with Digital pins # 0 - # 13.The Digital pins are preset as Output pins, so unless the pin was used as an Input in the same sketch, there is no reason to use the pinMode command to set the pin as an Output. Should a situation arise where it is necessary to reset a Digital pin to Output from Input use the command:

Pin Mode (pinNumber ,OUTPUT);

where pin Number is the Digital pin number set as Output. To send a DigitalOutput signal use the command:

digital Write(pin Number, value);

where pin Number is the Digital pin that is outputting the signal and value is the signal. When outputting a Digital signal value can be either HIGH (On) or LOW(Off).

AnalogWrite(pinNumber,value);

where pin Number is a Digital Pin with PWM capabilities and value is a number between 0 (0%) and 255 (100%). For more information on PWM

see the PWMworksheetsorS.I.K.circuit12.

Output can be sent to many different devices, but it is up to the user to figure out which kind of Output signal is needed, hook up the hardware and then type the correct code to properly use these signals.

THINGS TO REMEMBER ABOUT OUTPUT:

- Output is always Digital
- There are two kinds of Output :regular Digital or PWM (Pulse Width Modulation)
- To send an Output signal use *analog Write (pin Number ,value)*; (for analog) or
 - *Digital Write(pin Number ,value)*;(for digital)
- Output pin mode is set using the pin Mode command
- *pin Mode(pinNumber,OUTPUT)*;
- Ordinary Digital Output is in every case either HIGH or LOW
- PWMOutputvariesfrom0to255

The entirety of the electrical signs that the Arduino works with are either information or yield. It is critical to comprehend the contrast between these two sorts of sign and howto control the data these signs address.

4.1.4 INPUTSIGNALS

Simple Input enters your Arduino through the Analog In pins # - 5.Thesesignals or ignite from analog sensors and interface devices. Theseanalog sensors and devices use voltage levels to communicate their information instead of a simple yes(HIGH) or no (LOW). For this reason you cannot use a digital pin as an input pin for these devices. Analog Input pins are used only for receiving Analog signals. It is only possible to read theAnalog Input pins so there is no command necessary in the setup() function to prepare these pins for input. To peruse the Analog Input pins utilize the order: *analog Read (pinNumber)*;

Where pin Number is the Analog Input pin number. This capacity will return an Analog Input perusing somewhere in the range of 0 and 1023. A perusing of zero

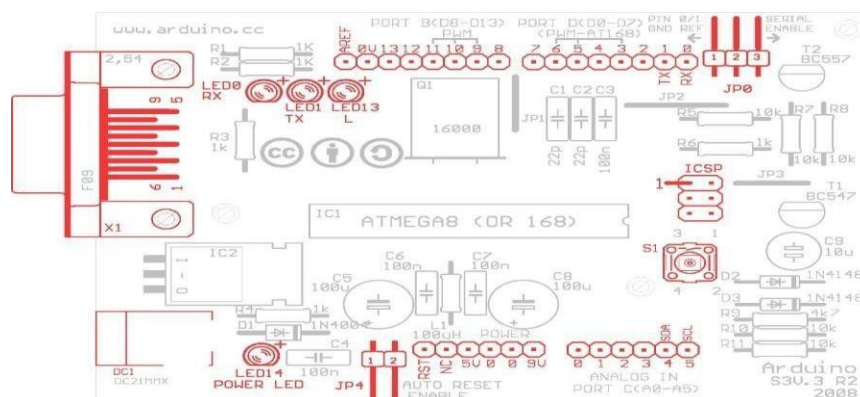
relates to 0 Volts and a perusing of 1023 compares to 5 Volts. These voltage esteems are transmitted by the simple sensors and interfaces. On the off chance that you have an Analog Input that could surpass Vcc +.5V you may change the voltage that 1023 relates to by utilizing the Are f pin. This pin sets the greatest voltage boundary your Analog Input pins can peruse. The Are pin's preset is 5V. Digital Input can enter your Arduino through any of the Digital Pins # 0 - #Digital Input signals are either HIGH (On, 5V) or LOW (Off, 0V). Because the Digital pins can be used either as input or output you will need to prepare the Arduino to use these pins as inputs in your setup()function. To do this type the command:

Pin Mode (pinNumber,INPUT);

inside the wavy sections of the arrangement() function where pin Number is the Digital pin number you wish to announce as an information .You can change the pin Mode in the loop()function if you need to witch a pin back and for the between input and output, but it is usually set in the setup()function and left untouched in the loop()function. To read the Digital pin set as inputs use the command:

digital Read(pinNumber);

where pin Number is the digital Input pin number .Input can come from many different devices, but each device's signal will be either Analog or Digital, it is up to the user to figure out which kind of input is needed, hook up the hardware and then type the correct code to properly use these signals.



X1:

DE-9serialconnector

Used to connect computer (or other devices) using RS-232 standard. Needs a serial cable, with at least 4 pins connected: 2, 3, 4 and 5. Works only when JP0 is set to 2-3 position.

DC1:

2.1mm. power jack Used to connect external power source. Centre positive. Voltage Regulator Work switch regulated +7 to +20 volts DC (9v. to 12v. is recommended). It is possible to alternatively connect external power using 9v. pin or 5v. pin. (see POWERPINOUT)

ICSP:

2x3 pin header Used to program Atmega with boot loader. The number 1 on the two sides of the board shows link pin1 position. Used to transfer outlines on Atmega ICs without boot loader (accessible just in Arduino IDE renditions 0011 and 0012).

JP0

3 pins jumper When in position 2-3, this jumper empowers sequential association (through X1 connector) to/from PC/gadgets. Utilize this as default position. When in position 1-2, it debilitates sequential correspondence, and empowers outside pull-down resistors on pin0 (RX) and pin1 (TX). Utilize this just to forestall commotion on RX (that appears to be approaching information to Atmega), that occasionally makes sketch not beginning. While eliminating this jumper, sequential correspondence is handicapped, and pin0 and pin1 fill in as an ordinary (coasting) computerized pin

JP4

2 pins jumper When in position 1-2, this jumper empowers auto reset

include, helpful while transferring a sketch to Arduino, resetting Atmega naturally. It makes pointless to squeeze reset button (S1) when transferring draws. Be certain that PC COM Port speed is set to 19200bps in any case auto reset won't work properly. If removed, disables auto reset feature. Very useful to prevent undesired At mega reset when using sketches that needs serial communication. Auto reset works with DTR heartbeat on sequential pin4. In some cases Arduino faculties a DTR beat while interfacing X1 (chronic connector) and a few virtual products sends a DTR beat when it begins or when it shuts, that makes Atmega reset when not wanted.S1

Tactile button This button resets Atmega, to restart uploaded sketch or to prepare Arduino to receive a sketch through serial connector (when auto reset is not active).

LEDS

Characteristic leds POWER drove Turns on when Arduino is controlled through DC1, +9v. pin or +5v. pin. RX drove Blinks while accepting information from PC/gadget through sequential association. TX drove Blinks when sending information to PC/gadget through sequential association. L drove This drove is associated with computerized pin13 with a current limiter resistor (that doesn't influence pin13). Valuable to test outlines. It isn't unexpected to squint while boot loading as well.

POWERPINOUT

6pinhead

erRST pin

Makes At mega reset when connected to GND. Use Fluor Shield Boards, or to connect external reset.

NCpin

This pin is not connected in Arduino S3v3. Arduino Decimal has a 3.3 voltspin in the same position.

+9v.pin

When Arduino DC1 is powered (with battery or DC adaptor), this pin is used as Vout, with the same voltage supplied on DC1 (see DC1), minus 0,7 volts. The total supplied current depends on external power source capacity. When Arduino DC1 is not powered, +9v. pin can be used as Vin, connecting it to an external regulated power source (+7 to +20 volts) and connecting 0v. pin to external power source GND. In this case +5v. pin can be used as Vout, supplying +5 volts. +5v. pin When Arduino DC1 is powered (with battery or DC adaptor), +5v. pin supplies +5 volts as a Vout pin. The total supplied current depends on Voltage Regulator (7805 supplies up to 1A). This applies only to +5v. pin: At mega in/out pins only supplies max. 40mA on each pin. When Arduino DC1 is not powered, this pin can be used as Vin, connecting it to a regulated +5v. and connecting 0v. pin to power source GND. In this case, +9v. pin is inactive. 0v. pin GND. Two 0v. pins between +5v. and +9v. One 0v. pin adjacent to AREF pin. At the point when Arduino DC1 is fueled, 0v. pin supplies 0 volts reference (GND) for +5v. pin and +9v. pin. At the point when DC1 isn't fueled, and Arduino is controlled through +5v. pin or +9v. pin, 0v. pin should be utilized as GND reference, interfacing it to the outside power source GND. GND pin see 0v. pin (GND). AREF pin

The AREF can be set to AVcc (default), inward 2.56 volts (Atmega8), interior 1.1 volts (Atmega168), or outside AREF. If there should arise an occurrence of AVcc or inner AREF, AREF pin can be utilized to connect an outer capacitor to decouple the signal, for better communication execution. If there should arise an occurrence of outer AREF, AREF pin is utilized to join the outside reference voltage. Recollect that it is important to change the breakers (circuit board), and re-transfer sketch, prior to associating outer voltage to AREF

4.2 SOFTWARE TIPS

When bootloading Atmega chip with Arduino 0010, there is an order (-i800) that makes bootloader postpone 10 minutes. In this way, on the off chance that you need to utilize bootloader, use order line rather than IDE, eliminating "-i800" order and adding "-F" order, or use Arduino 0007 IDE. To transfer program Arduino 0010 turns out great.

ARDUINO3v3NEWFEATURES

- full compatible with Shield Boards (Version 2 is the only Arduino Board not compatible with shield Boards because of ICSP header wrong position ,and tall components);
- A Vcc LP filter to reduce noise level nADC;
- Auto reset feature;
- Auto reset enable / disable jumper, to avoid not desired resetting ;
- Arduino decimal compatible reset pin;
- pin 13 on board led ,with current limiter resistor;
- TX and RX on board leds ;
- Power led with appropriate current limiter resistor (less20mAof consumption);
- jumper to disable serial communication and to enable RX external pull down resistor ,to avoid “RX floating error”.This feature allows to use digitalpin0and pin1as an or malpin, when serial communication is not needed;
- all similar components (diodes ,transistors ,leds, capacitors)has the same board orientation (to makes easier to m out with less mistakes);
- no wires between pads, more space between wires, larger wires, larger pads (better foretching, soldering and drilling ,with no short circuits ,soldering bridge so ropen wires in corrosion);
- only3 wire bridges;
- Electrolytic capacitor (in serial to TTL circuit) changed to bipolar type(to a void inverted voltage problem when serial cable is not connected);
- All jumpers are right angle type, to allow Shield Boards use.

4.3 ESP8266 NodeMCU Wi-Fi



Fig:4.4: NodeMCU

The ESP8266 is the name of a miniature regulator planned by Esp8266ressif Systems. The ESP8266 itself is an independent Wi-Fi organizing arrangement offering as a scaffold from existing miniature regulator to Wi-Fi and is additionally fit for running independent applications. This module accompanies an inherent USB connector and a rich variety of pin-outs. With a miniature USB link, you can interface NodeMCUdevkit to your PC and blaze it with no difficulty, very much like Arduino. It is likewise promptly breadboard cordial.

4.3.1 Specification:

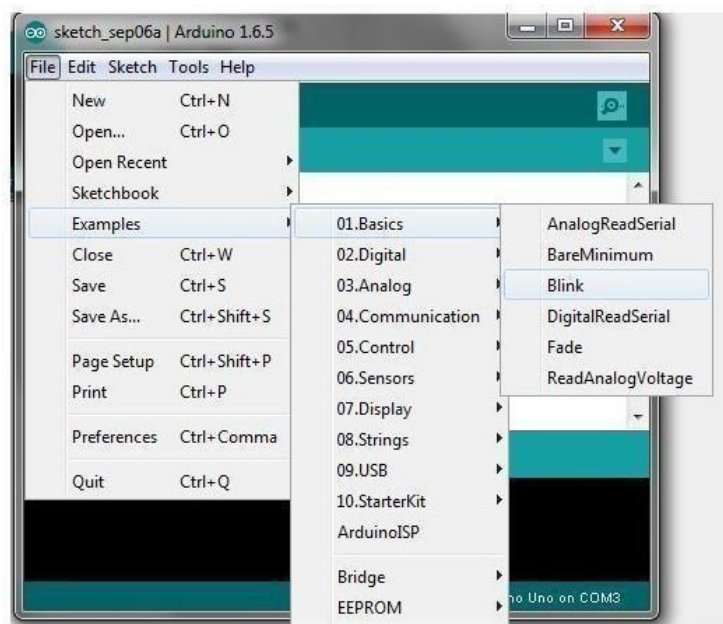
- Voltage:3.3V.
- Wi-Fi Direct(P2P),soft-AP.
- Current utilization: 10uA~170mA.
- Flashmemoryattachable:16MBmax(512Knormal).
- Integrated TCP/ IP protocol stack.
- Processor:TensilicaL10632-bit.
- Processorspeed:80~160MHz.
- RAM:32K+80K.
- GPIOs:17(multiplexed with other functions).
- AnalogtoDigital:1input with1024 step resolution.

:<https://www.arduino.cc/en/Main/Software>

This is the Arduino IDE whenever it's been opened. It opens into a clear sketch where you can begin programming right away. To begin with, we thought to arrange the board and port settings to permits to transfer code. Inter face your Arduino board to the PC through the USB link.

4.4.1 UPLOADING BLINK

One common procedure to check whether the board you're using is correctly founded is to upload the “Blink” sketch. This sketch is incorporated with all Arduino IDE delivers and may be gotten to by the File pull-down menu and visiting Examples, 01.Basics, then select Blink. Standard Arduino Boards include a surface-mounted LED labeled “L” or “LED” next to the “RX” and “TX” LEDs, that's connected to digital pin 13. This sketch will blink the LED at an every day interval, and is as straight forward thanks to confirm if your board is ready up properly and you were successful in uploading code. Go to the “Blink” sketch and press the “Upload” button within the upper-left upload “Blink” to the board.



Arduino IDE: Loading Blink Sketch

Fig: 4.6: Loading Blink Sketch

- 1.Download and introduce Arduino IDE(<https://www.arduino.cc/en/Main/Software>)
- 2.Plug in your Arduino Board
- 3.Select the right board in the IDE (Tools>Boards>Arduino)
- 4.SelectthecorrectCOMport(Tools>Port>COMx(ArduinoUno))
- 5.Openthe"Blink"sketch(File>Examples>Basics>01.Blink)
- 6.PresstheUploadcatchtotransfurtherprogramboard
7. Affirm that your board is functioning true to form by noticing LED

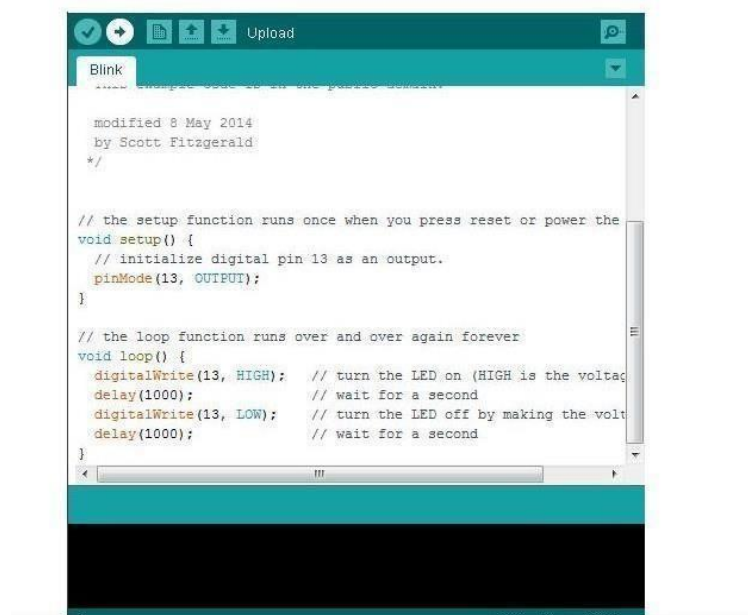


Fig: 4.7: Uploading Blink

Arduino has bunches of network backing and documentation. Your smartest option when running into unforeseen issues is to look through online for help. You should have the option to discover discussion where some body had as similar issue you are having, and somebody encouraged them fix it. In the event that you don't discover results ,take a stab at altering your pursuit, or post on the Arduino discussions.

4.5 Temperature & Humidity sensor

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be effectively interfaced with any miniature regulator, for example, Arduino, Raspberry Pi and so forth... to gauge mugginess and temperature momentarily. DHT11 dampness and temperature sensor is accessible as a sensor and as a module. The distinction between this sensor and module is the draw up resistor and a force on LED. DHT11 is a general stickiness sensor. To gauge the encompassing air this sensor utilizes a thermistor and a capacitive moistness sensor.

4.5.1 Working Principle of DHT11 Sensor

DHT11 sensor comprises of a capacitive moistness detecting component and a thermistor for detecting temperature. The mugginess detecting capacitor has two anodes with a dampness holding substrate as a dielectric between them. Change in the capacitance esteem happens with the adjustment in stickiness levels. The IC measure, measure this changed obstruction esteems and change them into computerized structure.

For estimating temperature this sensor utilizes a Negative Temperature coefficient thermistor, which causes a lessening in its obstruction esteem with expansion in temperature. To get bigger obstruction esteem in any event, for the littlest change in temperature, this sensor is normally comprised of semiconductor ceramics or polymers.

The temperature scope of DHT11 is from 0 to 50 degree Celsius with a 2-degree exactness. Dampness scope of this sensor is from 20 to 80% with 5% exactness. The testing pace of this sensor is 1Hz .for example it gives one perusing for consistently. DHT11 is little in size with working voltage from 3 to 5 volts. The greatest current utilized while estimating is 2.5mA.

DHT11 sensor has four pins-VCC, GND, Data Pin and a not associated pin. A draw up resistor of 5k to 10k ohms is given to correspondence among sensor and miniature regulator.

4.5.2 Applications

this sensors used in various applications such as measuring humidity and temperature values in heating ,ventilation and air conditioning systems Weather stations also use these sensors to predict weather conditions. The humidity sensor issued as apprehensive measure in homes where people are affected by humidity .Offices,cars ,museums, greenhouses and industries use this sensor form as uring humidity values and as a safety measure.

4.6 Gas Sensor

Ideal sensor for use to identify the presence of a risky LPG spill in your vehicle or in an assistance station, stockpiling tank climate. This unit can be handily consolidated into an alert unit, to sound a caution or give a visual sign of the LPG fixation.

4.6.1 Gas Sensor Construction



Fig: 4.8: Gas sensor

Of all the above-listed types, the most commonly used gas sensor is the Metal oxides semiconductor based gas sensor. All Gas sensors will consist of a sensing element which comprises of the following parts.

1. Gas sensing layer
2. Heater Coil
3. Electrode line
4. Tubular ceramic
5. Electrode

4.6.2 The purpose of each of these elements is as below:

Gas sensing layer: It is the primary segment in the sensor which can be utilized to detect the variety in the grouping of the gases and produce the change in electrical obstruction. The gas detecting layer is essentially a chemiresist or which changes its opposition esteem dependent on the

The centralization of specific gas in the climate. Here the detecting component is comprised of a Tin Dioxide (SnO_2) which is, by and large, has abundance electrons (contributor component). So at whatever point harmful gases are being identified the opposition of the component changes and the current flown through it fluctuates which addresses the adjustment in convergence of the gases.

Heater coil: The purpose of the heater coil is to burn-in the sensing element so that the sensitivity and efficiency of the sensing element increases. It is made of Nickel-Chromium which has a high melting points that it can stay heated up without getting melted.

Electrode line: As the sensing element produces a very small current when the gas is detected it is more important to maintain the efficiency of carrying those small currents. So Platinum wires come into play where it helps in moving the electrons efficiently.

Electrode: It is a junction where the output of the sensing layer is connected to the Electrode line. So that the output current can flow to the required terminal. An electrode here is made of Gold (Au —Aurum) which is a very good conductor.

Tubular ceramic: In between the Heater coil and Gas sensing layer, the tubular ceramic exists which is made of Aluminum oxide (Al_2O_3). As it has high melting point, it helps in maintaining the burn in preheating of the sensing layer which gives the high sensitivity for the sensing layer to get efficient output current.

Mesh over the sensing element: In order to protect the sensing elements and the setup, a metal mesh is used over it, which is also used to avoid/hold the dust particle entering into the mesh and prevent damaging the gas sensing layer from corrosive particles.

4.6.3 Gas Sensor Working

The ability of a Gas sensor to detect gases depends on the **chemiresistor** to produce current. The most commonly used chemiresistor is Tin Dioxide (SnO_2) which is an n-type semiconductor that has free electrons (also called as donor). Normally the atmosphere will contain more oxygen than combustible gases. The oxygen particles attract the free electrons present in SnO_2 which pushes them to the surface of the SnO_2 . As there are **no free electrons** available output current will be zero. The below is shown the oxygen molecules (blue color) attracting the free Electrons (black color) inside the SnO_2 and preventing it from having free electrons to conduct current.

When the sensor is placed in the toxic or combustible gases environment, this reducing gas (orange color) reacts with the adsorbed oxygen particles and breaks the chemical bond between oxygen and free electrons thus **releasing the free electrons**. As the free electrons are back to its initial position they can now conduct current, this conduction will be proportional to the amount of free electrons available in SnO_2 , if the gas is highly toxic more free electrons will be available.

How to use a Gas sensor?

A basic gas sensor has 6 terminals in which 4 terminals (A, A, B, B) act as input or output and the remaining 2 terminals (H, H) are for heating the coil. Of these 4 terminals, 2 terminals from each side can be used as either input or output (the terminals are reversible as shown in the circuit diagram) and vice versa.

These sensors are normally available as modules (shown right), these modules consist of the gas sensor and a comparator IC. Now let's see the pin description of the gas sensor module which we will generally use with an Arduino. The gas sensor module basically consists of 4 terminals

- **Vcc**—Power supply
- **GND**—Power supply
- **Digital output** – This pin gives an output either in logical high

logical low(0 or 1) that means it displays the presence of any toxic or combustible gases near the sensor.

□ **Analog output** – This pin gives an output continuous in voltage which varies based on the concentration of gas that is applied to the gas sensor.

As discussed earlier the output of a gas sensor alone will be very small (in mV) so an external circuit has to be used in order to get a digital high low output from the sensor. For this purpose, a comparator (LM393), adjustable potentiometer, some resistors and capacitors are used.

The purpose of LM393 is to get the output from the sensor, compare it with a reference voltage and display whether the output is logically high or not. Whereas the purpose of the potentiometer is to set the required threshold value of the gas above which the digital output should go high.

Applications

- Gas leak detection
- System Fire/Safety detection system
- Gas leak alarm Gas detector

Features

High Sensitivity

- Detection Range: 100-10,000 ppm iso-butane propane
- Fast Response Time: <10s
- Heater Voltage: 5.0V
- Dimensions: 18mm Diameter, 17mm High excluding pins, Pins-6mm High

4.7 SOIL MOISTURE SENSOR

The soil moisture sensor is one kind of sensor used to gauge the

volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, well as sample weighting. The sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content. The relation among the calculated property as well as moisture of soil should be adjusted & may change based on ecological factors like temperature, type of soil, otherwise electric conductivity. The microwave emission which is reflected can be influenced by the moisture of soil as well as mainly used in agriculture and remote sensing with in hydrology.

These sensors normally used to check volumetric water content, and another group of sensors calculates a new property of moisture within soils named water potential. Generally, these sensors are named as soil water potential sensors which including p_{sum} blocks and tensiometer.

4.7.1 Working of Sensor

The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and the ni tget the re instance value to measure the moisture value.

When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will bele ss water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.

This sensor can be connected in two modes; Analog mode and digital mode. First, we will connect it in Analog mode and then we will use it in digital mode.

Working Principle

This sensor mainly utilizes capacitance to gauge the water content of the soil (dielec tric permittivity). The working of this sensor can be done by inserting this sensor into the earth and the status of the water content in the soil can be reported in the form of a percent.

This sensor makes it perfect to execute experiment switch in science courses like environmental science, agriculture science ,biology, soil science, botany and horticulture.

4.7.2 Specifications

The specification of this sensor includes the following.

- The required voltage for workings 5V
- There required current for working is<20mA
- Type of interface is analog
- There required working temperature of this sensor is 10°C~30°C

4.7.3 Soil Moisture Sensor Applications

The applications of moisture sensor include the following.

- Agriculture
- Land scape
- Research
- Simple sensors for gardeners

This is all about the soil moisture sensor. From the above information, finally, we can conclude that this sensor is used to gauge the soil's volumetric water content, which makes it perfect to make experiment in the science field like agricultural science ,soil science, horticulture, environmental science, biology, and botany.

Specifications

Input Voltage	3.3– 5V
Output Voltage	0–4.2V
Input Current	35mA

The specifications of the soil moisture sensor FC-28 are as follows

PinOut–Soil Moisture Sensor

The soil Moisture sensor FC-28 has four pins

- VCC :For power
- A0:Analog output
- D0:Digital output
- GND:Ground

The Module also contains a potentiometer which will set the threshold value and then this threshold value will be compared by the LM393 comparator. The output LED will light up according to this threshold value.

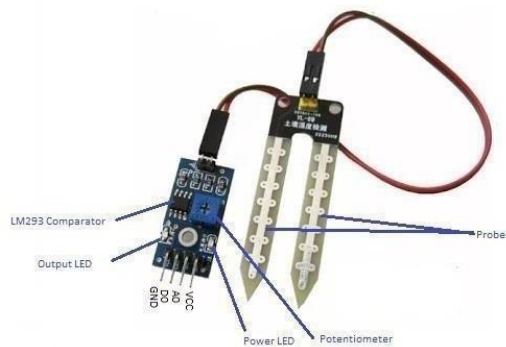


Fig.: 4.9: Soil Moisture Sensor

PinOut–Diagram

Analog Mode–Interfacing Soil Moisture Sensor and node mcu

To connect the sensor in the analog mode we will need to use the analog output of the sensor. When taking the analog output from the soil moisture sensor FC-28, the sensor gives us the value from 0 - 1023. The moisture is measured in percentage, so we will map these values from 0 - 100 and then we will show these values on the serial monitor.

Circuit Diagram

The connections for connecting the soil moisture sensor FC- 28 to the Arduino are as follows.

- VCC of FC-28 to 5 V of Arduino
- GND of FC-28 to GND of Arduino
- A0 of FC-28 to A0 of Arduino

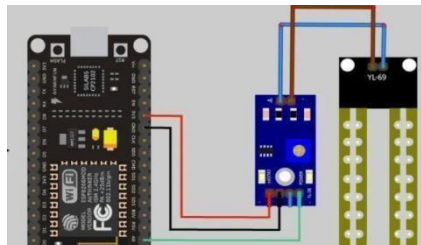


Fig.4.10 Connecting of Soil Moisture Sensor

Wiring the Moisture Sensor The Node CUs really easy The wiring connections are made as follows:

Connect the **two pins** of the moisture sensor to the **two pins** on the Amplifier circuit using jumper wires.

Connect the **Vcc** from the Amplifier to the **3.3Vp** In on the Node MCU.

Connect the **GND** pin to the ground (**GND**) pin on the Node MCU

. Connect the **Analog in** to the **A0p** in on the Node MCU.

Connect Node MCU to P C via USB cable.

After your completed with wiring connections, then insert the sensor into the soil or place it in any where you want.

CHAPTER - 5

5.1 Thing Speak

ThingSpeak is an IoT examination stage administration that permits you to total, envision and investigate live information streams in the cloud. ThingSpeak gives moment perceptions of information presented by your gadgets on ThingSpeak. With the capacity to execute MATLAB code in ThingSpeak you can perform online examination and preparing of the information as it comes in. ThingSpeak is regularly utilized for prototyping and verification of idea IoT frameworks that require investigation.

5.1.1 What is IoT?

Web of Things (IoT) depicts an arising pattern where countless implanted gadgets (things) are associated with the Internet. These associated gadgets speak with individuals and different things and frequently give sensor information to distributed storage and distributed computing assets where the information is handled and examined to acquire significant experiences. Modest distributed computing power and expanded gadget network is empowering this pattern.

IoT arrangements are worked for some vertical applications like natural observing and control, wellbeing checking, vehicle armada checking, mechanical checking and control, and home computerization.

At a high level, many IoT systems can be described using the diagram below:

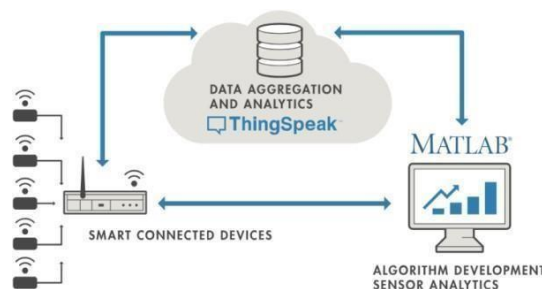


Fig:5.1: ThingSpeak

On the left, we have the smart devices (the “things” in IoT) that live at the edge of the network. These devices collect data and include things like wearable devices, wireless temperature sensors, heart rate monitors and hydraulic pressure sensors and machines on the factory floor.

In the middle, we have the cloud where data from many sources is aggregated and analyzed in real time, often by an IoT analytics platform designed for this purpose.

The right side of the diagram depicts the algorithm development associated with the IoT application. Here an engineer or data scientist tries to gain insight into the collected data by performing historical analysis on the data. In this case, the data is pulled from the IoT platform into a desktop software environment to enable the engineer or scientist to prototype algorithms that may eventually execute in the cloud or on the smart device itself.

An IoT system includes all these elements. ThingSpeak fits in the cloud part of the diagram and provides a platform to quickly collect and analyze data from internet connected sensors.

5.1.2 Thing Speak Key Features

ThingSpeak allows you to aggregate, visualize and analyze live data streams in the cloud. Some of the key capabilities of ThingSpeak include the ability to:

- Easily configure devices to send data to Thing Speak using popular IoT protocols.
- Visualize your sensor data in real-time.
- Aggregate data on-demand from third-party sources
- Use the power of MATLAB to make sense of your IoT data.
- Run your IoT analytics automatically based on schedules or events.
- Prototype and build IoT systems without setting up servers or developing web software.
- Automatically act on your data and communicate using third-party.

5.1.3 Create a Channel

1. Sign Into ThingSpeak™ using your Math Works® Account, or create a new Math work account.
2. Click Channels>My Channels.
3. On the Channels page, click New Channel.
4. Check the boxes next to Fields 1–3.



Fig: 5.2:CreatingChannel

Field1:Temperature(F)

Field2:Humidity

Field3:DewPoit

Fig: 5.3: Entering Field Names

Click Save Channel at the bottom of the settings. Youn

- Private View: This tab displays information about your channel that only you can see. Public View: If you choose to make your channel publicly available, use this tab to display selected fields and channel visualizations.
- Channel Settings:Third tab show sall the channel options you set at

creation. You can edit, clear, or delete the channel from this tab.

- **Sharing:** This tab shows channel sharing options. You can set a channel as private, shared with everyone (public), or shared with specific users.
- **API Keys:** This tab displays your channel
- **API Keys:** Use the key store and from and write to your channel.

Data Import / Export: This tab enables you to import and export channel data.

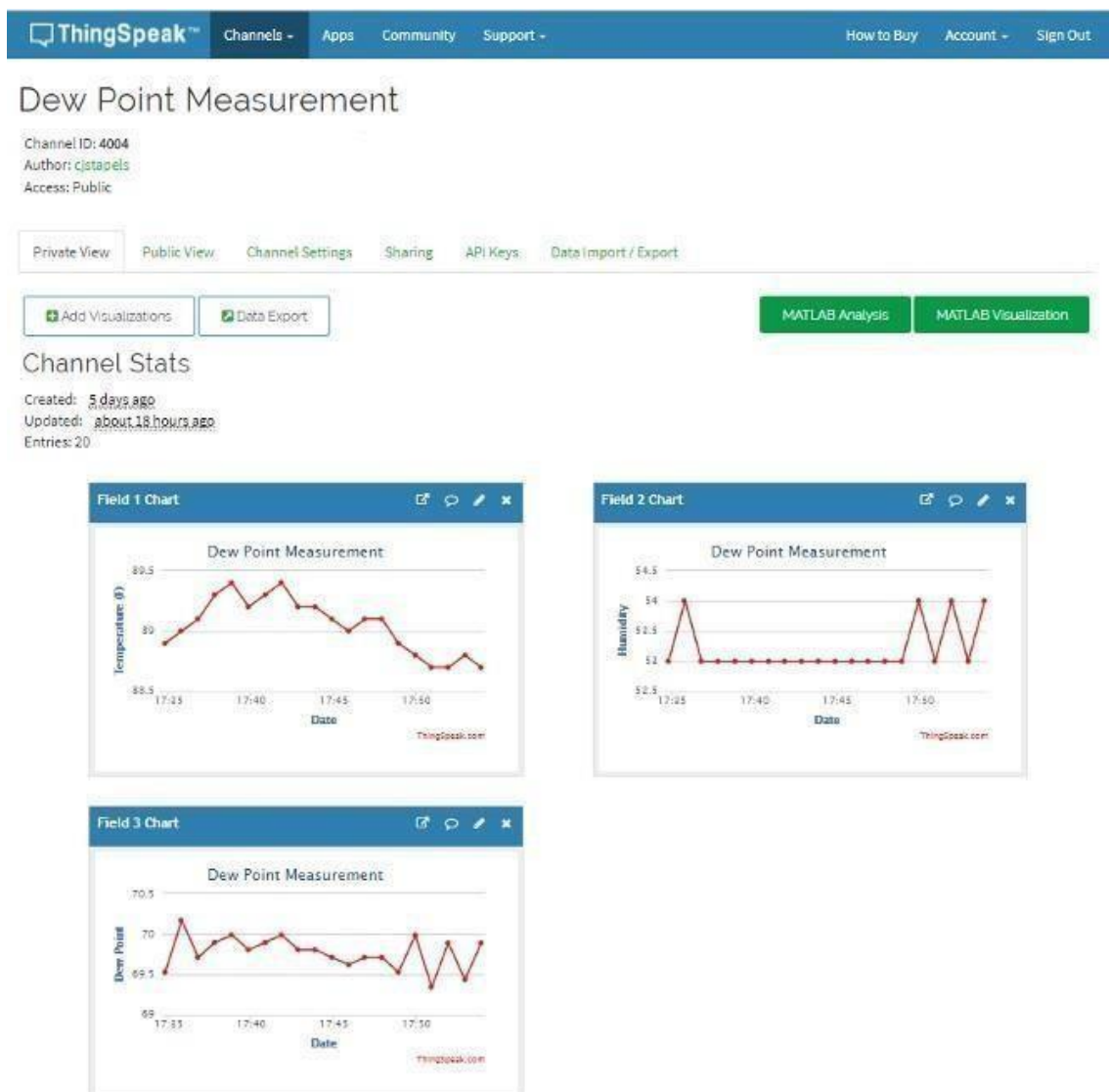


Fig: 5.4: Output draft picture

5.2 FUTURESCOPE

As per another market knowledge report by BIS Research, the worldwide savvy cultivating market is relied upon to reach \$23.14 billion by 2022, increasing at a build yearly development rate (CAGR) of 19.3% from 2017 to 2022.

The market development is basically ascribed to the expanding interest for higher harvest yield, the developing infiltration of data and correspondence innovation (ICT) in cultivating, and the expanding need for environment savvy horticulture.

The Growing Use of Smart Farming Worldwide

In the coming years, keen cultivating is projected to make an enormous effect on the farming economy by overcoming any issues among little and huge scope organizations. The pattern isn't just appropriate in evolved nations — non-industrial nations have understood its monstrous significance also.

In nations like China and Japan, wide-scale organizations of cell phones and web of things (IoT) frameworks have prompted a fast selection of exactness farming arrangements. The legislatures of a few nations have likewise understood the requirement for, and the upsides of these advances, and in this way, their drives to advance exactness cultivating methods are relied upon to drive the development of the market further.

Be that as it may, such progressive changes in cultivating rehearses accompany openings as well as specific difficulties which end up being a limitation in the development of the market. The mindfulness and information about more up to date horticulture innovation are yet to spread broadly, particularly in arising nations.

5.3 Types of Precision Agriculture

As indicated by the report, in 2017, the equipment frameworks arrangement section held over 72% of the all out worldwide savvy cultivating market. The accuracy crop cultivating application presently holds the biggest piece of the

pie of more than 31%.

Organizations in the market offer an assortment of answers for a few kinds of accuracy crop cultivating applications like exactness water system, yield observing and

anticipating, variable rate application, crop exploring, and recording keeping, among others.

Exactness water system items have been a significant supporter of the enormous piece of the pie of accuracy crop cultivating. With the developing requirement for the fitting utilization of agrarian information sources, variable rate application items in the market are relied upon to spread the development of the accuracy crop cultivating market in the following five years.

The presentation of self-sufficient draining robots into milk reaping is relied upon to increase the development of savvy horticulture in the domesticated animals area. Furthermore, developing urbanized zones and the expanding interest for new rural produce lasting through the year will spread the development of indoor cultivation.

Hydroponics is likewise seeing more noteworthy reconciliation of hydroponics theboard programming for the effective rearing of sea-going species.

Where Precision Farming Is Taking Off

Locally, North America is at the cutting edge of the worldwide savvy agribusiness market, with high market entrance in the U.S. In any case, Mexico is relied upon to have the most elevated market development in the coming five years.

The Asia-Pacific locale is projected to show the quickest market development from 2017 to 2022. The locale presents a monstrous extension for market advancement, attributable to the expanding metropolitan populace size, developing business sector entrance of web in ranch the board, and good government ventures. Additionally, the presence of monetarily propelling nations, for example, India and China are required to make the locale an essential piece of the development of accuracy farming in the impending years.

Automated Farming Trends

A change in the globalizing demo Graphical Triggered the adoption of automating farming practices. Automation and control systems manufacturers have witnessed a definite surge in their sales due to this profound change in the farming industry.

Over the past five years, agricultural robots have also been incorporated into farming operations as they treat soil and crops selectively as per their

requirements and reduce the need for annual labor. UAV/drones generated the highest revenue among one. agricultural robots utilized in smart farming. The majority of robot deployment was done for crop management.

Agriculture Companies to Watch in This Space

Vital participants working in this market have sloped up their item dispatch exercises over late years to create public mindfulness about their current and new items and advances and rival their rivals' item portfolio.

Organizations and coordinated efforts methodologies have likewise been essentially utilized for extension in the savvy cultivating market. With the expanding development in the worldwide market, organizations working in this industry are constrained to concoct communitarian techniques with other farming OEMs to support in the strongly serious market. For example, in February 2018, Trimble Inc. what's more, Aquarius Spectrum Ltd. consented to an arrangement for the conveyance of Aquarius Spectrum's remote break recognition and observing answers for water utilities

CHAPTER - 6

CONCLUSION

Keen cultivating can give a coordinated way out of secured advances and practices portrayed by solid polarization and market division. It offers a way toward manageable farming by enhancement of advances, yield and animals creation frameworks, and organizations across all entertainers of the agri-food area. There is no single strategy approach that can accomplish this vision, which upholds and works with the fitting utilization of ICT innovation. Maybe, the thought is to recognize the predominant systems that oblige or compromise an economical utilization of the innovation and to choose the most fitting activities in created and agricultural nations .

This may bring about better admittance to capital sometimes and to explicit help of interests in others. Besides, the help of helpfully utilized ranch observing innovation (e.g., together claimed automated ethereal vehicles checking fields of whole towns) or interests in schooling and preparing may likewise uphold the maintainable utilization of these advances. In all cases, nonetheless, the arrangement climate ought to give a reasonable, lawful setting that takes into consideration successful proprietorship and client rights.

The prospects of the advanced time may prompt new types of enhancement on ranches. Like the discussion and conceptualization of "shrewd urban areas," the

prospects of ICT

will probably not prompt one around the world uniform and quickly acknowledged cultivating framework however to a variety of cultivating frameworks. Specialized advancements adding to expansion are worked with by the board exhortation whenever given with high dependability and clearness, regardless of whether ranchers have not delivered a specific harvest previously. Current issues with obstruction, for instance to anti-microbials and pesticides, could be stayed away from with a higher variety of creation frameworks.

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