CHAPTER 1

INTRODUCTION

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Agriculture is the backbone of India and for many other countries. Irrigation is the "Heart of Agriculture". Irrigation is the application of controlled amounts of water to plants at needed intervals. Irrigation helps to grow and maintain the agricultural crops and soils in dry areas during the periods of less than the average rainfall. For the conservation of water we are using the present technology which is purely based on IOT, Machine Learning and Cloud Computing. IOT is often referred as Internet of Everything or Internet of Intelligent objects or Internet of Things. This is used for the application of Irrigation by using some hardware and software's. For conserving water we are using following Agriculture based irrigation systems.

Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation. Drip irrigation systems distribute water through a network of valves, pipes, tubing and emitters. Depending on how well designed, installed, maintained, and operated.

An Irrigation sprinkler is a device used to irrigate agricultural crops, lawns, landscapes, golf courses, and other areas. They are also used for cooling and for the control of airborne dust. Sprinkler irrigation is the method of applying water to a controlled manner in that is similar to rainfall. The water is distributed through a network that may consist of pumps, valves, pipes, and sprinklers. Irrigation sprinklers can be used for residential, industrial, and agricultural usage. Higher pressure sprinklers that themselves move in a circle are driven by a ball drive, gear drive, or impact mechanism (impact sprinklers). These can be designed to rotate in a full or partial circle.

Technologies are growing rapidly with a boom in all sectors. One such sector is agriculture, where the combination of Internet Of Things (IOT) devices, Image processing, Machine Learning and Cloud Computing makes a better progress in an efficient and effective way. Agriculture is considered as the basis of life for us as it is the main source of food and other raw materials. It plays a vital role in the growth of country's economy. Nowadays the availability of power and water is insufficient to fulfill the farmer's needs.

1.1 Problem statement

In irrigation water management, irrigation water use represents a substantial opportunity for agriculture water savings. Automation of irrigation systems, based on Soil Moisture Sensors Systems (SMSS) has the potential to provide maximum water use efficiency by maintaining soil moisture at optimum levels.

1.2 Objective

Water Conservation System is conserving the water on the basis of agriculture. Nowadays we are using drinking water for the agriculture purpose. By limited usage of water of obtaining the more crops is our aim, where the following systems are used for agricultural practices which can be implemented.

a. Developing a user-friendly agricultural Information System for worldwide web which will fulfil the Agriculture related People's requirements.
b. Targets: Mainly concentrating on India's economy.
c. Provide all the information for the farmers.
d. Database updating can be done by Administrator thought Internet
e. Monitoring and Backing up Database and Users details for future use and also for the Mobile Application.
f. Providing the user Authentication through encrypted password and only the Administrator will have access to the Account.

1.2 Proposed System

Agricultural robot

- It helps the farmers work uniformly by maintaining various field activities.

- Will deliver instructions to the farmer by sending the appropriate messages.
- Will monitor the field in the absence of farmer.
- Will guide the farmer to use limited amount of water.
- Is compatible to be used in the various plantations and fields.

There are two ways of conserving water in agriculture field and mainly for Irrigation purpose, they are classified as follows:

1. Drip Irrigation System.

2. Sprinkler System.

1. DRIP IRRIGATION SYSTEM:

Drip Irrigation is a form of Irrigation System which in particular has the potential to change the way the farms are irrigated if employed with Information Communication and Dissemination Technologies (ICDTs). The Smart Automatic Drip Irrigation System based on IOT is a new mode to ensure smart farming practices for irrigation purposes. Drip Irrigation is one of the efficient irrigation methods to save water by allowing the water drip slowly to the root of the plants, either into the soil surface or directly on to the root zone. In the modern Drip Irrigation System, the most significant advantage is supplying water near the root zone which in turn saves large amount of water. Smart Irrigation System is one such good example for IOT. It allows remote monitoring and controlling the fields through various android devices. With the advent of open source Embedded systems along with cheap sensors, it is feasible to create devices that can monitor the soil moisture content and irrigating fields. Our project involves a robot which will sense the moisture content available in the soil and monitor the results with the actual sensation of the plants.

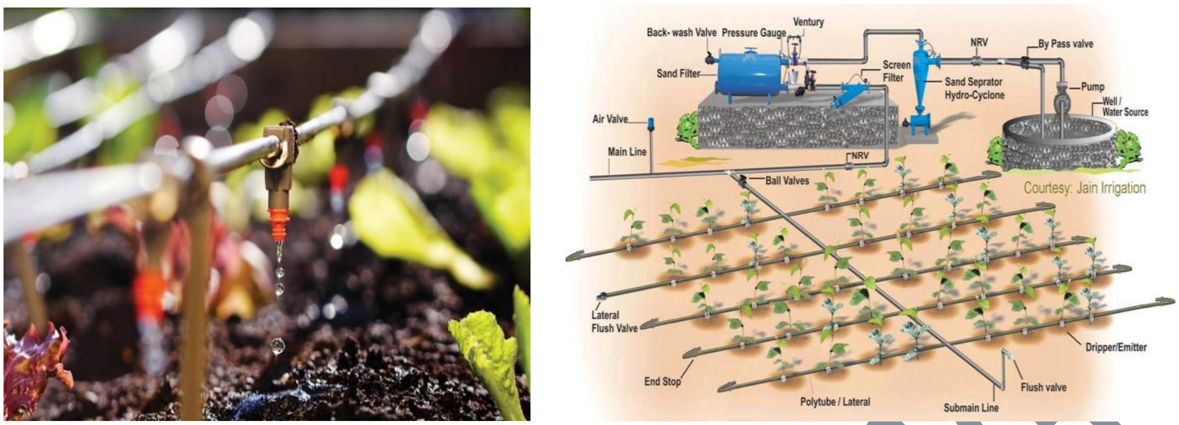


Fig 1: Drip Irrigation Model Description.

1.2 SPRINKLER SYSTEM:

A sprinkler system can be operated as an intelligent device on the basis of real time moisture content in the soil that is to be watered. A sprinkler is a watering device that is used to deliver necessary content of water to the soil evenly. Sprinklers need a lot of water to function properly and these days shortage of raining and land reservoir water has turned out to be a major issue. To solve this issue **Internet of Things** (IOT) is an introduced concept of having everyday objects connected through internet including smart phones, sensors etc. Once connected, they enable smart processes and services between them for convenience. Sprinkler is connected through it and can be controlled remotely by users. Our project involves a robot that will give required water for the plants whenever necessary and if in case the water content is more than required then the robot will not allow the flow of water for the plants.

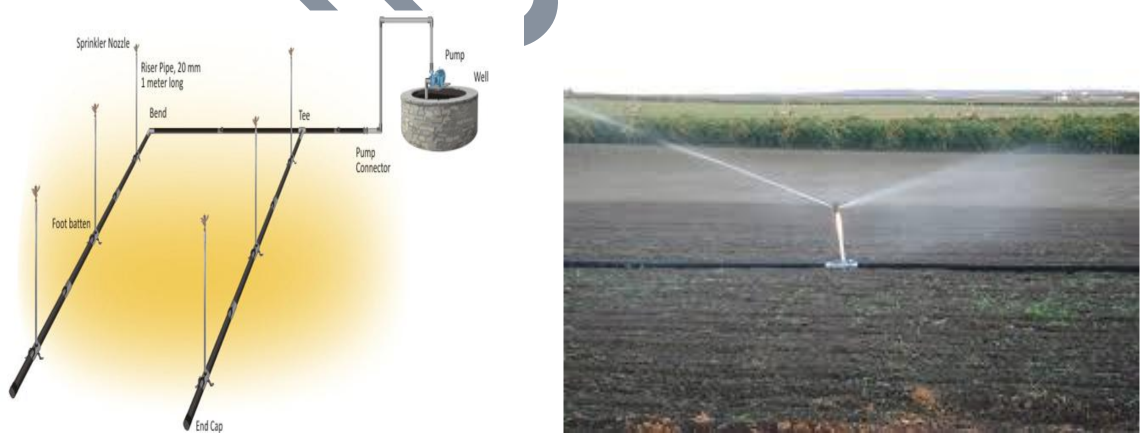


Fig 2: Sprinkler Irrigation Model Description.

In this project an automation of farm irrigation and soil moisture control by a Micro-Controller using soil moisture sensor and L293D module. This automatic irrigation system senses the moisture content of the soil and automatically switches the pump when the power is on. A proper usage of irrigation system is very necessary because the main reason is the shortage of land reserved water due to lack of rain, spontaneous use of water as a result large amounts of water goes waste. For this reason, we use this automatic plant watering and soil moisture monitoring system and this system is very useful in all climatic conditions. India is the agriculture based country. Our most of peoples are completely depended on the agricultural harvesting. Agriculture is a source of employment for the majority of Indians and has great impact on the economy of the country. In dry areas or in case of lacking rainfall, irrigation becomes difficult. So, it needs to be automated for proper watering a plant and handled remotely by farmer. When soil goes dry pump will start watering. The aim of the implementation is to reduce water use and automatic irrigation can be used for save time and low power monitor device. The aim of the implementation of this project is to demonstrate the automatic plant irrigation to reduce the usage of water as well as time.

Advantages of proposed System

- Drip irrigation application uniformity is very high, usually over 90%.
- Unlike sprinklers, drip irrigation applies water directly to the soil, eliminating water loss from wind.
- Application rates are low so water may be spoon fed to the crop or plant root zone in the exact amounts required (even on a daily or hourly basis). In contrast, other methods entail higher water application quantities and less frequency. If young plants need water frequently, much of the water applied is often wasted to deep percolation or runoff.
- Low application rates are less likely to run off from heavier soils or sloping terrain.
- Drip irrigation does not water non-targeted areas such as furrows and roads in agriculture, between beds, blocks or benches in greenhouses, or hardscape, buildings or roads in landscape.
- Drip irrigation easily adapts to odd-shaped planting areas which are difficult to address with sprinklers or gravity irrigation.
- Drip irrigation is capable of germinating seeds and setting transplants which eliminates the need for "sprinklering up" and eliminates the resulting waste in the early stages of crop growth.
- It saves water and improves water penetration.
- It reduces weed growth.
- Limited soil wetting permits uninterrupted agricultural operations.
- Lower operating pressures and lower flow rates require lesser energy for pumping.

- It enhances plant growth and improves crop yield.
- It does not require land preparation.
- It does not cause soil erosion.
- It improves fertiliser application efficiency.
- Saving of water and soil (due to no or negligible erosion of soil).
- Saving in cost of land preparation.
- Better control of soil moisture.
- Frequent and light irrigation results in better crop yields.
- Easy and uniform application of water, fertilizers and pesticides.

CHAPTER 2

LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

Existing System

2.1 Irrigation Trends Since 1947

India's irrigation covered crop area was about 22.6 million hectares in 1951, and it increased to a potential of 90 mha at the end of 1995, inclusive of canals and groundwater wells. However, the potential irrigation relies of reliable supply of electricity for water pumps and maintenance, and the net irrigated land has been considerably short. According to 2001/2002 Agriculture census, only 58.1 million hectares of land was actually irrigated in India. The total arable land in India is 160 million hectares (395 million acres). According to the World Bank, only about 35% of total agricultural land in India was reliably irrigated in 2010.

The ultimate sustainable irrigation potential of India has been estimated in a 1991 United Nations' FAO report to be 139.5 million hectares, comprising 58.5 mha from major and medium river-fed irrigation canal schemes, 15 mha from minor irrigation canal schemes, and 66 mha from groundwater well fed irrigation.

India's irrigation is mostly groundwater well based. At 39 million hectares (67% of its total irrigation), India has the world's largest groundwater well equipped irrigation system (China with 19 mha is second, USA with 17 mha is third).

India has spent ₹ 16,590 crore on irrigation development between 1950 and 1985. Between 2000-2005 and 2005-2010, India proposed to invest a sum of ₹ 1,03,315 crore and 2,10,326 crore on irrigation and flood control in India.

State	Total crop area (million hectares)	Groundwater irrigation crop area (million hectares)	Canal irrigation crop area (million hectares)	Total crop area actually irrigated (million hectares)
All India	159.6	39.43	22.48	58.13
Andhra Pradesh	14.3	2.5	2.7	4.9
Assam	3.0	0.13	0.1	0.22
Bihar	6.4	2.2	1.3	3.5
Chhattisgarh	5.1	0.17	0.74	0.85

State	Total crop area (million hectares)	Groundwater irrigation crop area (million hectares)	Canal irrigation crop area (million hectares)	Total crop area actually irrigated (million hectares)
Gujarat	9.9	3.1	0.5	3.2
Haryana	3.6	1.99	1.32	3.26
Himachal Pradesh	1.0	0.02	0.09	0.11
Jammu & Kashmir	0.9	0.02	0.38	0.37
Jharkhand	3.2	0.11	0.13	0.24
Karnataka	12.2	1.43	1.33	2.38
Kerala	1.5	0.18	0.21	0.39
Madhya Pradesh	15.8	2.74	1.70	4.19
Odisha	4.9	0.17	1.07	1.24
Punjab	4.0	3.06	0.94	3.96
Rajasthan	21.1	3.98	1.52	5.12
Tamil Nadu	6.5	1.61	1.43	2.66
Tripura	0.3	0.02	0.05	0.07
Uttar Pradesh	17.6	10.64	4.21	14.49
Uttarakhand	0.8	0.22	0.14	0.35
West Bengal	5.5	2.09	1.22	2.98

CHAPTER 3

REQUIREMENT SPECIFICATION

System Requirements Specification is a structured collection of information that embodies the requirements of a system. A business analyst, sometimes titled system analyst, is responsible for analyzing the business needs of their clients and stakeholders to help identify business problems and propose solutions. provides an overview of the entire system.

Software requirements specification establishes the basis for an agreement between customers and contractors or suppliers (in market-driven projects, these roles may be played by the marketing and development divisions) on what the software product is to do as well as what it is not expected to do. Software requirements specification permits a rigorous assessment of requirements before design can begin and reduces later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules.

The software requirements specification document enlists enough and necessary requirements that are required for the project development. To derive the requirements, we need to have clear and thorough understanding of the products to be developed or being developed. This is achieved and refined with detailed and continuous communications with the project team and customer till the completion of the software

Hardware Requirements:

BOARDS	:	Arduino UNO /Mega 2560. Raspberry Pi 3 B.
DEVICES	:	Motion Sensor, RTC (DS3231), GPS Tracker, Motion Activated Capture Camera, Servo Motor, Soil Moisture Sensor, DHT Sensor, LCD Display, Motor Driver Controller, Pump, etc.
RAM	:	2GB.
ROM	:	500GB on Windows. External SD Card (Raspberry Pi).

Software Requirements:

IDE	:	Arduino Ide 1.8.4.
OS	:	Windows 7 or Higher.
Languages	:	C, Python, PHP, Java (Android)/Django.
S/W for Raspberry Pi	:	Raspbian OS.
		Putty.

Software:

Web requirements:

1) Virtual Studio Code is the web authoring tool for front end.
2) Web browsing Tools such as Mozilla Firefox
3) Database SQL server either MySQL or SQLite3
4) PHP is the user Interface
5) Windows Platform or Linux Platform
6) Localhost web server such as Apache and Online web server such as freehosting.com

App requirements:

1) Android Studio
2) Mobile app Simulator
3) Sqlite3 or MySQL

Arduino requirements:

1) Arduino IDE
2) Libraries

Raspberry Pi requirements:

1) IDLE IDE
2) OpenCV
3) VNC Server

Hardware:

4) Dual core or higher Processor

5) Arduino Uno board

6) Raspberry pi 3 B board

7) Sensors

8) Motors

9) Wheels and rubber chain grip

10) Jumper Wires

11) Bread Board

12) Pi Camera

13) Buzzer

14) LED’s

15) Lippo 12v Battery along with 5v convertor

16) Internet connection through LAN or WiFi

17) USB cable
18) Mobile Charger
19)

FUNCTIONAL REQUIREMENT

NON FUNCTIONAL REQUIREMENT

CHAPTER 4

SYSTEM DESIGN AND METHODOLOY

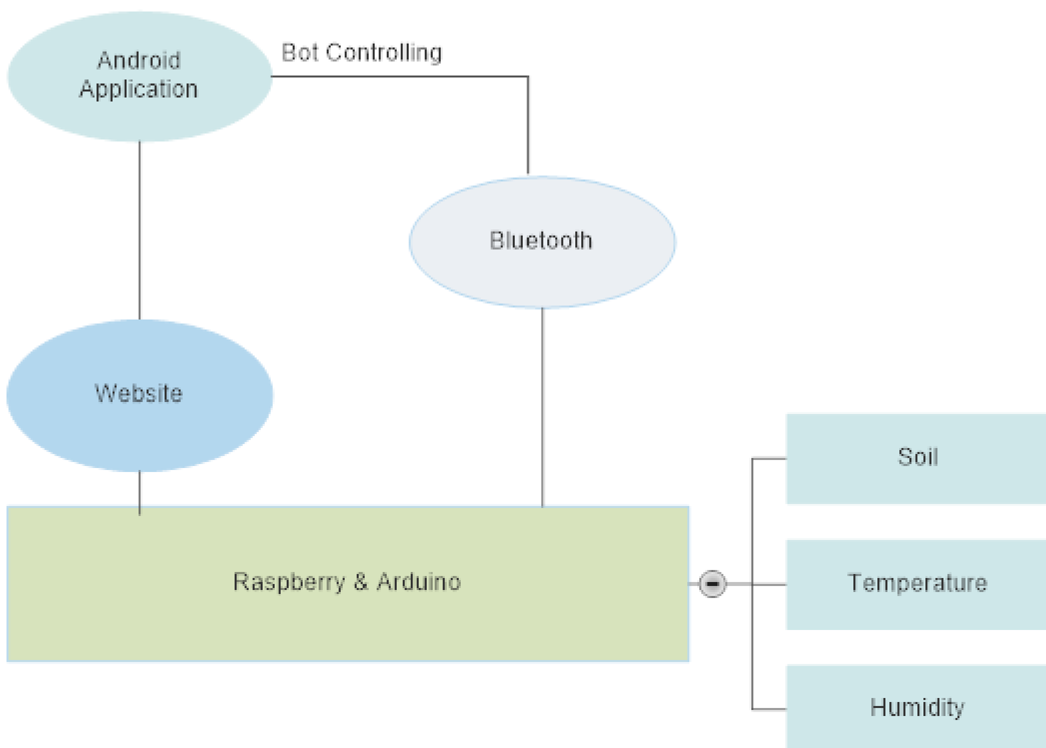


Fig 4.1 overall flow diagram

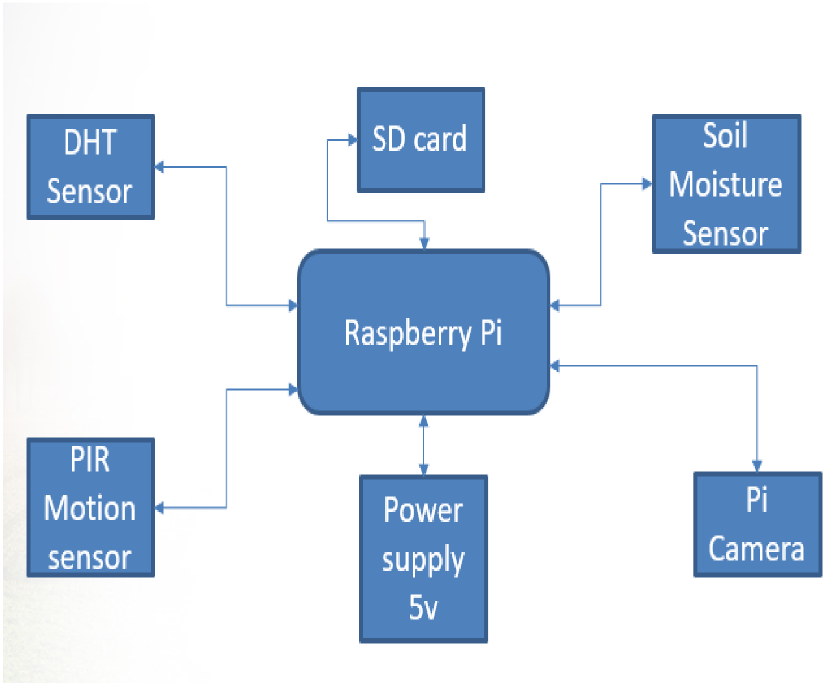


Figure 4.2: Raspberry Individual Mechanism

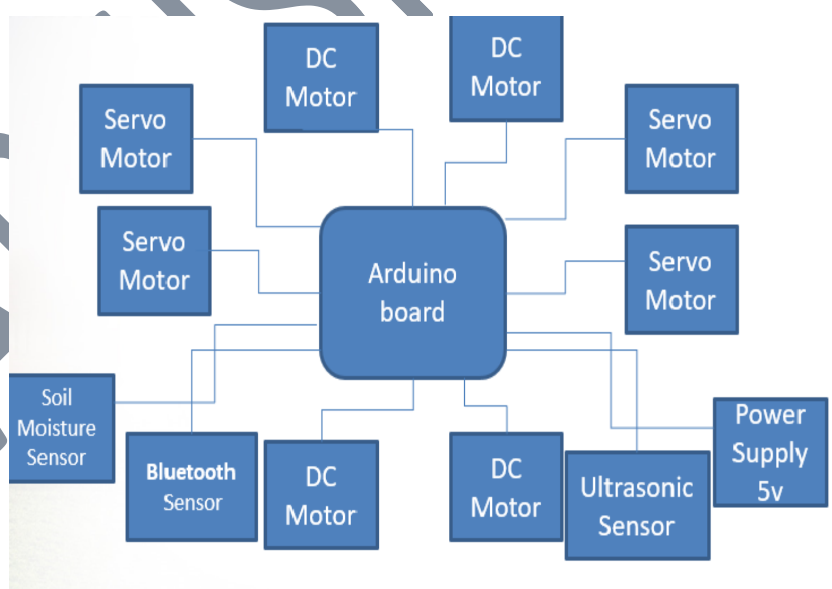


Figure 4.3: Arduino Individual Mechanism

Android apps can be written using Kotlin, Java, and C++ languages. The Android SDK tools compile your code along with any data and resource files into an APK, an Android package, which is an archive file with an **.apk** suffix. One APK file contains all the contents of an Android app and is the file that Android-powered devices use to install the app.

Each Android app lives in its own security sandbox, protected by the following Android security features:

- The Android operating system is a multi-user Linux system in which each app is a different user.
- By default, the system assigns each app a unique Linux user ID (the ID is used only by the system and is unknown to the app). The system sets permissions for all the files in an app so that only the user ID assigned to that app can access them.
- Each process has its own virtual machine (VM), so an app's code runs in isolation from other apps.
- By default, every app runs in its own Linux process. The Android system starts the process when any of the app's components need to be executed, and then shuts down the process when it's no longer needed or when the system must recover memory for other apps.

App components are the essential building blocks of an Android app. Each component is an entry point through which the system or a user can enter your app. Some components depend on others.

There are four different types of pp components:

Activities: An activity is the entry point for interacting with the user. It represents a single screen with a user interface.

Services: A service is a general-purpose entry point for keeping an app running in the background for all kinds of reasons.

Broadcast receivers: A broadcast receiver is a component that enables the system to deliver events to the app outside of a regular user flow, allowing the app to respond to system-wide broadcast announcements.

Content providers: A content provider manages a shared set of app data that you can store in the file system, in SQLite database, on the web, or on any other persistent storage location that your app can access.

Intent: An Intent is an object that provides runtime binding between separate components, such as two activities.

Android Studio automatically does three things:

- Creates the DisplayMessageActivity file.
- Creates the correspondingactivity_display_message.xml layout file.

Adds the required <activity> element in AndroidManifest.xml

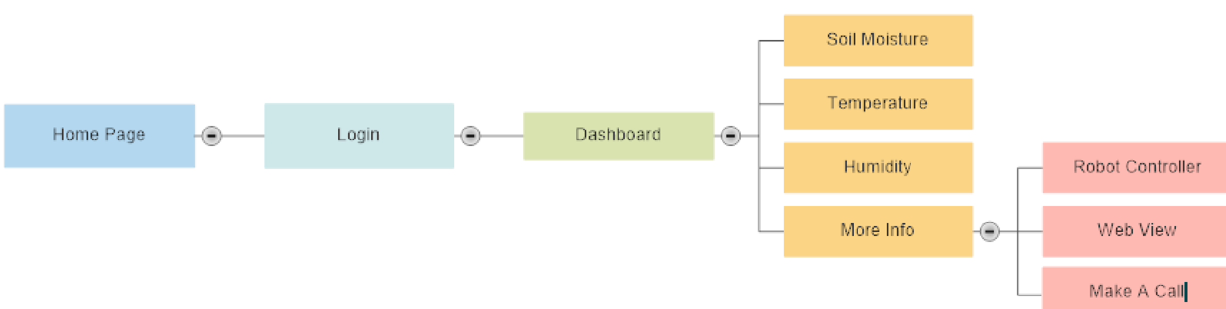


Figure 4.4: Flow diagram for android app

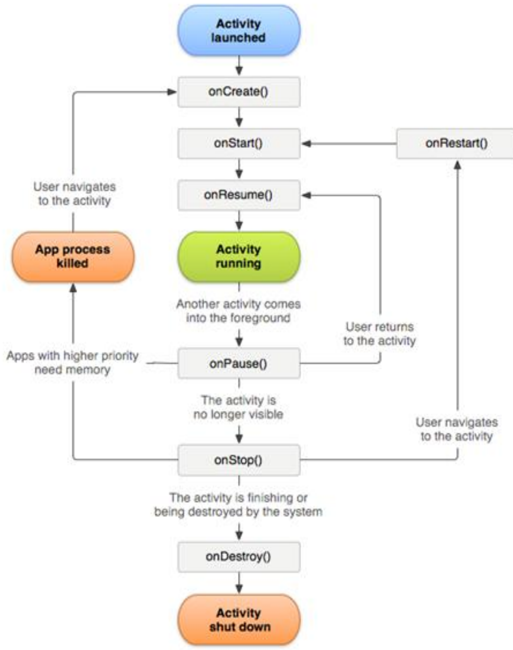


Figure 4.5: Activity of Android

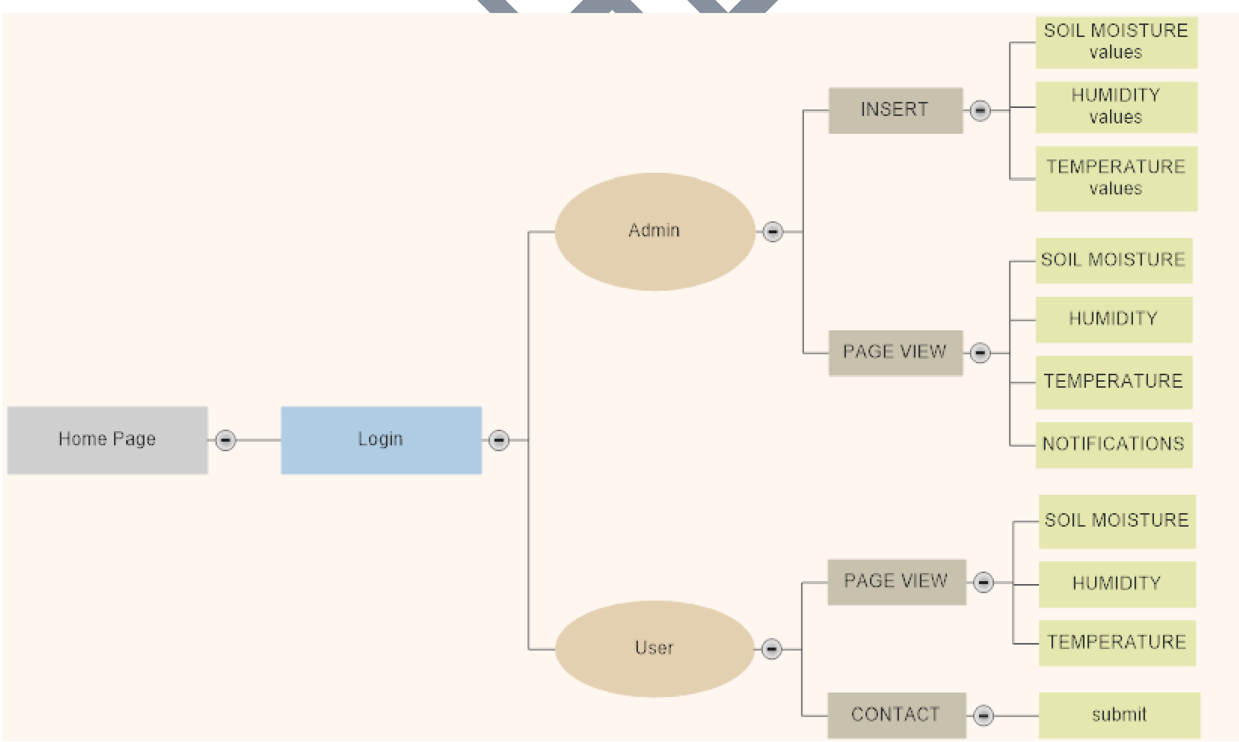
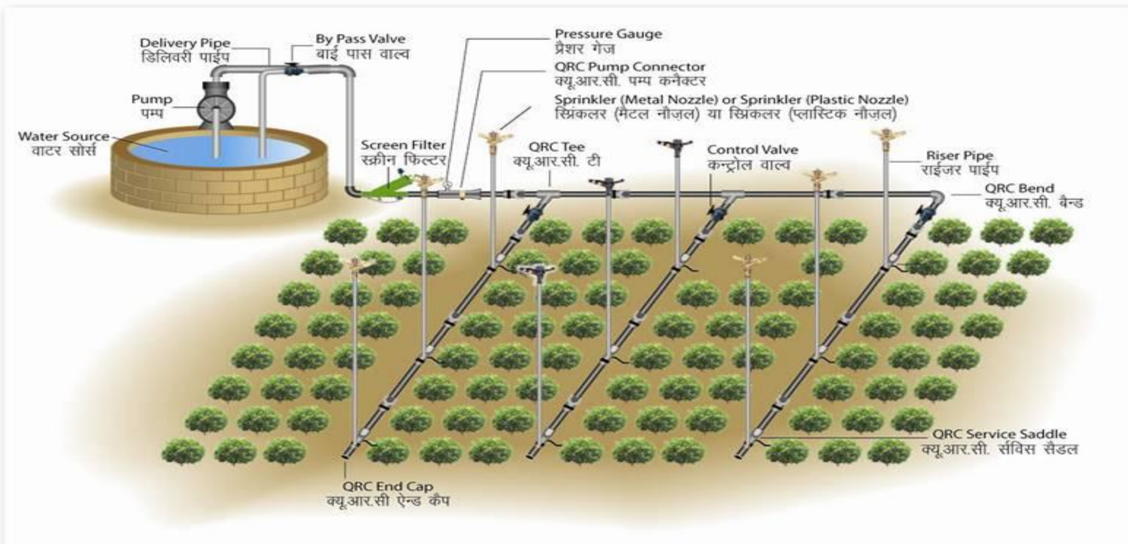


Figure 4.6: Flow diagram for website

A typical sprinkler irrigation system consists of the following components:

1. Pump unit
2. Mainline and sometimes sub-mainlines
3. Laterals
4. Sprinklers

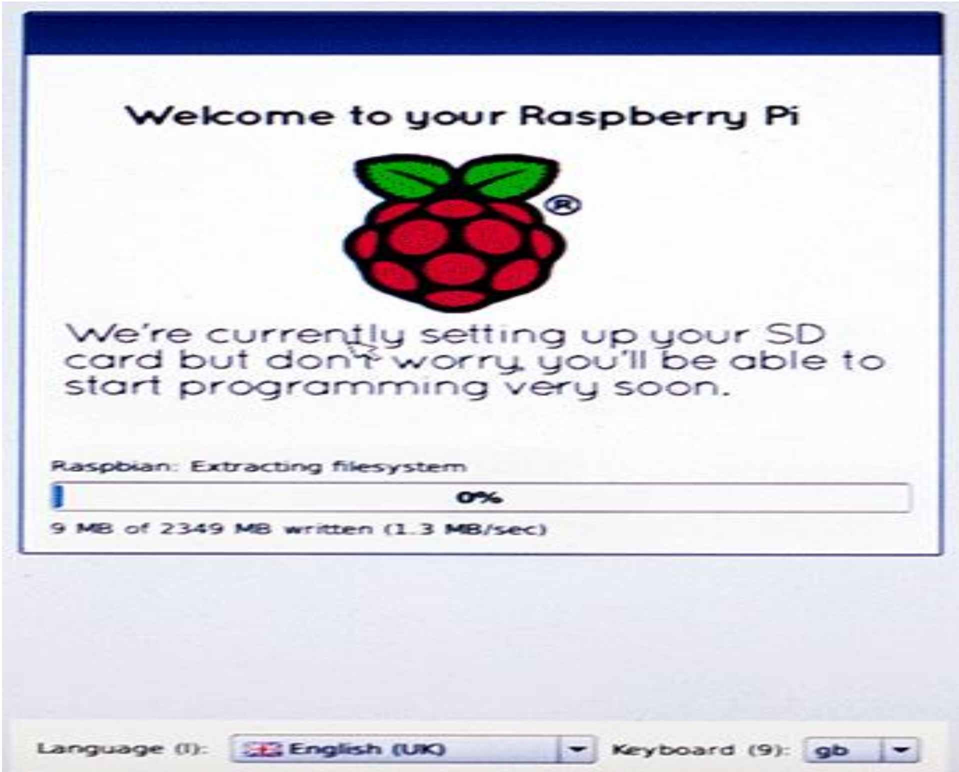


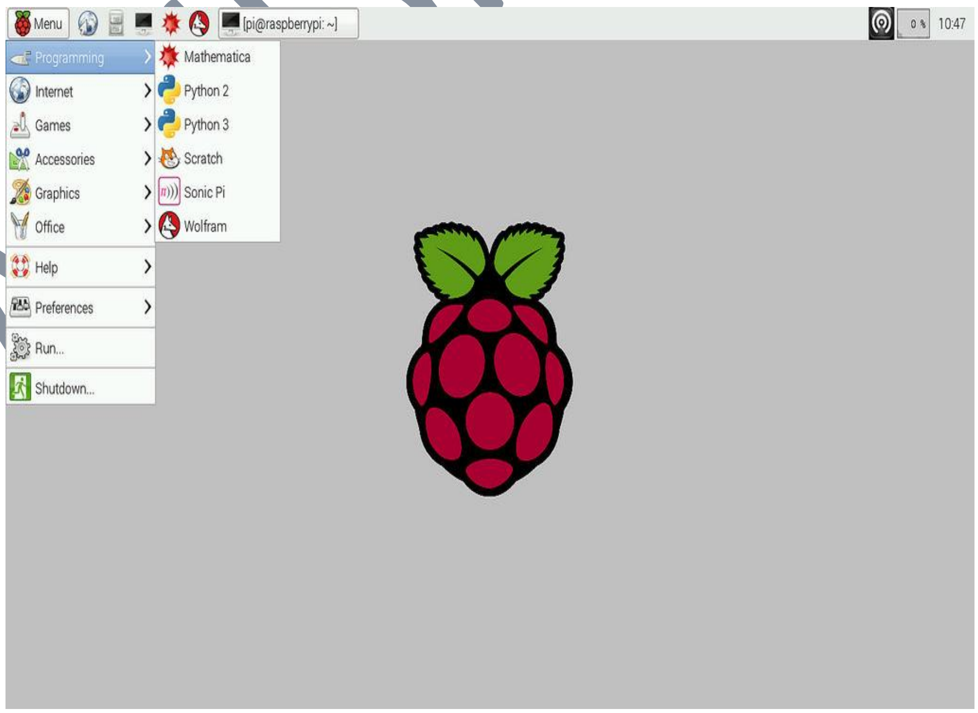
Layout of Sprinkler Irrigation System (छिड़काव सिंचाई प्रणाली का रेखाचित्र)

Fig: Layout of sprinkler irrigation system

CHAPTER 5

IMPLEMENTATION



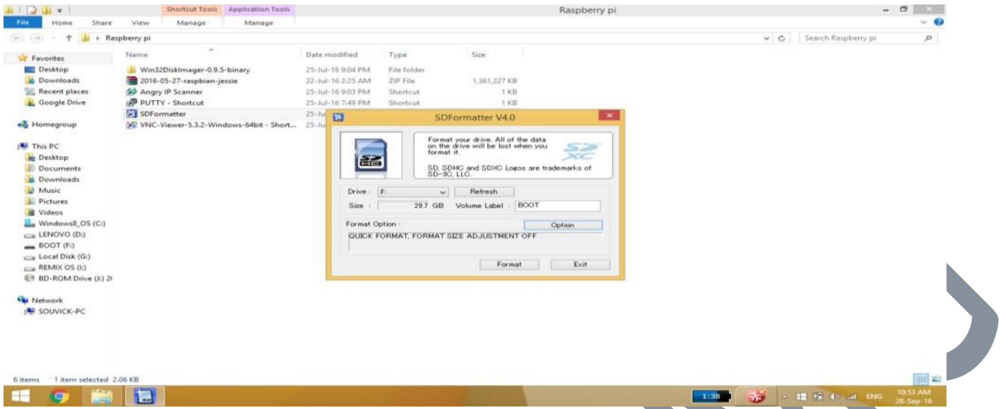


HOW TO INSTALL RASPBIAN OS IN YOUR RASPBERRY PI

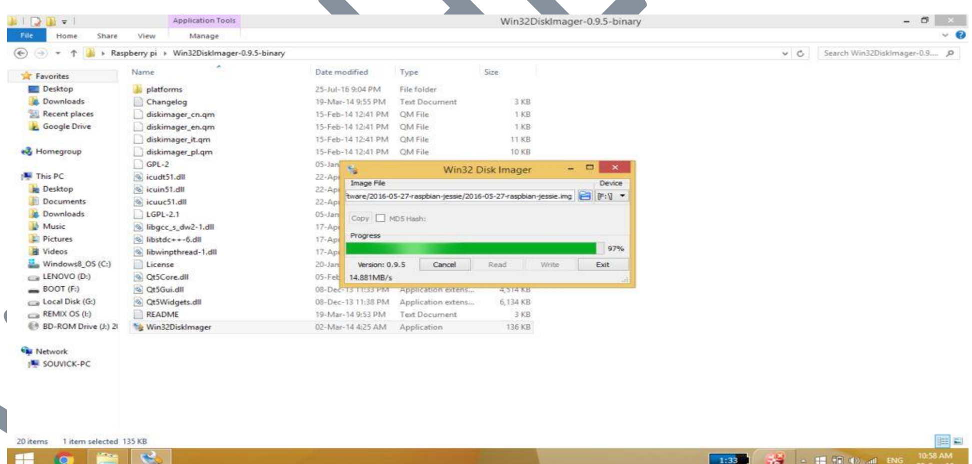
Step 1: Download the Required Software and Files

Step 2: Get the SD Card and the Card Reader

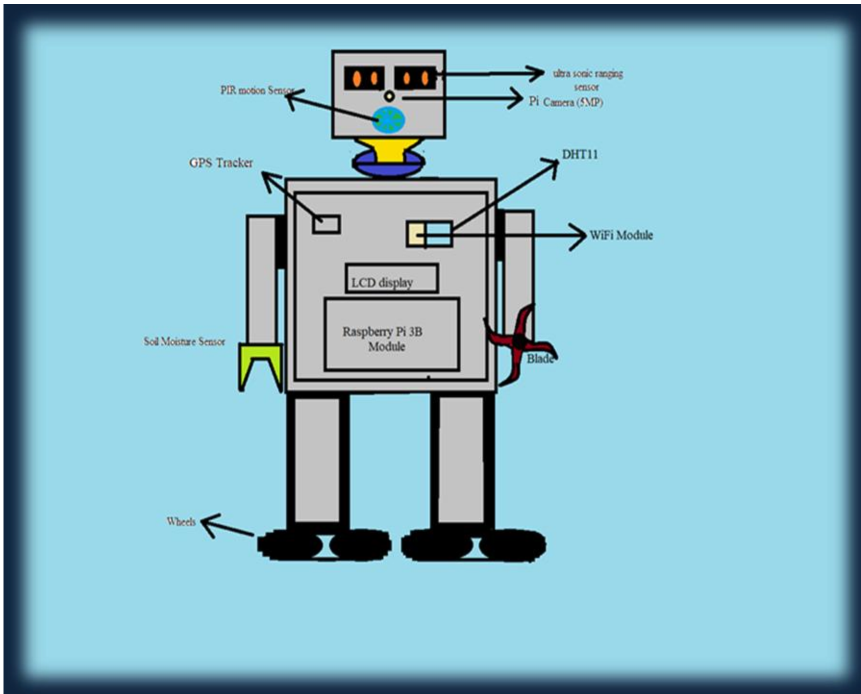
Step 3: Check the Drive in Which the SD Card Is Mounted



Step 5: Write the OS on the SD Card



Step 6: Eject the SD Card


ultra sonic ranging sensor
PIR motion Sensor
Pi Camera (5MP)
GPS Tracker
DHT11
WiFi Module
LCD display
Raspberry Pi 3B Module
Soil Moisture Sensor
Blade
Wheels

CHAPTER 6

TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionalities of components, sub-assemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the software system meets its requirements and user expectations and does not fail in an unacceptable manner. There is various type of test. Each test type addresses a specific testing requirement. System testing is performed on the entire system in the contest of Functional Requirement Specification (FRS) and/or a System Requirement Specification (SRS).

System testing tests not only the design, but also the behavior and even the believed expectations of the customer. It is also intended to test up to and beyond the bounds defined in the software or hardware requirement specifications. System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements.

System testing falls within the scope of Black box testing, and as such, should require no knowledge of the inner design of the code or logic. As a rule, system testing takes, as its input all of the “integrated” software components that have passed integration testing and also the software system itself integrated with any applicable hardware system.

6.1 Types of Tests

There are mainly two types of testing. They are unit testing and integration testing.

6.1.1 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is a testing of individual software units of the applications. It’s done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit test performs basic tests and component level and test a specific business process, application, and/or system configuration. Unit test ensure that each unique path of a business process performs accurately to the documented specifications and contents clearly defined inputs and expected results. Unit testing is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures, are tested to determine whether they are fit for use. However, one can view a unit as the smallest testable part of an application. In procedural programming, a unit could be an entire module, but it is more commonly an individual function or procedure. In object-oriented programming, a unit is often an entire interface, such as a class, but could be an individual method. Unit tests are short code fragments created by programmers or occasionally by white box testers during the development process. It forms the basis for component testing.

6.1.2 Integration Testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that all the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components. It is the phase in software testing in which individual software modules are combined and tested as a group. It occurs after unit testing and before validation testing. Integration takes as its input modules that have been unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and its output the integrated system ready for system testing.

6.1.3 Functional Testing

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals. Functionally testing is performed to verify that a software application performs and functions correctly according to design specifications. During functionality testing we check the core application functions, text input, menu functions and installation and setup on localized machines, etc. Functional testing is cantered on the following items:

Valid input: identified classes of valid input must be accepted.

Invalid input: identified classes of invalid input must be rejected.

Functions: identified functions must exercise.

Output: identified classes of applications outputs must be exercised

Systems/procedures: interfacing systems or procedure must be invoked

6.1.4 System Testing

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration-oriented system integration test. System testing is based on process description and flows, emphasizing pre-driven process links and integration points. It is the testing of a complete and fully integrated software product. It is done by professional testing agents on the completed software products before it is introduced to the market.

6.2 Test Approach

Testing can be done in two ways:

6.2.1 Bottom up Approach:

Testing can be performed starting from smallest and lowest level modules and proceeding one at a time. For each module in bottom up testing a short program executes the module and provides the needed data so that the module is asked to perform the way it will when embedded within the larger system. When bottom level modules are tested attention turns to those on the next level that use the lower level ones they are tested individually and then linked with the previously examined lower level modules.

6.2.2 Top down Approach:

This type of testing starts from upper level modules. Since the detailed activities usually performed in the lower level routines are not provided stubs are written. A stub is a module shell called by upper level module and that when reached properly will return a message to the calling module indicating that proper interaction occurred. No attempt is made to verify the correctness of the lower level module.

6.3 Verification and Validation

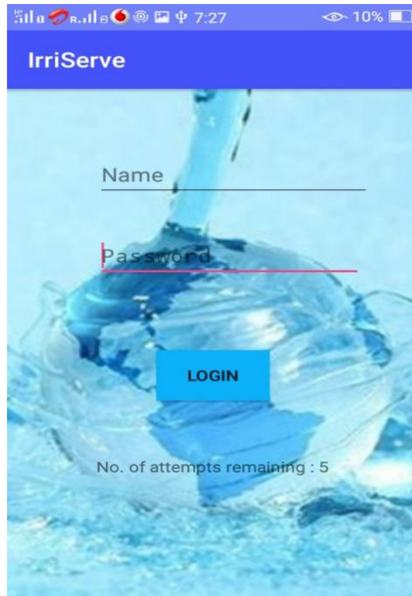
The system has been tested and implemented successfully and thus ensured that all the requirements as listed in the software requirements specification are completely fulfilled. In case of erroneous input corresponding error, messages are displayed. In software project management, software testing, and software engineering, verification and validation (V&V) is the process of checking that a software system meets specifications and that it fulfils its intended purpose. It may also be referred to as software quality control. It is normally the responsibility of software testers as part of the software development lifecycle.

CHAPTER 5

RESULTS AND SNAPSHOTS

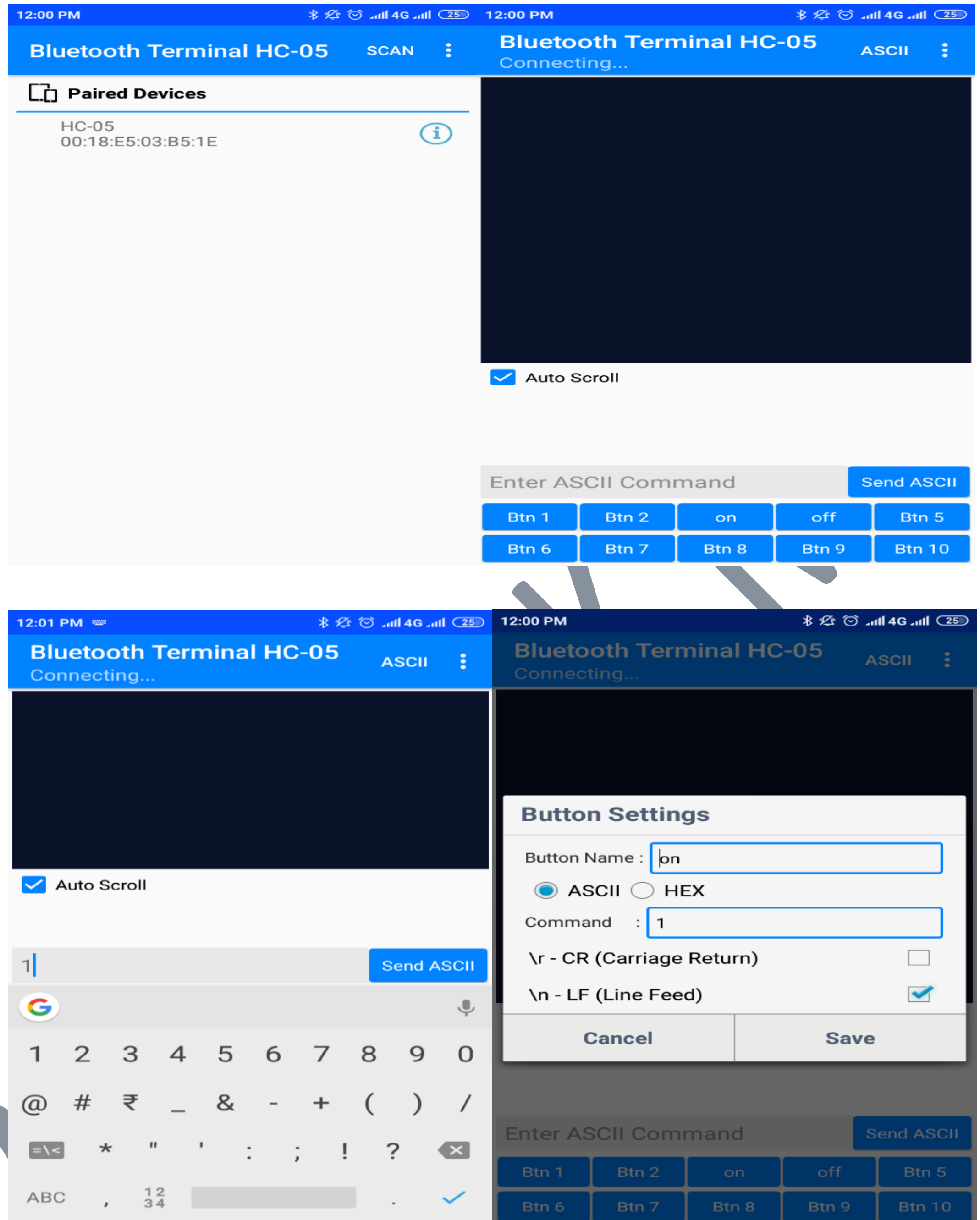
Fig 5.1 Robot


7:27
10%
IrriServe
IrriServe
WELCOME


7:27
10%
IrriServe
Name
Password
LOGIN
No. of attempts remaining : 5


7:27
10%
IrriServe
Less water....More yield
CLICK HERE FOR MORE INFO....
Soil moisture 800
Humidity 85%
Temperature 30'C


7:28
10%
IrriServe
BLUTOOTH CONNECTIVITY
WEB VIEW
MAKE A CALL



a) Bluetooth Connection b) Bluetooth Terminar

c) Bluetooth Value Passing d) Bluetooth Value setting

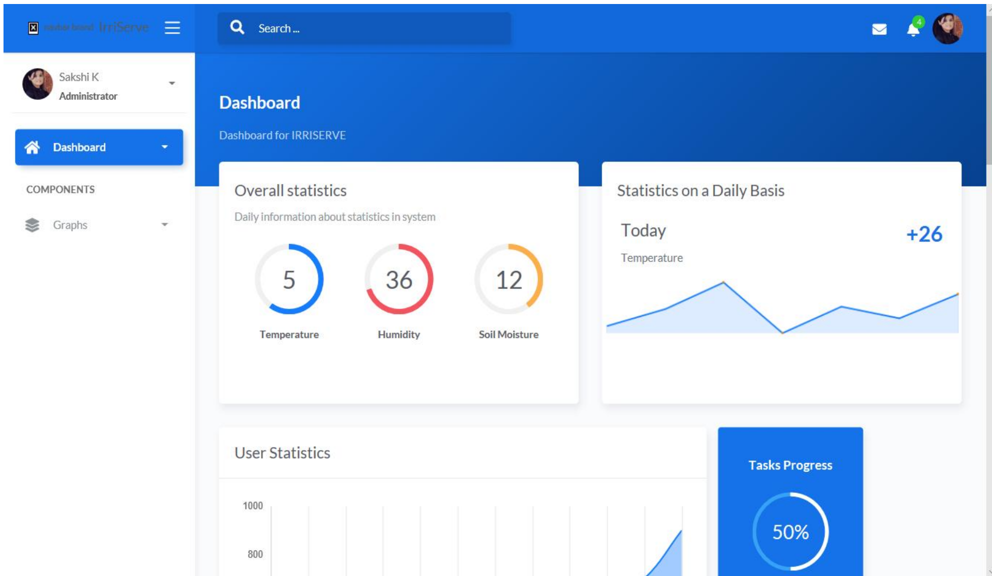


Figure 4.7: Index Page

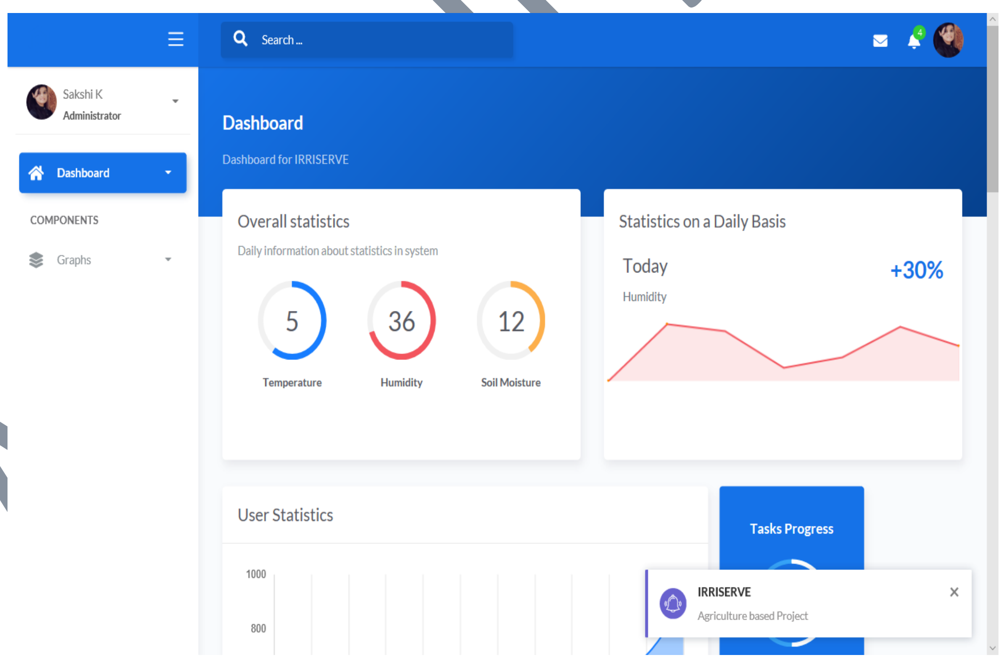


Figure 4.8: Temperature soil moisture and humidity page

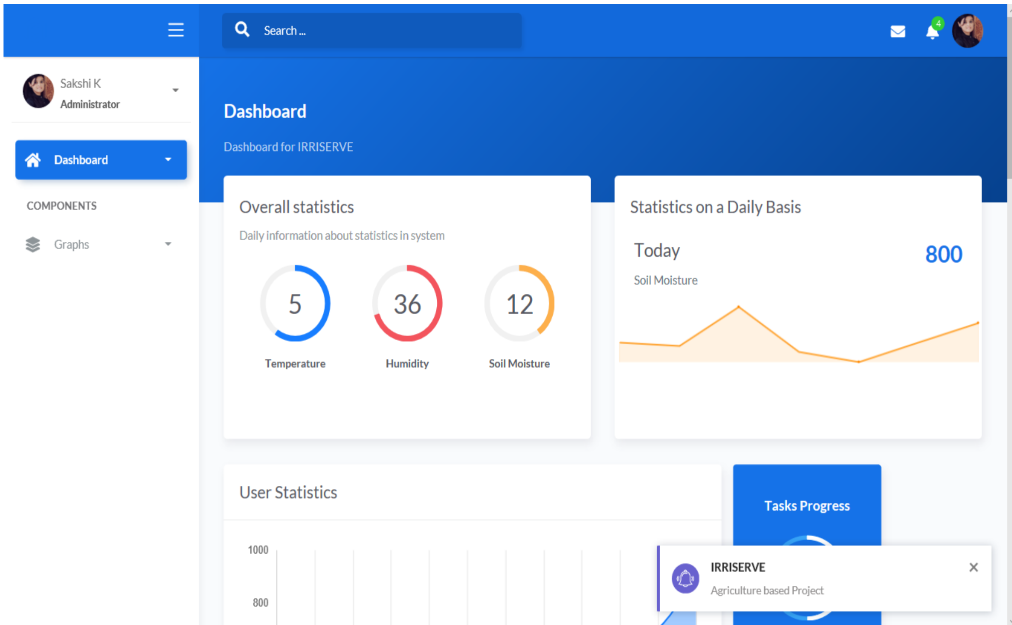


Figure 4.9: Web based soil moisture retrieval in graph

CHAPTER 8

CONCLUSION AND FUTURE SCOPE

8.1 Conclusion

The developed system IrriServe is simple and cost effective when compared to already existing systems in the market. It measures different field conditions which includes measurement of atmospheric temperature, relative humidity and soil moisture. This system uses wireless Bluetooth module for the communication and control of the Robot. So, it can be used in open fields based on the range of the wireless module up to 10meters with / without obstacles. With the use of this wireless module, the system attains flexibility, robustness, etc. The Robot can easily move all over the field and can be relocated easily. The Robot limits the wastage of water through automatic water pump and optimizes water resources to obtain better crop yield. This system is advantageous to farmers as it not only saves water but also helps the farmer to monitor the field on his behalf. Hence, the project has been made keeping both farmer's as well as environment in mind.

8.2 Future Scope

For future developments it can be enhanced by developing this project for large acres of land. Also, the system can be integrated to check the quality of soil and the growth of crop in each soil. The sensors and microcontrollers are successfully interfaced, and wireless communication is achieved between various nodes. All observations and experimental tests prove that this project is complete solution to field activities and irrigation problems. Implementation of this kind of system in the field can definitely help to improve the yield of crops and overall production.

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