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# DESIGN OF SENSING SOIL MOISTURE CONTENT BYAUTO IRRIGATION SYSTEM

[1]D.Bhargav Reddy, [2]S.MD.Saleem
[1] Student, [2] Student
[1] Master of Computer Applications
[1]Madanapalle Institute of Technology and Science, Madanapalle, Andhra Pradesh, India.

## ABSTRACT

Soil moisture index analysis is a good way to determine when and how much to water, regardless of the irrigation method. Soil moisture monitoring provides detailed information on soil moisture status, to know which crops should be irrigated in which fields. Irrigation planning through soil moisture analysis improves efficiency and can lead to improved quality, yield and profitability. Measuring soil moisture helps manage many irrigation problems. To be effective, the sensors must be placed in a field that will accurately represent how the field or area is being wetted by the system. Using sensor soil moisture values, we will classify which crops should be irrigated in the field using machine learning algorithms.

***Keywords***—Machinelearning, LogisticRegression, RandomForestAlogorithm, Statistics, datapreprocessing, Exploritive data analytics.

## INTRODUCTION

The economies of many countries depend on agriculture. To get the best quality, it is important to focus on a few characteristics such as proper water supply and proper irrigation schedule for the crop that need to be considered. Farmers around the world struggle to meet these standards, especially those living in poverty. And with continued lack of effort and delays in irrigation, their crops were unable to grow, leading to many problems. This is due to a lack of economic knowledge of methods and technologies. There are different irrigation methods such as drip irrigation, sprinkler irrigation and others, but there are always problems such as when the water is cut off, the water comes out. Agriculture industry is of great importance, so it is necessary to solve all these problems by developing smart irrigation system.

## LITERATURE SURVEY

S.P.Maniraj, Tanya Chaudhary, Akanksha Agarwal, Nandin i Kishore, Vaibhavi Verma "Irrigation Management System Using Soil Moisture Sensor and Arduino" Journal of Network Communication and Emerging Technologies (JNCET) Volume 8.
Missing Rainwater and water scarcity in reservoirs and poor water conservation
mechanisms affect food production. This prompted us to do extensive research to conserve water in agriculture. Advances in wireless sensor networks make it possible to detect several factors such as soil moisture, temperature and humidity. By deploying sensors in agricultural fields in this way for monitoring, we can save water for irrigation. This article briefly explains the automatic irrigation system using the soil moisture sensor. In the proposed system, the humidity data is updated to adjust the water pump. This article will give you a clear knowledge of the proper method for better irrigation.
NVGowtham Deekshithulu, G. Ravi Babu, R. Ganesh Babu et Many areas of agricultural fields are effectively over or under irrigated due to spatial variability in water infiltration and runoff of rainfall and irrigation, crop water use and irrigation depth. Under-irrigated areas experience water stress and loss of production, while over-irrigated areas experience crop disease and nutrient leaching.This This study presents the design of a microcontroller-based soil moisture sensor developed at the College of Agricultural Engineering, Bapatla. It was developed for the adaptation of Indian farmers to facilitate efficient use of water by replacing hardware components with software functions that enable farmers to apply the right amount of water at the right time. . The developed 8051 sensor microcontroller is designed using keil µvision 3 software for up to four sensors in each field and controls the water supply to the fields to be irrigated with a solenoid valve. Sensors present in each field will automatically stop the pump through the microcontroller when the field reaches the field capacity and the motor automatically turns on when the soil moisture reaches 70% of the field capacity. The microcontrollers then supply water to the specific field the water needs, until the sensors are disabled again. The test field of 1330 m² for growing sweet corn was selected for yield evaluation with three subplots, i.e. flood method,

single row and double row drip method. The overall reaction yield and water efficiency for growing sweet corn were highest in the single-row drip method with 7.93 tons ha-1 and 23.88 kg/ha-mm, respectively. Water applied in a drip irrigation system using a soil moisture sensor was detected as 332 mm instead of 520 mm in the flood method for sweet corn and a water saving of 36%. The total cost of the microcontroller based soil moisture sensor is Rs 3755. Compared to Rs. 10,000 automated systems are available in the market

Pavithra D.S, M. S. Srinath, "A GSM-based Automated Irrigation Control System for Efficient Resource Utilization and Crop Planning Using Android Mobile Devices," IOSR Journal of Mechanical and Civil Engineering.

Modern agriculture based on greenhouses is a recent requirement in all agricultural sectors in India. In this technology, the humidity and temperature of the plants are precisely controlled. Due to different atmospheric conditions, these conditions can sometimes vary from place to place on a large farm, making it difficult to maintain uniformity manually across all sites on the farm. very difficult. It has been observed that for the first time, an Android phone controls an irrigation system, which can provide the means to maintain uniform environmental conditions. The Android Software Development Kit provides the necessary tools and application programming interfaces to start developing applications on the Android platform using the Java programming language. Mobile phones have almost become an indispensable part of people's lives, meeting the diverse needs of people. This application uses the GPRS [General Packet Radio Service] function of the mobile phone as a solution for the irrigation control system. GSM (Global System for Mobile Communications) is used to inform the user about the exact status of the field. Information is transmitted at the request of the user in the form of SMS messages.

R. R. Suresh, S. Gopinath, K. Govindaraju, T. Devika, N. Suthanthira Vanitha, "GSM-based Automatic Irrigation Control with Raingun Irrigation System", International Journal of Advanced Research in Computer and Communication Engineering Vol.
3 number 2.

Due to the increasing population of the world, every field and every part of life is updated to increase efficiency and output. As such, it is also necessary to develop departments related to agriculture and agriculture. Lack of rain and eventually water scarcity are observed in many parts of the world. Another aspect is that there are a large number of leaks in the pipes, which wastes a lot of water. Automation is required, which is the ultimate solution to problems. This document focuses on this problem and solves problems and offers valuable practical solutions. Automated engineering is the best solution to reduce electricity, reduce water waste and increase efficiency. In order to achieve the optimal method of watering

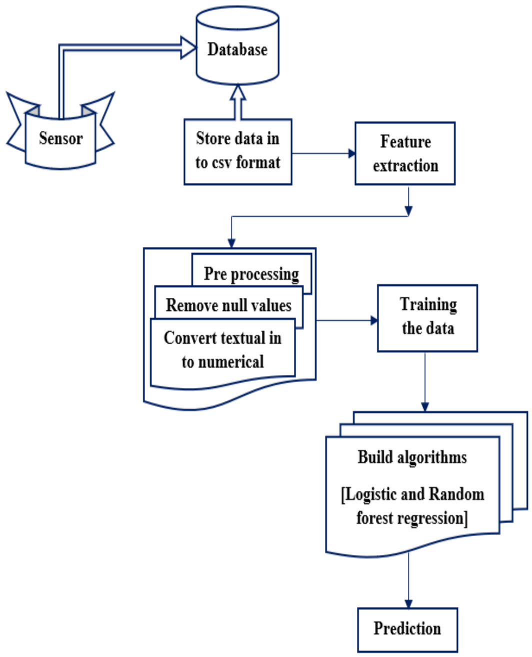
The system consists of a temperature sensor, a moisture sensor and a soil moisture sensor, which are located in the root zone of the plant. The importance of this paper includes proposing an effective method in the field of irrigation system under automatic monitoring and control system. We proposed an improved GPRS (Common Packet Radio Service). What on-board control system for irrigation. The
system automatically depends on certain parameters such as temperature, humidity and water level in the soil by reading sensors and can automatically water the field without the intervention of the farmer. Information is exchanged between the remote terminal and the designed system through the GPRS module.

Chaitali R. Fule and Pranjali K. Awachat, "Design and implementation of real-time sirrigation systems using wireless sensor networks", Proceedings of the International Journal of Advanced Research in Computing and Research manager, volume 2, number 1.

Modern agriculture based on greenhouses is a recent requirement in all agricultural sectors in India. In this technology, the water level and temperature of the plants are precisely controlled. Due
to different atmospheric conditions, these
conditions can sometimes vary from place to place on a large farm, making it difficult to maintain uniformity manually across all sites on the farm. very difficult. The farming system is used to control the entire farm through the Raspberry Pi and Android apps. Another idea is to calculate the value of pH, moisture and soil condition displayed on the 16X2 LCD screen and Android apps. It has been observed that an Android phone controls the irrigation system, which can provide the means to maintain uniform environmental conditions. The Android Software Development Kit provides the tools and application programming interfaces needed to start developing applications on the Android platform. Mobile phones have almost become an indispensable part of people's lives, meeting the diverse needs of people. This application uses the GPRS [General Packet Radio Service] function of the mobile phone as a solution for the irrigation control system.

## ARCHITECTURE AND WORKDONE

The flow for the project is given below:




## Object Detection

The main goal of this project is to develop an intelligent system that solves most of the problems related to irrigation and agriculture such as controlling and saving water and electricity, increasing agricultural production using small amounts of water. , minimizing manual intervention in irrigation operations with increased irrigation. speed, preserving plants from fungus, and finally, ease of use. All these features make these methods a sustainable option to consider for improving agriculture and irrigation efficiency.

## Proposed System

Obstacle detection for the visually impaired. I develop an Android application that

detects obstacles inthepath of a blind person and tells the

m which objects are in which direction. placed so that will help them know what's going on and turn to the right w

ay. The difficulty in obstacle detection is how to locate and separate the obstacle from the complex background. Traditional computer vision algorithms cannot handle this very well because handcrafted features are vulnerable in complex backgrounds. In this article, we use a deep complex neural network (CNN) to detect obstacles in a complex scene. CNN's deep architecture ensures that the features learned by the network are rich and effective in detecting obstacles. The results show that the model works well

## Modules UserSystem

1. **Users:**

1.1 Download Dataset():

Users can download the dataset.

1.2 Data preprocessing():

The user can preprocess the data.

1.3 Training data():

User can train data.

1.4 View data():

User can view performance data.

1.5 Show Results():

User can display the final result.2. System:

**2.1 Take dataset():**

The system can get the data.

2.2 Data preprocessing():

The system can start processing data.

2.3 Form data ():

The system can generate data.

2.4 **Performance Model():**

Data Executable System.

2.5 **Predict Result():**

The system can predict the end result.

The user can apply the model to the dataset for greater accuracy.

KITTI dataset and Open Image dataset. As you can see below, there

are different models available, different within these

models. These different models have different architectures and

thus offer different accuracy but there is a trade-off between execution speed and bounding box placement accuracy.

## ALGORITHMS

**LOGISTIC REGRESSION**

Logistic regression is a classification **algorithm** used when the **values of** the target variable **are** categorical in nature. Logistic regression is most commonly used when the data in question has a binary output, so when it belongs to one class or another it is either 0 or 1.

Here are examples of situations where you can use logistic regression: is the message spam or not
1. If the tumor is malignant or benign
2.If the mushroom is poisonous or edible

3.we will import the logistic regression algorithm from Scikit -learning.

```
from sklearn.linear_model import LogisticRegression
LogReg_clf = LogisticRegression (random_state = 0)
classifier.fit (X_train, y_train)
```

Random Forest Classifier:

Each decision tree has high variance, but when we combine all of them in parallel, the resulting variance will be low because each decision tree is perfectly trained on that particular data sample.

and thus the output depends not on one decision tree but on many decision trees. In case of classification problems, the final result is made using a majority vote classifier. In the case of a regression problem, the final output is the average of all the outputs. This section is general.

Random Forest is an aggregation technique capable of performing both regression and classification tasks using multiple decision trees and a technique known as Bootstrap and Aggregation, commonly known as bagging. The basic idea behind this is to combine multiple decision trees to determine the end result instead of relying on individual decision trees. A random forest has multiple decision trees as its basic learning model. Perform row sample and feature sample randomization from the data set to form a sample data set for each model. This section is called Bootstrap. Import the random forest regression algorithm from scikit-learning. sklearn.ensemble enter RandomForestRegressor

regressor = RandomForestRegressor (n_estimators = 100, random_state = 0)

regressor.fit (x, y)STEPS:

1. Randomly select "K" features from the total number of "m" features where k << m
   2. From "K" features, compute the "d" node using the split point best
   3. Divide the node among the child nodes according to the best division
   4. Repeat steps a to c until the number of nodes "l" is reached
2. **.EXISTING SYSTEM**
   In India, agriculture is the most essential livelihood of Indians and it is one of the main sources of livelihood. Agriculture also has a major impact on the country's economy.

Water consumption is increasing day by day, which can lead to water shortage. Nowadays, not only for plants, growing plants outdoors at home is becoming quite difficult for them. In the case of the traditional irrigation system**,** the irrigation is done manually by the **farmer. Since** water is irrigated directly **into** the **soil,** plants **are subjected to** high **pressure due to changes** in soil moisture, **which reduces** plant **appearance.**

**Disadvantages:**

1.High **temporal** resolution.
2.**Results are highly variable.**
3.Low efficiency.

## PROPOSED SYSTEM_

Today, the agricultural sector faces many difficulties due to the lack of water resources. To help farmers overcome difficulties, smart irrigation systems were used. Smart irrigation systems offer many outstanding advantages over traditional irrigation systems. Smart irrigation systems can optimize water levels based on factors such as soil moisture and weather conditions. These traditional methods cannot work effectively, so by using machine learning techniques we are able to produce accurate results. We can apply many techniques as required and we can also calculate the accuracy. Different techniques produce different accuracy, so it is important to schoose the right algorithm and model it as required. Here we use LR (logistic regression) and RF (random forest regression). Load multiple variables and predict the outcome.

Advantages:

1..Low temporal resolution.
2.High efficiency.
3.Low variable results.
4.Reduce water consumption.
5. Increase agricultural output through timely irrigation according to crop needs.

## APPLICATIONS

1. 1. It will help us save water for the next time we raise.
   2. Based on the soil moisture parameter, the farmer will plan the crops that will be used to irrigate the farm.
   3. This can help farmers better understand and track growth status/stage to make informed decisions.farmers in making significant and potentially costly decisions, such as rain, moisture, and temperature when and how much to irrigate.

## STEPS FOR EXECUTING THE PROJECTS

1. Import the library/package.
2. Load a CSV file (comma separated values).
3. Displays the first five lines of the CSV file.
4. Display basic sample data information.
5. Brief statistical description of the sample data.
6. Check if the sample data set contains null values.
7. If it contains zeros, fill in with zeros using the mean, median, or mode.

8

Fill in null values using the newly calculated value.

9. Calculation of soil types in the dataset.
10. Graphical representation of soils using counters.
11. Graphical representation of crops in the data set follows the count chart.
12. Convert text values to numeric values for later use.
13. Separate X (independent variable) and Y (dependent or target variable).
14. Apply train_test_split algorithm to separate the dataset for training and testing purposes.
15. Now start applying logistic regression algorithm on your preprocessed data
16. Adjust the dataset for training purposes in the algorithm.
17. Apply the exact scoring algorithm and calculate the precision of the regression algorithm.
18. Predict the outcome.
19. Apply another algorithm, calculate the accuracy and predict the result.
20. Create data frames for applied algorithms.
21. Algorithm and accuracy representation by bar graph.

SYSTEM 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 functionality of components, sub- **Assembly, Assemblies** and/or **Finished Goods The** process of **running** software **for** the **purpose** of ensuring that **a software** system meets its requirements and user expectations and does not fail in unacceptable **ways.** There are various types of test. Each test type addresses a specific testing requirement.

## TYPES OF TESTS

Unit testing involves the design of test cases that confirm that the internal logic of the program works correctly and that the program input produces valid output. All decision branches and internal code flows must be authenticated. This is testing the individual software units of the application. It is performed after the completion of an individual unit before integration. It is a structural test, based on knowledge of its structure, and is an invasive test. Unit testing performs basic component level testing and tests a particular business process, application, and/or system configuration. Unit testing ensures that each unique path of the business process works exactly according to documented specifications and contains clearly defined inputs and expected results.

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Integration testing

Integration tests are designed to test integration software components to determine if they actually run as a single program. Tests are event-driven and biased towards the underlying results of the screen or field. Integration tests demonstrate that although components worked individually, as indicated by successful unit tests, the combination of components was correct and consistent. Integration testing specifically aims to expose problems caused by a combination of components.

*Functional test*

Functional testing provides systematic demonstration that the tested functions are available in accordance with business and technical requirements, system documentation and user manuals.

Functional testing focuses on the following:

Valid input: Classes defined as valid input must be accepted.

Invalid input: classes defined as invalid input should be discarded.

Functions: defined functions must be implemented.

Output: The specified application output classes should be executed.

System/Procedure: The intersecting system or procedure must be called.

Organize and prepare functional testing focusing on requirements, key functionality or special test cases. In addition, systematic coverage involves defining business process flows; Data fields, predefined procedures, and subsequent procedures must be taken into account for testing. Before functional tests are completed, additional tests are determined and the efficacy value of existing tests is determined.

**SYSTEM TEST**

System testing ensures that the **overall** integrated software system meets requirements**.** It checks the configuration to make sure the results are known and predictable. An example of system testing is configuration-oriented system integration testing. System testing is based on process descriptions and flows, with emphasis on process linkages and pre-piloted integration points.

*White Box Testing*

White box testing is a test in which the software tester knows the inner workings, structure and language of the software, or at least its purpose. That's the point. It is used to check the areas inaccessible from the black box level.

*Black Box Testing*

Black Box testing tests the software without any knowledge of the inner workings, structure or language of the module under test. Black box testing, like most other types of testing, must be written from a final source document, such as a specification or requirements document, such as a specification or requirements document. bridge.

This is a test in which the software under test is treated as a black box. You cannot "see" into it. The test provides input and output feedback regardless of software operation.

**Unit Testing:**
Unit testing is usually conducted as part of the combined coding and unit testing phases of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted in two separate phases. separate.

Testing Strategy and Approach
Field testing will be done manually and functional testing will be written in detail.
Objectives of the test
1. All field inputs must work correctly.
2.Pages must be activated from the specified link.
3.Input, message and response screens are not delayed.
**Features to be tested**

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

**Integration Testing**
Software integration testing is incremental integration testing of two or more software components integrated on a single platform to produce bugs caused by interface failures. The task of integration testing is to verify that software components or applications, e.g. components of a software system or - a step further - enterprise-grade software applications - interact no erroTest Results: All the test cases mentioned above passed successfully. No defects encountered.
**6.3 Acceptance Testing**
User acceptance testing is an important phase of any project and requires significant end-user involvement It also ensures that the system meets functional requirements**.**
Test Result: All the above mentioned test cases pass. No errors were encountered.
Arduino
Arduino is an easy-to-use open source step-by-step computer program and device. The Arduino leaves can look at the inputs - light on the sensor, finger on the button or Twitter message - and turn them into outputs - turn on the motor, turn on the Driver, deliver something online. You can tell your board what to do by sending a set of flash to the microcontroller on the board. To do this, you use the Arduino programming dialect (based on wiring) and the Arduino computer program (IDE), processor, and other open source software.
Moisture Sensor
The soil moisture sensor consists of two tests that are used to measure the volume of the substance of water. Both tests allow current to flow through the ground, giving a resistance estimate at a moisture estimate. When water is present, the ground will be more conductive**,** which implies that there will be less drag. Dry soil conducts electricity less efficiently, so when there is less water present, the soil will conduct electricity less efficiently, which means more resistance.

Temperature Sensor
The temperature sensor is as accurate as it sounds - a sensor used to measure the ambient temperature. This particular sensor has three pins - an anode, a ground, and a flag. This is a simple temperature sensor. A one-degree Celsius change in temperature is converted to a 10 millivolt change at the sensor's output. The TMP36 sensor has a visible voltage of 750 mV at 25°C (around room temperature). In this circuit you will learn how to combine a temperature sensor with
Red Board or Arduino Uno R3, and utilize the Arduino IDE’s serial screen to show the temperature.

## CONCLUSIONS

**A** soil moisture sensor measures the amount of moisture **in** the soil.. Soil moisture is an important part of the atmospheric water cycle. The growth of agricultural products depends on soil moisture. So it is necessary to know the soil moisture in the farmer's farm in agriculture. The proposed method predicts the crops used for irrigation in the farm based on soil moisture, temperature and humidity. Using our own sensor-gathered data sets, we were able to select crops that are appropriate for this situation.

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