IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 6, June Month 2021

DOI 10.17148/IJARCCE.2021.106131

IRRIGATION MANAGEMENT USING IoT and MACHINE LEARNING

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Abstract: An automated irrigation system was developed to enhance production of crops. The system consists of sensors placed within the root zone of the plants. Additionally, sensor information is handled by a gateway unit, which transmits data to a mobile application. An algorithm was developed which can predict threshold values of temperature and soil moisture into a micro controller-based gateway. The system was supported by a cellular-Internet interface that allows data inspection and irrigation scheduling through a mobile application. The automated system was tested, and overall efficiency increased up to 90% compared with traditional irrigation practices of the agricultural zone. The system has the potential to be useful in geographically isolated areas.

INTRODUCTION

The Smart Irrigation System is an IoT based device designed to automating the irrigation process by analyzing the temperature, humidity, light and the climate condition. Parameters are measured through the sensors and the sensed values are displayed on cloud platform and also on a mobile application .The need of automated irrigation system is to stop over irrigation and under irrigation. the aim of smart irrigation system is that to defeat the traditional methods of cultivation done by farmers. In the traditional methods the farmer did everything manually, by user interaction with the motors, pump etc. This conventional method was not efficient and had unpredictable output. the traditional methods were tormented by conditions like under irrigation and over irrigation. The farmer unable to complete everything in a very particular time and frequently this led to decreased output and poor management. Thus, there came the necessity to automate it and make an efficient irrigation system in order to improve it. The shortcomings of the regular Smart irrigation system were it only worked for paddy crop. Only the temperature predictions were being calculated in real time.Advanced control features were absent which are included in these three cases Connectivity issues were there which were resolved, and good connectivity has been provided. within the previous version there was no choice to control it from any third-party apps on the market. There were problems with data transfer which had an impact on the system. Performance optimization has been provided here Hence; we are re-engineering the system which might be very accurate in nature thanks to the assorted machine learning techniques which are applied on thereto so on make the system as efficient as possible in nature. Thus, during this effort we aim to advance the Irrigation system which offers complete automation through parameters like temperature, water content, humidity, light etc. , then predicting the future values and consistent with these predictions controlling the whole process on its own and hence making the method fully automated in nature.

PROBLEM STATEMENT

The economy of the many countries depends on agriculture, it's important to specialize in some vital characteristics like the sustainable source for generation of electricity for irrigating crops. Farmers face problems in meeting these standards, especially those living in poverty. This idea investigates developing an automatic irrigation system that would be controlled through mobile application. This method will help attenuate the number of workers in an exceedingly crop field, control and save water and electricity, increase agricultural production using small quantities of water, lower manual intervention in watering operations by increasing the watering speed and preserving plants from fungi. These features make this research a sustainable choice to be considered to enhance the agricultural and irrigation efficiency.

OBJECTIVES

•To make the system completely automated by taking in parameters like temperature, water content, humidity and light
•To predict the longer-term values and in keeping with these predictions controlling the complete process on its own and hence making the method fully automated in nature.
•To alert and control through Telegram App, which basically ensures that the user can get real time information.
•To optimize water consumption and decrease the value of operation.
•To visualization of temperature data using polynomial visualizer.

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MOTIVATION

Farmers working within the farmlands are solely captivated with the rains and bore wells for irrigation of their land. In recent times, the farmers are using traditional methods through which the manual controlling was done they irrigate the land by toggling the water-pump ON/OFF whenever required at regular intervals. they'll should travel up to now for switching on/off the motor, they will be laid low with hot sun, rain and dark. After reaching their farm during a power cut they are unable to work to resolve of these problems, we can use smart irrigation system

BLOCK DIAGRAM

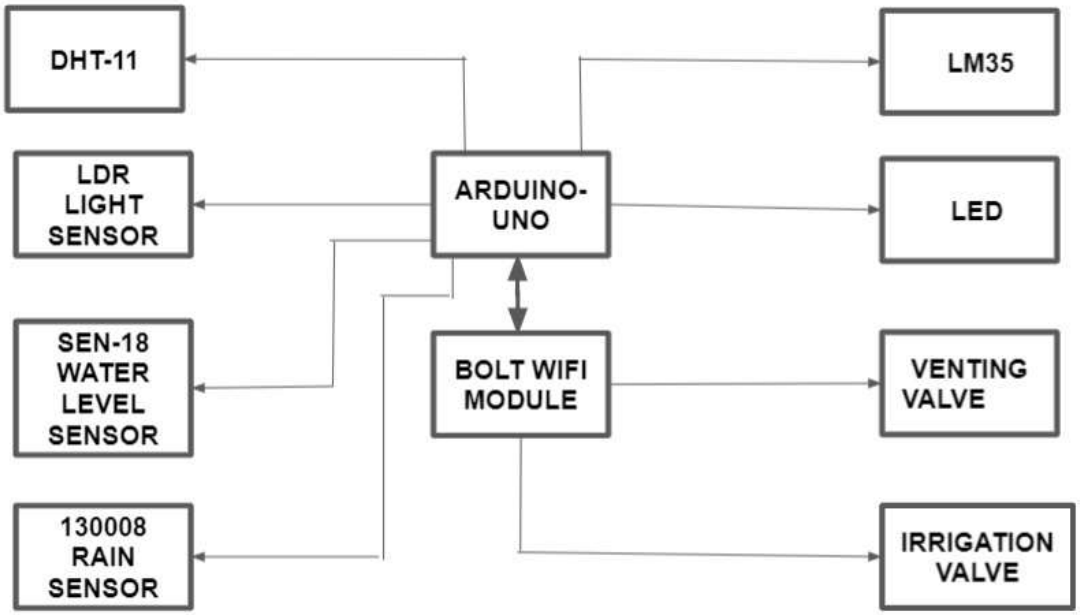

Figure 1

TEMPERATURE SENSOR (LM35) A temperature sensor is sensor to live the ambient temperature. This sensor consists of three pins –a positive, a ground, and a flag.

LEVEL SENSOR The water-level pointer is used to demonstrate the water level within the tank, by using this sensor we are able to control the flood of the water still know the amount of the water within the tank, and at any time we are able to know the water level within the tank

LIGHT SENSOR a lightweight Sensor could be a gadget that recognizes light. It creates a yield flag that's like the escalated of sunshine. a light-weight sensor measures the brilliant vitality display within the wide run of frequencies within the light range. some of the common frequencies are infrared, obvious and bright.

RAIN SENSOR A rain sensor may be a switching device activated by rainfall. the applying may be a water conversation device connected to an automatic irrigation system that causes the system to clean up within the event of rainfall.

SERVO MOTOR A servomotor could be a positioner or linear actuator that permits for precise control of angular or linear position, velocity and acceleration of a liquid. It consists of a motor coupled to a sensor for feedback.

HUMIDITY SENSOR (DHT11) is commonly used for Temperature and humidity checking. The sensor comes with a zealous NTC to live temperature and an 8-bit micro controller to output the values of temperature and humidity as serial data. The sensor is additionally factory calibrated and hence easy to interface with other micro controllers

BOLT WIFI MODULE It connects to the Bolt Cloud out of the box. Comes with GPIO, ADC and UARTI 2 C and S PI via Arduino Adaptor. Bolt IoT platform gives you the potential to regulate your devices and collect data from IoT devices safely and securely regardless of where you're. Get notifications by deploying machine learning algorithms just through some clicks,and to detect defects future as predict sensor values.

ARDUINO UNO The Arduino uno is an open-source micro controller board supported the Microchip A T mega 328P microcontroller. The board is equipped with sets of digital and analog input/output(I/O) pins that will be interfaced to varied expansion boards(shields) and other circuits .The board has 14 digital I/O pins and 6 analog I/O pins, and is programmable with the Arduino IDE, via a kind B USB cable. It may be powered by the USB cable or by any 9-volt battery, though it accepts voltages between 7 and 20 volts

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METHODOLOGY

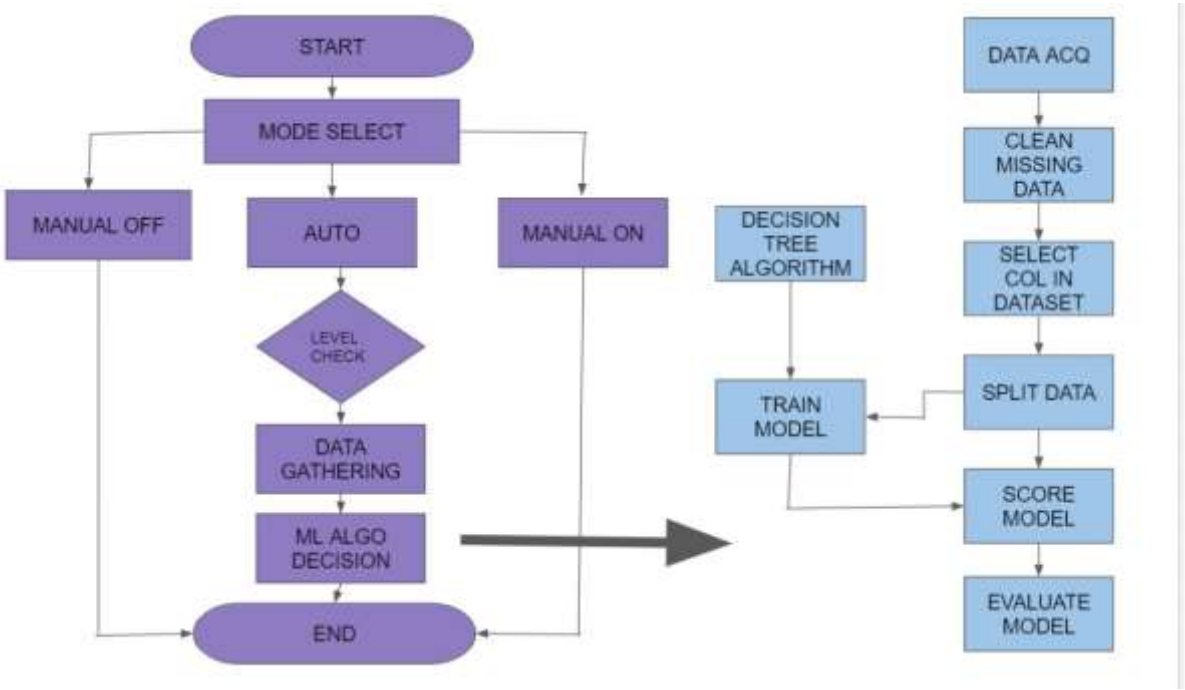

Figure 2

MACHINE LEARNING

Machine learning (ML) is the scientific study of algorithms and models that computer systems can use to perform a task without using explicit instructions, looking forward to patterns and inference instead. it is seen as a branch of a computer science. Machine learning algorithms build a mathematical model to support sample data, referred to as "training data", to create predictions without being specifically built to perform the task.

DECISION TREE

Decision Tree algorithm is a supervised learning algorithm. Unlike any other supervised learning algorithms, the choice tree algorithm is often used for solving regression and classification of problems too. The goal of employing a Decision Tree is to make a training model which will use to predict the category or value of the target variable by learning simple decision rules inferred from prior data (training data). In Decision Trees, for predicting a category label for a record we start from the bottom of the tree Types of decision trees are supported the sort of target variable we've. It is of two types

1. Categorical Variable Decision Tree: Decision Tree which contains a categorical target variable then it called a Categorical variable decision tree
2. Continuous Variable Decision Tree: Decision Tree has a continuous target variable then it is called Continuous Variable Decision Tree

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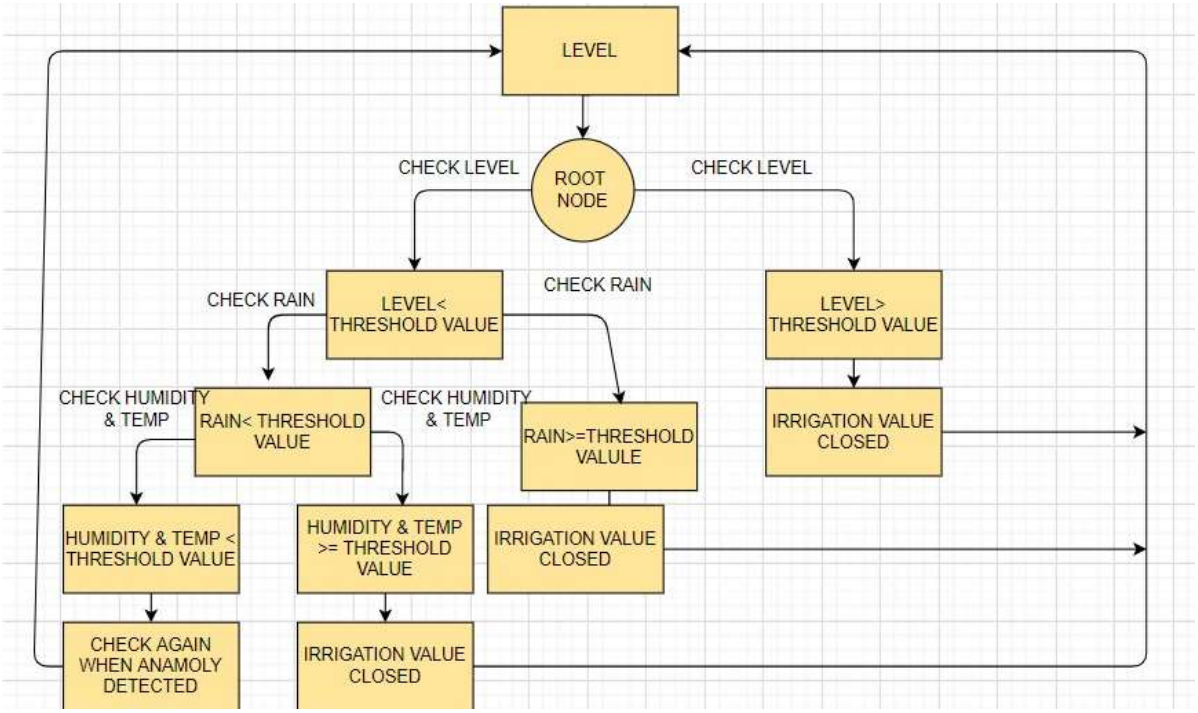

Figure 3

RESULT

A complete automated system by taking in parameters like temperature, water content, humidity and light is build using various machine learning models and the best model is chosen among the tested algorithms. To predict the longer-term values and in keeping with these predictions controlling the complete process on its own and hence making the method fully automated in nature. An alert system was successfully built and the application used to control the automation process is Telegram App, which ensures that the user can get real time information. To optimize water consumption and decrease the value of operation the automation has been carried out. Temperature visualization is performed used polynomial visualizer. Figure 4 illustrates the machine learning model with the telegram app in use in parallel to the execution of the model. Figure 5 depicts the working of the Telegram app and gives us an idea about functionalities of an automation irrigation system.

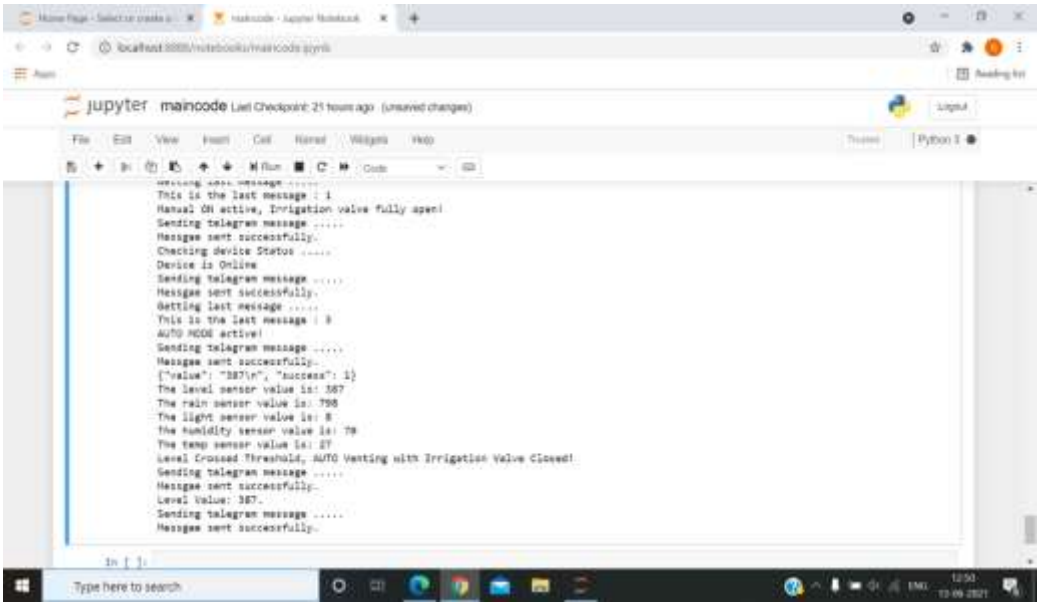

Figure 4

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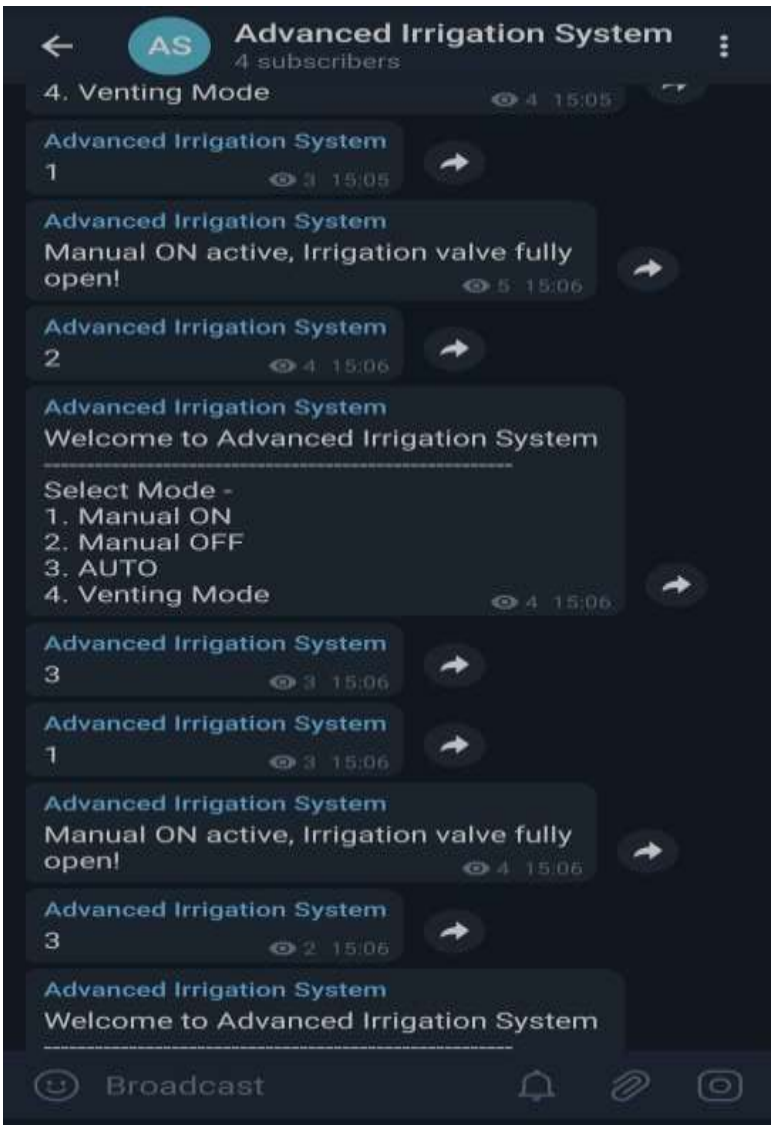

Figure 5 CONTROL THROUGH MOBILE APPLICATION

CONCLUSION

The automated irrigation system implemented was found to be feasible and value effective for optimizing agricultural production. This system allows cultivation in remote areas thus improving sustainability. The automated system developed proves that the use of traditional methods is not as effective. the employment of machine learning during the irrigation process is significantly important for organic crops and other agricultural products that are in remote areas, where the investment in manpower and workforce would be expensive. The irrigation system is often adjusted to a range for desired crop's needs and requires low maintenance. The modular configuration of the automated irrigation system allows it to be scaled up for larger fields. The app-controlled system provides a robust decision-making concept for adaptation of farmlands. Furthermore, the mobile app allows the supervision through mobile devices, like a smartphone. Besides the monetary savings the importance of enhancing efficiency justify the utilization of this kind of irrigation systems.

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