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MACHINE LEARNING SYSTEM ON PLANT GROWTH USING AQUACULTURE

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Abstract - High increment price of human populace brings approximately the necessity of efficient usage of worldwide assets. One way of attaining that is providing the vegetation with the top-quality amount of water at the proper time in agricultural applications. In this paper, a cloud primarily based drip irrigation gadget, which determines the amount of irrigation water and plays the irrigation method robotically, is offered. Essentially, water stage in a class A pan is continuously measured via a water level sensor and period of irrigation is calculated the use of overall amount of level decrement in a given time c language. The irrigation manner is initialized by way of powering solenoid valves thru a microcontroller board. To degree the environmental quantities such as temperature, humidity and stress, a further sensor is included within the device. A GSM/GPRS module enables net connection of the system and all of the sensor statistics as well as machine fame facts are recorded in a cloud server. Furthermore, an accompanying Android software is developed to screen the immediately status of the machine. The device is examined on a strawberry field in a greenhouse. Currently, it's miles energetic for about 4 months and primary observations mean that the system is capable of efficaciously perform the irrigation undertaking.

Keyword: automatic irrigation; internet, cloud, water, strawberry, agriculture

1. INTRODUCTION

The world populace has visible an explosion with the advancements of the era in the remaining a long time. Due to this large boom inside the global population, the required quantity of meals manufacturing is accelerated. In an effort to gain this, new procedures such as hydroponics, vertical farming, biotechnology, etc. are being carried out. Alternatively, development of methods for effective usage of water sources is needed because shortage of water components, which is one of the leading results of rising weather change, is on the upward thrust [1]. Consequently, it turns into inevitable to consist of automation and facts processing techniques in modern-day agricultural irrigation structures on the way to optimize the water usage.

The machine advanced by way of Gutiérrez et al. consists of soilmoisture and temperature sensors for information collection, a gateway unit for triggering actuators and net connection, and an internet application for monitoring and programming of the device [3]. Their system changed into examined on a sage crop field and executed water savings up to 90% in comparison with conventional irrigation practices. In any other paintings, irrigation scheduling for cucumber is accomplished through a standalone clever irrigation machine with ZigBee and GPRS communication abilities [5]. The device is programmed to keep the soil moisture above 17%. Irrigation control is performed via fuzzy common sense method which makes use of sensor statistics which include soil moisture, ambient temperature, solar radiation and amount of water ate up. Drought strain and irrigation in potted plants are controlled the use of an automatic device proposed by way of Nemali and Iersel [6]. The system consists of a dielectric moisture sensor, records logger and solenoid valves. In this gadget volumetric water content of a substrate is measured each 20 mins and irrigation is controlled according to this measurement. A solar powered and flexible drip irrigation gadget is developed by Dursun and Özden [eight]. Their paintings entails generating a soil moisture distribution map in an orchard. That is finished by placing some of soil moisture sensors and an synthetic neural network model. Using this device, useless irrigation is prevented and consequently water and strength intake is decreased. In a rather current paintings, laptop and mobile modules are advanced for facilitating irrigation scheduling inside the strawberry sector particularly at some stage in the crop season [13]. The irrigation time inside this device is calculated by the use of a formerly constructed database. Which includes diverse agricultural facts confirmed to be affecting the irrigation necessities.

Despite the fact that there are various strategies for irrigation automation within the literature, structures using evaporation pans offering cloud connection is not cited. In evaporation pan applications, the pan is hooked up in a greenhouse and the water degree within the pan is determined on a normal basis. At a given time c language, the water loss inside the soil is anticipated consistent with the amount of water evaporated from the pan. Conventionally, the water degree in the pan is located with bare eyes and the valves are controlled manually. This approach brings some negative aspects along with losing time and electricity.

In this take a look at, a cloud-based automatic drip irrigation gadget that includes size of the water degree in a category-A evaporation pan is proposed. Measurements from a water degree sensor connected to the pan and an environmental sensor are continuously transmitted to a microcontroller that controls the solenoid valves. The use of a GSM/GPRS module, the received sensor data and device fame associated facts are sent to a cloud server. Opening hour of the valves and irrigation frequency are decided with the aid of the consumer. Alternatively, the period of irrigation is mechanically calculated consistent with the water stage decrement in the pan. Also, an Android application is advanced to display device repute remotely and update the

water stage information within the cloud. Block diagram of the system is provided in Fig. 1. The machine components are brought in section II. Experimentation of the gadget on a strawberry greenhouse area is given in element in phase III. Segment IV carries the conclusions and future paintings.

2. THE IRRIGATION SYSTEM

The irrigation system entails 4 essential parts that are power & actuator, facts amassing, manage & net connection, and monitoring. These gadgets are precise in the approaching subsections.

A. electricity & Actuator Unit
A transformer and solenoid valves constitute this unit. The solenoid valves are opened when 24V AC is carried out to their terminals. Therefore a transformer to reduce the 220V AC line voltage to 24V AC is utilized to strength the solenoids. Switching of the solenoids is achieved through sending manage indicators from the controller unit to the relays positioned on solenoid power cables.

B. records amassing units
This unit consists of a water stage sensor, an environmental sensor and a transceiver module. these additives are connected to a microcontroller board primarily based on ATmega328P (Atmel organisation, San Jose, CA).
The water stage sensor PN-12110215TC-8 (Milone technologies, Sewell, NJ) is constant inside of the evaporation pan to continuously measure the water degree. Via the environmental sensor BME 280 (Bosch Sensortec GmbH, Germany) temperature, humidity and barometric strain inside the greenhouse medium are measured. The transceiver module NRF24L01+ (Nordic Semiconductor, Trondheim), allowing RF conversation at 2.four GHz frequency, is used for transmitting those four measurements to govern & net connection unit.
A calibration method is required for efficient usage of the water level sensor. despite the fact that the sensor output is claimed to be close to linear within the sensor datasheet, lower take a look at errors is carried out while a quadratic model for calibration curve is used in preference to the use of a linear model. For this reason, when filling the empty pan with water, the output voltage examine from the sensor is recorded at each 5 mm of degree increment. subsequent, coefficients of a 2d order polynomial to those levelvoltage pairs are calculated the usage of least squares method.

C. Control & net Connection Unit.
The components of this unit are actual-time clock (RTC) module, transceiver module and GSM/GPRS module.

Processing of the information from these modules and execution of the instructions are performed on a microcontroller board primarily based on ATmega2560 (Atmel organisation, San Jose, CA).

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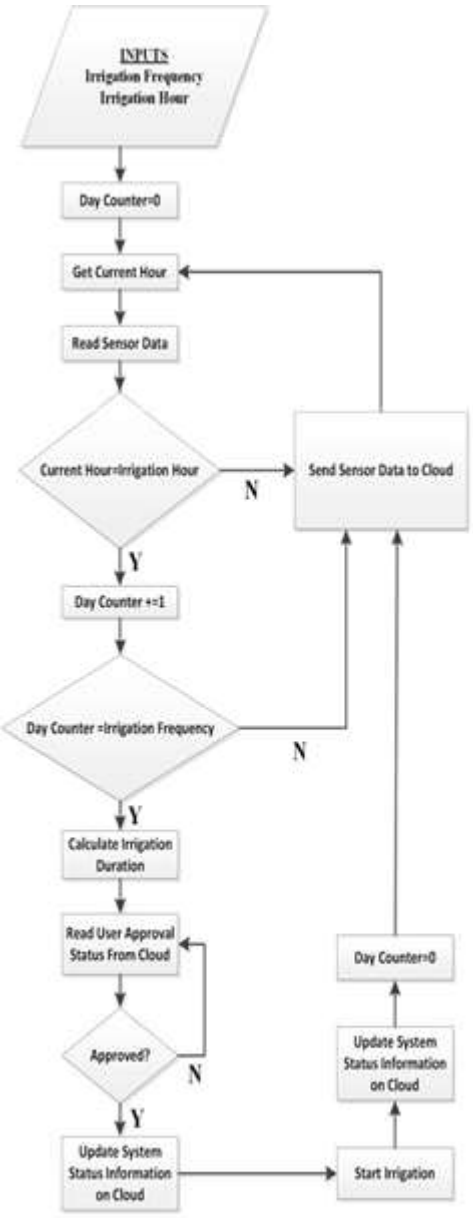

Fig. 1. Block Diagram of the Irrigation System

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The RTC module DS 1302 (Maxim incorporated, Sunnyvale, CA) is used for immediate reading of nearby time and date. This facts is needed to determine while to generate manipulate signal to initialize the irrigation manner. The use

of the transceiver module NRF24L01+, a wi-fi communique is setup with information gathering unit and the measured information are received. The net connection of the device is accomplished through the GSM/GPRS module, SIM900 (SIMCom, Shanghai, China). A SIM card is connected to the GSM/GPRS module and the usage of a chain of AT instructions, the sensor records as well as machine fame associated records which include country of solenoid valves (openclosed), date and period of last irrigation are send to a cloud provider.

D.tracking Unit

The tracking unit includes an Android application developed using MIT AppInventor [14]. The software permits the user to test the modern-day status of the machine and look at the instant environmental situations inside the greenhouse. Furthermore, it's far possible to replace the water degree statistics the use of the utility. This may be necessary when the evaporation pan is refilled with water or when the analyzing from the water degree sensor is not correct enough.

The software screen is divided into 4 important components with horizontal crimson stripes (Fig. 2). The topmost element carries modern sensor facts. In the 2d element, water level records as well as measurement date and time statistics for remaining two irrigations are supplied. Modern states of valves, period and starting time of closing irrigation are given inside the 0.33 element. The valve nation facts are color-coded where red way valve is closed and inexperienced approach valve is open. The bottom element is for consumer intervention. The usage of the textbox, the person is able to replace the water stage statistics. Except, the general status of the system is furnished in this part. This fame may also either be passive, energetic, or watching for consumer approval. If all the valves are closed, the popularity is passive. Similarly, the popularity is energetic if any of the vales is open. The popularity is looking ahead to consumer approval best at the scheduled irrigation time. On this country, an enter from the person for the water degree is prompted and the irrigation is initialized only after send button is tapped.

3. APPLICATION

The system is deployed in a high tunnel region (a form of greenhouse) interior studies fields of Çukurova University, Agriculture College and examined on cultivation of strawberries (Fig. 3).

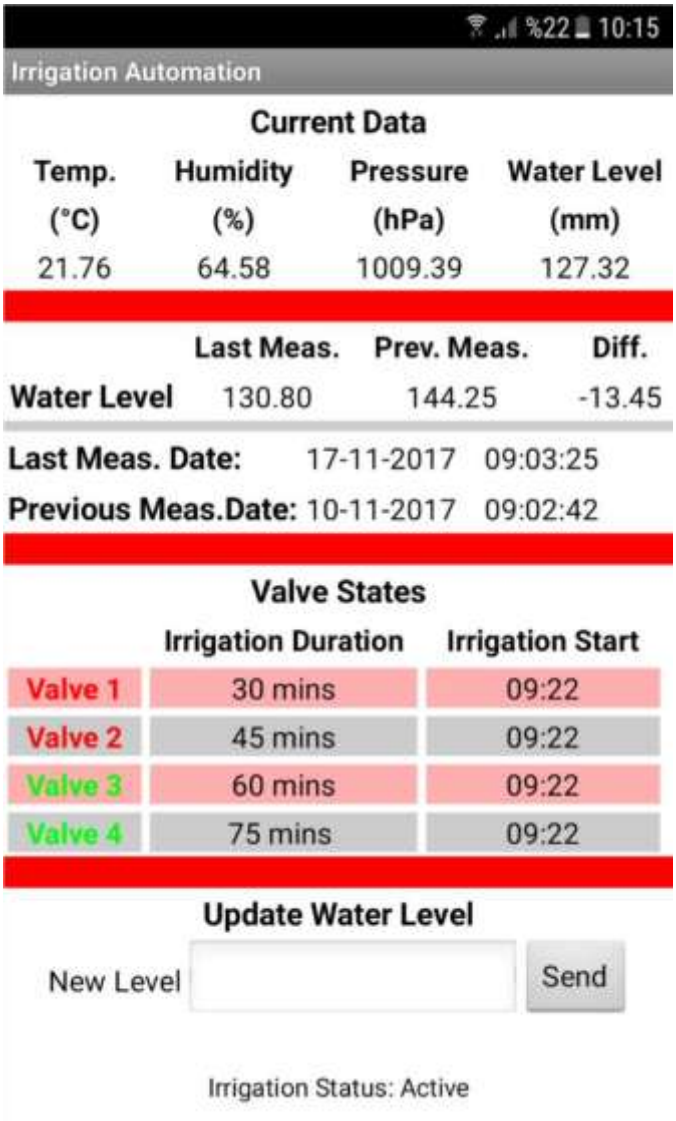
Separate high tunnel areas are used so as to check the overall performance of our device. First one is the experimental place on which the automated drip irrigation device is hooked up. 2nd one is the control region that's irrigated the use of traditional techniques. Because of the rural studies necessities, every place is split into 4 subsections and four unique irrigation regimes (i.e. distinctive irrigation intervals) are carried out to each subsection. In an effort to calculate the irrigation duration, the following equation is used:

$$t = \frac{Epan \times Kcp \times P \times A}{q \times n} \quad (1)$$

where Epan is the cumulative free floor water evaporation at irrigation c program languageperiod (mm), Kcp is plant-pan coefficient, P is plant cover (%), a parameter related with place of plant leaves,

A is field location (m), q is drift charge from the emitters, and n is the variety of drippers within the area [15].
There are 4 irrigation remedies, targeted as Ir50, Ir75, Ir100, Ir125, in which the water portions carried out are zero. Five, zero.75, 1.00 and 1.25 instances the pan evaporation (Epan) measured by way of the us climate service class-A pan with a wellknown 120.7 cm diameter and 25 cm intensity positioned over the crop canopy in the center of the excessive tunnel. In this way, the best irrigation regime for the strawberry could be understood after harvesting and analyzing them.

presently, the gadget is energetic for about four months. in step with the most recent observations, the strawberry flora in experimental place and manage place are in same states in phrases of boom, plant fitness and soil situations.



3. CONCLUSIONS

an automated irrigation gadget based on microcontrollers linked to a cloud provider is defined and its utility to a strawberry area is proven right here. Whilst in comparison to its opposite numbers, our gadget has a few novel functions. Initially, the foremost amount of water required for irrigation is routinely computed. This computation is primarily based on the water stage decrement at a positive amount of time inside the evaporation pan. Usage of choicest water quantity prevents the vegetation from now not most effective drought pressure, but also the over-watering associated fungal and bacterial sicknesses. Besides, this device has an accompanying Android application which makes it possible to remotely check the present day gadget repute. With this system, possibility of human-related mistakes as well as reserved hard work time for irrigation project are minimized. Furthermore, usage of

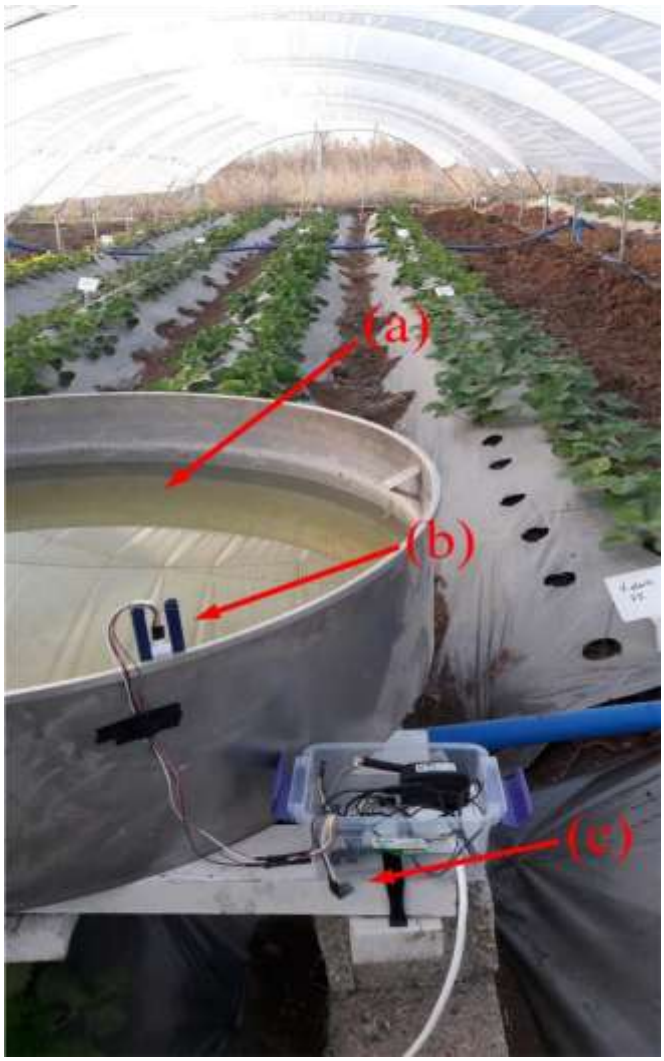


Fig. 3. Data gathering unit inside the greenhouse. (a) Evaporation pan, (b) Water level sensor, and (c) Environmental sensor. Most excellent quantity of water for pleasant crop exceptional truely makes contribution to modest water consumption on this planet.

The entire gadget associated statistics which include sensor values, general evaporation between consecutive irrigations, irrigation dates, times and durations are saved in a cloud server. The use of these values, a statistical version to estimate the entire evaporation can be constructed within the destiny. Additionally, presently the gadget is on-grid all of the time and in case of a power outage, sensor measurements are halted and internet connection is lost. Consequently, supplying energy to the machine with batteries which are charged via sun panels is amongst our future plans. More sensors together with anemometer and soil moisture sensor are going to be delivered to the gadget as nicely.

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