iJRASET
International Journal For Research in Applied Science and Engineering Technology



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 10 **Issue:** IX **Month of publication:** September 2022

**DOI:** https://doi.org/10.22214/ijraset.2022.46606

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 10 Issue IX Sep 2022- Available at www.ijraset.com*

# A Review on Soil Moisture Detection and Plant Watering System in Smart Agriculture

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***Abstract:*** ***Soil moisture sensor is a novel device which detects the moisture content in the soil, and with reasonable system permits water to be flooded relying upon the moisture content of the soil. This permits stream of water or stoppage of water to the plants by utilizing a mechanized water system. Presently a day's water is turning out to be exceptionally valuable because of shortage in getting spotless water for homegrown reason including water system. To advance the utilization of water, system to foster water discussion is the need of great importance. Likewise, computerization in rural systems is a need to enhance water utilization, lessen water wastage, and to execute present day innovation in farming systems. Soil moisture sensor is a novel device which detects the moisture content in the soil, and with reasonable system permits water to be flooded relying upon the moisture content of the soil. This permits stream of water or stoppage of water to the plants by utilizing a mechanized water system. The device comprises of an Arduino board, which is the miniature regulator which initiates the water siphon and supplies water to plants through Rotating Platform Sprinkler. The intension of this paper is to review various implemented systems. There are various systems have been implemented that are usually based on Arduino UNO and various IoT based devices that may vary as per the costs.***

***Keywords— Soil Moisture Detection, Plant Watering System, Arduino UNO, Smart Agriculture, Relay, Motor.***

## I. INTRODUCTION

The utilization of water has been a cultivating practice since more established days. Ranchers were utilized to inundate their properties physically or use flood water system by redirection of ground water from wells, surface water removed from streams, lakes or repositories or from non-traditional sources like treated wastewater, seepage water or other related sources. Such act of manual water system isn't proficient with constraints among others, non-uniform dispersion of water for the harvests or plants, filtering off soil supplements and composts, disintegration because of flooding, loss of water from plant surfaces through dissipation, water wastage which can result to water shortage in dry season regions and creation of undesirable yields and powerless efficiency [1]. Contest for water assets, the downfall and shortage of water assets, high water system siphoning costs and the general effect on our current circumstance and ecosystem drives us to make a legitimate and viable water system the executives. On the planet, water advancement for horticulture is fundamentally important, yet inadequately planned and arranged water system water the executives strategies and practices subverts endeavors to further develop occupations and uncovered individuals and climate to gambles [2]. Lately, a few examination works have been finished to foster reasonable water system control systems incorporating with capacity of remotely overseeing ranch fields. The work in [3], [4] explored how to involve the DTMF phone flagging procedure for somewhat controlling horticultural siphons utilized for water system. Water system water siphons will be enacted from a distance from a phone keypad when there is a need of watering of the homesteads. A few works have likewise shown microcontroller based water system control systems where controlling is executed in light of the estimation of the soil water strain, soil water pull, soil water potential which all are boundaries straightforwardly connected with the soil moisture content [1], [2], [5], [6]. The higher the outright soil water pressure (estimated in units of Pascal or bars), the higher how much energy that the plant expects to remove water from the soil. Every one of the proposed systems depend on soil moisture content of the soil, which thusly flags the microcontroller that controls the water-siphons relying upon the sensor input. The soil moisture sensor types can be tensiometric systems, which measure water potential, resistive sensors which measure the soil-water resistivity, time area reflectometry in view of dielectric steady of soil water and capacitance based sensors [7], [8]. The WATERMARK granular lattice sensor is an illustration of soil moisture sensor in light of estimating the electrical obstruction or conductivity of soil-water. It comprises of a granular lattice upheld in a metal or plastic screen and a wafer of gypsum implanted in the granular grid.

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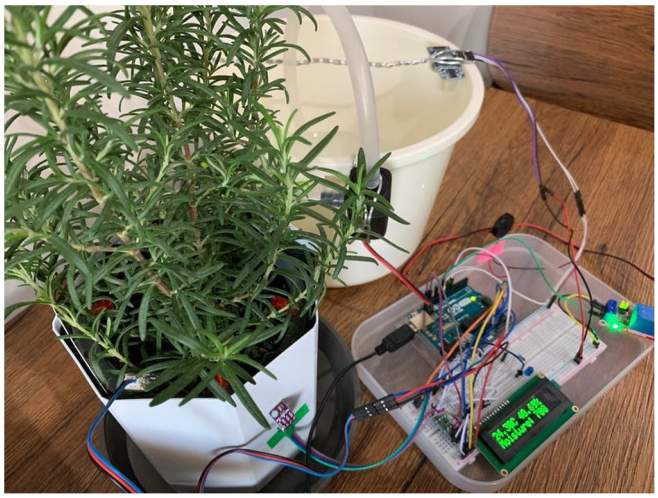


Fig. 1.Automatic Plant Watering System & Soil Moisture Detection [9]

The terminals are implanted in the granular fill material and the deliberate electric conductivity between the installed cathodes gives an incentive for the water strain inside the sensor [10]. Considering the electrical conductivity of water, the granular network sensor answers changes in the items in soil moisture. As the soil dries, water is eliminated from the sensor and the opposition estimation increments and on the other hand, when the soil is rewetted, the obstruction brings down and hence giving different opposition estimations as indicated by the items in soil moisture. In this work, we expected such kind of soil moisture sensor as sensor input information of the in general electronic system. Rather than the past related works, which are microcontroller based water system systems, the generally electronic plan in this work depends on effectively accessible discrete latent and dynamic electrical and electronic parts, which can be handily built in a Laboratory.

## II. RELATED WORKS

### *A. Related Works*

Beza Negash Getu et al. [11] proposed a paper, in which an electronic system is intended to control and work a water siphon naturally founded fair and square of the soil moisture (water) content. The various phases of the proposed system are planned utilizing effectively accessible discrete parts, entryways, clocks, operation amps and transfers. The plan is tried utilizing MULTSIM recreation programming and an ideal siphon controlling is accomplished by copying various instances of soil moisture content. The proposed system disposes of the manual changing component utilized by ranchers or clients to ON/OFF a water system or comparable watering system. In addition, the system accomplishes appropriate water the executives, saves human power and improves harvest or plant efficiency from robotizing. The general plan approach can be utilized for planning and fostering a high level system equipped for giving a few degrees of water siphoning as indicated by the condition of the soil moisture content.

Table I Load Voltage For Different Soil Moisture Content Cases [11]

| Cases | Soil moisture content | Load Voltage (V) |
|---|---|---|
| 0 | Maximum wet | 0 |
| 1 | Over-mid wet | 45.71 |
| 2 | Medium-wet | 95.44 |
| 3 | Minimum wet | 144.94 |
| 4 | Dry | 194.49 |

Syed Musthak Ahmed et al. [12] proposed an IoT based programmed plant watering system. NodeMCU gathers information from all sensors and transfers to Blynk IoT server. The soil moisture sensor detects the moisture content present in the soil. On the off chance that the soil is dry it conveys a high message to nodemcu which understudy turns ON the water siphon through the hand-off. In the event that the soil gets sufficient wet, the sensor conveys a low message to Nodemcu, consequently the water siphon gets switched OFF naturally. Accordingly the total system is tried. It is more productive with reasonable expense for execution in little home gardens and can be stretched out for huge scope development of ranchers. The planned system comprises of microcontroller (nodemcu) which has both WiFi and microcontroller capacities and is a best suit for IoT application projects. The system further comprises of bundle of sensors like soil moisture sensor to detect the moisture level in soil, DHT11 sensor for temperature and stickiness checking, LDR sensor for light power lastly a raindrop sensor for precipitation detection.

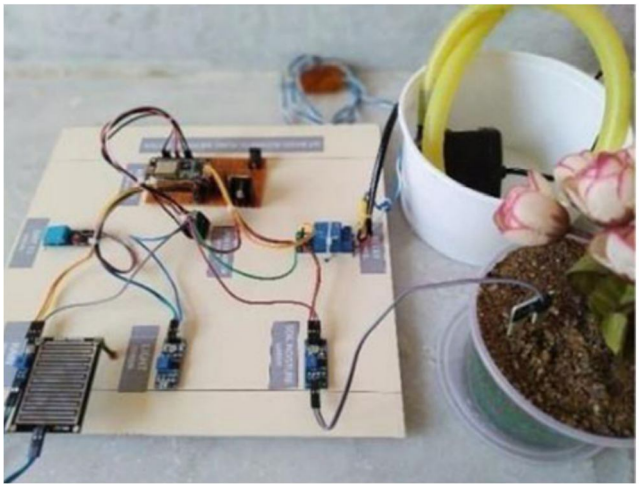


Fig. 2.Setup of the Proposed System [12]

Horticulture and Cultivation of paddy, wheat and vegetables essentially happens in Rural regions where innovation isn't accessible to that broaden where this sort of enormous creation of grains and vegetables can be mechanized to help ranchers. Ranchers invest the majority of their energy in the Agriculture field for watering the harvest by leaving different works. Consequently to help ranchers from remaining on the field entire day, we thought of an undertaking which detects soil moisture and in view of the information this system naturally transforms ON the water siphon into the field, and when the soil arrives at sufficient moisture level, then water siphon consequently gets switched OFF. Thus this idea might give a drawn out answer for the ranchers for an upkeep free horticulture where ranchers don't need to remain on the field breathing poisonous synthetics and ruining their wellbeing. The proposed project additionally have different highlights like detecting the Ambient temperature and stickiness in the Agricultural field, detecting sunlight force and precipitation detection on the field. Subsequently this reasonable undertaking can give an answer for some rural and wellbeing related issues. To execute this venture in a simple entry and refreshed way, we have consolidated IoT stage where the rancher can screen this multitude of field boundaries over web on their PDA application. Subsequently this could be an achievement in revamping what's in store [12].

Yin Yin Nu et al. [13] proposed a system which is based on Arduino UNO for University park. Watering is the main social practice and most work serious assignment in everyday nursery activity. Watering systems facilitate the weight of getting water to plants when they need it. Knowing when and the amount to water is two significant parts of watering process. To make the landscaper works effectively, the programmed plant watering system is made. There have a different sort utilizing programmed watering system that are by utilizing sprinkler system, cylinder, spouts and other. This system utilizes Arduino UNO board, which comprises of ATmega328 microcontroller. It is modified so that it will detect the moisture level of the plants and supply the water whenever required. This kind of system is frequently utilized for general plant care, as a feature of really focusing on little and enormous nurseries. Typically, the plants should be watered two times day to day, morning and night. Thus, the microcontroller must be coded to water the plants in the nursery around two times each day. Anyway for a great many people it becomes testing to keep them solid and alive. This system mechanization is intended to be assistive for the University Park. This system trusts that through this model individuals will appreciate having plants without the difficulties connected with missing or absent mindedness.

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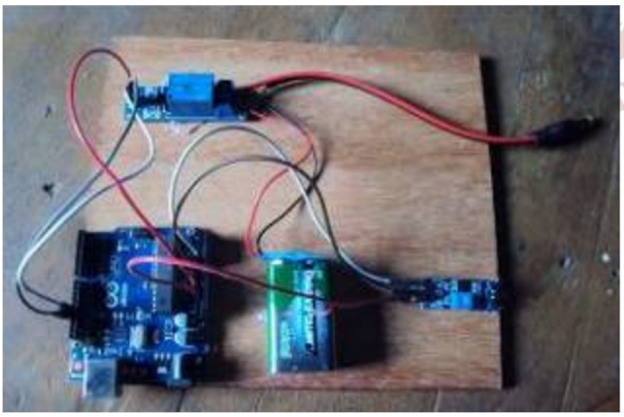


Fig. 3.Proposed Setup [13]

Despite the fact that it is by all accounts really difficult and testing, there are numerous different conceivable outcomes like making complex associations of plants of comparable assortment or somewhere in the vicinity called "Web of Plants". Additionally, utilizing more than one sensor is one more thought for an exploratory endeavor, yet there are likewise numerous other trial and challenge-like thoughts, for example, utilizing sun based power supply, clock for setting water system and so on. In any case, freely of how used to develop it, there is no question that this system can be exceptionally useful in tackling numerous issues, from those that appear to be innocuous to those that are on the size of the most significant and most perilous ones for human populace. Through this system, it is feasible to control how much water let out of the method involved with watering the plant. This system robotization is intended to be assistive for the University Park. Despite the fact that it tends to be extremely useful for humankind by and large, agriculturists, experts, and botanists could have the greatest advantage of utilizing this system [13]. Swapnil Bhardwaj et al. [14] proposed a system which is based on Plant Watering System using IoT. In this paper, a total structure is introduced for programmed watering of a plant which can be extremely valuable since everybody generally furnishes the plant with a specific degree of water and subsequently forestall over-watering. Something else that society would profit from this approach is the asset the executives that we would do, from saving water to removing the power at the right second to have an ideal use. This system has a soil moisture sensor and hand-off associated with the Arduino Uno board. The sensor will be put in the soil which will check the moisture content of the soil and will send the data to the Arduino Uno board, and afterward to hand-off module which will turn ON/OFF the engine to water the plant on a case by case basis. This model aides control the clamminess substance of the soil of a plant. As shown by soil clamminess, water siphoning motor turned-on or off through the hand-off normally. Thusly, there is irrelevant abuse of water. The system also empowers the transport to the plant when expected considering the sort of plant, soil sogginess, and watched temperature. The endeavor might have to restrict the undertakings made by individuals and besides once in a while the imprudence by them. Various pieces of the structure can be adjusted and used programming to align the necessities of the plant. The result is a flexible, supporting development. Using this sensor, we can see that the soil is wet or dry. If it is dry, the motor will subsequently siphoning. In the midst of the execution, number of ends has been seen as considering the reasonable results procured from the realized systems and the going with are the most imperative ones: The structure formed is commonsense when appeared differently in relation to various procedures with build such systems.

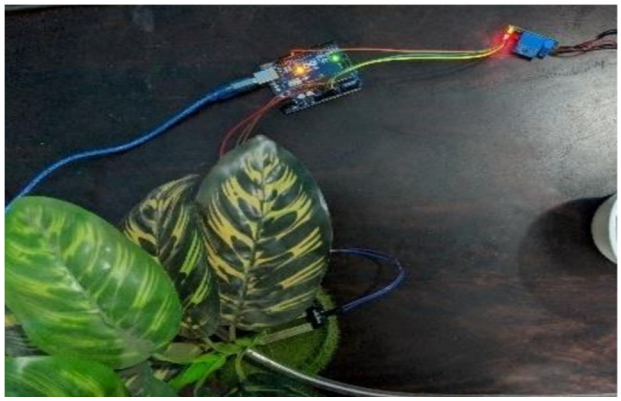


Fig. 4.Proposed Work Setup [14]

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G. Boopathi Raja et al. [15] proposed an Automatic Irrigation System in light of soil moisture utilizing Arduino has thusly been created and tried effectively. It was planned with incorporated usefulness by coordinating all the equipment parts utilized. The presence of every module has been contemplated out and painstakingly situated, in this manner prompting the best work of the unit. Accordingly, the Arduino Based Automatic Plant Watering System has been tentatively planned and tried. The programmed activity of the device has been tried. The dampness sensors measure the moistness level of the various plants (water content). The moisture sensor conveys the message to the Arduino board, which utilizes the Rotating Platform/Sprinkler to cause the Water Pump to turn ON and supply the water to the individual plant, assuming the moisture level goes beneath the essential and restricted level. At the point when the objective moisture level is reached, the system stops all alone, and the water siphon is turned down. Consequently, the whole system's plan has been widely checked and it is said to effectively work.

Kotni.Naga Siva et al. [16] proposed an Automated Water Planting System utilizing Arduino is a system that actions the water content in the soil and controls the pace of stream of water. The system utilizes sensors, put in soil, to get how much water present in the soil. The system, subsequent to accomplishing the moisture content, checks assuming that it is in the deductively recommended range. On the off chance that it isn't in the recommended range, it controls the water content as needs be. This system dispenses with the potential outcomes of human blunder. Shut circle modified water system structure, perception of soddenness and utilization of water are the great features of the system. The proposed model computerizes the control of the condition of the system(ON/OFF), in this manner dispensing with the manual need, as per the consequence of the checking performed. After the checking, a banner is shipped off Arduino board subsequently setting off the siphon. Sprinklers are utilized for water supply.

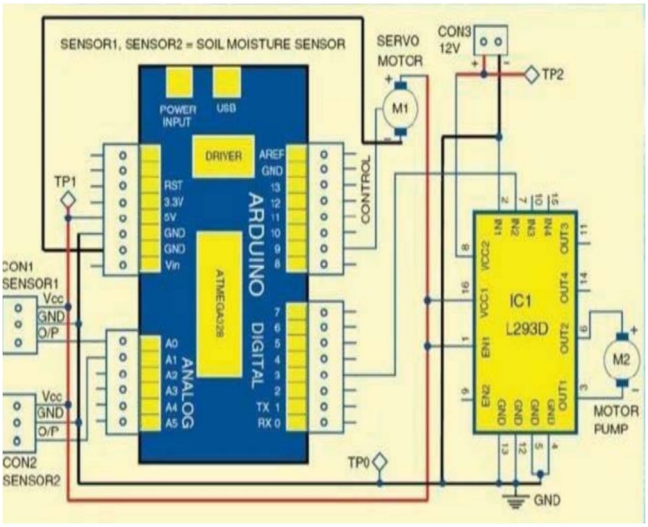



Fig. 5.Curcuit Diagram [16]

There are numerous devices in India which are utilized with labor supply (manual) that is they are worked with actual presence of a person. They won't quantify the water content of the soil and the expected temperature to be aware on the off chance that the soil entirely watering or not. The vitally two perspectives that we ought to consider in manual watering that I referenced previously. System of savvy watering of plants is made For reducing manual work. By placing this system in your field or ranch you save water as well as cause your plants to be the best they could be. Sprinklers or dribble producers or both can be utilized for making a viable system for all plants in any homestead or field. Ill-advised watering of fields which is an immediate reason for the harm of plant wellbeing. A straightforward programmed plant watering system will finish the work. In this undertaking we use Arduino and soil moisture sensor with assistance of the two we water the plants without actual presence. Our task's fundamental spotlight is on effective water and power supply watering device. The undertaking relies upon a direct considered clamminess or moisture of soil. The Arduino based system is altered to distinguish soddenness aspect of plants at explicit event of time, on the off chance that the moisture content isn't precisely resolved which is the necessary water substance and as demonstrated by it the ideal proportion of water gave till it accomplishes edge. This thought is to design and develop insignificant expense system which relies upon installed system for water system structure. This system uses soil moisture sensor to recognize the water sum present in soil. The venture uses Arduino Uno which is a regulator to deal with the information [16].

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 10 Issue IX Sep 2022- Available at www.ijraset.com*



Fig. 6.Physical Setup [16]

Kiran Gowd M R et al. [17] proposed a mechanization in rural systems is a need to enhance water use, decrease water wastage, and to execute present day innovation in farming systems. Soil moisture sensor is a novel device which detects the moisture content in the soil, and with reasonable system permits water to be flooded relying upon the moisture content of the soil. This permits stream of water or stoppage of water to the plants by utilizing a mechanized water system. The device comprises of an Arduino board, which is the miniature regulator which enacts the water siphon and supplies water to plants through Rotating Platform Sprinkler. A sub engine siphon is utilized for this motivation behind siphoning water. This system utilizes low power utilization and siphons water up to 100 liters/hour. Important tunings for siphoning and providing water is organized relying upon the utilization of water. This includes a power supply of 2.5 V to 6 V. Soil moisture sensor is embedded in the soil which contains a test to gauge the moisture content of the soil.

This is a microcontroller based control system utilized for information handling. The initiation of the siphon to supply water through the tunings associated with the siphon relies on the signs got through the detecting system. The object is to direct water and advance the water stream so that plants are not kept from water. This is especially helpful during summer seasons when water is scant. During storm and winter seasons, the water stream can be enhanced relying upon the necessity, accordingly saving valuable water. As the innovation is further developing step by step, the fundamental thought is to foster another device to this venture GSM, (Global System for Mobile) controlled soil moisture sensor. GSM module is utilized to work the soil moisture sensor. The device is exceptionally delicate and care is taken to utilize a 5V microcontroller device and communicated with 240 V energy meter, utilized for homegrown power utilization.

Manisha Mayuree et al. [18] proposed a low spending plan project which the ranchers of the nation can without much of a stretch manage and can be additionally further developed utilizing innovation. This task takes care of the issue of manual watering and saves a ton of time client. It additionally centers around preserving water with expanded precision in water dissemination to the harvests and energy. This venture incorporates checking soil moisture and providing water consistently to the plants utilizing sprinkler or trickle system. It likewise monitors water level. The information pins of soil moisture sensor is associated with A0 pin of Arduino board and its test is set close to the underlying foundations of the plant. what's more, Vcc pin is associated with 5 V pin of board and GND of sensor and engine driver is associated with GND of board. Test of soil moisture sensor ought to be embedded close to the underlying foundations of the plant. 6V siphon is associated with L293d engine driver. It is associated in this manner in light of the fact that how much power that is given to the engine straight by Arduino isn't adequate to run it.

The information pin of engine driver is associated with pin 9 of board. Working is as per the following: the test associated with the sensor sends some measure of current into the soil. On the off chance that the soil is having high moisture content, it will permit the current to handily go through it. Yield pin will be low and engine will stay OFF. On the off chance that the soil has less moisture content, it won't permit the current to move through. Yield pin will be high and engine will stay ON. By looking at the distinction in the pace of stream of current, the moisture in the soil is determined. The moisture sensor measures as indicated by the code moved into the Arduino board. On the off chance that the readings of the sensor arrives at more than X1 (as coded), a SMS will be shipped off client utilizing GSM, it is inundated to express that the field. In view of the contribution of water level sensor put inside the tank GSM will tell the client to turn ON the fundamental water engine, to fill the tank, in the event that the water level arrives at a lower limit. It will likewise advise the client to turn OFF the engine once it arrives at the greatest edge.

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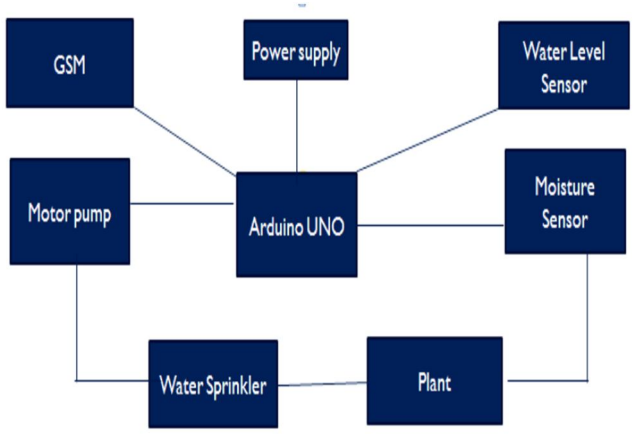



Fig. 7.Block Diagram [18]

## III. CONCLUSION & FUTURE SCOPE

Agribusiness is one of the basic ventures where new innovation is being used to alleviate rancher trouble. We led an overview of shrewd water system devices. This paper examinations and talks about broadly accessible and infrequent expense based water system robotization for sprinkler, trickle, and floor watering. The potential for future exploration exertion in the water system process is referenced to construct a superior modernized water system device with minimal expense and extensively less circuit intricacy to support ranchers. In the current day world Scarcity of dinners and water primarily happens because of the expansion in populace to avoid this there's a need to sell the horticulture zone. Agribusiness is quite possibly of India's most significant industry, representing 18% of the nation's GDP. The best still up in the air by the water system device used, which affects the area. The conventional water system courses of action utilized in the significant parts don't convey the best yield for the plants. The endeavor's primary objective is to foster an Automated Irrigation System that might be utilized to enhance customary water system techniques. The work isn't really confined to the horticulture area; it might likewise be finished at our homes or organizations with yards and plants. There are a ton of wastage water and different sources inside the harvest discipline. To forestall this trouble, we're utilizing an Arduino-based programmed plant watering device. This instrument estimates the moisture content of the soil and furnishes adequate water as per the need .So while the soil is dry the siphon will mechanical partner water the fields and while the soil is wet the siphon automated partner stops, there by annihilate the need of labor supply and protect the time.

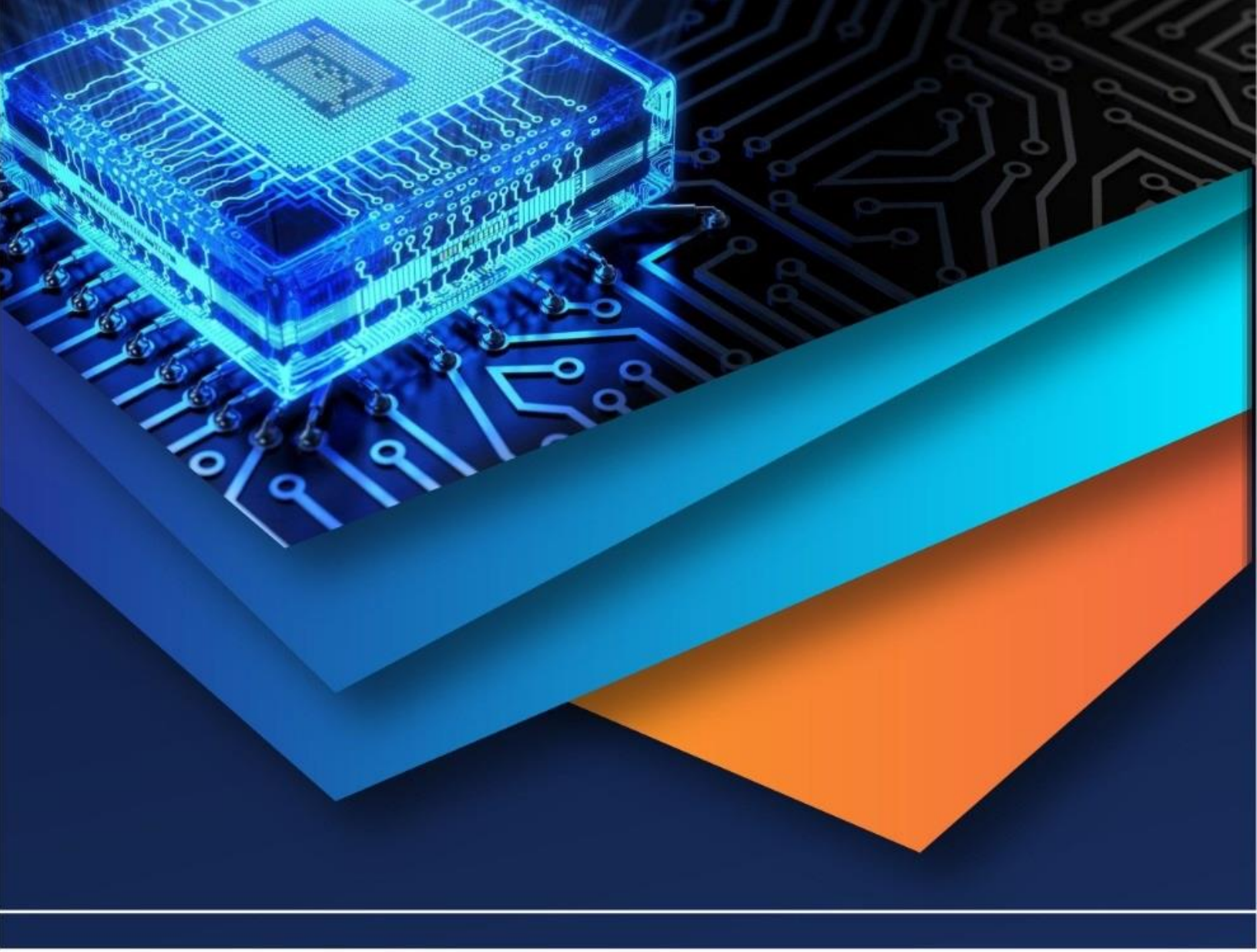
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