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MOBILE NURTURING: REVOLUTIONIZING PLANTCARE FOR ELDERLY GARDENERS WITH IOT

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Abstract: This study presents an innovative Internet of Things-based project aimed at simplifying and automating the process of plant watering, with a special emphasis on meeting the unique needs of the elderly. To enable efficient monitoring and administration of watering activities, the system includes a variety of components, including sensors, a microcontroller, and an easy-to-use mobile application. The primary purpose of this system is to provide an accessible and user-friendly solution for elderly people to cultivate healthy plants without the physical effort that has traditionally been associated with this task.This study addresses the widespread problem of plant neglect among the elderly, providing a straightforward way for them to actively participate in gardening while ensuring their plants receive maximum care. This research represents a huge step forward in fostering independence and active involvement among senior gardeners, demonstrating the potential of IoT technology to improve their gardening experience.

Keywords: IoT, Sensors. Arduino

1.INTRODUCTION

Gardening is a beloved hobby that brings joy and a sense of connection to nature.For many, including our elderly citizens, it can be a therapeutic and fulfilling experience. However, as people age, they often face challenges when it comes to taking care of their plants. These challenges may include physical limitations, memory issues, and the sometimes-complex world of modern technology.To help address these issues, this paper introduces an exciting solution: an IoT-based planting system that works alongside an easy-to-use mobile app, designed with the unique needs of elderly gardeners in mind. Our elderly citizens have contributed significantly to our society, and they should be able to continue enjoying their love of gardening without the burden of physical limitations or the worry of neglecting their belovedplants.


Fig. 1: Elderly gardener and his effort.

Our project aims to empower them to care for their plants and maintain thriving gardens, all while fostering independence and well-being. This paper begins by discussing the common problems that elderly gardeners face, such as struggling with regular plant watering due to physical limitations and forgetting to care for their plants, which can lead to inconsistent care. We also explore the challenge of introducing advanced technologies into the lives of those who may not be very familiar with them. The main challenge we tackle is how to provide the best care for the different types of plants loved by elderly gardeners, taking into account their specific watering needs. In the following sections, we take a close look at existing systems and highlight the difficulties that elderly gardeners often encounter.The IoT planting: watering system we propose is an exciting answer to these challenges.It's made up of smart sensors, a central microcontroller, and a customized mobile app. These components work

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together to create a system that not only watches over and waters plants but also adapts to the unique needs of elderly gardeners. Soil moisture sensors keep an eye on the plants' hydration levels, making sure they get just the right amount of water. The mobile app is user-friendly, allowing elderly individuals to look after their plants, change watering schedules, and receive reminders to care for their green companions.

2.LITERATURE REVIEW

To improve the agricultural yield with fewer resources and labour efforts, substantial innovations have been made throughout human history[1]. Nevertheless, the high population rate never let the demand and supply match during all these times. According to the forecasted figures, in 2050, the world population is expected to touch 9.8 billion, an increase of approximately 25% from the current figure [2]. Almost the entire mentioned rise of population is forecasted to occur among the developing countries [3].

On the other side, the trend of urbanization is forecasted to continue at an accelerated pace, with about 70% of the world's population.The associate editor coordinating the review of this article and approving it for publication was Kun Mean Hoution predicted to be urban until 2050 (currently 49%) [4]. Furthermore, income levels will be multiples of what they are now, which will drive the food demand further, especially in developing countries. As a result, these nations will be more careful about their diet and food quality; hence, consumer preferences can move from wheat and grains to legumes and, later, to meat.

In order to feed this larger, more urban, and richer population, food production should double by 2050 [5], [6]. Particularly, the current figure of 2.1 billion tons of annual cereal production should touch approximately 3 billion tons, and the annual meat production should increase by more than 200 million tons to fulfill the demand of 470 million tons [7], [8]Not only for food, but crop production is becoming equally critical for industryindeed crops like cotton, rubber, and gumare playing important roles in the economies of many nations. Furthermore, the food-crops-based bioenergy market started to increase recently. Even before a decade, only the production of ethanol utilized 110 million tons of coarse grains (approximately 10% of the world production) [8], [9]. Due to the rising utilization of food crops for bio-fuel production, bio-energy, and other industrial usages, food security is at stake. These demands are resulting in a further increase of the pressure on already scarce agricultural resources.

Unfortunately, only a limited portion of the earth's surface is suitable for agriculture uses due to various limitations, like temperature, climate, topography, and soil quality, and even most of the suitable areas are not homogenous. When zooming the versatilities of landscapes and plant types, many new differences start to emerge that can be difficult to quantify. Moreover, the available agricultural land is further shaped by political and economic factors, like land and climate patterns and population density, while rapid urbanization is constantly posing threats to the availability of arable land. Over the past decades, the total agriculture land utilized for food production has experienced a decline [10]. In 1991, the total arable area for food production was 19.5 million square miles (39.47% of the world's land area), which was reduced to approximately 18.6 million square miles (37.73% of the world's land area) in 2013 [11]. As such, the gap between demand and supply of food is becoming more significant and alarming with the passage of time.

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3.BLOCK DIAGRAM

The Block Diagram of our prototype is as shown below

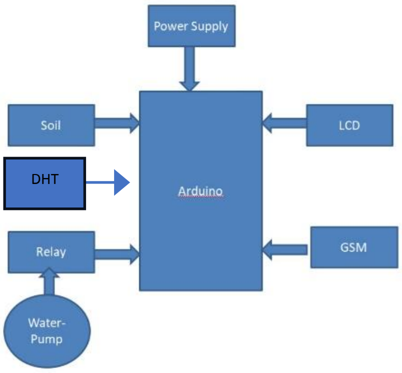

Fig.2 Block Diagram

3.1 COMPONENTS:

Arduino: The Arduino board serves as the central controller for the system. It processes data from sensors, communicates with the mobile app, and controls the watering mechanism.

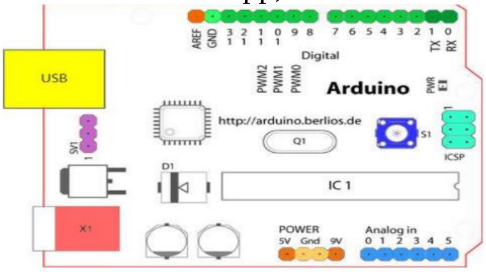

Fig .3Arduino layout

Power Supply: You'll need a suitable power supply to provide power to the Arduino, water pump, and other components. Ensure it can provide the necessary voltage and current.

LCD (Liquid Crystal Display): The LCD screen can display essential information about plant hydration levels, system status, and more.

Fig.4Lcd display

Soil Moisture Sensor: This sensor is used to measure soil moisture levels. It helps in determining whento water the plants.

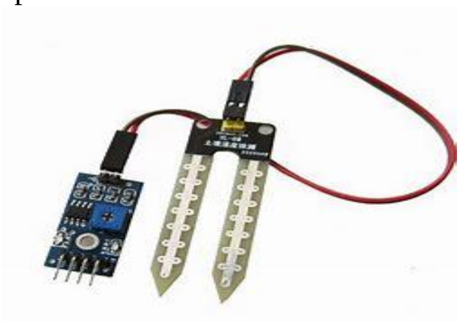

Fig.5Soil moisture sensor

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Relay Module: The relay module is used to control the water pump. It acts as a switch to turn the pump onand off based on sensor readings.

Fig 3.1.4: relay module

Water Pump: The water pump is responsible for delivering water to the plants. When activated, it pumps water from a reservoir to the plants.

Fig 6 water pump

GSM Module:A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system[1]. The modem (modulator-demodulator) is a critical part here[1]. It allows electronic devices to communicate with each other over the GSM network[2]. The common radio frequencies in which a typical GSM Module operates are 850MHz, 900MHz, 1800MHz and 1900MHz[3].

Fig 7:GSM module

DHT sensor: The DHT sensor, specifically the DHT11 or DHT22, is used to monitor temperature and humidity levels in the environment, providing essential data for optimizing plant care.

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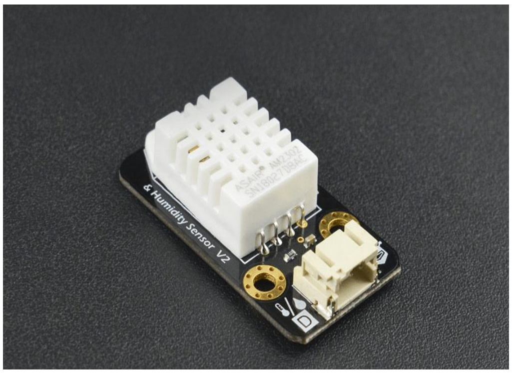

Fig.8: DHT Sensor

4.DESIGN FLOW& WORKING

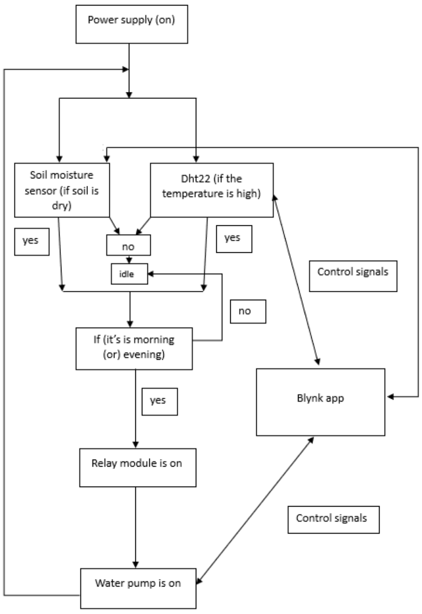

Fig 9: Design flow of the project

The system initiates its operation by activating the power supply. This step serves as the foundation for subsequent actions.Next, the system employs a soil moisture sensor to assess the moisture content in the soil. If the sensor detects that the soil is dry, the system proceeds to the following steps. In the event that the soil moisture is within an acceptable range, the system remains in an idle state, patiently awaiting further instructions.

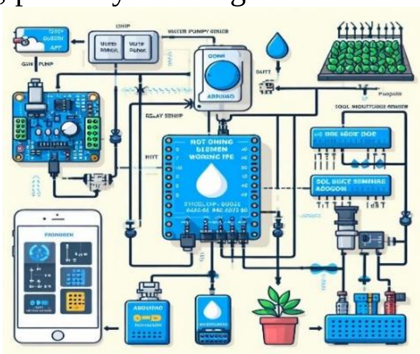

Fig 10: Brief idea of the system

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To enhance environmental monitoring, the system also incorporates a DHT22 temperature sensor. If the temperature readings exceed a predefined high threshold, it triggers the continuation of the sequence. Conversely, if the temperature remains within acceptable limits, the system remains in idle mode.After these initial assessments, the system prompts the user for confirmation,seekingthe affirmative response "yes."

A brief delay is introduced by setting a timer for a specific duration, precisely 7 seconds, allowing for controlled temporal coordination within the system.

Following this pause, the system returns to an idle state, providing a momentary respite in its operationalsequence.

The user's affirmation is once again solicited with the response "yes."

Continuously, the system monitors for incoming control signals that may influence its operations or settings.

In a consideration of time, the system checks whether it is either morning or evening. If the time corresponds to one of these two temporal conditions, it proceeds to the next set of actions. In the absence of these time frames, the system remains in an idle state, conserving energy and resources.To facilitate user interaction and remote control, the system opens the Blynk mobile application, providing a platform for monitoring and controlling various parameters.

An important element in the system's operation, the relay module is activated at this stage, allowing for control over other electrical devices integrated into the system.
Lastly, in the event that conditions align for the requirement, the water pump is activated. This initiates the operation of the water distribution or irrigation system, as determined by the system's pre-configured settings and control parameters.

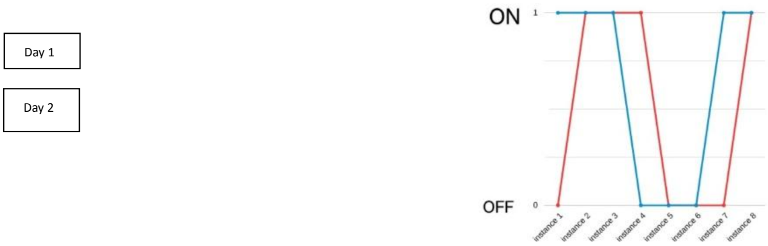

Fig11: Results of relay ON in different instances in two days.

The line chart presented here offers an insightful view of the relay module's operation over the course of two days within the context of a smart gardening system. It provides a visual representation of when the relay module, responsible for controlling the water pump, is in the "On" state, indicating the active state of the water pump, and when it transitions to the "Off" state, denoting the water pump's inactivity. Understanding the relationship between the relay module's status and specific conditions, such as soil moisture and temperature, is pivotal for effective plant care and irrigation management in the realm of smart gardening. The line chart is divided into two distinct days, marked in different colors, and further segmented into morning and evening periods, shedding light on the module's dynamic response to changing environmental factors. Let's delve into the detailed interpretation of the line chart to gain a

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comprehensive understanding of the relay module's behavior and its relevance to the smart gardening system.

Day 1 (Red Line):

- Initially "Off" in the morning, indicating water pump inactivity due to favorable conditions.
- Shifts to "On" from instances 2 to 4, activating the pump.
- Returns to "Off" as morning conditions favor inactivity.
- Stays "Off" in the evening (instances 5-7) due to suitable conditions.
- Switches back to "On" at the eighth instance, signaling a change in evening conditions.

Day 2 (Blue Line):

- Begins "On," signifying pump activity in the morning under favorable conditions.
- Shifts to "Off" at the fourth instance due to changing morning conditions.
- Remains "Off" during the evening (instances 5-7) as conditions favor inactivity.
- Turns "On" at the eighth instance, indicating a shift in evening conditions.

This concise interpretation highlights the relay module's role in responding to environmental conditions for effective automated plant irrigation in smart gardening. Understanding these patterns is essential for efficient watering.

5.CONCLUSION

In conclusion, this project represents a significant step forward in the domain of smart gardening, where the interplay of technology and environmental factors harmonizes to optimize plant care. The project's core component, the relay module, seamlessly coordinates the operation of the water pump based on real-time conditions, ensuring that plants receive precisely the care they need. This intelligent and responsive system not only conserves valuable resources but also promises to revolutionize gardening practices, making them more efficient and environmentally conscious. The project's working showcases the potential for technology to enhance the future of agriculture and plant maintenance, aligning gardening practices with the sustainable goals of our times.

Looking to the future, the scope of this project is promising. Further developments could expand the system's capabilities, integrating data from additional sensors and providing even more precise control over plant care. Additionally, the project's principles can be extended to larger-scale agricultural applications, contributing to resource-efficient and sustainable farming practices. The importance of this work extends beyond the realm of gardening, as it embodies a significant advancement toward achieving more intelligent and environmentally responsible cultivation methods. In summary, this project offers a compelling vision of the future, where technology and nature work in tandem to nurture healthier, more sustainable plant life.

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