A Smart Watering System Using IoT

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Abstract

This paper is based on the development of a smart watering system using Internet of Things (IoT). In this work, an Arduino based integrated system is designed to optimize the use of water in irrigation field. This proposed system mainly uses Arduino Uno board, soil moisture sensor and temperature-humidity sensor. Soil moisture sensor senses the soil moisture level and temperature - humidity sensor is used to track the temperature and humidity of soil. This system can help people by automatically monitoring the irrigation process and it can be easily implemented in irrigation field with lower cost. The approach involved in this work can be considered as a suitable approach in irrigation field in terms of saving time, money and man power as compared to the traditional approaches.

Keywords: *Smart Watering System, IoT, Arduino Uno, Soil Moisture Sensor, Temperature-Humidity Sensor*

1. Introduction

Generally, smart watering system [1-23] is used for the supply of water to the root of plant. This system helps in the growing of agricultural crops, maintenance of landscape and re-vegetation of disturbed soils in dry areas and during periods of inadequate rainfall. During crop production, irrigation helps in protecting plants against frost, suppressing weed growth in grain fields and preventing soil consolidation. Irrigation systems are also used for dust suppression, disposal of sewage, and in mining. The traditional approaches which are used in irrigation generally focuses on the use of watering cans, water channels that have to be opened and closed manually or backpack sprinklers due to which a lot of water is wasted. So, there is need for the improvement on the traditional approaches of irrigation. The proposed system can be considered as a suitable solution to the irrigation field.

The main contributions of this paper are stated as follows:

1. Smart watering system is mainly designed to optimize the use of water in irrigation process. This system continuously monitors the soil moisture level to determine the amount of water requirement in the soil.

2. In this system, the hybridization of soil moisture sensor and temperature-humidity sensor is carried out.

3. Soil moisture sensor is used to track the moisture level of soil and a pumping system is used to supply water to the soil.

4. Temperature - humidity sensor is used to track the temperature and humidity of soil.

The rest of the paper is organized as follows. Section 2 presents the related works. Section 3 presents the methodology. Section 4 presents the results and discussion. The conclusion of this work is at Section 5.

2. Related Works

In this section some works related to smart watering systems are focused.

Dasgupta et al. [24] focuses on autonomous monitoring of irrigation system in small as well as large plantation estates to eradicate the manual system that deals with personal liability as well as the ignorance of field workers. The presented system can monitor the temperature, humidity and soil moisture content. It can also monitor the physical factors such as presence of major pollutants in air such as PM2.5, PM10, CO. The dataset of past surveys is compared with the crop yield and the factors to predict the necessity of irrigation. It can monitor the growth of plant horizontally and longitudinally. Koduru et al. [25] focuses on utilization of water resources effectively with simplified irrigation across several agricultural farms. This paper presents a cloud and IoT based framework to implement a smart irrigation system. The use case for automated smart irrigation system is developed on the basis of defined framework and a mechanism is defined to utilize excessive water effectively generated from showers for increasing the ground water levels. The use case may provide flexibility to farmers in order to monitor the farms by the help of farmer's cockpit in real time. Maha et al. [26] proposed a smart sensor system which is supported by actuators in order to automate the farming and to give precision farming experience. This system can help people with inferior knowledge of technology for understanding and maintaining the system with a smart board. This board helps in monitoring the status of farm and provides action command to the machineries of farm. The information related to government agriculture announcements can be provided by this board which may be beneficial for the farmers. This system focuses on the mixture of several technologies including a smart sensor network system.

Alzu'bi et al. [27] focuses on smart employment of internet of multimedia sensors in smart farming for optimizing the irrigation process. To make the irrigation decision, the concepts of image processing, IoT sensors, machine learning methods are used. This work mainly focuses on yellowing leaves and sprinkles in soil by the help of multimedia sensors for detecting the plant thirstiness level in case of smart farming. The sensors reading are used as training dataset which indicate the plants thirstiness and the machine learning methods along with the deep learning mechanism are used in the next phase in order to find the optimal decision. The experimental results show that the use of deep learning mechanism may be a better approach in the internet of multimedia things environment. Muangprathub et al. [28] proposed a wireless sensor network based system for watering agriculture crops optimally. This work focuses on the design and development of a control system by the help of node sensors in the crop field with data

management using smart phone and web application. The components such as hardware, web application and mobile application are used here. Soil moisture sensors are used for monitoring the field. Web based application is used for manipulating the crop details as well as the information of field. It is also used to analyze data to predict suitable temperature, humidity and soil moisture for the future management of growth of crops optimally. Mobile application is used for controlling the crop watering process. It allows automatic and manual control. This system may be useful in agriculture. The soil moisture content is maintained for the growth of vegetable which may reduce cost and increase agricultural productivity.

3. Proposed Methodology

The proposed system mainly focuses on the units such as power supply, sensing unit, control unit and motor unit. Soil moisture sensor is used to track the moisture level of soil and a pumping system is used to supply water to the soil. Temperature and humidity sensor is used to track the temperature and humidity of soil. Soil moisture sensor is connected to Arduino Uno board for analog input, which helps in tracking the temperature content present in soil and it is mentioned in Fig. 1.

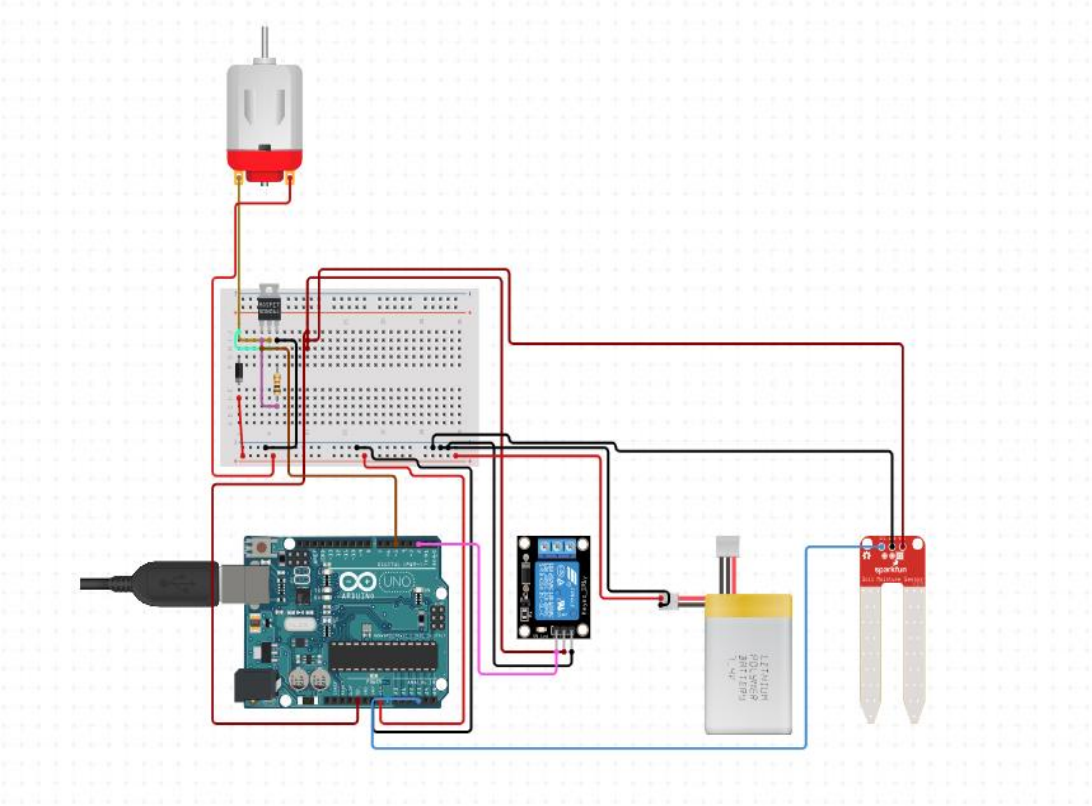
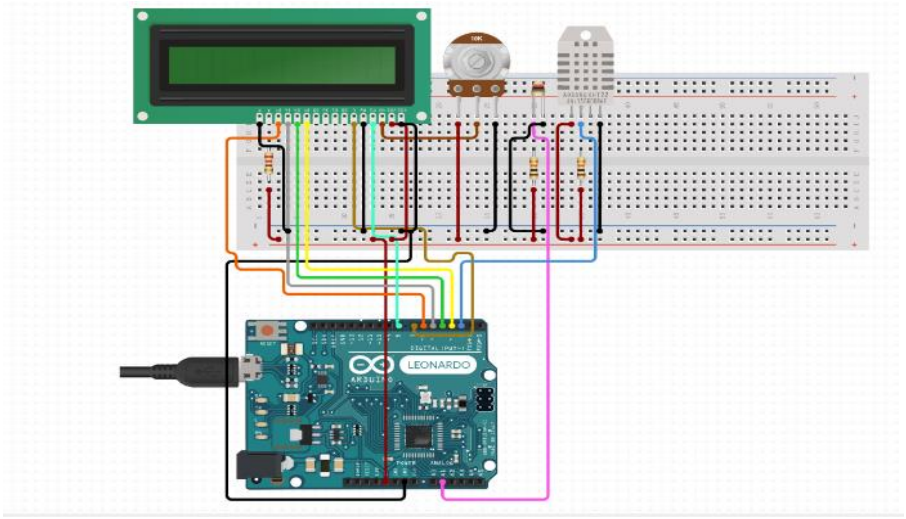
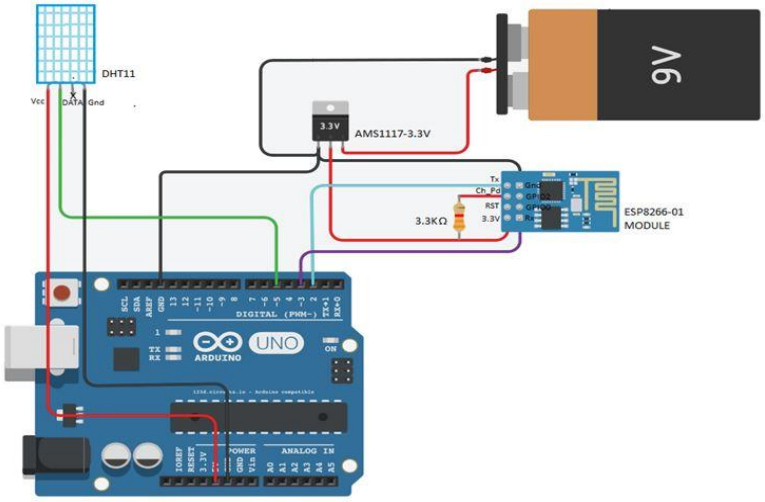


Figure 1. Soil moisture measurement using Arduino Uno [29,30]

Motor driver module is also connected with Arduino board and it passes the current to the motor pump by monitoring the temperature. Humidity and temperature are common parameters to measure environmental conditions. In the proposed system, ambient temperature and humidity are measured and displayed on a screen as mentioned in Fig. 2 by using a combined temperature and humidity sensor with Arduino uno. IOT helps in connecting each and every network with a common controller using which the smart watering system is controlled. This system displays the values of several sensors on the smart phone screen or computer screen.



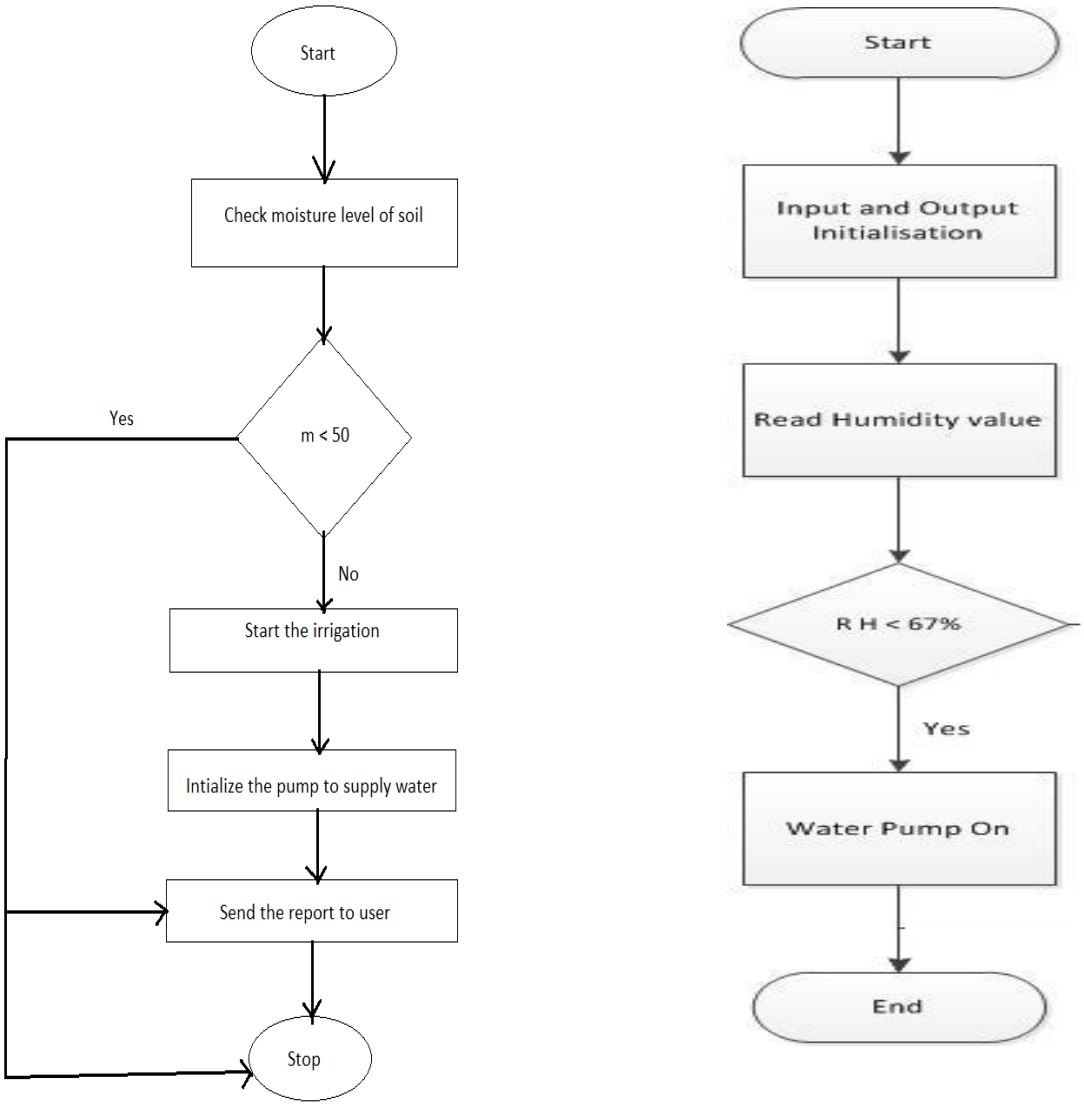
(a)



(b)

Figure 2(a)&(b).Temperature and humidity measurement using Arduino Uno and LCD display[29, 30]

Basically, this system senses the condition of soil and compares the moisture with the referred moisture (mentioned in Fig. 3). If the moisture of soil is less than the referred moisture, then it sends the signal to the Arduino and it starts the motor until the moisture of soil gains it's referred value. When it comes to its peak value, then it sends the signal and the mptor stop pumping the water. This process is performed automatically. The proposed system monitors the soil moisture content from time to time. The working mechanism of soil moisture sensor and temperature-humidity sensor is mentioned in Fig. 3.

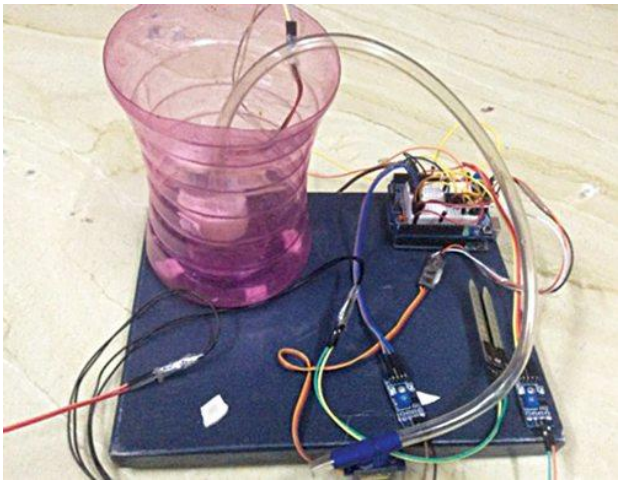


(a) (b)

Figure 3. (a) Pictorial representation of soil moisture measurement mechanism (b) Pictorial representation of temperature-humidity measurement mechanism

4. Results and Discussion

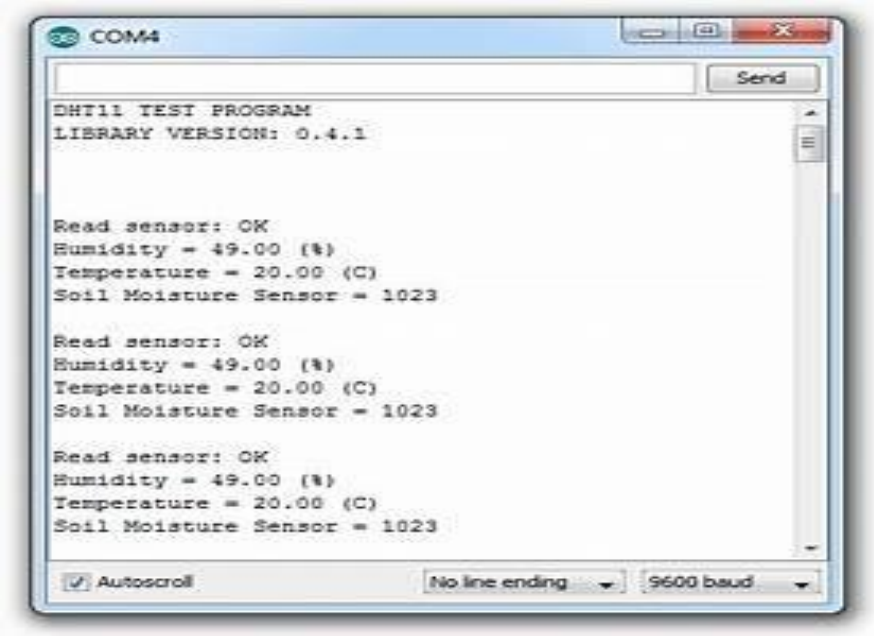
The proposed system uses Arduino Uno board, soil moisture sensor and temperature-humidity sensor. The working output of this system is mentioned in Fig. 4. and the output of soil moisture sensor and temperature-humidity sensor is mentioned in Fig. 5. This system is automatically monitoring the irrigation process. So, this system can be considered as a suitable system in irrigation field as it saves time, money and manpower.



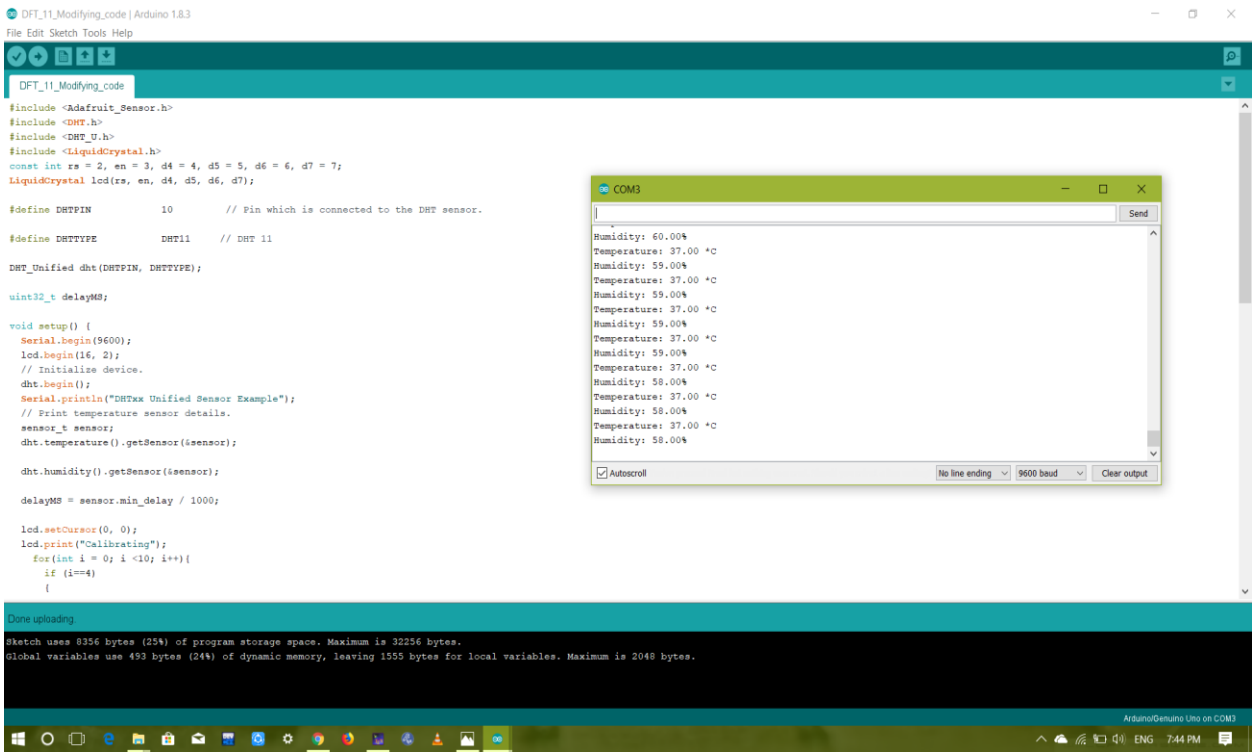
(a)

(b)

Figure 4 (a)&(b). Working of Smart watering system



(a)



(b)

Figure 5 (a)&(b). Output of soil moisture sensor and temperature-humidity sensor

5. Conclusion

In this work, an Arduino based integrated system (smart watering system) is developed using IoT. This system mainly uses Arduino Uno board, soil moisture sensor and temperature-humidity sensor. Soil moisture sensor senses the soil moisture level and temperature - humidity sensor is used to track the temperature and humidity of soil. The main objective of this system is to optimize the use of water in irrigation field. This system is very much beneficial to the people as it automatically monitors the irrigation process and it can be easily implemented in irrigation field with lower cost. The approach focused in this work can be considered as a suitable approach in irrigation field as compared to other traditional approaches as it saves time, money and manpower.

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