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Smart Farming System for Indian Farmers using Arduino based Technology

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ABSTRACT: This work aims at developing an entirely automated plant/crop watering system. The main motivation behind this system is to conserve the wastage of water and to effectively manage the amount of watering of the plants. It also aims at reducing human labour, effort and errors due to human negligence. It uses solar panels to provide power to the system at daytime. Solar energy is used to run the system during daytime and charge the batteries to operate at night. It uses moisture sensors to sense the level of moisture in the soil. When the moisture content of the soil goes below a certain limit for a plant/crop, the pump system is triggered and the plant/crop is watered. The plants are watered efficiently till the desired value is reached and the pump is switched off automatically.
KEYWORDS: Arduino, Moisture Indicator, Moisture Sensor, Solar Panel, Water Pump.

I.INTRODUCTION

The increasing demand for energy, the continuous reduction in existing sources of fossil fuels and the growing concern regarding environment pollution, have pushed mankind to explore new non-conventional, renewable energy resources such as solar energy, wind energy, etc for the production of electrical energy. Since India receives sunlight all 12 moths of a year. Hence utilizing it in the different fields is a wise idea.

India is an agricultural country. India ranks second worldwide in farm output. At present, farmer manually irrigates land at regular interval. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Solar powered smart farming irrigation system not only overcomes this problem but also provide clean source of energy.

II.AIM OF THE WORK

In the work the investigator has used different sensors/components like

(i) Temperature sensor
(ii) Moisture sensor
(iii) Solar panel and battery
(iv) Humidity sensor to tackle different problems of farmers.

The work is also incorporated with GSM technology so that it will work as a link between microcontroller and farmer. By using GSM technology, information regarding emergency situation may be send to the farmer so that they may take necessary action in unavoidable situations.

III.FLOW CHART OF THE PROJECT

The flow chart of the work is shown in the fig.1. In Fig (a) the digits 1,2,3,4,5 shows various sensors The Arduino micro controller is working as the main CPU of the project. It takes the inputs from the sensors and then control different outputs and parameters. In Fig. (b), (c), (d), (e) and (f) different output controls and parameters have been shown.

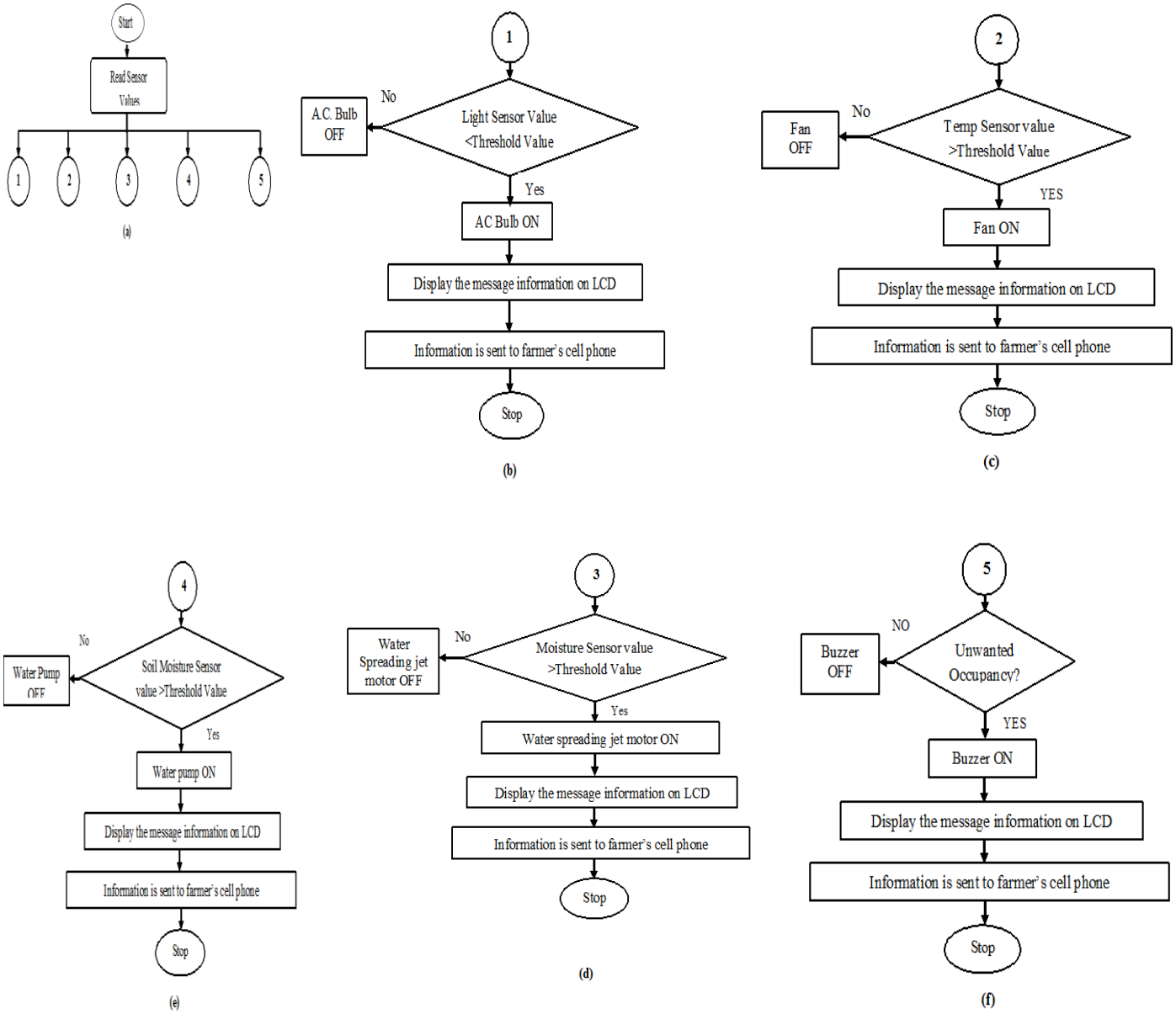

Fig. 1 Flow Chart of the Project

IV. WORKING OF THE HARDWARE

First of all we will have to take the data from five sensors- soil moisture sensor, LDR sensor, Temperature sensor, DHT 11 humidity sensor and ultrasonic sensor. These sensors provide information to the Arduino UNO. Arduino takes necessary decision/action, and also informs about the sensor values and its necessary actions to farmer through farmer's cell phone by message with the help of GSM module. In fig. 2 sensor connection is shown. In figure 3, the complete hardware developed is shown.

Fig 2 Sensor used in Plants.

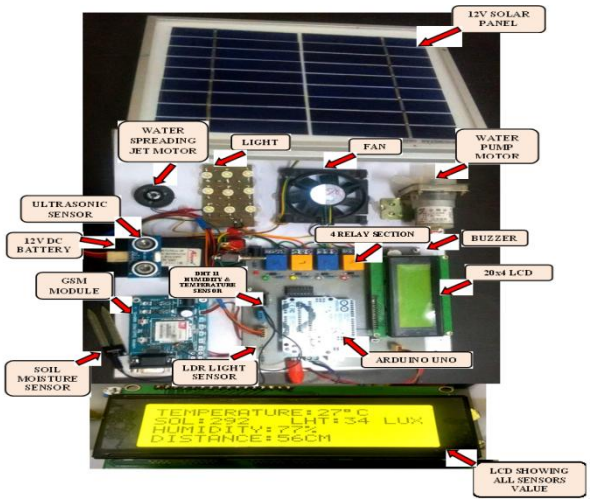

Fig. 3 Hardware Model of Smart Farming Sys for Indian farming Arduino UNO.

The whole hardware and sensors connection was tested for accuracy and it is found that the whole project is working properly and accurately.

V.TESTING AND HARDWARE IMPLIMENTATION

Out of all necessities for farming, irrigation has the most important role to play that is why investigator has concentrated over water retention by soil. For this soil moisture sensor has been used. For the successful implementation to get fruitful results investigator has done series of testing experiments using soil moisture sensor.

In the testing, set of three different soils and plant combinations were taken say A, B and C as shown in Fig. 4.

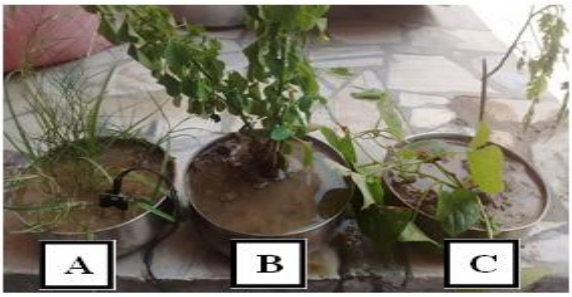

Fig. 4 Three Different Soil and Plant Combinations A, B and C.

Fig. 5 Soil and Plant Combination A (Without Water).

Plant A with first type of soil and plant was exposed to three different water levels i.e., low water content, normal water content and excess water content. It was observed during experiment that sensor was smart enough to detect the water level and information was sent through controller which was received on farmer's cell phone and the necessary action was also performed like

(i) If the water level was below the predefined limit (without water) then water pump automatically switched "ON" until it reached to the required level shown in Fig. 5.

(ii) If the water level was up to the predefined limit (average water) then it remained in passive mode shown in Fig. 6.

Fig. 6 Soil and Plant Combination

Fig. 7Soil and Plant Combination C (Excess Water)

(iii) If the water level was above the predefined limit (excess water) then water pump automatically switched "OFF" shown in Fig. 7.

In order to test the compatibility of sensor with different soil and plant combinations, investigator used it with combination B, which was the second combination of plant and soil as shown in Fig. 8

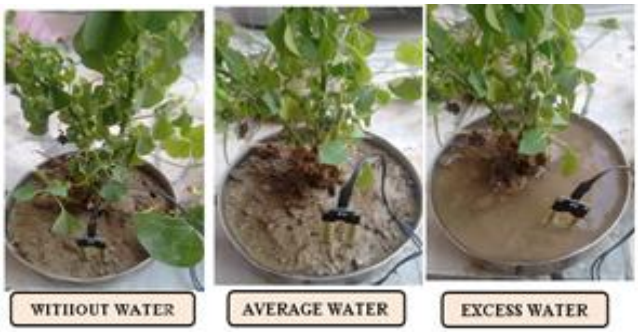

Fig. 8 Soil and Plant Combination B

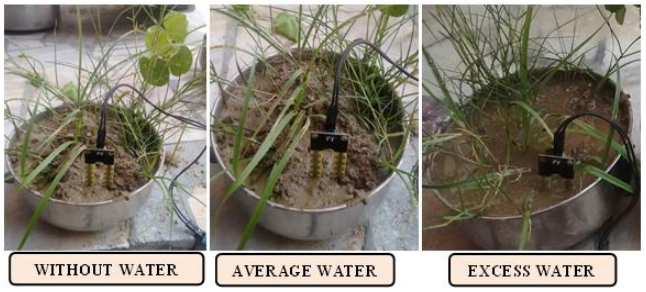

Fig. 9 Soil and Plant Combinations C

The same results as in combination A were found to be true. For the confirmation of the results obtained with A and B, third and last combination of soil and plant i.e., C, was used as shown in Fig. 9.

The results found with combinations A and B were repeated hence it was confirmed that sensor was sensitive enough to produce the same results with different soils and different plants combinations using different water level conditions.

VII.RESULT AND DISCUSSION

The investigator has given solution to Water Problem that is it will control the prespecified water level in the farming system for overall growth of the plants. Problem of unwanted occupancy and vendalisation of crops is met by using an automatic buzzer system which provides information about any unwanted entry/occupancy if detected in farmer's land entrance area. To control the temperature sensors are used which sends signal to the UNO so that it will switch ON or OFF the fan according to the situation. Solar panel with battery gives additional facility of the electricity. In this way it may be said that the work is highly useful for Indian farmers.

Table 1: Relation between Transmitter and Receiver

Transmitted Data Moisture (%)	Received Data Moisture (%)	Distance between Tx and Rx (meter)	Obstacle	Time Taken to Receive First Data (second)
9	9	5	-	0.50
12	12	5	Wall	0.75
15	15	5	Metal Body	0.75
20	20	5	Magnet	1.25
25	25	15	-	1.75
36	36	15	Wall	2.75
38	38	15	Metal Body	3.00
45	45	15	Magnet	3.25
50	50	15	-	4.00
60	60	25	Wall	4.15
75	75	25	Metal Body	4.50
100	100	25	Magnet	5.00

125	125	25	-	7.00
150	150	35	Wall	-
150	150	35	Metal Body	-
150	150	35	Magnet	-

CONCLUSION

The developed system is Simple and cost effective than most other systems present in the market. It measures different environmental conditions. It includes measurement of atmospheric temperature, relative humidity and soil temperature, etc. System uses wireless module for the data transfer, communication purpose. So it can be use in open fields as well as inside greenhouse as the range of wireless module is up to 25m with / without different obstacles like trees, benches, walls, cupboard, magnet, etc. With the use of wireless module, system becomes flexible, robust, etc. Sensors can be placed anywhere in the field and if there is need of relocation then it can be easily done. System is also tested for different temperature and it is found that all the sensors work with minimum deviation in output. With the use of drip irrigation, water is provided directly to the roots of the crop. Thus wastage of water is minimized and water resources are optimized to obtain better crop yield. This system is advantageous to farmers as it not only saves water but also helps farmers in fighting the diseases. Thus it will increase the yield of the crop.

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