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Development of Smart Irrigation System For ABUAD Farms.

One of the major Challenges of ABUAD farms, Ado Ekiti is that during the dry season there is insufficient supply of water to the farm and manual methods of irrigation will not be sufficient for it. The shortcomings of manual methods of irrigation can be rectified using automated process. This development presents the idea of automatic irrigation method and the following research sustains this idea. The task of automatic irrigation is done through assistance of soil moisture sensors. In the project, apart from soil moisture sensor. Humidity and temperature sensors are also used to make the process more advanced. The electricity required by components is provided through solar panels hence this liberates us from interrupted power supply due to load shedding. The water content is constantly judged and whenever moisture level of soil gets low, the system sounds an alarm and sends a signal to motors asking them to turn on. The motors automatically stop after soil reaches its maximum upper threshold value which is decided by user. The

major advantages of the project include avoidance from water wastage, growth of plants to their maximum potential, less chances of error due to less labour and uninterrupted supply of water due to solar energy.

The factors affecting agricultural progress must be studied thoroughly to obtain maximum results. The significant building block of agriculture is the irrigation system. In other words, the efficiency of irrigation system may induce ample effects on agriculture. Irrigation process should provide water to soil consistently when it is needed and stops water flow as well, when soil has soaked enough water. The excess of water in the crops is of no good, not only water is wasted but it also destroys crops. Considering Pakistan, whose economy is mainly based on agriculture requires efficient and modern methods for water provision in the crops fields. The failures caused through manual methods of irrigation has let us to think about some advance method which can be relied upon. Anything which is cost effective, labour saving and energy saving is considered efficient. Hence in this proposed system, a method which uses very less or no labour (runs on its own) has been recommended, saves electricity and is easy to use. The proposed system is automatic irrigation system. The automaticity means that it turns itself on and off depending upon the soil moisture requirement. This automatic behaviour of irrigation is achieved using different sensors which sense and tell the operator through an alarm if water is required or not and how much water will be enough for soil so that water wastage is also avoided. The errors which may arise when manual irrigation is used are also rectified for the most part using this method. The major source of electricity in Pakistan is through hydroelectric power but this source has not paid the country with requisite amount of electrical power hence there is shortage of

electricity which is not good for process of irrigation as motors need uninterrupted supply of electricity. As electricity deficiency is a major problem of Pakistan, so the system is made more flexible through using solar energy.

The countries where agriculture has a big impact on economy demand a highly effective way of irrigation. A timely and consistent irrigation is need of the hour in such countries. Where lack of water is not tolerated by soil during irrigation, the excess of water provision is also not recommended for crops flourishment. Hence a feasible irrigation for any land requires suitable amount of water with minimum amount of delays. Today's world demands improved methods as compared to the old ones to carry out processes faster and the world is moving towards automation of every process. In the proposed system, automatic irrigation system has been suggested which detects the soil moisture level and programmed in a way that if water level goes below necessary amount, it automatically starts the pumps to supply water. In this way, maximum results are attained out of the fields and water wastage is also reduced to significant level. If there is no water in the tank for the irrigation to take place, an alarm is rung in order to notify that.

(B) Hardware and Software components: The process has to be done both on software and hardware. The required equipment is as follows: 1. PC with Arduino software,

2. Arduino Mega 2560,

3. Soil moisture sensor (YL 69),

4. Humidity sensor (DHT11),

5. Temperature sensor (LM35),

6. Arduino Water Level Sensor,

7. Relays,

8. Solar panels,

9. LCD 20 × 4 display,

10. DC motors,

11. DC fan.

(I) Arduino Mega 2560 Arduino is genesis of the proposed system. The centre of all operations taking place in the system. Components are connected to Arduino through different ports and are dependent on its instruction. Arduino Mega 2560 has been used because of its versatility. It has 54 digital I/O ports. There are 16 analog inputs, 4 UART's, 16 MHz crystal oscillator, USB port, power port, reset button and ICSP header. The flash memory is 256 Kb and EPROM memory is 4 Kb. All the data from sensors comes directly in Arduino which processes it and sends the signal forward. The Arduino commands further process whether to start or stop the motors. Basically, the code is being fed into Arduino will judge the moisture condition of soil and decides if motors need to be turned on or off. The code is written on Arduino software and transferred to the device using USB cable. C language is used in code and threshold values for upper and lower points are defined in the code. Basically, the code tends to keep the water content in between its threshold, if it crosses either value, the status of motor will be changed.

(II). Sensors: The participation of sensors in automatic irrigation is most important. They play vital role to make the system automatic. Without them, the process cannot be imagined as automatic. Four different sensors have been used. Three sensors measure the water content of the soil. The sensors include: I. YL 69, II. DHT11, III. LM35 YL 69 is the soil moisture sensor. The fourth sensor is the Arduino Water level sensor which tells us the water level of the tank and

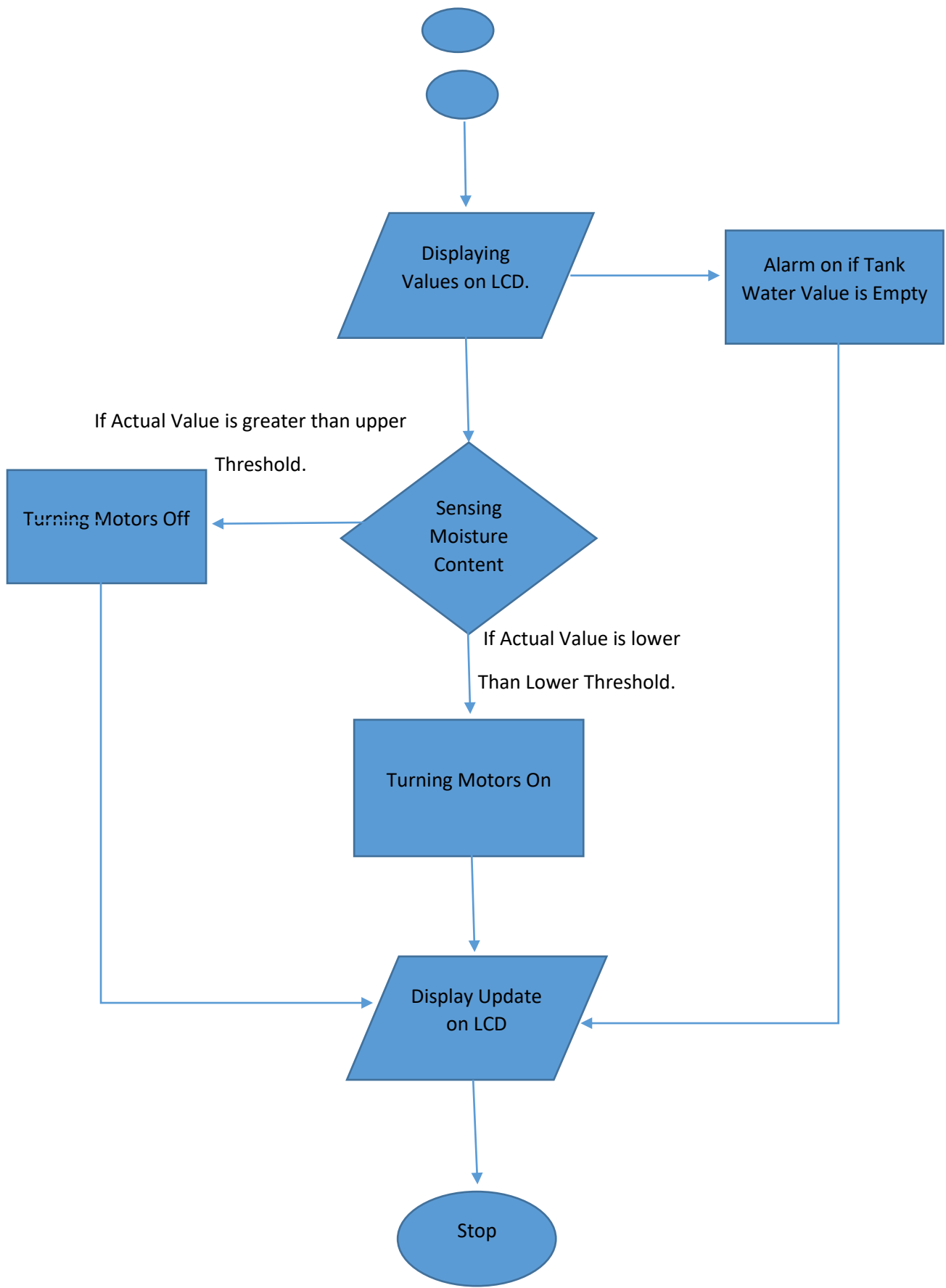consist of an alarm system which tells us if there is water or not in the tank. These are most important as the information forwarded by them is most relative regarding water requirement. The sensor has two prongs which are submersed in the soil. It has 4 ports. Ports are for GND, VCC and outputs for analogue and digital values. DHT11 is the humidity sensor. They detect the water content in atmosphere. The high humidity may increase dampness in soil. LM35 is the temperature sensor. They judge the temperature of environment. The advantage of LM35 is its feature that it always gives temperature in Celsius further calculations are not required to convert output to get temperature in Celsius. The latter two sensors are used to make the system more reliable. These two sensors are left in open environment. They constantly give the value of temperature and humidity. When the temperature or humidity level of environment alter, it may affect the moisture level of soil so to eradicate any changes that may fluctuate the process of irrigation these sensors send signal to Arduino to take some action. In the design, if humidity level goes above our defined value then to mild its effect the Arduino sends signal to DC fans located near the sensors. The DC fans automatically turn on themselves and kept on running until normal conditions are achieved.

(III) Photo Voltaic Panels Solar panels are used to liberate irrigation from the shackles of load shedding. The requirement of water is judged and information is transmitted to the solar circuit which modifies its configuration such that it provides enough DC power to drive the pumps and fulfil the assigned task. This method is not only power efficient but also proves to be cost effective when considered in long run. The solar irrigation process proves to be of great worth to the irrigation cites which are far from grid stations.

(C)Working Principle: The basic working principle of the system is easy to understand. The system is divided into smaller circuitries. First one is solar circuit, it provides DC power to the components when power is needed by them. Second circuit is the sensor network. Moisture sensors are submersed into soil and connected back with the main system. The sensors give values of moisture content of soil and these values can be seen on LCD. The sensors also give the water level of the tank to know if it is sufficient or not. The actual value of water content in soil is read by the moisture sensors which are submersed in soil. The code compares this value with the two user defined threshold values. In the Flowchart of Automatic Irrigation Process If actual value happens to be below than the lower threshold value, the code will generate a signal that will turn motors on. The process will be autonomous and the dried part of soil gets moisturized. The values of moisture level are constantly compared with the threshold values in code and if actual moisture value crosses the upper threshold value then again code will send the signal of turning off the motors. The process starts with sensors reading the value and displaying them on LCD. As the value of moisture falls below the lower threshold point, the motor starts and if the content climbs the upper threshold value the motors shuts off. The status of motors is also displayed on LCD.

- **Flowchart:**

```
        ( )
         |
        ( )
         |
         v
   ┌─────────────┐                    ┌─────────────┐
   │  Displaying  │──────────────────▶│  Alarm on if Tank │
   │ Values on LCD.│                   │ Water Value is Empty│
   └─────────────┘                    └─────────────┘
         │                                    │
         v                                    │
If Actual Value is greater than upper         │
                                              │
         Threshold.                           │
┌─────────────┐         ◇                     │
│Turning Motors Off│◀──── Sensing             │
└─────────────┘         Moisture              │
         │              Content               │
         │                 ◇                  │
         │              If Actual Value is lower│
         │                                    │
         │              Than Lower Threshold. │
         │            ┌─────────────┐         │
         │            │             │         │
         │            │Turning Motors On│      │
         │            │             │         │
         │            └─────────────┘         │
         │                  │                 │
         │                  v                 │
         └─────────▶  Display Update  ◀───────┘
                      on LCD
                         │
                         v
                      ( Stop )
```
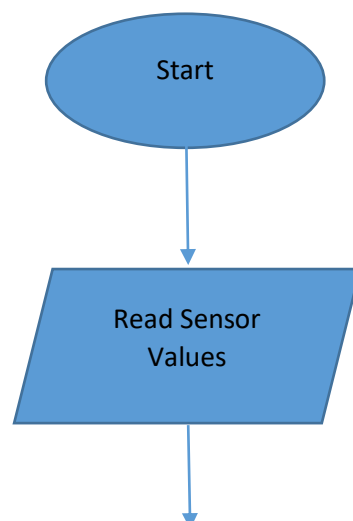
- **Algorithm:**

Step 1. Start.

Step 2. Read Sensor Values.

Step 3. Print Values on LCD.

   If Tank water level is empty,

   Turn on Alarm.

Step 4. Sensing Moisture Content.

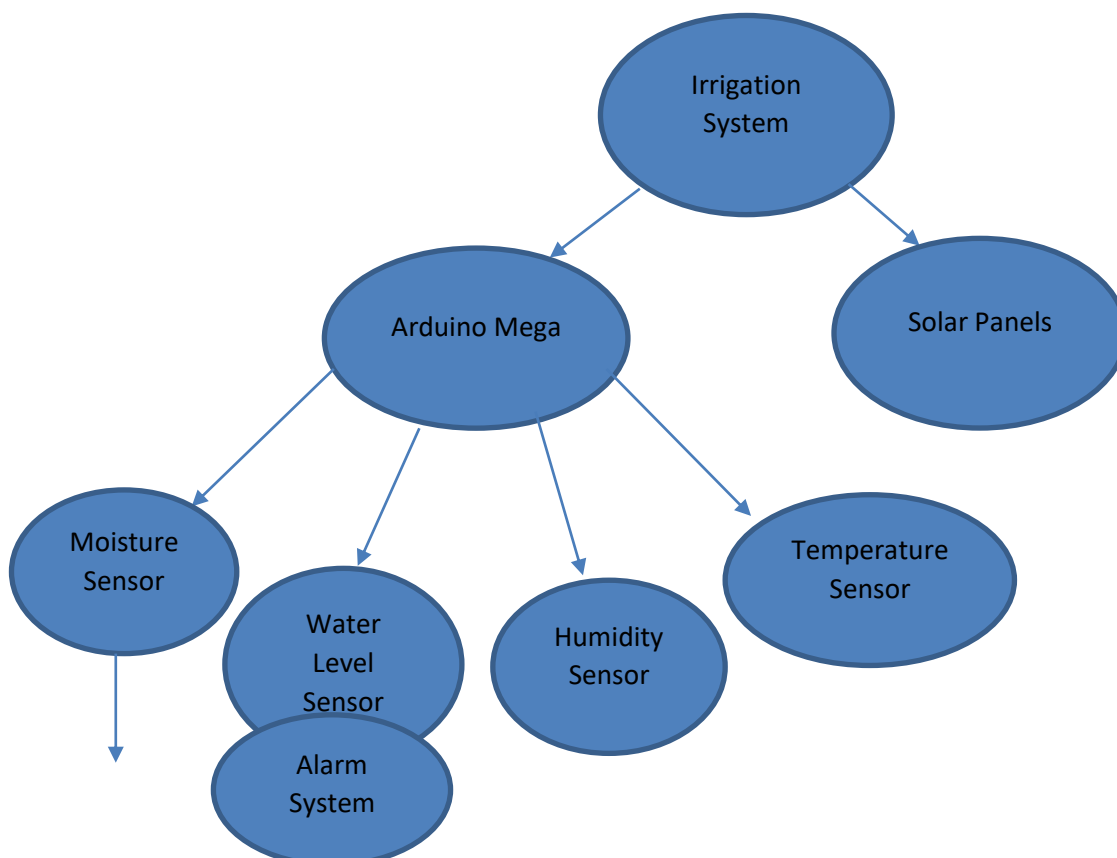   If Actual value is greater than Upper Threshold,

   Turn Motors off.

Step 5. Turn Motors On.

Step 6. Display Update on LCD.

Step 7. Stop.

- **Top-Down Design Approach:**

DC
Motors