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Automation of Irrigation system using ARM processor

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Abstract: Agriculture is the backbone of Indian economy. The continuously increasing population in India demands for the fast development in food production technology. Water is the main resource for agriculture. Therefore, efficient water management of freshwater resources and proper utilization of available water resources has a crucial importance. To save the water and to increase the yield of crop proper method of irrigation by drip is very economical and efficient. This paper presents a fully automated drip irrigation system which is controlled and monitored by using ARM processor. Soil moisture sensors is used to monitor the moisture content of the soil and depending on that the valves of the system are turned ON or OFF automatically for different interval of time. Humidity is also measured and monitored using different sensors. We can display the received data on a virtual monitor. We can do the simulation of this project using software, Proteus design suite, in which me can implement the simulation of any project and test it by programming the processors.

***Index Terms* – ARM7 (LPC2148), Agriculture, Temperature sensor, Soil moisture sensor.**

I. INTRODUCTION

INDIA IS THE COUNTRY OF VILLAGE AND AGRICULTURE PLAYS AN IMPORTANT ROLE FOR DEVELOPMENT OF COUNTRY. IN OUR COUNTRY, AGRICULTURE DEPENDS ON THE MONSOONS WHICH HAS INSUFFICIENT SOURCE OF WATER. SO, THE IRRIGATION IS USED IN AGRICULTURE FIELD. IN IRRIGATION SYSTEM, DEPENDING UPON THE SOIL TYPE, WATER IS PROVIDED TO PLANT. IN AGRICULTURE, TWO THINGS ARE VERY IMPORTANT, FIRST TO GET INFORMATION OF ABOUT THE FERTILITY OF SOIL AND SECOND TO MEASURE MOISTURE CONTENT IN SOIL. NOWADAYS, FOR IRRIGATION, DIFFERENT TECHNIQUES ARE AVAILABLE WHICH ARE USED TO REDUCE THE DEPENDENCY OF RAIN. AND MOSTLY THIS TECHNIQUE IS DRIVEN BY ELECTRICAL POWER AND ON/OFF SCHEDULING. IN THIS TECHNIQUE, WATER LEVEL INDICATOR PLACED IN WATER RESERVOIR AND SOIL MOISTURE SENSORS ARE PLACED ROOT ZONE OF PLANT AND NEAR THE MODULE AND GATEWAY UNIT HANDLES THE SENSOR INFORMATION AND TRANSMIT DATA TO THE CONTROLLER WHICH IN TURNS THE CONTROL THE FLOW OF WATER THROUGH THE VALVES.

1.2 Motivation

For continuously increasing demand and decrease in supply of food necessities, it's important to rapid improvement in production of food technology. Agriculture is only the source to provide this. This is the important factor in human societies to growing and dynamic demand in food production. Agriculture plays the important role in the economy and development, like India. Due to lack of water and scarcity of land water result the decreasing volume of water on earth, the farmer use irrigation. Irrigation may be defined as the science of artificial application of water to the land or soil that means depending on the soil type, plants are to be provided with water.

1.3 Area of Utility

- The primary focus of this project is to help the farmers and reduce their work.
- This module can be implemented in perennial plant irrigation land and gardening land.

II. LITERATURE SURVEY

The different audits on various works of robotized water system framework has been introduced in this subsection. In [1], Sahu et al. proposed a savvy brilliant water system framework which was built utilizing raspberry-pi and Arduino. The raspberry-pi is utilized to control a three-way electromagnetic valve which chooses the heading of the water stream. While the valve is kept open, the engine is turned ON and the rancher is informed through Short Messaging Administration (SMS) or email to his enlisted email account. In [2], Paucar et al. has proposed the remote framework design for shrewd water system. The framework uses a remote sensor organization to accumulate sensor information to assess the natural circumstances. Riadh et al. [3] has proposed a brilliant water system framework at a ranch scale covering field crops as well as manors. In [4], Sanga et al. has likewise examined about the minimal expense savvy water system framework which upgrades the rancher's life and Indian economy. Navarro et al. [5] proposed the choice help brilliant water system framework. This framework appraises the week-by-week water systems requirements of the yield, and it can anticipate the water system necessities of one or a few harvests, in light of the data given by the sensors and furthermore from the authentic document of the earlier year water system reports. Arvind et al. [6] has proposed an affordable and simple method for utilizing Arduino-based robotized water system framework that is somewhat constrained by an android advanced mobile phone. Natta et al. [7] has fostered a robotized horticultural framework which measures the ecological information from the vegetable yield utilizing remote sensor organizations and controls the water system framework. Different estimated natural information was sent back to the server hub through facilitator hubs. In [8], Kumar et al. has proposed a mechanized water system framework for productive administration of water assets in farming area. The System utilizes impedance-based sensors to quantify the overall dampness of the dirt. Nesa et al. [9] proposed the robotized water system framework utilizing Medium Access Control (MAC) convention through remote sensor organizations. In [10], Patricia et al. has introduced the execution of financially savvy shrewd water system framework utilizing changed remote sensor organization. Ayman et al. [11] has exhibited the design of a remote sensor network for the board of harvest water system from trenches. The framework comprises of stream sensors, water level sensors, entryway and an water system the executives stage. The entryway sends the got information to the web server through GPRS association. The web server relates to data set for following the water levels in every one of the channels. The benefit of the proposed framework is its minimal expense hubs and area-based water utilization planning. Milos et al. [12] has introduced an outline of brilliant water system programming arrangements. The introduced arrangements utilize the natural information to pursue ongoing choices and plan the water system plan. The information was assembled from different sensors, existing data sets, web sources and weather conditions stations. In [13], a fluffy rationale-based water system framework has been introduced. Direct sensor information like air temperature, soil-dampness, sun-oriented radiation and water stream have been given gained utilizing various sensors and are given straightforwardly as the contributions to fluffy rationale regulator. It requires a greater number of conditions for deciding the time furthermore, term of water system.

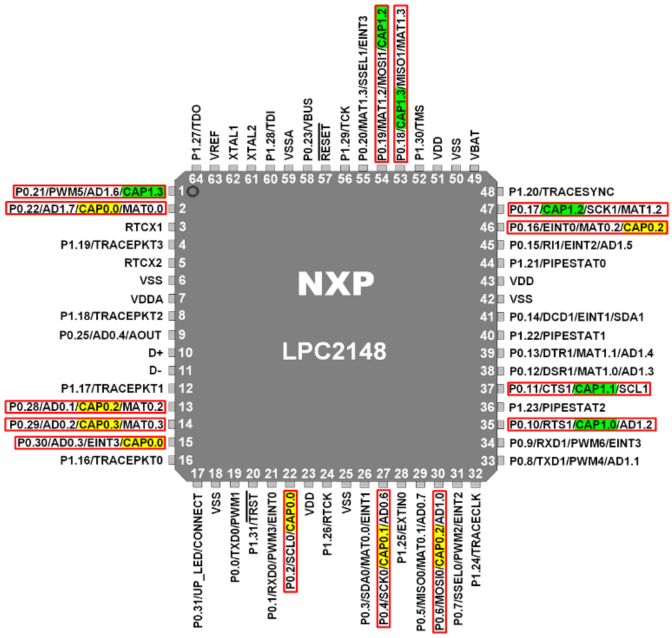
III. Proposed System

The goal of the proposed system is to design a agriculture system, which is low cost, Fast, Easy to handle and Reliable. The recommended system uses an ARM 7 Microprocessor to run the programs more effectively. The ARM 7 processor is integrated with a soil moisture sensor, a temperature sensor, and a humidity sensor to automate the system. It uses a network of sensors to regulate the applications, which aids in the observation and maintenance of the irrigation process for increased agricultural productivity. These sensors assist the user in automating the irrigation process; the sensors and water pump motors do all the tasks using the processor ARM7. On a virtual screen, we may see updates on the procedures that have been conducted.

IV. Hardware used

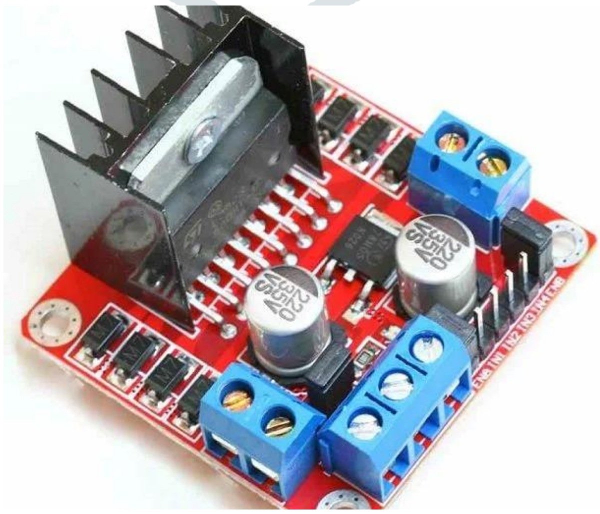
a) **Power System:** It provides components with electric power. The power source must give +5V for the components to work. To maintain a constant voltage of +5V, the IC LM7805 is employed. The alternating current voltage (220V) is connected to a transformer, which converts it to a direct current output. A full wave rectified voltage is generated by a diode rectifier, which is then filtered using a simple capacitor filter to produce a direct current voltage. The resulting dc voltage has some ripple in it. Even when the input dc voltage varies, a regulator circuit eliminates ripples and maintains the same dc value.

b) **Processor:** The LPC214x microcontrollers have a 32/16-bit ARM7TDMI-S CPU with real-time emulation and inbuilt trace support, as well as embedded high-speed flash memory ranging from 32 to 512 kB. 32-bit code execution at the highest clock rate is possible because to a 128-bit wide memory interface and a unique accelerator design. The alternative 16-bit Thumb mode cuts code by more than 30% with negligible performance loss for essential code size applications.

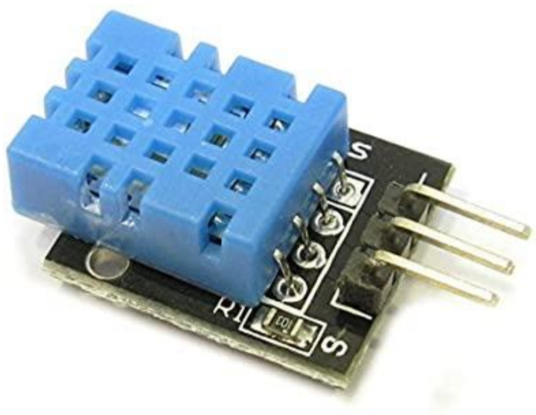


c) **Temperature Sensor:** The temperature sensor is a transducer that converts the temperature of the environment into electricity. The voltage is then converted to Celsius, then to Fahrenheit, and the Fahrenheit temperature is shown on the LCD monitor.

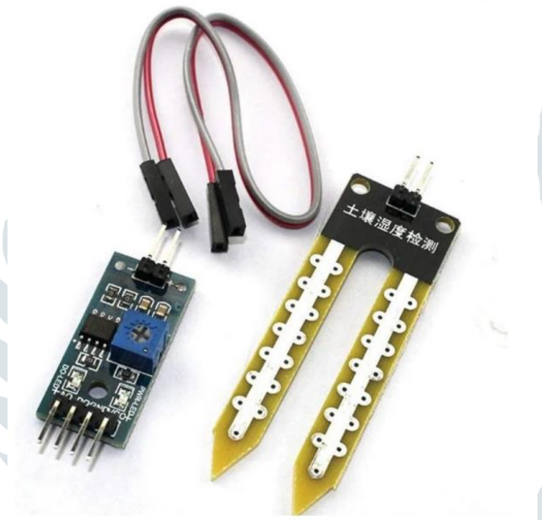
d) **L293D Motor Driver:** The L293D is a 16-pin motor driver IC that can simultaneously drive two DC motors in either direction. At voltages ranging from 4.5 V to 36 V (at pin 8!), the L293D can drive bidirectional currents of up to 600 mA (per channel). It can control small dc motors.



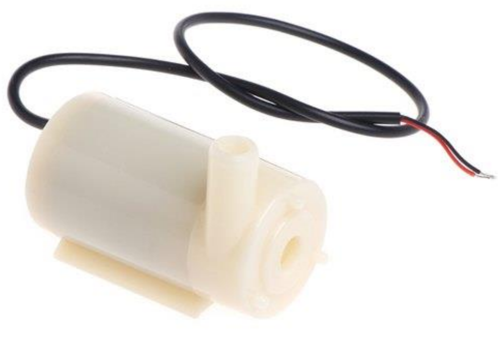
e) **Humidity Sensor:** The AM2302 has a plastic body that houses a capacitive humidity sensor and a thermistor temperature sensor. A power supply of 3 to 5 volts DC is required. 2.5 mA is the rated current consumption. Every two seconds, the module sends digital signals to the DATA pin. This sensor can detect relative humidity levels ranging from 0 to 100% R.H. It is possible to attain humidity sensing precision of 2 to 5% R.H.



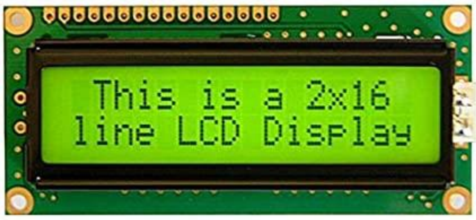
f) **Soil Moisture Sensor:** The ambient humidity affects the soil moisture sensor. They're often used to determine how much moisture is in the soil. Both analog and digital outputs are possible from the sensor module. It also features an Integrated Chips (IC) LM393 comparator on board, as well as a potentiometer for setting a threshold value.



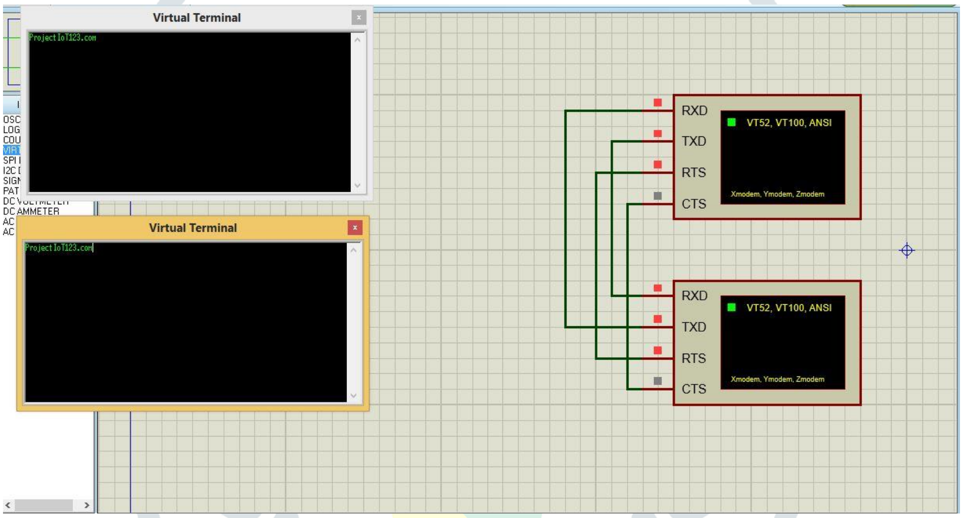
g) **Water Pump:** The water pump is a submersible water pump with a power output of 18 watts. The pump's working voltage is 220/240V AC @ 50 Hz. The maximum flow rate is 1100 liters per hour. Dry runs should be avoided, and the pump should always be operated completely immersed.



h) **LCD 16x2:** An LCD (Liquid Crystal Display) screen is a sort of electronic display module that may be used for a variety of purposes. A 16x2 LCD is a basic module that may be found in a wide range of devices and circuits. A 16x2 LCD has two lines and can display 16 characters per line. On this LCD, a 5x7 pixel matrix represents each character. The 224 unique characters and symbols may be seen on the 16 x 2 intelligent alphanumeric dot matrix display.



i) **Virtual Monitor:** The Virtual Terminal feature in Proteus is handy. One may simply imitate serial connectivity in his or her embedded systems using Virtual Terminal. It's worth noting that practically every embedded microcontroller includes an inbuilt UART, which is used to do serial communication with other embedded hardware that supports Universal Asynchronous receipt and transmission.



V. SOFTWARE DETAILS

a) **Programming Language Used:** C+

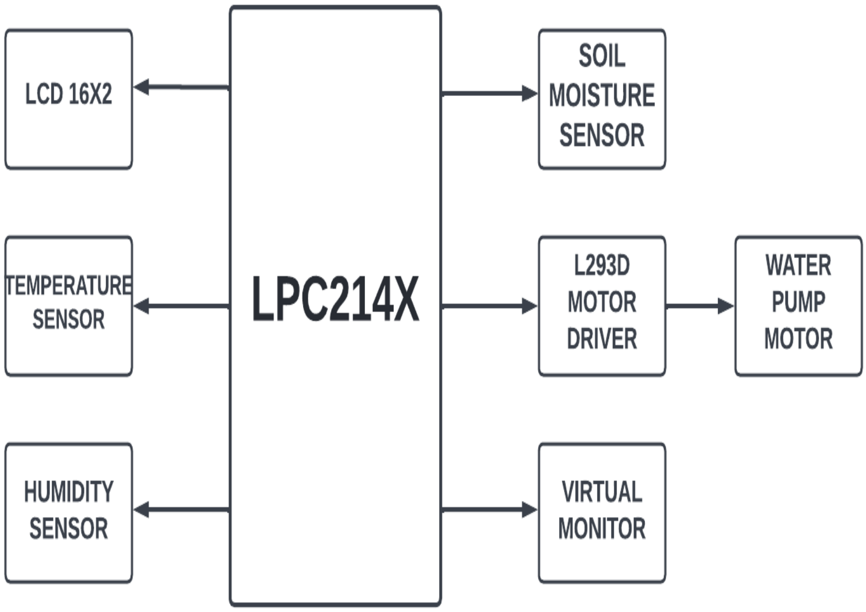
b) **IDE Used:** Keil µVision IDE

c) **Software Used:** Keil µVision version 4 and Proteus Design Suite.

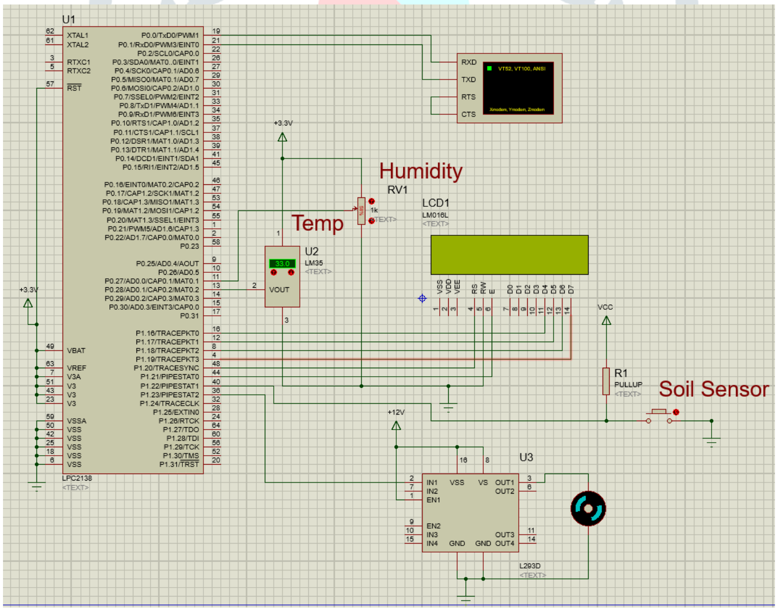
DATABASE: **KEIL MICRO VISION** IS A FREE APPLICATION THAT ALLEVIATES MANY OF THE PROBLEMS THAT AN EMBEDDED PROGRAMMER OR DEVELOPER FACE. THIS APPLICATION IS AN INTEGRATED DEVELOPMENT ENVIRONMENT (IDE) THAT INCLUDES A TEXT EDITOR, A COMPILER, AND THE ABILITY TO CONVERT SOURCE CODE TO HEX FILES.

The **Proteus Design Suite** is a proprietary software tool suite that is primarily used to automate electrical design. Electronic design experts and technicians use the programmer to develop schematics and electronic prints for manufacturing printed circuit boards.

VI. BLOCK DIAGRAM



VII. CIRCUIT DIAGRAM



First, the necessary connections are formed in the proper sequence. To guarantee that the findings may be shown on the virtual monitor, the Arm7 is coupled to the Soil Moisture Sensor and Temperature. The temperature sensor, soil moisture sensor, and humidity sensor are all integrated with the Arm7 to provide input value when they are activated. Using the given code, the Arduino Uno module accepts all inputs and outputs results. To give real-time output results, the LCD is connected to the Arduino Uno.

VIII. ALGORITHM

Step 1: Initialize LCD and Sensors.

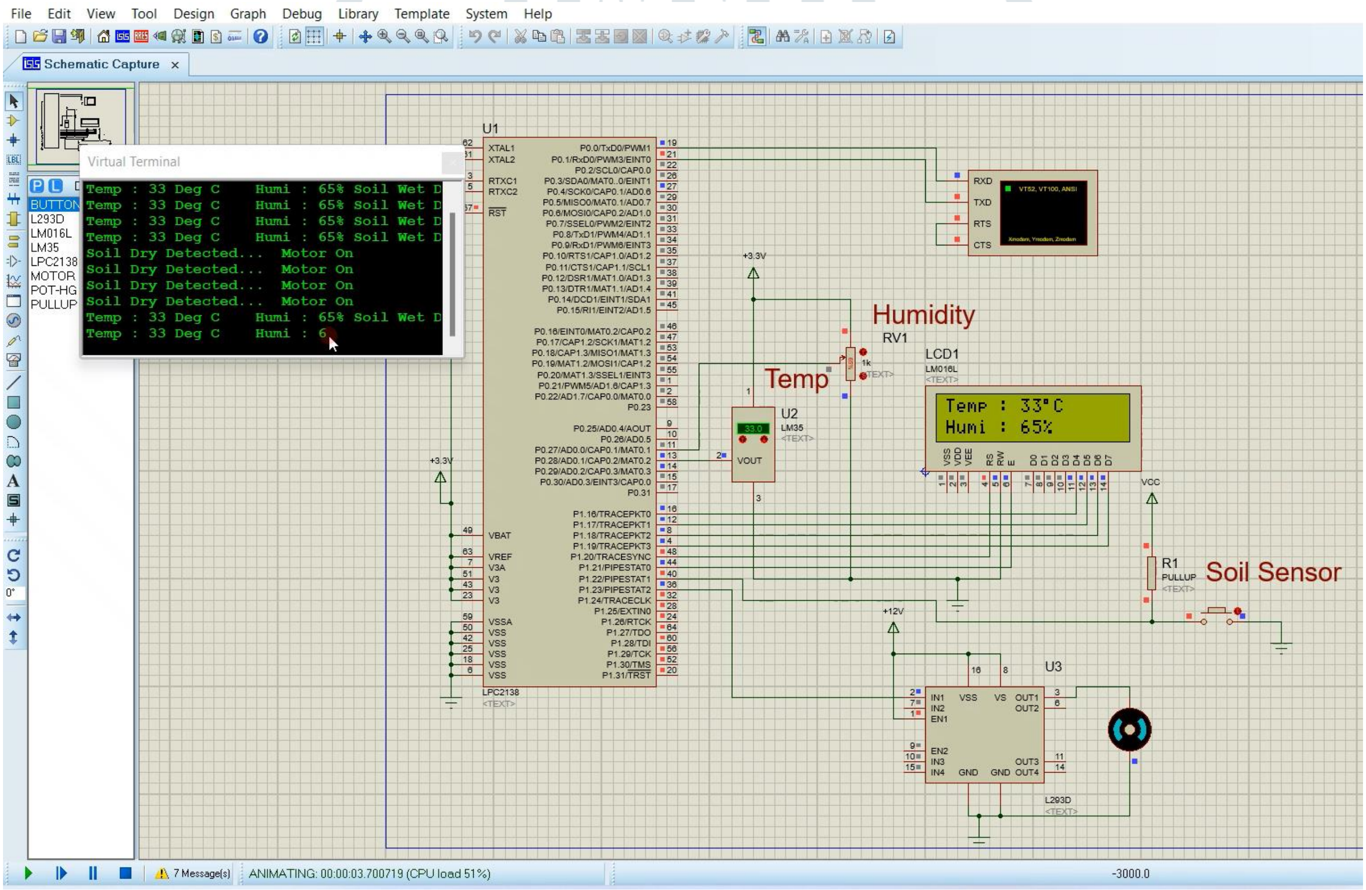
Step 2: Display initial test.

Step 3: Checking if the sensor gets triggered.

Step 4: If the sensor value is low or high update the values to LCD or Virtual Monitor.

IX. RESULTS

The results show that when the soil moisture sensors detect no moisture in the soil, they send a signal to the microprocessor ARM7 LPC2148, which turns on the water pump motor. The soil moisture sensors detect when the soil becomes damp, and the water pump motor is shut off. This procedure is presented on an LCD and a virtual monitor, which allows us to acquire updates on the functions that are being done with Time, Temperature and Humidity. The entire procedure is an automated system that runs on ARM7 and conducts the operation based on the input code.



X. ACKNOWLEDGEMENT

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