

## International Journal of Innovative Research in Science, Engineering and Technology

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# Design and Development of ARM Cortex LPC1768 Based Water Level Management System

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**ABSTRACT:** Now a day's water and energy resources are becoming scarcity and therefore more valuable. In conjunction with the population growth over last century especially in India, the need for finding new and sustainable methods with high efficiency for agricultural cultivation and food production is very much essential. To facilitate this process, we are designing, building, and evaluating a system to utilize the minimum usage of water and energy for agriculture fields which is most useful for farmers to manage water and energy respectively. Our system aims to make cultivation and irrigation with more efficient as the farmer is able to make better informed decisions and thus save time and resources. ARM CORTEX based system is developed to know the level of water and control the flow of water in the field of plants or crops. This system monitors the water level in the field and automatically switches ON the motor when water level goes below the prescribed level in the field of plants or crops. The motor is switched OFF when the field is full of water level. Here the water level of the field is indicated on LCD (Liquid crystal Display). Using this system, the wastage of water and energy can be avoided. The ARM Cortex LPC1768 based system is developed for water level management and energy management which is useful for farmers to reduce power consumption.

**KEYWORDS:** ARM CORTEX M3 (LPC1768), 2X16 LCD, Relay, Pump Motor.

### I. INTRODUCTION

Water is commonly used for agriculture, industry and domestic consumption. Unfortunately a huge amount of water is being wasted by uncontrolled use. To avoid wastage of water, an automated water management system is developed and implemented. Our intension of this research work was to establish a flexible, economical and easy configurable system which can solve our water losing problem and damage of crops. The water is a precious for human and living organism and now a days the water quality and wastage a big issue. This is done by lower water treatment management and wastages of Water. Therefore, efficient use and water monitoring are potential binding for agriculture and home water management system. Last few decades several monitoring systems integrated with level of water detection have become agreed. Monitoring of water level is a challenging task for farmers in the field of plants. In this way, it will be possible to follow the actual implementation of such initiatives with integration of various controlling activities. Therefore, controlling system of water implementation makes potential significance in agriculture and home applications. The existing automated level detection method is described and that can be used to make a device ON/OFF. Moreover, the common control of water pump is simply to start the feed pump at a low level and allow it to run until a higher level of water is reached in the field. This is not properly supported for adequate controlling system. When proper monitoring is needed to ensure water sustainability is actually being reached to sensing and automation.

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## II. GENERAL DESCRIPTION OF THE HARDWARE AND SOFTWARE

### A.HARDWARE:

The system performs the sensing level and control activities without the manual observation and attention. Since it is an automated system, it provides enough information to the farmers and water usages for such a long period.

**Block Diagram:** The block diagram of the hardware is shown in the below figure 1 which consists of ARM CORTEX LPC1768, 16x2 LCD, Relay and Pump Motor.

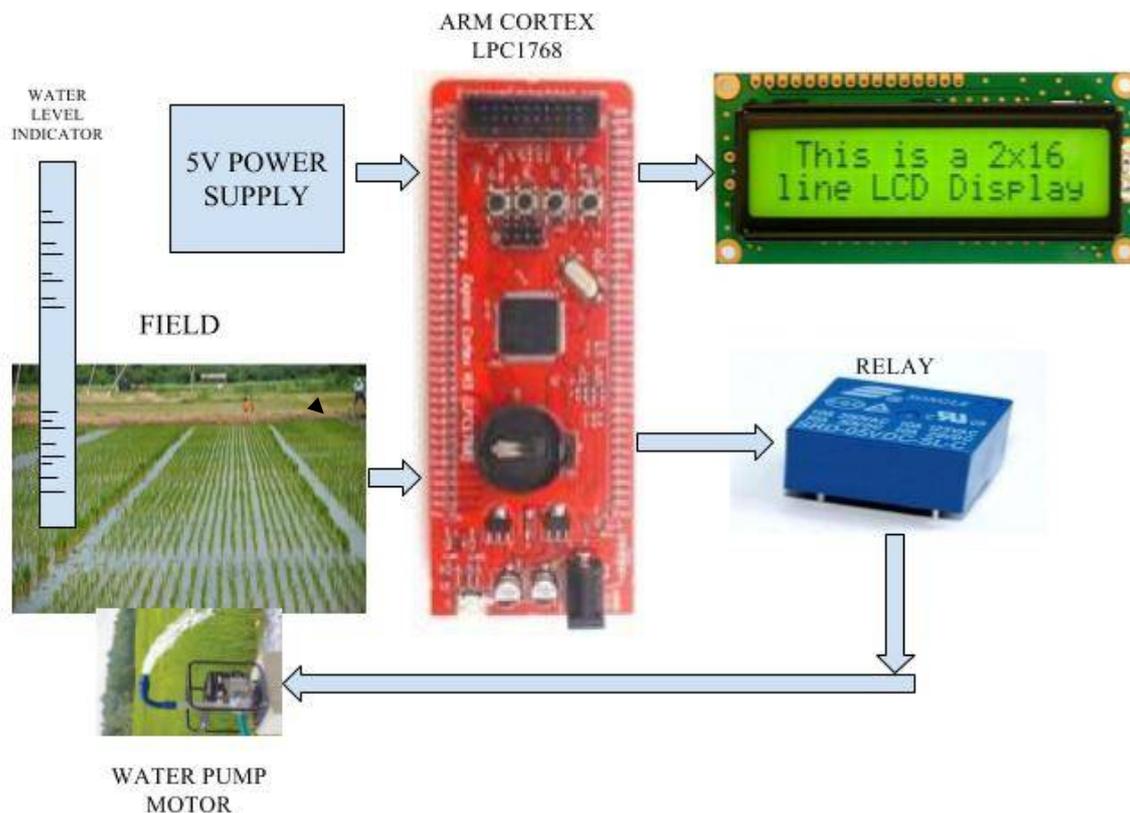


Figure 1: Block Diagram

### A1. ARM Cortex LPC1768:

The LPC1768 is ARM Cortex-M3 based microcontroller for embedded applications featuring a high level of integration and low power consumption. The LPC1768 operate at CPU frequencies of up to 100 MHz. The peripheral complement of the LPC1769/68/67/66/65/64/63 includes up to 512 kb of flash memory, up to 64 kB of data memory, Ethernet MAC, USB Device/Host/OTG interface, 8-channel general purpose DMA controller, 4 UARTs, 2 CAN channels, 2 SSP controllers, SPI interface, 3 I2C-bus interfaces, 2-input plus 2-output I2S-bus interface, 8-channel 12-

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bit ADC, 10-bit DAC, motor control PWM, Quadrature Encoder interface, four general purpose timers, 6-output general purpose PWM, ultra-low power Real-Time Clock (RTC) with separate battery supply, and up to 70 general purpose I/O pins.



### A2. Liquid Crystal Display (LCD):

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing by LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons. These components are “specialized” for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

### A3. Relay (5V SPDT):

**Relay** is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to switch a 230V AC mains circuit.

### A4. Pump Motor:

A **pump** is a device that moves fluids by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid. Pumps operate by some mechanism and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity engines or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps. Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis.

## B. SOFTWARE DESCRIPTION:

### KEIL $\mu$ VISION (IDE):

Keil an ARM company makes C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, evaluation boards, and emulators for ARM7/ARM9/Cortex-M3, XC16x/C16x/ST10, 251 and 8051 MCU families. When starting a new project simply select the microcontroller from the Device Database and the micro vision IDE sets all compiler, assembler, linker, and memory options. The Keil ARM tool kit includes three main tools, assembler, compiler and linker. An assembler is used to assemble the ARM assembly program. A compiler is used to compile the C source code into an object file. A linker is used to create an absolute object module suitable for in-circuit emulator. To compile the C code you need the KEIL software. They must be properly set up and a project with correct settings must be created in order to compile the code. To compile the code, the C file must be added to the project. In

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Keil, you want to develop or debug the project without any hardware setup. You must compile the code for generating HEX/BIN files. In debugging Mode, you want to check the port output without LPC1768 Primer Board.

**Proteus:**

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design. The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards. The Proteus Design Suite is a windows application for schematic capture, simulation and PCB layout design.

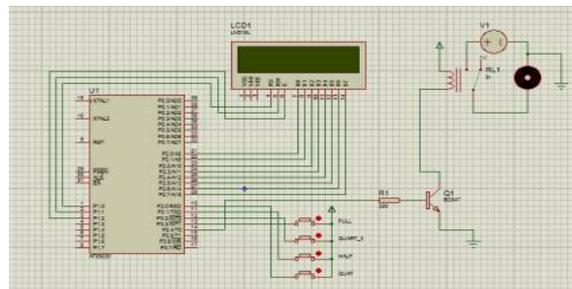


Figure 3: Schematic Design in Proteus

**Flowchart:**

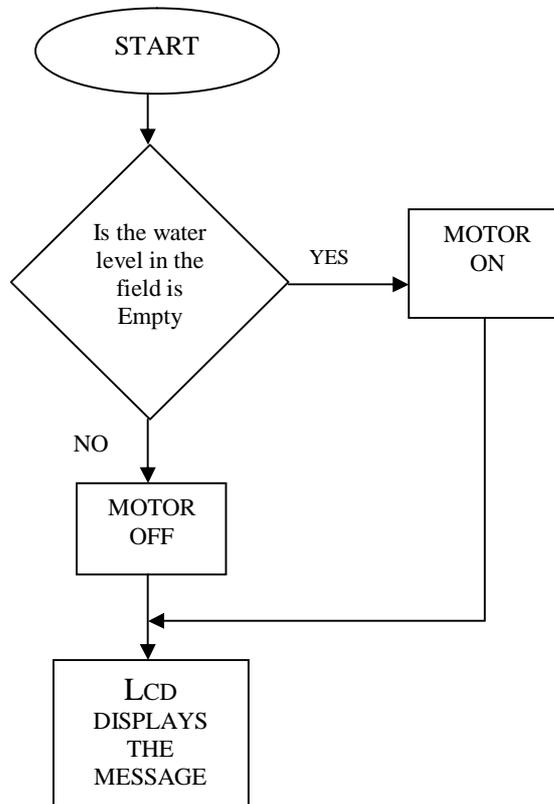


Figure 4: Flowchart of Water Level Management System

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### III.WORKING PRINCIPLE

This **water management system** works on the principle that water conducts electricity. An electric wire is connected to VCC and the second electric wire which will act as a sensor is dipped into the field of water. The wire sensor detects the water level and indicates the water level whether the field is full of water or empty. If the water is full in the field of plants, the motor automatically turn OFF otherwise turn ON and this output is taken on pin P0.0 via a transistor BC547. Port P1 is connected to data pins of LCD and P2.0, P2.1, P2.2 are connected to RS, RW, and EN pins of LCD respectively.

Initially when the water level in the field is empty LCD will show the message *EMPTY*. Then the motor turns ON and pump the water to the field filled with sufficient water level, water touches the sensor which gives the positive voltage because water acts partially conducting media. This voltage is then fed to their corresponding pins on controller. When water level reaches to FULL the LCD displays the message as *FULL*. Then automatically motor turns OFF through a relay.

### IV.EXPERIMENTAL RESULTS



Figure 5: LCD displays the message "EMPTY"



Figure 6: LCD displays the message "FULL"

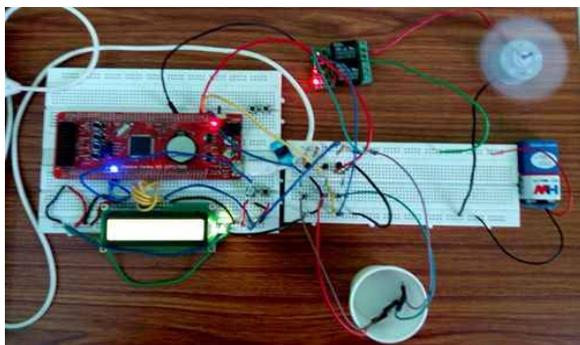


Figure 7: Screenshot of Total Experimental Set up

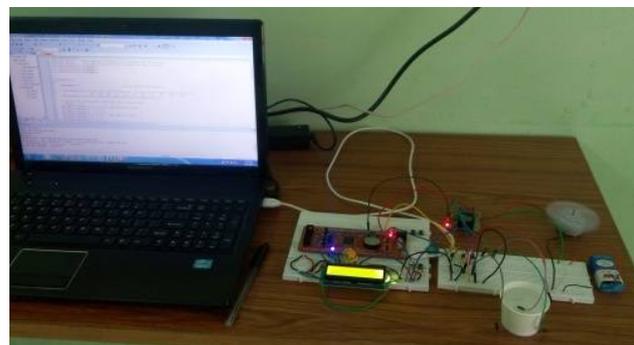


Figure 8: Screenshot of Total Experimental Set up with code

### V.CONCLUSION

The water management system employs a simple mechanism to detect and indicate the water level in the field of plants. The sensing is done by using a probe which is placed at one of the levels of the field. This system is very beneficial to the farmers to protect the crops from damage. It helps in the efficient utilization of available water

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resources. If used on a large scale, it can provide a major contribution in the conservation of water for us and the future generations. In these days, when the Earth's reserve of consumable water is decreasing every moment, every drop has its value. Water level controller is a simple and effective and implemented to prevent wastage of water and to protect the plants from the damage. In future the system to be upgraded by using Zigbee and GSM technology. This Zigbee and GSM technology is going to use to switch ON/OFF the motor and monitor the water level in the field.

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