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Smart Drip Irrigation System Using Raspberry Pi and Arm7

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ABSTARCT:

In this paper Low cost drip irrigation system serves as the proof of the concept .The design can be used in big agriculture fields as well as in small gardens. The use of magnetic sensors and AC submersible motor make a smart drip irrigation system. Here we are employing a LPC2148 as our controller to know the level of water in a tank using magnetic sensors and accordingly the motor can be switched on/off depending on the water level. Raspberry pi is also used to capture the image and forward through E-mail. So that owner can have a glance about their farm/garden. The Raspberry Pi is a credit-card sized in an single-board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi has a Broadcom BCM2836 system on a chip. It does not include a built-in hard disk or solid-state drive, but Uses an SD card for booting process and storage.

Keywords:

ARM7 Processor, Raspberry pi, Magnetic sensor.

I.INTRODUCTION:

The requirement for automation system is increasing. Industrialist and researchers are working to build efficient systems to control different machines based on the requirement. Automation makes the efficient use of power and water. Drip irrigation system use water and fertilizer efficiently. Water is slowly dripped to the roots of the plants through narrow tubes. Water is fed directly to the base of the plants.

The Existing automatic drip irrigation systems water plants based on soil humidity. These parameters are required in fields where productivity of the crop matters.Our proposed irrigation system will be very efficient where watering at regular interval matter.

II.SYSTEM MODEL:

The project and its security features along with the system flow will be explained in a step by step format in the following text.The irrigation system starts when the LPC2148 relieves the ON command from the level 4 magnetic sensor which is placed at the bottom of the tank.The LPC2148 sends the signal to raspberry pi to capture the image and to send an email to the user.Then the motor will be in ON condition.During the level 3 and level 4 the motor will be in ON condition.If the level 1 sensor sends the signal to the LPC2148 the motor will be OFF and raspberry pi sends the captured image to the user.The level 4 sensor is placed at the top of the tank.

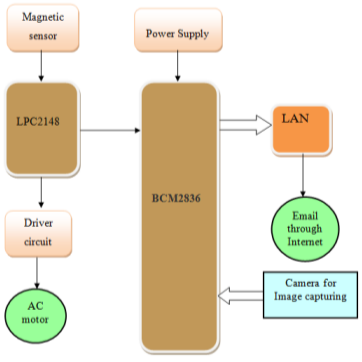

Fig1: Block Diagram

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III.METHODOLOGY

MAGNETIC SENSOR:

The reed switch contains a pair of flexible, metal reeds whose end portions are separated by a small space when the switch is open. Then the reeds are hermetically sealed in opposite ends of a tubular glass envelope.

Fig2: Magnetic Sensor

LPC2148:

The LPC2148 microcontrollers is widely used IC from ARM7 family. It is a 16-bit/32-bit ARM7TDMI-CPU with real-time emulation and combine microcontroller with embedded high speed flash memory from 32 KB to 512 KB. It requires the crystal frequency of 12 MHZ and runs voltage of 5v. LPC2148 are ideal for applications where it is a key requirement, Serial communications interfaces from a USB 2.0 Full-speed device, 2 UARTs, 2 SPI, 2 I2C-bus and on-chip SRAM of 8 KB up to 40 KB, two 32-bit timers, single 10-bit DAC, watchdog timer, real time clock (RTC), PWM channels and GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers.

A 128-bit wide memory interface enable 32-bit code execution at the highest clock rate for critical code size applications, the alternative 16-bit Thumb mode reduces code with minimal performance. Due to their tiny size and low power consumption, LPC2148 is ideal for applications where miniaturization is a key requirement. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways, soft modems, voice recognition and low end imaging, providing high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC and 45 fast GPIO lines with up to nine edge external interrupt pins make these microcontrollers suitable for industrial control.

RASPBERRY-PI:

The Raspberry Pi has a Broadcom system on a chip (SoC), which includes an a quad-core Cortex-A7 cluster. The Cortex-A7 MP Core processor is a high-performance, low-power processor that implements the ARMv7-A architecture.

Fig3: Raspberry pi Modem

The Cortex-A7 processor has one to four processors in a single multiprocessor device. The Raspberry Pi foundation has released an upgraded version of the Raspberry Pi. Raspberry Pi 2 model B features must have the same ports and form factor as Raspberry Pi Model B+, by replaces Broadcom BCM 2835 ARM11 processor @ 700 MHz with a much faster Broadcom BCM2836 quad core ARM7 processor @ 900 MHz, and with an upgrade to 1GB RAM. The Raspberry Pi is manufactured through licensed manufacturing deals with Newark element14 and Egoman. All of these companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China, which can be distinguished from other Pis by their red coloring and lack of FCC marks. The hardware is the same across all manufacturers.

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The ARM Cortex-A7 processor is the power-efficient processor. The Cortex-A7 powers sub-$100 entry-level smart phones, as well as a number of high-end wearable devices. The processor led the multicore revolution for entry-level and mid-range mobile smart phones, and devices based on the quad- and octa-core configurations are shipping in huge volumes. The Cortex-A7 processor is aligned with the very high-performance processors, enabling devices based on big LITTLE™ technology.

The Cortex-A7 processor is supported by a optimized IP targeted at mid-range solutions, bringing maximum efficiency levels and ease of integration. All of our Mali™ mid-range and high-end graphics processors can be integrated with the Cortex-A7, as well as the Mali-V500 video processor and Mali-DP500 display processor. Our pervasive range of physical and system IP is also available as standard.

CAMERA MODULE:

The Raspberry Pi has a custom designed Camera Module. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. This interface uses the dedicated CSI interface, which was designed especially for interfacing the cameras. The CSI bus is capable of extremely high data rates, and it carries pixel data.The board is small, at around 25mm x 20mm x 9mm. It also weighs just over 3g, making it perfect for mobile or other applications where size and weight are very important. It connects to Raspberry Pi by way of a very short ribbon cable. The camera is connected to the BCM2835 processor on the Pi , a higher bandwidth link which carries pixel data from the camera back to the processor. This bus travels along the ribbon cable that attaches the camera board to the Pi. The sensor itself has a native resolution of 5 megapixels, and has a fixed focus lens onboard. In terms of still images, the camera is capable of 2592 x 1944 pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video. The following figure shows how the camera module is connected to the Raspberry PI.

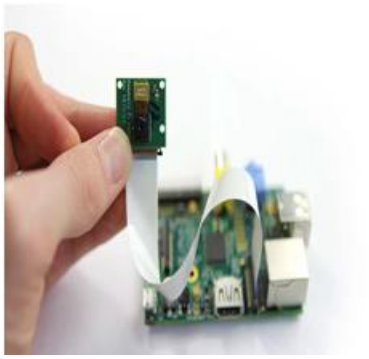

Fig 4: Camera Module Interface to the Raspberry PI

VI.SOFTWARE:

Keil compiler is a software tool, which is used as machine language code is written and compiled. After compilation is done, the machine code is converted into hex code which is to be dumped into the microcontroller for processing. Keil compiler also supports C language code.

RESULT AND CONCLUSION:

In this project, we reported and implemented a complete working model using an ARM7 Processor and Rasspberry Pi. This work includes the study of Magnetic sensor and this project can be very much useful in real time applications. This is a real-time based paper which tells that there is a Smart drip irrigation system. For the future scope, we can add GSM technology.

Fig5. Output of the kit

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