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Irrigation System Using Raspberry PI and GSM

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Abstract:
The aim of this paper is to develop a smart irrigation monitoring system using raspberry pi and GSM technology. Focus area will be parameters such as temperature, humidity and soil moisture. This system will be a substitute to traditional farming method .We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world. It proposes a automatic irrigation system for the agricultural lands. Currently the automation is one of the important role in the human life. It not only provide comfort but also reduce energy, efficiency and time saving. Now the industries are use automation and control machine which is high in cost and not suitable for using in a farm field. So here it also design a smart irrigation technology in low cost which is usable by Indian farmers. Raspberry pi is the main heart of the whole system. An automated irrigation system was developed to optimize water use for agricultural crops. Automation allows us to control appliances automatically. The objectives of this paper were to control the water motor automatically.

Key words:
Raspberry Pi,GSM module, Temperature sensor, Moisture sensor ,Humidity Sensor.

Introduction to Embedded Systems:

Embedded systems are electronic devices that incorporate microprocessors with in There implementations. The main purposes of the microprocessors are to simplify the system design and provide flexibility.

Having a microprocessor in the device means that removing the bugs, making modifications, or adding new features are only matters of rewriting the software that controls the device. Or in other words embedded computer systems are electronic systems that include a microcomputer to perform a specific dedicated application. The computer is Hidden inside these products. Embedded systems are ubiquitous. Every week millions of tiny computer chips come pouring out of factories finding their way into our everyday products.Embedded systems are self-contained programs that are embedded within a piece of hardware. Whereas a regular computer has many different applications and software that can be applied to various tasks, embedded systems are usually set to a specific task that cannot be altered without physically manipulating the circuitry. Another way to think of an embedded system is as a computer system that is created with optimal efficiency, thereby allowing it to complete specific functions as quickly as possible.

Proposed System:

The purpose of this project is to monitor and control the water flow to an irrigation system using Raspberry Pi and GSM. This can be achieved by use of sensor like temperature sensor, soil sensor and humidity sensor. These sensors output is given to ARM based control system i.e., Raspberry PI for further data processing. The GSM based irrigation system may offer users the flexibility to regulate and control the operations of their irrigation systems with little intervention to reduce runoff from over watering for improvement in crop yield.

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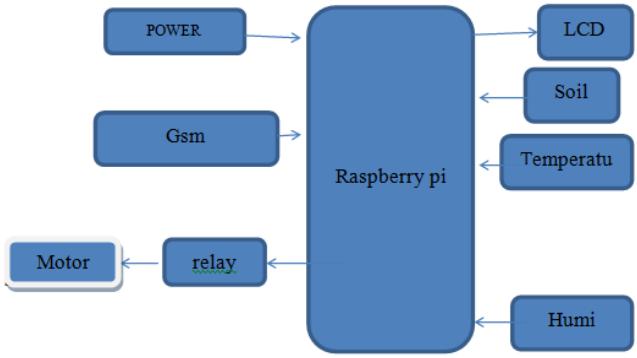
This enables users to take advantage of the globally deployed GSM networks with its low SMS service cost to use mobile phones and simple SMS commands to manage their irrigation system.

2. SYSTEM DESIGN

BLOCK DIAGRAM:



Raspberry Pi

- The Raspberry Pi is a *credit-card* sized computer
- It can be plugged into your TV and a keyboard, and can be used for many of the things that your average desktop does - spreadsheets, word-processing, games and it also plays high-definition video.
- measuring approximately 9cm x 5.5cm
- The Raspberry Pi is the work of the Raspberry Pi Foundation, a charitable organisation.
- UK registered charity (No. 1129409), May 2009
- It's supported by the University of Cambridge Computer Laboratory and tech firm Broadcomm
- Computer science skills increasingly important
- Decline in CS student numbers
- Access to computers
- Computers are the tool of the 21st century
- Computer Science is concerned with much more than simply being able to use a computer.
- Children should understand how they work and how to program them
- The Raspberry Pi is a fully featured micro-computer squashed onto a circuit board measuring approximately 9cm x 5.5cm.

Features

- The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC),which includes an ARM1176JZF-S 700 MHz processor
- Video Core IV GPU
- Originally shipped with 256 megabytes of RAM, later upgraded to 512MB.
- It does not include a built-in hard disk , but uses an SD card for booting and long-term storage.
- 10/100 BaseT Ethernet socket
- HDMI socket
- USB 2.0 socket
- RCA video socket
- SD card socket
- Powered from microUSB socket
- 3.5mm audio out jack

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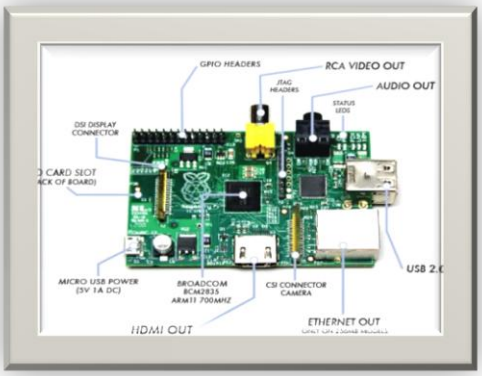
- Header footprint for camera connection



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Linux on a bootable SD card

- Fedora
- Raspbian
- Debian
- ArchLinux ARM

By default, supporting Python as the educational language.

- Any language which will compile for ARMv6 can be used with the Raspberry Pi.

Applications

- **Raspberry Pi Medical Device Input Shield**
- Solar Raspberry Pi Power Pack
- Voice-Activated Coffee Machine
- Raspberry Pi Dynamic Bike Headlight Prototype
- It can make your Old TV in to a smart TV. (You can play Videos, 3D Games, Music, Browse Internet and much more.
- Raspberry Pi can Act as Full HD 1080p Media Player.
- Its a Mini Computer which just cost Rs.2,350/-
- You can connect a Monitor, Keyboard and Mouse and use it as a normal computer.
- Its Graphics Capabilities is better than Apple Products.

ADVANTAGES &DISADVNATAGES

- It does not have a Hard Disk associated with it for permanent storage pf files,we have to connect one externally or have to use SD card for the purpose.
- The RAM is a POP package on top of the SoC, so it's not removable or swappable.

Tablet version

- Interesting low-cost screen technologies emerging
- Brambles! (Networks of Raspberries

have been defined before or immediately following the equation. Use "(1)", not "Eq. (1)" or "equation (1)", except at the beginning of a sentence: "Equation (1) is . . ."

POWEW SUPPLY

In this project we have power supplies with +5V & -5V option normally +5V is enough for total circuit. Another (-5V) supply is used in case of OP amp circuit .Transformer primary side has 230/50HZ AC voltage whereas at the secondary winding the voltage is step downed to 12/50hz and this voltage is rectified using two full wave rectifiers .the rectified output is given to a filter circuit to fiter the unwanted ac in the signal After that the output is again applied to a regulator LM7805(to provide +5v) regulator. Whereas LM7905 is for providing –5V regulation (+12V circuit is used for stepper motors, Fan and Relay by using LM7812 regulator same process like above supplies.)

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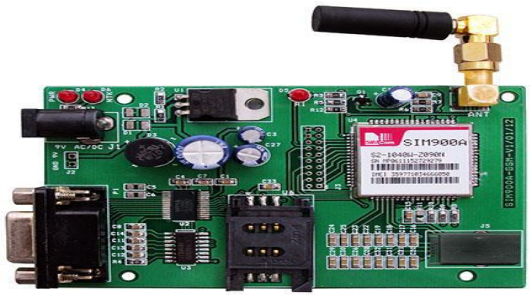
Do not use the word "essentially" to mean "approximately" or "effectively". In your paper title, if the words "that uses" can accurately replace the word "using", capitalize the "u"; if not, keep using lower-cased.

GSM:

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world for transmitting mobile voice and data services. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. GSM was first introduced in 1991. As of the end of 1997, GSM service was available in more than 100 countries and has become the de facto standard in Europe and Asia.

3.1 What does GSM offer

GSM supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service). GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. The 850MHz band is also used for GSM and 3G in Australia, Canada and many South American countries. By having harmonized spectrum across most of the globe, GSM's international roaming capability allows users to access the same services when travelling abroad as at home. This gives consumers seamless and same number connectivity in more than 218 countries. Terrestrial GSM networks now cover more than 80% of the world's population. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.



HISTORY:

In 1982, the European Conference of Postal and Telecommunications Administrations (CEPT) created the Group Special Mobile (GSM) to develop a standard for a mobile telephone system that could be used across Europe. In 1987, a memorandum of understanding was signed by 13 countries to develop a common cellular telephone system across Europe. Finally the system created by SINTEF lead by TorleivMaseng was selected.In 1989, GSM responsibility was transferred to the European Telecommunications Standards Institute (ETSI) and phase I of the GSM specifications were published in 1990. The first GSM network was launched in 1991 by Radiolinja in Finland with joint technical infrastructure maintenance from Ericsson. By the end of 1993, over a million subscribers were using GSM phone networks being operated by 70 carriers across 48 countries.

3.3 GSM Frequencies

GSM networks operate in a number of different frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G). Most 2G GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas (including Canada and the United States) use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. Most 3G GSM networks in Europe operate in the 2100 MHz frequency band. The rarer 400 and 450 MHz frequency bands are assigned in some countries where these frequencies were previously used for first-generation systems. GSM-900 uses 890–915 MHz to send information from the mobile station to the base station (uplink) and 935–960 MHz for the other direction

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(downlink), providing 124 RF channels (channel numbers 1 to 124) spaced at 200 kHz. Duplex spacing of 45 MHz is used. In some countries the GSM-900 band has been extended to cover a larger frequency range. This 'extended GSM', E-GSM, uses 880–915 MHz (uplink) and 925–960 MHz (downlink), adding 50 channels (channel numbers 975 to 1023 and 0) to the original GSM-900 band. Time division multiplexing is used to allow eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio timeslots (giving eight burst periods) grouped into what is called a TDMA frame. Half rate channels use alternate frames in the same timeslot. The channel data rate for all 8 channels is 270.833 Kbit/s, and the frame duration is 4.615 ms. The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

3.4 GSM ARCHITECTURE

The GSM network consists mainly of the following functional parts:

MSC

The mobile service switching centre (MSC) is the core switching entity in the network. The MSC is connected to the radio access network (RAN); the RAN is formed by the BSCs and BTSs within the Public Land Mobile Network (PLMN). Users of the GSM network are registered with an MSC; all calls to and from the user are controlled by the MSC. A GSM network has one or more MSCs, geographically distributed.

16 * 2 Alphanumeric LCD

Liquid crystal display is very important device in embedded system. It offers high flexibility to user as he can display the required data on it. A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. LCDs therefore need a light source and are classified as "passive" displays. Here the lcd has different memories to display data, those are discussed below.

Display data RAM (DDRAM) stores display data represented in 8-bit character codes. Its extended capacity is 80 X 8 bits, or 80 characters. The area in display data RAM (DDRAM) that is not used for display can be used as general data RAM. So whatever you send on the DDRAM is actually displayed on the LCD. For LCDs like 1x16, only 16 characters are visible, so whatever you write after 16 chars is written in DDRAM but is not visible to the user.

Figure below will show you the DDRAM addresses of 2 Line LCD.

SERIALCOMMUNICATION

INTRODUCTION

Computers transfer data in two ways: parallel and serial. In parallel data transfers, often 8 or more lines (wire conductors) are used to transfer data to a device that is only a few feet away. Examples of parallel transfers are printers and hard disks; each uses cables with many wire strips. Although in such cases a lot of data can be transferred in a short amount of time by using many wires in parallel, the distance cannot be great. To transfer to a device located many meters away, the serial method is used. In serial communication, the data is sent one bit at a time, in contrast to parallel communication, in which the data is sent a byte or more at a time. The 8051 has serial communication capability built into it, thereby making possible fast data transfer using only a few wires.

When a microprocessor communicates with the outside world, it provides the data in byte-sized chunks. In some cases, such as printers, the information is simply grabbed from the 8-bit data bus of the printer. This can work only if the cable is not too long, since long cables diminish and even distort signals. Furthermore, an 8-bit data path is expensive. For these reasons, serial communication is used for transferring data between two systems located at distances of hundreds of feet to millions of miles apart. The Figures shows serial versus parallel data transfers.

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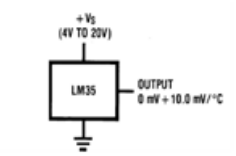

Motors

Motor is a device that creates motion, not an engine; it usually refers to either an electrical motor or an internal combustion engine.

It may also refer to:

- Electric motor, a machine that converts electricity into a mechanical motion
- AC motor, an electric motor that is driven by alternating current
- Synchronous motor, an alternating current motor distinguished by a rotor spinning with coils passing magnets at the same rate as the alternating current and resulting magnetic field which drives it
- Induction motor, also called a squirrel-cage motor, a type of asynchronous alternating current motor where power is supplied to the rotating device by means of electromagnetic induction.

RELAY

A relay is used to isolate one electrical circuit from another. It allows a low current control circuit to make or break an electrically isolated high current circuit path. The basic relay consists of a coil and a set of contacts. The most common relay coil is a length of magnet wire wrapped around a metal core. When voltage is applied to the coil, current passes through the wire and creates a magnetic field. This magnetic field pulls the contacts together and holds them there until the current flow in the coil has stopped. The diagram below shows the parts of a simple relay.

Figure: Relay

Operation:

When a current flows through the coil, the resulting magnetic field attracts an armature that is mechanically linked to a moving contact.

The movement either makes or breaks a connection with a fixed contact. When the current is switched off, the armature is usually returned by a spring to its resting position shown in figure 6.6(b). Latching relays exist that require operation of a second coil to reset the contact position.

TEMPERATURE SENSOR

Temperature Sensor which converts temperature value into electrical signals. We used IC called LM 35 as a temperature sensor. LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. . The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range.

LM35

- LM35 is precision integrated circuit temperature sensor. Its output voltage is linearly proportional to temperature(in celsius).
- The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over full −55 to +150°C temperature range

a) Soil temperature sensor

The temperature sensor used here is DS1822 digital thermometer with ± 2°c accuracy over a -10°c to +85°c range. Data is read over a 1 wire serial bus in 2´s complement format with 9 to 12 bits of resolution. The DS1822 requires only one data line (and ground) for communication with a central microprocessor. It has an operating temperature range of –55°Cto +125°C. In addition, the DS1822 can derive power directly from the data line, eliminating the need for an

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external power supply. Each DS1822 has a unique 64-bit serial code, which allows multiple DS1822s to function on the 1-Wirebus; thus, it is simple to use one microprocessor to control many DS1822s distributed over a large area. Applications that can benefit fromthis feature include temperature monitoring systems inside buildings, equipment or machinery, and process monitoring and control.

b) Soil moisture sensor

The module consists of, detection probe, and sensor board. It is having triple output mode, digital, analog, and serial with exact readings. The sensor will detect the moisture of the soil surrounding it, i.e. shortage of water content of the soil. If the contents are low the module output will be high otherwise the output will remain in neutral conditions. This moisture sensor has two probes used to pass the current into the soil, and then itreads that resistance between two probes to get the moisture level. More water present in the soil makes the soil conduct electricity more easily indicate less resistance, while dry soil having less water conducts electricity poorly indicate more resistance.

What's New in µVision4?

µVision3 adds many new features to the Editor like Text Templates, Quick Function Navigation, and Syntax Coloring with brace high lighting Configuration Wizard for dialog based startup and debugger setup. µVision3 is fully compatible to µVision4 and can be used in parallel with µVision4.

What is µVision4?

µVision3 is an IDE (Integrated Development Environment) that helps you write, compile, and debug embedded programs. It encapsulates the following components:

- A project manager.
- A make facility.
- Tool configuration.
- Editor.
- A powerful debugger.

To help you get started, several example programs (located in the \C51\Examples, \C251\Examples, \C166\Examples, and \ARM\...\Examples) are provided.

- HELLO is a simple program that prints the string "Hello World" using the Serial Interface.
- MEASURE is a data acquisition system for analog and digital systems.
- TRAFFIC is a traffic light controller with the RTX Tiny operating system.
- SIEVE is the SIEVE Benchmark.
- DHRY is the Dhrystone Benchmark.
- WHETS is the Single-Precision Whetstone Benchmark.

Additional example programs not listed here are provided for each device architecture.

Building an Application in µVision4

To build (compile, assemble, and link) an application in µVision4, you must:

1.Select Project - (forexample,166\EXAMPLES\HELLO\HELLO.UV4).

2.Select Project - Rebuild all target files or Build target.

µVision4 compiles, assembles, and links the files in your project.

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CONCLUSION:

The project "Automatic irrigation system through wireless technology using raspberry pi "has been successfully designed and tested Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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Electronics For You, November 2012, Page 18

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