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Globally Accessible Machine Automation Using Raspberry Pi

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Abstract:

In The Present World, There Are Many High Tech Appliances In Our Homes That Make Our Lives Easier. It Is Necessary To Control These Appliances Remotely. To Automate A Machine, A Secondary Brain (Another Machine) Is Required To 'Think' And Control Machines To Do Tasks As Per The Convenience Of The User From Long Distances. An Automation System Is Proposed For The Users To Control Home Electronic Appliances With High Mobility And Security. A Set Of Switches Will Be Controlled By Internet With The Use Of A Raspberry Pi Micro-Controller Board. A Raspberry Pi Micro-Controller Board Obtains User Input From A Website That Is Accessed Through A User Name And Password. The Customized User Friendly Website Has Several Buttons To Control The Appliances. A Raspberry Pi Will Be Located In A Room And Will Be Connected To All Electronic Appliances In The Home With The Help Of Electromagnetic Relays.

The Raspberry Pi Can Be Controlled From Any Distant Place With The Help Of Weaved Cloud Service. Webiopi Framework Gives Us A Platform To Interact With Raspberry Pi's General Purpose Input Output Pins. The Raspberry Pi Then Either Passes Or Stops Current Through An Electromagnetic Relay Connected To The Intended Switch And This Closes/Opens The Circuit Allowing The Appliance To Run Or Get Switched Off. Thus Globally Accessible Automation Of Electronic Appliances Can Be Made Possible With The Use Of A Raspberry Pi Micro-Controller Board, An Internet Connection And Relay Switches In A User Friendly Way.

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.

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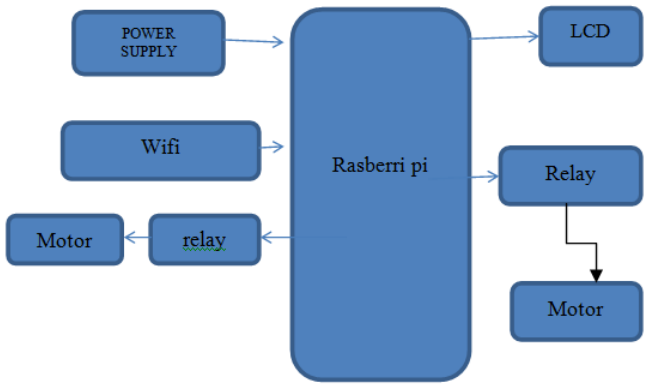
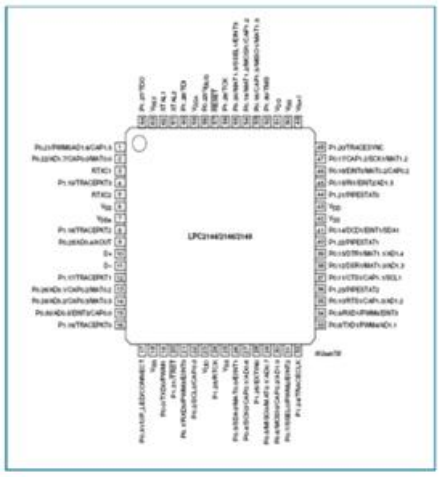
BLOCK DIAGRAM:





ARM Microcontroller: LPC2148:

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8kB up to 40kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.The application program may also erase and/or program the flash while the application is running, allowing a great degree of flexibility for data storage field firmware upgrades, etc.

ARM7TDMI-S processor has two instruction sets:

The standard 32-bit ARM set.

• A 16-bit Thumb set.

The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM processor connected to a 16-bit memory system. The particular flash implementation in the LPC2141/42/44/46/48 allows for full speed execution also in ARM mode. It is recommended to program performance critical and short code sections (such as interrupt service routines and DSP algorithms) in ARM mode. The impact on the overall code size will be minimal but the speed can be increased by 30% over Thumb mode.

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.

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- 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
- Header footprint for camera connection

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

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- 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.)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.

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

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

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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.

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
- DC motor, an electric motor that runs on direct current electricity
- Brushed DC electric motor, an internally commutated electric motor designed to be run from a direct current power source
- Brushless DC motor, a synchronous electric motor which is powered by direct current electricity and has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes
- Electrostatic motor, a type of electric motor based on the attraction and repulsion of electric charge
- Servo motor, an electric motor that operates a servo, commonly used in robotics
- Internal fan-cooled electric motor, an electric motor that is self-cooled by a fan, typically used for motors with a high energy density

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.

Wireless Network Technology: Embedded Serial to Wi-Fi Modules

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Wifi stands wireless fidelity Wireless technology has become common in modern society .It can be used in many application because the power consumption is very less expensive . It is very simple ,reduces wiring harness compare with the olden devices .wifi module efficiently transmit data up to 100 meters compare with the blue tooth the range of wifi is very high. This is the one of the standard protocol to transmit the data the IEEE 802.11.b.g/n and in the wireless application it can place special role by using this wifi we connect the network anywhere ,if you know the encryption password you can access easily monitoring everything on the internet.

In the early 2007, embedded serial to Wi-Fi modules have become eagerly obtainable in public consumer markets. Each brand boasts similar features such as low power consumption and onboard wireless encryption or firewall security. The following section will investigate two embedded serial to Wi-Fi modules currently available on the market. Embedded serial to Wi-Fi modules function as device servers bridging serial devices to 802.11b/g wireless LANs. The Wireless-fidelity modules utilize RS232 serial ports in conjunction with UART to interact with serial machines. Some Wi-Fi modules such as the Wireless fidelity employ custom serial protocols .Additionally the modules are prepared with programmable processor chipsets with an OS that coordinates the data transfer between serial and Internet protocols. The Wi-Fi modules attach to wireless access points by utilize a built-in wireless adapter.

The typical embedded serial to Wifi module is designed for somewhat simple installation. The attachments involve a Data bus 9 pass end to end serial cable that links the module to a serial port terminal. For most modules, power is supplied by a 4 -12v dc voltage un fettered , 3.3V regulated, or in some cases 2-3 V low down power battery sources. Initially, users must configure the module by connecting to a PC and utilizing the provided installation software prior to connecting the module to a serial module to controller device.

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.

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•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.

Conclusion:

The project "GLOBALLY ACCESSIBLE MACHINE AUTOMATION 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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