

Raspberry Pi - Linux Platform Based Smart Home Implementation

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Abstract : This paper manages the control of Household appliances. The Controller will absolutely monitor the electrical parameters. It is based on controlling the Household machines. This will give the remote control of parameters in light of Image handling. It will spare the electrical force and human Energy. The created framework is more adaptable for operation .This Project is made with the assistance of Microcontroller Raspberry Pi.

Keywords: Raspberry pi, image processing, camera module, Drivers, DC motor, Bulb

I. Introduction

The Raspberry Pi is a movement of credit card-sized single-board PC's. It was discovered by Wales in the Raspberry Pi Foundation to improve the teaching of key programming designing in schools and making countries. All Raspberry Pi processors with an ARMv6-perfect center or more up to date ARMv7 centers and have included on a chip with Video Core IV GPU, and have at 256 megabytes of RAM, aside from later (models B and B+) that have 512 MB. The framework has Secure Digital (SD) (models A and B) or MicroSD (models A+ and B+) attachments for boot media and steady stockpiling.

In this venture raspberry pi is associated with the camera to get the photo quickly and after that contrasted and the put away picture in the raspberry pi. In the raspberry pi it will have inbuilt memory to store the image.so we take the picture and store in the SD card which was put in the raspberry pi.

The undertaking will depict about the programmed control of home appliances. If the client demonstrates the pictures to the camera it will contrasted with the put away picture and after that consequently turn on the electrical appliances. If the client demonstrates the picture again to the camera it will kill the electrical appliances. It will spare the human vitality and after that it will primarily valuable to the incapacitated persons. In this we will utilize the electrical machines as fan and 2 bulbs. Instead of fan we utilize the dc engine and for light we utilize the LED.

The DC motor has two crucial parts: the rotating part that is known as the armature and the stationary part that joins twists of wire called the field circles. The stationary part is moreover called the stator. The armature is made of circles of wire wrapped around the middle, and the inside has an increased shaft that turns on course. The key sections of a DC motor fuse the armature get together, which fuses all turning parts; the edge get together, which houses the stationary field twists; and the end plates, which provide guidance to the motor shaft and a mounting point for the brush altering.

Fundamentally, LEDs are simply modest lights that fit effectively into an electrical circuit. A LED (light-emitting diode) is a two-lead semiconductor light source. It is a p-n crossing point diode, which transmits light when activated. When a suitable voltage is associated with the leads, electrons can recombine with electron openings within the device, releasing as photons. Light-transmitting diodes are as of now used as a piece of uses as different as flight lighting, auto headlamps, publicizing, general lighting, development signals, camera flashes and lit wallpaper.

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III. Project Description

This task manages the most recent innovation called the intuition. It's a convenient interface that enlarges the physical world around us with the computerized data. It's simply conceived idea which permits client to interface with this present reality flawlessly. Intuition innovation is with which a framework could be prepared to perceive and percept certifiable questions and respond as fancied. Intuition innovation crosses over any barrier between the physical world and the advanced world, bringing impalpable, computerized data out into the substantial world, and=A2X6890-] allowing us to associate with this data through picture preparing. In this undertaking we are making utilization of standalone ARM11 processor for picture preparing. Also camera is utilized with ARM11 processor to empower the task with machine vision. This task can be utilized to control the high voltages home apparatuses, for example, light; fan and so forth utilizing machine vision. Client needs to demonstrate the pictures drawn on a paper and demonstrate to it the camera. In light of the predefined rationale the electrical gadgets will be turned ON or OFF.

The current framework depended on no remote control operation, rely on upon others to work direct pc collaboration. It has the weaknesses of manual operation; physically tested individuals can't ready to switch on/off the gadgets. To conquer these issues this picture based home computerization is utilized as remote control. It grants extra adaptability through humanoid gadget. It gives security and validation. This is anything but difficult to switch on gadgets.

A. Raspberry pi

The Raspberry Pi 2 conveys 6 times the handling limit of past models. This second era Raspberry Pi has an updated Broadcom BCM2836 processor, which is an intense ARM Cortex-A7 based quad-center processor that keeps running at 900MHz. The board additionally includes an expansion in memory ability to 1Gbyte.

The Raspberry Pi is a progression of credit card-sized single-board PCs created in Pencoed, Wales by the Raspberry Pi Foundation with the aim of advancing the educating of fundamental software engineering in schools and creating nations. The first Raspberry Pi and Raspberry Pi 2 are fabricated in a few board arrangements through authorized assembling concurrences with Newark element14 (Premier Farnell), RS Components and Egoman. These organizations offer the Raspberry Pi on the web. Egoman produces a rendition for circulation exclusively in Taiwan, which can be recognized from different Pi's by their red shading and absence of FCC/CE stamps.

The Foundation gives Debian and Arch Linux ARM circulations for download. Instruments are accessible for Python as the primary programming dialect, with backing for BBC BASIC (through the RISC OS picture or the Brandy Basic clone for Linux), C, C++, Java, Perl, Ruby,]and Smalltalk. Starting 8 June 2015, around five to six million Raspberry Pi's have been sold. While as of now the quickest offering British PC, it has additionally dispatched the second biggest number of units behind the Amstrad PCW, the "PC Word-processor", which sold eight million.

B. Serial Communication

PCs move information in two ways: parallel and serial. In parallel information exchanges, frequently 8 or more lines (wire channels) are utilized to exchange information to a gadget that is just a couple feet away. Samples of parallel exchanges are printers and hard plates; every utilizations links with numerous wire strips. In spite of the fact that in such cases a considerable measure of information can be moved in a short measure of time by utilizing numerous wires as a part of parallel, the separation can't be extraordinary.

To exchange to a gadget found numerous meters away, the serial strategy is utilized. In serial correspondence, the information is sent one piece at once, as opposed to parallel correspondence, in which the information is sent a byte or more at once. The ARM has serial correspondence ability incorporated with it, along these lines making conceivable quick information exchange utilizing just a couple wires.

Data transfer rate: The rate of information move in serial information correspondence is expressed in bps (bits every second). Another generally utilized wording for bps is baud rate. In any case, the baud and bps rates are not as a matter of course equivalent. This is because of the way that baud rate is the modem phrasing and is characterized as the quantity of sign changes every second. In modems, there are events when a solitary change of sign exchanges a few bits of information. Similarly as the transmitter wire is concerned, the baud rate and bps are the same.

The information exchange rate of a given PC framework relies on upon correspondence ports fused into that framework. For instance, the early IBM PC/XT could exchange information at the rate of 100 to 9600 bps. However as of late, Pentium-based PCs exchange information at rates as high as 56K bps. It must be noticed that in offbeat serial information correspondence, the baud rate is by and large restricted to 100,000 bps.

Baud rate: The ARM exchanges and gets information serially at numerous baud rates. The baud rate in the ARM is programmable. This is finished with the assistance of clock 1. The relationship between the precious stone recurrence and the baud rate is examined here.

The ARM isolates the precious stone recurrence by 12 to get the machine cycle recurrence. On account of $XTAL = 11.0592 \text{ MHz}$, the machine cycle recurrence is 921.6 kHz ($11.0592 \text{ MHz}/12 = 921.6 \text{ kHz}$). The ARM's serial correspondence UART hardware partitions the machine cycle recurrence of 921.6 kHz by 32 again before clock 1 to set the baud rate utilizes it. Subsequently, 921.6 kHz separated by 32 gives $28,800 \text{ Hz}$.

C. Relay as drive

A transfer is an electrically worked switch. Current moving through the loop of the hand-off makes an attractive field which draws in a lever and changes the switch contacts. The curl current can be on or off so transfers have two switch positions and they are twofold toss (changeover) switches.

Transfers permit one circuit to switch a second circuit which can be totally separate from the first. For instance a low voltage battery circuit can utilize a hand-off to switch a 230V AC mains circuit. There is no electrical association inside the hand-off between the two circuits; the connection is attractive and mechanical.

At the point when a present moves through the loop, the subsequent attractive field draws in an armature that is mechanically connected to a moving contact. The development either represents the deciding moment an association with an altered contact. At the point when the current to the loop is exchanged off, the armature is returned by a power around half as solid as the attractive power to its casual position. Generally this is a spring; however gravity is additionally utilized normally as a part of modern engine starters. Most transfers are produced to work rapidly. In a low voltage application, this is to decrease commotion. In a high voltage or high current application, this is to decrease arcing.

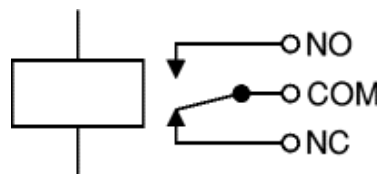


Fig. 1. Circuit symbol of a relay

The relay's switch connections are usually labeled COM, NC and NO:

COM = Common, always connect to this, it is the moving part of the switch.

NC = Normally Closed, COM is connected to this when the relay coil is off.

NO = Normally Open, COM is connected to this when the relay coil is on.

D. Power supply

Every single electronic circuit works just in low DC voltage, so we require a force supply unit to give the suitable voltage supply to their legitimate working. This unit comprises of transformer, rectifier, channel and controller. Air conditioning voltage of commonly 230volts rms is associated with a transformer voltage down to the level to the sought air conditioning voltage. A diode rectifier that gives the full wave corrected voltage that is at first separated by a basic capacitor channel to create a dc voltage. This subsequent dc voltage for the most part has some swell or air conditioning voltage variety. A controller circuit can utilize this dc information to give dc voltage that has a great deal less swell voltage as well as continues as before dc esteem even the dc voltage shifts to some degree, or the heap associated with the yield dc voltages changes.

A transformer is a static bit of which electric force in one circuit is changed into electric force of same recurrence in another circuit. It can raise or lower the voltage in the circuit, yet with a relating lessening or increment in current. It works with the standard of common affectation. In our task we are utilizing a stage down transformer to giving an important supply to the electronic circuits. Here we venture down a 230volts air conditioning into 12volts air conditioning.

A dc level acquired from a sinusoidal info can be enhanced 100% utilizing a procedure called full wave correction. Here in our undertaking for full wave amendment we utilize span rectifier. From the fundamental scaffold setup we see that two diodes (say D2 and D3) are leading while the other two diodes (D1 and D4) are in off state amid the period $t = 0$ to $T/2$. Accordingly for the negative cycle of the information the directing diodes are D1 and D4. Thus the extremity over the heap is the same.

In the scaffold rectifier the diodes might be of variable sorts like 1N4001, 1N4003, 1N4004, 1N4005, 1N4007 and so forth... can be utilized. Be that as it may, here we utilize 1N4007, on the grounds that it can withstand up to 1000v.

So as to get a dc voltage of 0 Hz, we need to utilize a low pass channel. So that a capacitive channel circuit is utilized where a capacitor is associated at the rectifier output & a dc is acquired crosswise over it. The separated waveform is basically a dc voltage with irrelevant swells and it is at last encouraged to the heap.

The yield voltage from the capacitor is more sifted and at long last managed. The voltage controller is a gadget, which keeps up the yield voltage steady independent of the adjustment in supply varieties, load varieties and temperature changes. Here we utilize altered voltage controller specifically LM7805. The IC LM7805 is a +5v controller which is utilized for microcontroller.

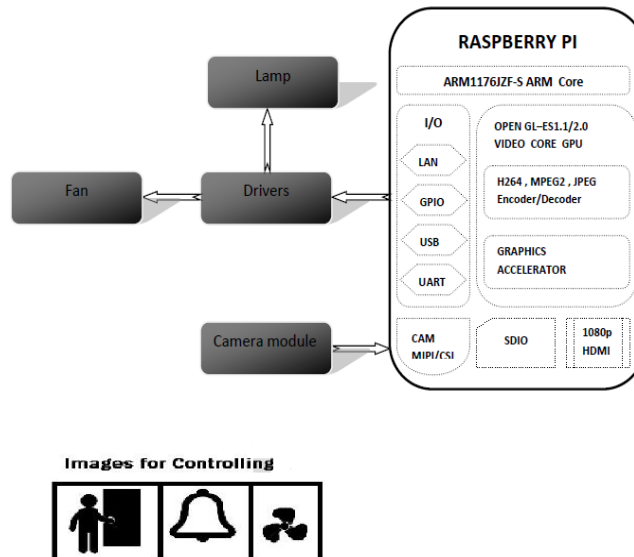


Fig. 2. Block diagram

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

IV. Block Diagram Explanation

The framework comprises of Raspberry Pi microcontroller, camera, and the high voltages home apparatuses, for example, light, fan and so on. The client can impart to raspberry-pi through camera. In the event that the client needs to turn on any gadget, they demonstrate the symbol picture to the camera, and the client needs to turn off the same gadget, they remove the symbol from the camera.

We have a database of pictures. When we take another picture, we contrast it with the pictures in the database and get a closeness score (utilizing Open CV). Thus we will identify, if the picture, which is fundamentally the same as the new picture. The main errand that Open CV has (object arrangement) is the execution of Bag of visual Words (BOW). It can process extraordinary sorts of picture elements and train a visual words vocabulary. Next, you can utilize this vocabulary to discover comparative pictures in your database and register a comparability score. Here is Open CV documentation for sack of words. Likewise, Open CV has a specimen named `bagofwords_classification.cpp`. It is huge yet may be useful.

We require a straightforward and quick approach to think about two pictures for comparability. i.e. we need to get a high esteem on the off chance that they contain the very same thing yet might have some somewhat distinctive foundation and might be moved/resized by a couple of pixels. (More concrete, if that matters: The one picture is a symbol and the other picture is a subarea of a screenshot, and I need to know whether that subarea is precisely the symbol or not). Separate both pictures into 10x10 cells, and for each of those 100 cells, analyze the shading histogram. At that point, we can set some made-up limit esteem, and if the quality we get is over that edge, we accept that they are comparable.

The functions compare two dense histograms using the specified method:
`Correlation (method=CV_COMP_CORREL)`

$$d(H_1, H_2) = \frac{\sum_I (H_1(I) - \bar{H}_1)(H_2(I) - \bar{H}_2)}{\sqrt{\sum_I (H_1(I) - \bar{H}_1)^2 \sum_I (H_2(I) - \bar{H}_2)^2}}$$

Where,

$$\bar{H}_k = \frac{1}{N} \sum_J H_k(J)$$

and N is a total number of histogram bins.

Chi-Square (method=CV_COMP_CHISQR)

$$d(H_1, H_2) = \sum_I \frac{(H_1(I) - H_2(I))^2}{H_1(I)}$$

Intersection (method=CV_COMP_INTERSECT)

$$d(H_1, H_2) = \sum_I \min(H_1(I), H_2(I))$$

$$d(H_1, H_2) = \sqrt{1 - \frac{1}{\sqrt{H_1 H_2 N^2}} \sum_I \sqrt{H_1(I) \cdot H_2(I)}}$$

The function returns $d(H_1, H_2)$. When the function works well with 1-, 2-, 3-dimensional dense histograms, it may not be suitable for high-dimensional sparse histograms. In such histograms, because of aliasing and sampling problems, the coordinates of non-zero histogram can slightly shift. To compare such histograms or more general sparse configurations of weighted points, consider using the `EMD()` function.

Thus the image is compared by above histograms and the output is given as YES or NO. Yes refers to the compared image is matched. NO refers to the compared image is not matched with the data base image. This output is send to the raspberry pi output port and the corresponding device will be switched on/off respectively.

V. Result

The model is in operation in a trial home with different electrical machines frequently utilized by an inhabitant. The takings after appliances were controlled: Light, Fan. The apparatuses are taken as pictures in various points and put away in the database of Raspberry Pi. For information we utilize symbols of the electrical machines as image. The symbols are contrasted and the predefined image. For looking at the picture the product sets an edge value. If the histogram of the data and the predefined picture is equal to or above the threshold value, then the apparatuses are controlled. If the histogram of the pictures is beneath the limit value, then there is no adjustment in the appliances. Thus the customary family unit electrical apparatuses are controlled through the Raspberry Pi by picture preparing.

VI. Conclusion

In this system we tend to develop a sixth sense based mostly home automation system victimization raspberry pi that is small in size and simple to handle. This system effectively controls the electrical appliance usages at associate degree old home.

Thus the real time monitoring system is extended to the complete intelligent building. this technique is simply interacted for illiterate people. This study conjointly aims to assess consumer's response toward perceptions of smart grid technologies, their advantages and drawbacks, potential issues, and overall perceived utility.

Controlling over remote is that the previous comes however it's the disadvantage that it have to be compelled to learn the method of victimization remote that is tough for illiterate people. This technique is incredibly helpful for physically challenged people that cannot stand and activate the appliance and no need the knowledge of handling remote. The developed system is robust and versatile operative.

In future this project can be improvised as comparing the presently captured images of appliances instead of using permanent icons.