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Research paper

Raspberry Pi Based Smart Surveillance Enhanced with Wi-Fi Tecnology

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Abstract

Nowadays, mobile devices are integrated with our everyday life. The security and remote surveillance system is increasingly prominent features on the mobile phone. The modern surveillance is integrated with many automation technologies. In this modern world crime has become ultramodern tools. In this current time a lot of incident occurs like robbery, stealing unwanted entrance happens, threatening abruptly robbery. So the does matters in this daily life. People always remain busy in their daily to daily work also wants to ensure their safety of their beloved things. To prevent such incidents, we are proposing a smart surveillance system enhanced with WI-FI technology. This work presents the monitoring and controlling of surveillance robot for safety enhanced with Wi-Fi technology. This system consists of webcam, PIR sensor smoke sensor and Raspberry PI. In this system, we are using PIR sensor to detect the motions or to trace out the intruders and smoke sensor to detect fire accidents. In above of any human movement or fire accident occurs, the system will activate the Web camera. The webcam will capture live data in the surroundings and transmitting the live video to the social network through WI-FI. Simultaneously, the alert message is send to the respective people. The system also consists of buzzer to alert the nearby people and sprays the chloroform liquid on the intruders.

Keywords: *Webcam, PIR Sensor, Smoke sensor, Raspberry PI, Wi Fi, HDR,USB, Internet of Things (IOT), wireless LAN ,Bluetooth, Transistor-transistor logic (TTL), Linux.*

1. Introduction

Surveillance is the process of observe a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety[1-6]. The security and remote surveillance system is prominent feature on the mobile phone. As the internet of things is the concept, newly introduced in the field of electronics. The concept is about handling the things with the use of internet and the best model for these applications is raspberry pi. Automation and security is getting the big priority all over the world. Automation and security at various places like home, office etc.. can be achieved by using different types of surveillance robots .On the other hand, thanks to the Internet of Things (IOT) , new communication models can be built. In fact, it interconnects a large a number of heterogeneous devices able to collect and transmit data over the Internet. IOT can considerably impact the video surveillance system. Indeed, recent advances in computer vision technologies and video analytics have driven the deployment of surveillance systems based on smart cameras. Nowadays, the detection and processing of incidents are part of the functionalities included in the cameras[7-13].

Even better, the proliferation of modern video sensors able to capturing HD and HDR footage would improve the accuracy of the event detection algorithms. Thus, the interconnected smart cameras can act independently and make autonomous decisions. Being deployed in sensitive environment, a special attention should be drawn to the data security and privacy of video surveillance system. In fact, over the last years, multiple incidents have exploited the vulnerabilities of both new and traditional video surveillance cameras. This is not only for privacy violation purposes but also to involve them in large-scale hacking attacks. For instance, in late 2016, multiple high-profile targets, such as Dyn, OVH and Krebs on Security blog, were the victims of massive DDoS attacks. The attack on the DNS provider Dyn achieved around 1.2 Tbps and caused the failure of a set of websites such as PayPal and Twitter.

2. Proposed System:

In Fig no.1, proposed system called smart surveillance safety system enhanced with WI-FI technology is explained. This system is proposed with the help of low cost PIR sensor and smoke sensor to trace out the intruders and to detect the fire accident. In case of any human movement or fire accident occur, the system will activate the Web camera and simultaneously transmit the live video to social network via WI-FI. In the meantime, alert message also send to the respective people through GSM module. The system consists of buzzer to alert the nearby people or control unit. The sprayer sprays the chloroform liquid on the intruders. The sprinkler discharges water when the effect of the fire has been detected.

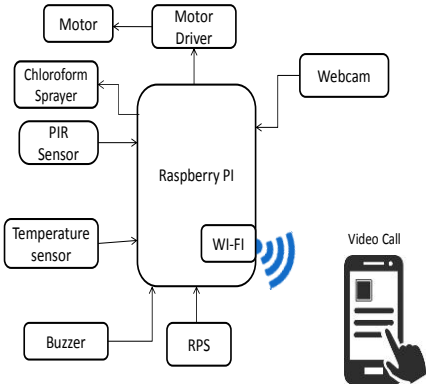

Fig. 1: Outline of Raspberry PI Installation with Wi-Fi

2.1. Raspberry PI

Fig.2: Raspberry PI

In Fig.no.2, Raspberry Pi 3 Model B is the third generation Raspberry Pi shown. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs. In Fig.no.3 Raspberry Pi Connection Plug the preloaded SD Card into the Pi. Plug the USB keyboard and mouse into the Pi, perhaps via a USB Hub. Connect the Hub to power, if necessary. Plug the video cable into the screen (TV) and into the Pi.

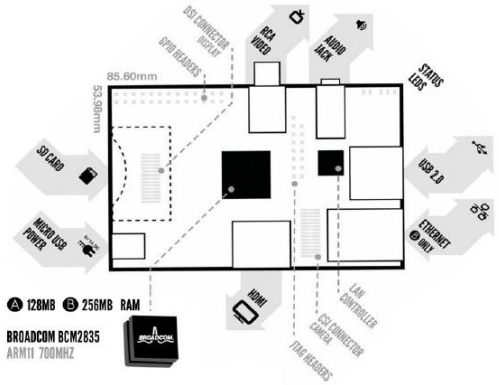

Fig.3: Raspberry Pi Connection

Plug your extras into the Pi (USB Wi-Fi, Ethernet cable, hard drive etc.) as shown. This is where you may really need a USB Hub. Ensure that your USB Hub (if any) and screen are working. Plug the power source into the main socket. With your screen on, plug the other end of the power source into the Pi. The Pi should boot up and display messages on the screen.

2.2. L293D Motor Driver:

The L298 is an integrated monolithic circuit. It accept standard TTL (Transistor-transistor logic (TTL). TTL logic gates fabrication. The most commonly used motor driver IC's L293 series such as L293D, L293NE, etc.

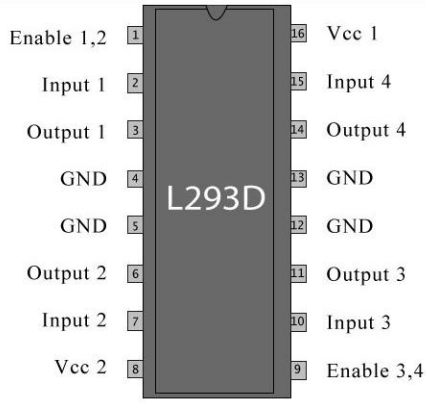

Fig.4: Pin Diagram of L293d motor driver

In Fig. 4, a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller. There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

2.3. Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to plug and play.

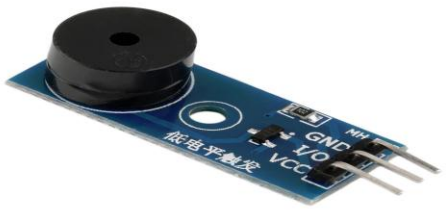

Fig.5: Buzzer

In Fig.no.5, A buzzer or beeper is an audio signaling device which is mechanical, electro mechanical or piezoelectric. Typical uses of

buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or roke.

2.4. DC Motor

Fig.6: DC motor

In Fig.no.6, A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. A machine that converts dc power into mechanical energy is known as dc motor. Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. The direction of the force is given by Fleming's left hand rule. Working principle of DC Motor mainly depends upon Fleming Left Hand rule. In a basic DC motor, an armature is placed in between magnetic poles. If the armature winding is supplied by an external DC source, current starts flowing through the armature conductors. As the conductors are carrying current inside a magnetic field, they will experience a force which tends to rotate the armature. Suppose armature conductors under N poles of the field magnet, are carrying current downwards (crosses) and those under S poles are carrying current upwards (dots)

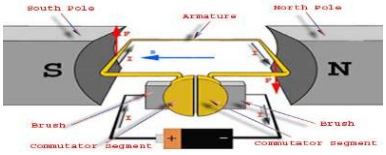

Fig.4: DC Motor Architecture

In Fig.no.4, By applying Fleming's Left hand Rule, the direction of force F, experienced by the conductor under N poles and the force experienced by the conductors under S-poles can be determined. It is found that at any instant the forces experienced by the conductors are in such a direction that they tend to rotate the armature. Again, due this rotation the conductors under N-poles come under S-pole and the conductors under S-poles come under N-pole. While the conductors go form N-poles to S-pole and S-poles to N-pole, the direction of current through them, is reversed by means of commutator. Due to this reversal of current, all the conductors come under N-poles carry current in downward direction and all the conductors come under S-poles carry current in upward direction as shown in the figure. Hence, every conductor comes under N-pole experiences force in same direction and same is true for the conductors come under S-poles. This phenomenon helps to develop continuous and unidirectional torque.

3. Methodology

Camera is interfaced with the raspberry pi. Camera captures the video as frame (image) Continuous frames produces a video. We have considered the single frame. Initially the image in the video is 3-Dimensional image (i.e., RGB image). RGB image is converted into HSV image. Based on the HSV value of the colour, average value of the colour of the object is taken. Color variation is obtained by using contour algorithm. Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition. Then it is converted into binary image by using binary conversion. From the binary image, the black and white pixels can be calculated. From the pixel variation, the motion or the fire can be detected.

Secondary Memory Interface (SMI)

The SMI peripheral is an asynchronous NAND type bus supporting Intel mode80 type transfers at 8 or 16 bit widths and available in the ALT1 positions on GPIO banks 0 and 1 (see Table 9 and Table 10). It is not publicly documented in the Broadcom Peripherals Specification but a Linux driver is available in the Raspberry Pi Github Linux repository (bcm2835 smi.c in linux/drivers/misc).

Display Parallel Interface (DPI). A standard parallel RGB (DPI) interface is available on bank 0 GPIOs. This up-to-24-bit parallel interface can support a secondary display. Again this interface is not documented in the Broadcom Peripherals Specification but documentation can be found here

SD/SDIO Interface

The BCM283x supports two SD card interfaces, SD0 and SD1. The first (SD0) is a proprietary Broadcom controller that does not support SDIO and is the primary interface used to boot and talk to the eMMC or SDX x signals. The second interface (SD1) is standards compliant and can interface to SD, SDIO and eMMC devices; for example on a Raspberry Pi 3 it is used to talk to the on-board BCM43438 WiFi device in SDIO mode. Both interfaces can support speeds up to 50MHz single ended (SD High Speed Mode).

CSI (MIPI Serial Camera)

Currently the CSI interface is not openly documented and only CSI camera sensors supported by the official Raspberry Pi firmware will work with this interface. Supported sensors are the OmniVision OV5647 and Sony IMX219. It is recommended to attach other cameras via USB.

DSI (MIPI Serial Display)

Currently the DSI interface is not openly documented and only DSI displays supported by the official Raspberry Pi firmware will work with this interface. Displays can also be added via the parallel DPI interface which is available as a GPIO alternate function - see Table 9 and Section

USB

The BCM283x USB port is On-The-Go (OTG) capable. If using either as a fixed slave or fixed master, please tie the USB OTGID pin to ground. The USB port (Pins USB DP and USB DM) must be routed as 90 ohm differential PCB traces. Note that the port is capable of being used as a true OTG port however there is no official documentation. Some users have had success making this work.

HDMI

BCM283x supports HDMI V1.3a. It is recommended that users follow a similar arrangement to the Compute Module IO Board circuitry for HDMI output. The HDMI CK P/N (clock) and D0-D2 P/N (data) pins must each be routed as matched length 100 ohm differential PCB traces. It is also important to make sure that each differential pair is closely phase matched. Finally, keep HDMI traces well away from other noise sources and as short as possible. Failure to observe these design rules is likely to result in EMC failure. 20

Composite (TV Out)
The TVDAC pin can be used to output composite video (PAL or NTSC). Please route this signal away from noise sources and use a

75 ohm PCB trace. Note that the TV DAC is powered from the VDAC supply which must be a clean supply of 2.5-2.8V. It is recommended users generate this supply from 3V3 using a low noise LDO. If the TVDAC output is not used VDAC can be connected to 3V3, but it must be powered even if the TV-out functionality is unused.
Thermals
The BCM283x SoC employs DVFS (Dynamic Voltage and Frequency Scaling) on the core voltage. When the processor is idle (low CPU utilization), it will reduce the core frequency and voltage to reduce current draw and heat output. When the core utilization exceeds a certain threshold the core voltage is increased and the core frequency is boosted to the maximum working frequency. The voltage and frequency are throttled back when the CPU load reduces back to an 'idle' level OR when the silicon temperature as measured by the on-chip temperature sensor exceeds 85C (thermal throttling). A designer must pay careful attention to the thermal design of products using the CM3/CM3L so that performance is not artificially curtailed due to the processor thermal throttling, as the Quad ARM complex in the BCM2837 can generate significant heat output.
Temperature Range
The operating temperature range of the module is set by the lowest maximum and highest minimum of any of the components used. The eMMC and LPDDR2 have the narrowest range, these are rated for -25 to +80 degrees Celsius. Therefore the nominal range for the CM3 and CM3L is -25C to +80C. However, this range is the maximum for the silicon die; therefore, users would have to take into account the heat generated when in use and make sure this does not cause the temperature to exceed 80 degrees Celsius.

4. Output and result

The output image in Fig.no.7 This module working using Raspberry Pi, the input microcontroller connected to the Raspberry Pi and its consist of PIR sensor, Temperature sensor and Buzzer. .The power supply SMPS of 5v is given to the raspberry pi. when the motion is captured in the given web camera output indicates using buzzer, motor one works for fire purpose and motor two is works for chloroform spray and then sends notification to mobile pone as a video call using line phone application. The DC motor works only in 12v, but the raspberry Pi give 5v. So we are using two motor drivers for converting 5v into 12v.

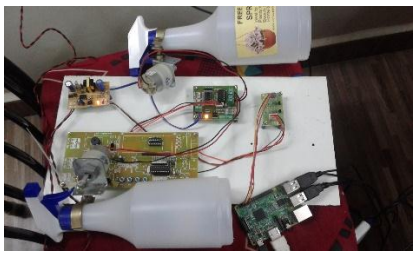

Fig.7: Output Module

Our future scope is to identify the persons or an animal by their live movements. We can implement the motors in raspberry pi itself. In order to make more convenient, we can use battery to replace the power supply.

5. Conclusion

Video surveillance is the process of monitoring a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety. Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. There are also added risks of losing personnel in the event of getting caught by the enemy. With advances in technology over the years, it is possible to remotely monitor areas of importance by using robots in place of humans .We have developed a robot which can be used for video surveillance & monitoring which can be controlled through a GUI interface. The control mechanism is provided with a video transmission facility. The video transmission is practically achieved through high-speed image transmission. Initially, the robot will be equipped with a camera which will capture the scenes and transfer the images to the server on which the user will be controlling and watching the live feed. The proposed system can be operated from anywhere in the world using IOT. The LINUX operating system is used to reduce the hardware components. It can perform risky jobs which cannot be done by humans. High accurate and low cost. This system can be used for both home and military surveillance purposes.

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