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A Smart Monitoring System for Lockers

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***Abstract*: IOT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to delivers complete systems for a product or service.**

These systems allow greater transparency, control, and performance when applied to any industry or system. IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. In world of internet of things (IOT) when most have all the technologies to revolutionize our life, it's a great idea to develop a system which can be controlled and monitored from anywhere. So a low cost simple Raspberry pi based intruder alert system is built which sends the picture of intruder when it detects any.

In our daily life, people are difficult to identify the unauthorized person's who tries to open the lockers without owner's permission. To overcome this problem, there is an idea of using Raspberry pi by interfacing camera (spy camera) while insist into the locker system then if any intruder intrudes into the locker this system captures the images in raspberry pi and finds the culprits. We want to extend this project by adding some additional features. That includes: 1) A feature of getting notification on Gmail to the authorized person, 2) A feature of getting SMS alert to the registered person through cloud computing.

***Keywords*: Smart Monitoring System, Lockers**

1. Introduction

Everywhere around us, internet of things(IOT) and its applications are creating breakthroughs by introducing automations and ease of use applications for our daily lives.

One such problem we problem we face every day is the management of analog manual locker systems which includes safety, security and reliability of usage.

To overcome these problems, we have proposed a method i.e.," Smart Monitoring System For Lockers."

2. Module description block diagram and flow chart

A smart monitoring system for locker is the future technology electronic device. The key features of the project are sending the image of unauthorized person to the owner through G-mail, a SMS alert, as well as tweeter to the owner who tries to opens the locker.

Firstly, the person has to place the finger to the sensor and pass the test, then only the locker will be opened. Otherwise when the unauthorized person is detected then camera captures the image and sends image to the owner through g-mail along with SMS and tweeter alert. Initially the owner had toad the finger print information to the data base. The number of authorized person has to register initially and their finger print information have to be added to the data base. If and only if the authorized person accesses the locker, then only the locker is opened.

The raspberry pi takes the input from the finger print sensor if the finger print matches with the data base then only the locker opens and if it is not matched then the pi camera module takes the picture of the unauthorised persons and send the image to the owner with the help of gmail, SMS, as well as twitter.

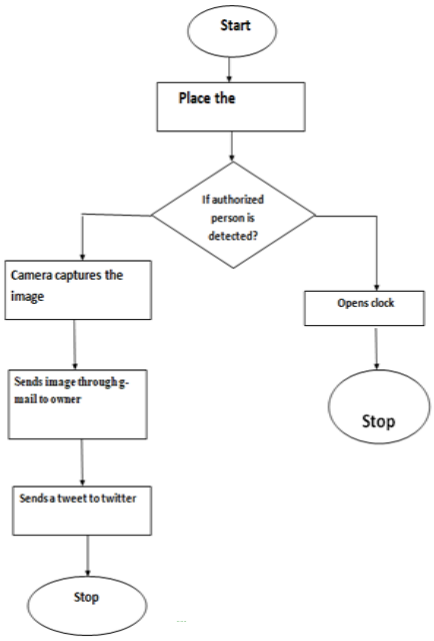

Fig. 1. Flowchart of the project

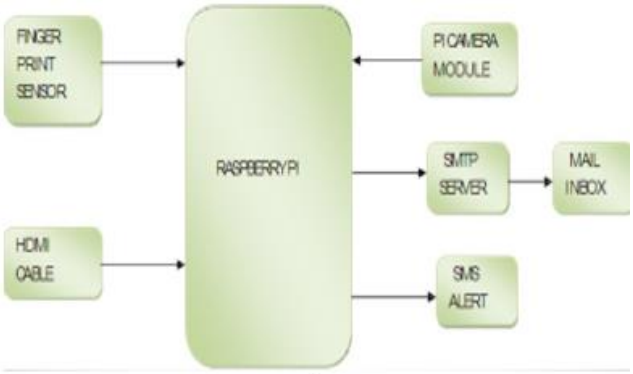

Fig. 2. Block diagram of the smart monitoring system for lockers

Fig. 3. Raspberry Pi

The Raspberry Pi is a credit-card sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games. It also plays high-definition video. We want to see it being used by kids all over the world to learn how computers work, how to manipulate the electronic world around them, and how to program.

Specifications:

- Chip Broadcom : BCM2835 SoC
- Core architecture : ARM11
- CPU : 700 MHz Low Power ARM1176JZFS

Applications Processor:

- GPU : Dual Core Video Core IV® Multimedia Co-Processor Provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
- Memory : 512MB SDRAM
- Operating System : Boots from Micro SD card, running a version of the Linux operating system
- Dimensions : 85 x 56 x 17mm
- Power : Micro USB socket 5V, 2A

Connectors:

- Ethernet : 10/100 BaseT Ethernet socket
- Video Output : HDMI (rev 1.3 & 1.4) Composite RCA (PAL and NTSC)
- Audio Output : 3.5mm jack, HDMI
- USB : 4 x USB 2.0 Connector
- GPIO Connector : 40-pin 2.54 mm (100 mil) expansion header: 2x20 strip Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines
- Camera Connector : 15-pin MIPI Camera Serial Interface (CSI-2)
- JTAG : Not populated
- Display Connector: Display Serial Interface (DSI) 15-way flat flex cable connector with two data lanes and a clock lane
- Memory Card Slot: Micro SDIO

General Purpose I/O (GPIO):

On the technical features of the GPIO pins available on BCM2835 in general. For usage examples, see the GPIO Usage section. When reading this page, reference should be made to the BCM2835 ARM Peripherals Datasheet, section 6.

GPIO pins can be configured as either general-purpose input, general-purpose output or as one of up to 6 special alternate settings, the functions of which are pin-dependant.

There are 3 GPIO banks on BCM2835. Each of the 3 banks has its own VDD input pin. On Raspberry Pi, all GPIO banks are supplied from 3.3V. Connection of a GPIO to a voltage higher than 3.3V will likely destroy the GPIO block within the SoC.

A selection of pins from Bank 0 is available on the P1 header on Raspberry Pi.

The GPIO peripheral has three dedicated interrupt lines. These lines are triggered by the setting of bits in the event detect status register. Each bank has its' own interrupt line with the third line shared between all bits.

The Alternate function table also has the pull state (pull-up/pull-down) which is applied after a power down.

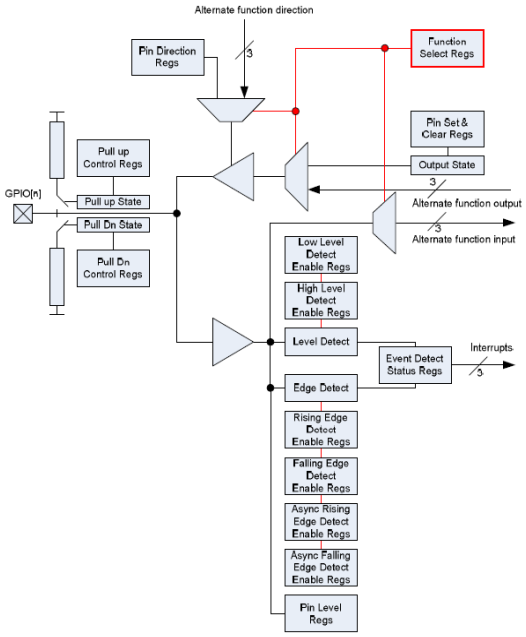

Fig. 4. GPIO pins of Raspberry pi

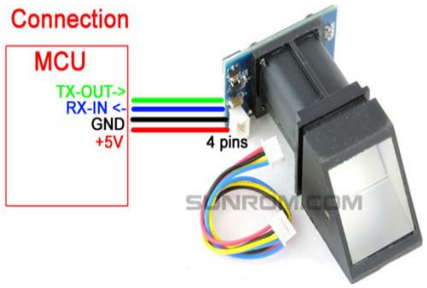

Fig. 5. Finger print sensor (R307)

This is a finger print sensor module with TTL UART interface. The user can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person. The FP module can directly interface with 3v3 Microcontroller. A level converter (like MAX232) is required for interfacing with PC.

R307 Fingerprint Module consists of optical fingerprint sensor, high-speed DSP processor, high-performance fingerprint alignment algorithm, high-capacity FLASH chips and other hardware and software composition, stable performance, simple structure, with fingerprint entry, image processing, fingerprint matching, search and template storage and other functions.

The R307 fingerprint module has two interface TTL UART and USB2.0, USB2.0 interface can be connected to the computer; RS232 interface is a TTL level, the default baud rate is 57600, can be changed, refer to a communication protocol; can and microcontroller, such as ARM, DSP and other serial devices with a connection, 3.3V 5V microcontroller can be connected directly. Needs to connect the computer level conversion, level conversion note, embodiments such as a MAX232 circuit.

A. Pin outs

Pin# Pin Name Details

1. 5V Regulated 5V DC
2. GND Common Ground
3. TXD Data output - Connect to MCU RX
4. RXD Data Input - Connect to MCU TX
5. TOUCH Active Low output when there is touch on sensor by finger
6. 3.3V Use this wire to give 3.3V to sensor instead of 5V
7. USB Cable Connections are 5V/D+/D-/GND (Optional)

Features:

- Supply voltage: DC 4.2 ~ 6.0V
- Supply current: Working current: 50mA (typical) Peak current: 80mA
- Fingerprint image input time: <0.3 seconds
- Window area: 14x18 mm
- Matching method: Comparison method (1:1)
- Search method (1: N)
- Characteristic file: 256 bytes
- Template file: 512 bytes
- Storage capacity: 1000 pieces
- Security Level: Five (from low to high: 1,2,3,4,5)
- Fake rate (FAR): <0.001%
- Refusal rate (FRR): <1.0%
- Search time: <1.0 seconds (1: 1000 hours, mean value)
- Host interface: UART \ USB1.1
- Communication baud rate (UART): (9600xN) bps Where N = 1 ~ 12 (default N = 6, i.e. 57600bps)
- Working environment: Temperature: -20 ℃ - +40 ℃ Relative humidity: 40% RH-85% RH (no condensation)
- Storage environment: Temperature: -40 ℃ - +85 ℃ Relative humidity: <85

Pi Camera Module:

The Raspberry Pi Camera Module is a 5MP CMOS camera with a fixed focus lens that is capable of capturing still images as well as high definition video. Stills are captured at a resolution of 2592 x 1944, while video is supported at 1080p at 30 FPS, 720p at 60 FPS and 640x480 at 60 or 90 FPS. The camera is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system.

Fig. 6. Pi camera module

Features:

- 1.4 µm X 1.4 µm pixel with OmniBSI technology for high performance (high sensitivity, low crosstalk, low noise)
- Optical size of 1/4"
- Automatic image control functions
- Automatic exposure control (AEC)
- Automatic white balance (AWB)
- Automatic band filter (ABF)
- Automatic 50/60 Hz luminance detection
- Automatic black level calibration (ABLC)
- Programmable controls for frame rate, AEC/AGC 16-zone size/position/weight control, mirror and flip, cropping, windowing, and panning
- Digital video port (DVP) parallel output interface
- 32 bytes of embedded one-time programmable (OTP) memory
- Raspberry Pi Camera Module Setup

Outputs:

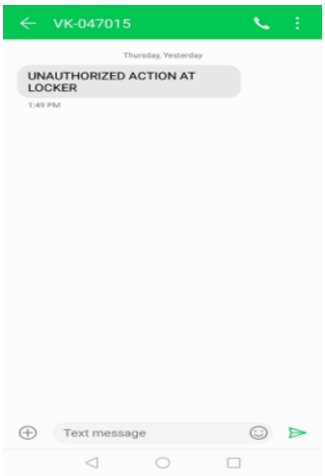

Fig. 7. SMS to the owner

Fig. 8. Tweet message to the owner

Fig. 9. Photo of unauthorized persons

3. Conclusion

Smart monitoring system for lockers is a best technology and the major necessity on the lockers because the total control of houses, banks, office...etc. Will be under the finger print sensor and there is no need of mechanical instruments like lock and keys and several problems can be solved.

Future scope:

- Since internet is required to unlock the locker, an alternate offline method using OTP. Along with a more user-friendly user interface of the application software.
- Lastly, a proposed enhancement is for the user to get a snapshot of the inside of the locker at real time so that he or she is aware of the contents present inside it.

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