An Embedded System Based Density Calculation and Energy Conservation in Buildings

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Introduction:

With the proliferation of Internet of Things (IoT) devices such as smartphones, sensors, cameras, and RFIDs, it is possible to collect massive amount of data for localization and tracking of people within commercial buildings. Enabled by such occupancy monitoring capabilities, there are extensive opportunities for improving the energy consumption of buildings via smart HVAC control. In this respect, the major challenges we envision are 1) to achieve occupancy monitoring in a minimally intrusive way, e.g., using the existing infrastructure in the buildings and not requiring installation of any apps in the users' smart devices, and 2) to develop effective data fusion techniques for improving occupancy monitoring accuracy using a multitude of sources. This paper surveys the existing works on occupancy monitoring and multi-modal data fusion techniques for smart commercial buildings.

Existing System:

In many public speeches and in auditoriums one need to continuously watch and control the people entering into that auditorium. If that place is completely full of public and if it is not possible to control others coming in. The people waiting outside may not know the condition whether the seats are vacant or not. So that the security people should restrict others entering into auditorium by telling them each and every time. We have a solution to count the number of people entering into the auditorium and also to display that. Microcontroller is the heart of the entire system. IR sensor is interfaced to the microcontroller and it is used to determine the number of persons entering inside.

IR follows the principle of line-of-sight and if it experiences any obstacle then there will be an increment in the counter of a microcontroller.

Drawback:

Here there is only a LCD display, no remote monitoring is given

BLOCK DIAGRAM:
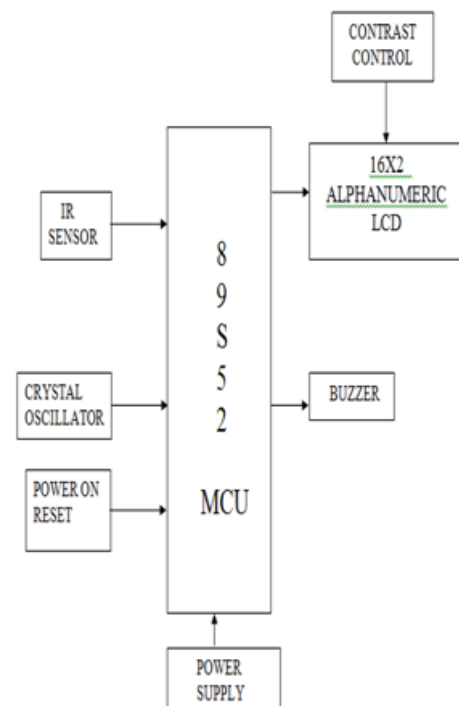
Proposed System:

In this project, for the occupany collection of data, IR sensors are used for the detection of existence of the persons and it will count the people in the buildings entering. At the exit also the sensor is used to reduce the count as they are out of the building.

The sensor is IR pair, Infra Red made of LED and A Photo Transistor. This enhances the occupancy data in the buildings, leading to the smart buildings. This data will be displayed on the Phone as well the computer using IOT module. The occupancy will be displayed on the LCD . LCD 16*2 is interfaced to the controller used. The Buzzer is also connected to the Microcontroller, so that the alert will be issued to the security people. The IOT module is interfaced to the controller to send the information of occupancy to the concern person or the authorities of the smart buildings. This project output can be checked at the Android mobile Phone or in the computer. This project uses the voltage according to the controller used here.
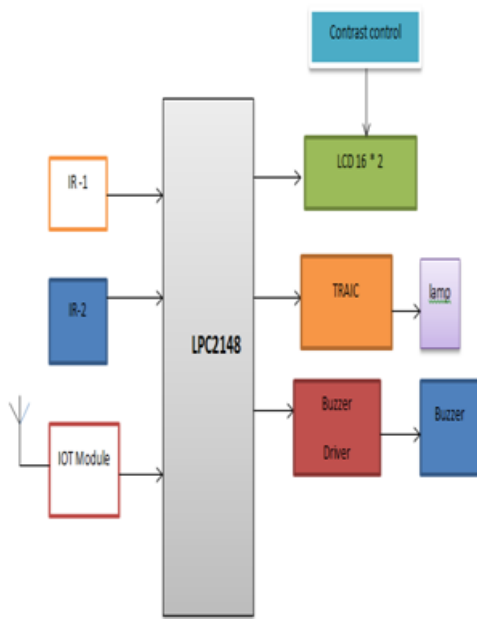

HARDWARE MODULES:
ARM7:

The LPC2148 are based on a 16/32 bit ARM7TDMI-S™ CPU with real-time emulation and embedded trace support, together with 128/512 kilobytes of embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30% with minimal performance penalty.

With their compact 64 pin package, low power consumption, various 32-bit timers, 4- channel 10-bit ADC, USB PORT,PWM channels and 46 GPIO lines with up to 9 external interrupt pins these microcontrollers are particularly suitable for industrial control, medical systems, access control and point-of-sale. With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.
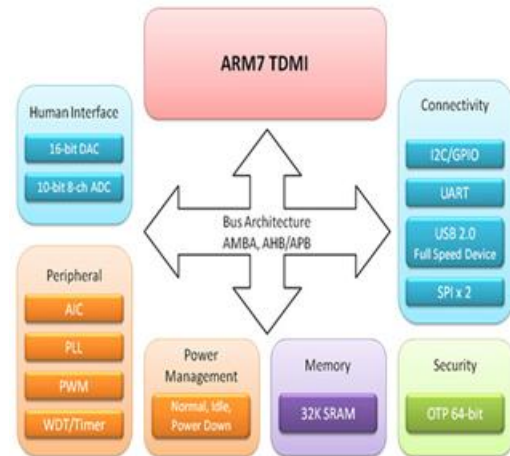
LCD:

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

LCD:

Command	RS	RW	D7	D6	D5	D4	D3	D2	D1	D0	Execution Time
Clear display	0	0	0	0	0	0	0	0	0	1	1.64mS
Cursor home	0	0	0	0	0	0	0	0	1	x	1.64mS
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	40uS
Display on/off control	0	0	0	0	0	0	1	D	U	B	40uS
Cursor/Display Shift	0	0	0	0	0	1	D/C	R/L	x	x	40uS
Function set	0	0	0	0	1	DL	N	F	x	x	40uS
Set CGRAM address	0	0	0	1	CGRAM address						40uS
Set DDRAM address	0	0	1	DDRAM address							40uS
Read "BUSY" flag (BF)	0	1	BF	DDRAM address							-
Write to CGRAM or DDRAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	40uS
Read from CGRAM or DDRAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	40uS

IR sensor:

IR reflectance sensors contain a matched infrared transmitter and infrared receiver pair. These devices work by measuring the amount of light that is reflected into the receiver. Because the receiver also responds to ambient light, the device works best when well shielded from abient light, and when the distance between the sensor and the reflective surface is small(less than 5mm). IR reflectance sensors are often used to detect white and black surfaces. White surfaces generally reflect well, while black surfaces reflect poorly. One of such applications is the line follower of a robot.
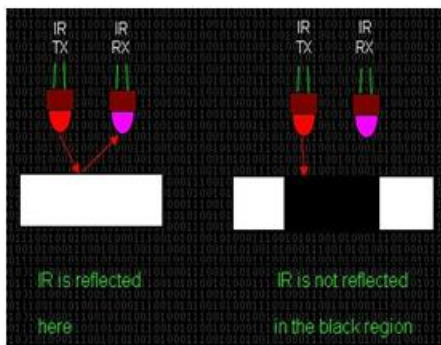

ESP8266

- 802.11 b/g/n
- Integrated low power 32-bit MCU
- Integrated 10-bit ADC
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- Supports antenna diversity
- WiFi 2.4 GHz, support WPA/WPA2
- Support STA/AP/STA+AP operation modes
- Support Smart Link Function for both Android and iOS devices
- SDIO 2.0, (H) SPI, UART, I2C, I2S, IR Remote Control, PWM, GPIO
- Deep sleep power <10uA, Power down leakage current < 5uA
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)
- +20 dBm output power in 802.11b mode

Schematic Diagram:
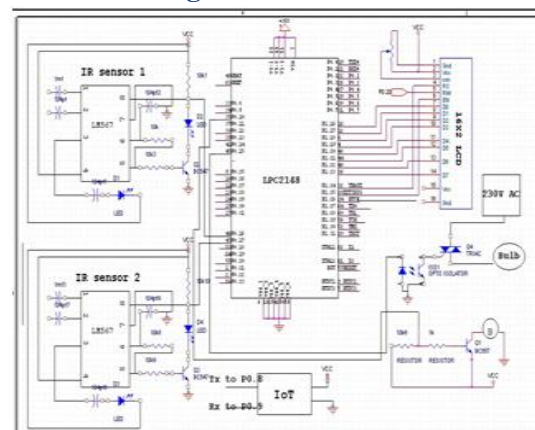
Software Tools:

Keil compiler is a software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.
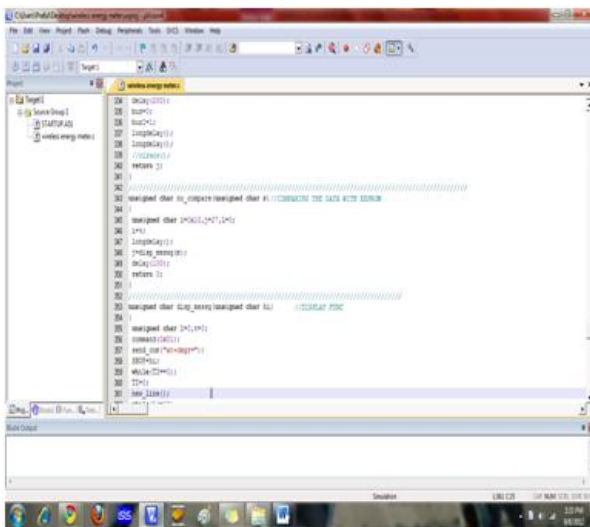
Flash Magic:

Flash Magic is a tool which is used to program hex code in EEPROM of micro-controller. It is a freeware tool. It only supports the micro-controller of Philips and NXP. It can burn a hex code into that controller which supports ISP (in system programming) feature. Flash magic supports several chips like ARM Cortex M0, M3, M4, ARM7 and 8051.

Devices For Monitoring:

(OR)

Applications:

Offices, colleges, schools
Industry
Hospitals
Hotels

Advantages:

Counting
Provides security
Occupancy detection
Highly reliable
Fit and forget system

Conclusion:

Hence this project is implemented using LPC2148 and ESP8266 to have the knowledge about the strength inside a building.

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