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IOT Based Two Way Safely Enabled Intelligent Stove with Age Verification using Machine Learning

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ABSTRACT

Smart embedded systems have become a core component in the latest technologies, and IoT based smart embedded system is the trendiest field in the research area. In our research, we are proposing an IoT based smart stove. Any accident might occur at any time from a stove. So we are designing a two-way safety enabled stove with a child lock system and gas leakage detection feature. The intelligent stove will try to ensure safety and will detect age from real-time video streaming. Our main focus is a child would not be able to turn the stove on. As well as, the stove can entitle safety via gas detection alarm. We are using a Raspberry Pi and Gas Detection Module with a buzzer for the hardware implementation. Also, we are applying a Machine Learning object detection algorithm (Haar Cascade) for the system execution. Since our stove is IoT - based, the stove is ensuring safety remotely as well as manually which will try to prevent accidental occurrences.

KEYWORDS: LPG leakage detection and avoidance, child lock in gas stove.

I. INTRODUCTION

Detection of the liquefied natural gas (LNG) leakage attracts increasing attention for preventing environments and governments from severe pollution and economic loss. Existing frameworks take advantage of stationary surveillance thermal cameras to detect the LNG leakage, which comprises background subtraction and leakage classification. However, these methods are limited in rural areas due to the lack of sensitivity and accuracy. In this study, a generalized framework, i.e., tensor based leakage detection (TBLD), is proposed to detect LNG leakage in the rural area from surveillance thermal cameras. First, the proposed TBLD takes advantage of tensor factorization to fuse thermal image and corresponding gradient maps for improving sensitivity. Additionally, a finite-state-machine (FSM) is designed to maintain leakage foreground along with the video streaming. The experiments demonstrate the robust performance of TBLD in the background subtraction stage. Second, multiple classification techniques are explored in the leakage classification stage. The results suggest that the TBLD can accurately detect the LNG leakage by applying 50 layers of residual networks (ResNet50). Finally, compared with contemporary frameworks, the TBLD has consistently improved performance concerning the different distances of LNG leakage. The experimental results demonstrate the effectiveness of the proposed TBLD, which also shows the great potential of TBLD in future industrial applications.

II. PROPOSED SYSTEM

In proposed method, here detecting age and ON/OFF the solenoid valve depends on age. Here, giving buzzer alert for gas leakage .More Safe by using age detection.

III. BLOCK DIAGRAM

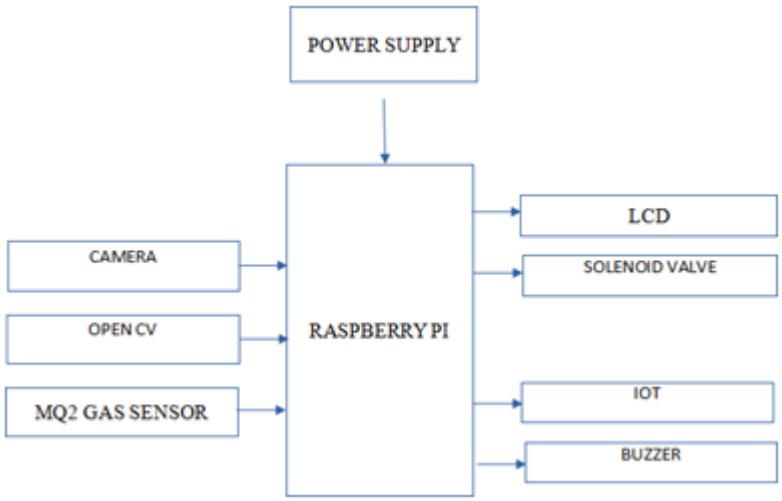

Fig.1 block diagram

IV. WORKING PRINCIPLE

The RASPBERRY PI is used in this proposed method. The LCD is used to display the current execution process. Camera is used to detect the age of person. Solenoid valve is used to ON and OFF the valve and leaking the gas. MQ2 gas sensor is used to detect the gas leakage and if any gas leakage buzzer will alert. The GPS is used to provide the Location of the device. The buzzer is used to provide the audio alert. IOT is used to update the sensor in the webpage.

RASPBERRY PI 3:

The Raspberry Pi is a computer, and from a connections point of view it doesn't look much different to a normal desktop computer. It has USB ports for connecting a keyboard and mouse, and a video output port for connecting up a display. Because it is more compact and lower cost than a large desktop PC, it becomes possible to use the Raspberry Pi or other small single board computers (SBCs) as they are known, for many scenarios where a desktop or laptop PC would not be feasible. The Raspberry Pi 3 Model B features a quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz. This puts the Pi 3 roughly 50% faster than the Pi 2. Compared to the Pi2, the RAM remains the same – 1GB of LPDDR2-900 SDRAM, and the graphics capabilities, provided by the Video Core IV GPU, are the same as they ever were. The Pi 3 now includes on-board 802.11n Wi-Fi and Bluetooth 4.0. Wi-Fi, wireless keyboards, and wireless mice.

	Raspberry Pi 3 Model B	Raspberry Pi Zero	Raspberry Pi 2 Model B	Raspberry Pi Model B+
Introduction Date	2/29/2016	11/25/2015	2/2/2015	7/14/2014
SoC	BCM2837	BCM2835	BCM2836	BCM2835
CPU	Quad Cortex A53 @ 1.2GHz	ARM11 @ 1GHz	Quad Cortex A7 @ 900MHz	ARM11 @ 700MHz
Instruction set	ARMv8-A	ARMv6	ARMv7-A	ARMv6
GPU	400MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV
RAM	1GB SDRAM	512 MB SDRAM	1GB SDRAM	512MB SDRAM
Storage	micro-SD	micro-SD	micro-SD	micro-SD
Ethernet	10/100	none	10/100	10/100
Wireless	802.11n / Bluetooth 4.0	none	none	none
Video Output	HDMI / Composite	HDMI / Composite	HDMI / Composite	HDMI / Composite
Audio Output	HDMI / Headphone	HDMI	HDMI / Headphone	HDMI / Headphone
GPIO	40	40	40	40
Price	$35	$5	$35	$35

Fig.2 raspberry pi specifications

SPECIFICATIONS OF RASPBERRY PI 3:

SoC: Broadcom BCM2837

CPU: 4× ARM Cortex-A53, 1.2GHz

GPU: Broadcom Video Core IV RAM: 1GB LPDDR2 (900 MHz)

Networking: 10/100 Ethernet, 2.4GHz 802.11n wireless Bluetooth: Bluetooth 4.1 Classic, Bluetooth Low Energy Storage: microSD

GPIO: 40-pin header, populated

Ports: HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)

ANTENNA:

There's no need to connect an external antenna to the Raspberry Pi 3. Its radios are connected to this chip antenna soldered directly to the board, in order to keep the size of the device to a minimum. Despite its diminutive stature, this antenna should be more than capable of picking up wireless LAN and Bluetooth signals – even through walls.

SYSTEM-ON-CHIP (SOC):

Built specifically for the new Pi 3, the Broadcom BCM2837 system-on-chip (SoC) includes four high-performance ARM Cortex-A53 processing cores running at 1.2GHz with 32kB Level 1 and 512kB Level 2 cache memory, a VideoCore IV graphics processor, and is linked to a 1GB LPDDR2 memory module on the rear of the board.

GPIO:

The Raspberry Pi 3 features the same 40-pin general-purpose input-output (GPIO) header as all the Pis going back to the Model B+ and Model A+. Any existing GPIO hardware will work without modification; the only change is a switch to which UART is exposed on the GPIO's pins, but that's handled internally by the operating system.

USB CHIP:

The Raspberry Pi 3 shares the same SMSC LAN9514 chip as its predecessor, the Raspberry Pi 2, adding 10/100 Ethernet connectivity and four USB channels to the board. As before, the SMSC chip connects to the SoC via a single USB channel, acting as a USB-to- Ethernet adaptor and USB hub.

POWER SUPPLY:

This section describes how to generate +5V DC power supply.

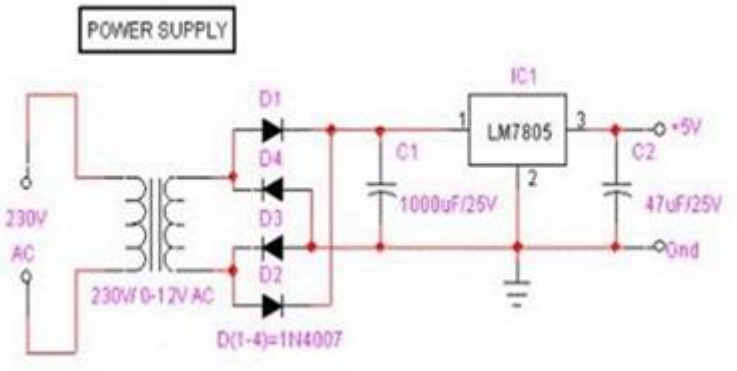

Fig.3 power supply for the hardware

The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805.

LCD:

LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

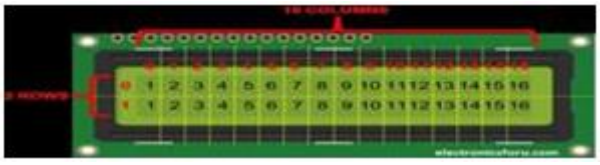

Fig.4 LCD

We come across LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses

liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in projects. The 16×2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

Gas sensor (MQ-2):

Fig.5 MQ-2 Gas Sensor

Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, The sensor's conductivity is more higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application. Sensor is sensitive to flammable gas and smoke. Smoke sensor is given 5 volt to power it. Smoke sensor indicate smoke by the voltage that it outputs .More smoke more output. A potentiometer is provided to adjust the sensitivity. But when smoke exist sensor provides an analog resistive output based on concentration of smoke. The circuit has a heater. Power is given to heater by VCC and GND from power supply. The circuit has a variable resistor. The resistance across the pin depends on the smoke in air in the sensor. The resistance will be lowered if the content is more. And voltage is increased between the sensor and load resistor.

ESP-12E BASED NODEMCU:

The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect NodeMCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

Fig.6 ESP-12E BASED NODEMCU

ESP-12E Wi-Fi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra-low power 32-bit MCU micro, with the

16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on- board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller. ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Fig.7 Buzzer

APPLICATIONS:

1. Our proposed smart stove has two-way safety enables i.e. a child lock system and an accidental gas leakage alarming system.
2. The stove is IoT based the users can ensure safety by monitoring it remotely.

ADVANTAGES:

- Age Detection
- Gas Detection
- A Machine Learning Object Detection Algorithm

V. CONCLUSION

Though many works have been done previously relating age detection and gas leakage detection separately, we have proposed a combined method of both regarding the safety measurements. We have enabled two-way safety features in our smart stove i.e. a child lock system in the stove. And the other feature is, our smart stove will give an alarm if there is any accidental gas leakage. Since our smart stove, we have proposed in this paper is IoT based so the users will be able to monitor the stove remotely and prevent any accidental occurrences. Moreover, our system has been established in the perception of Bangladesh. The system of the smart stove is IoT based so the users can monitor it remotely to ensure safety. A GSM module can be installed in our system so that the users can not only monitor the stove but also be notified via an email or SMS.

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