Advanced Home Automation System using Raspberry Pi

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Abstract - Internet of things is a technology of the future that has already started to touch our homes. Here we propose an Advanced home automation system using raspberry pi that automates home appliances and allows user to control them easily through internet from anywhere over the world. LPG gas leakage sensor to avoid gas leakage and also prevent from heavy fire accidents. Fire Detection system uses the Thermister for detecting fires. The surveillance system mainly beneficial for determining crime, it monitors scenarios and activities, helpful for gathering evidences and detecting thefts instantly. Water Level Controller will help in automatically controlling the water motor by sensing the water level in a tank. The automatic gate opening and closing by Bluetooth.

Key words –Raspberry Pi, LCD Display, Pi Camera, PIR Sensor, Water level sensor, Buzzer, Relay, Motor, LPG-Gas sensor.

I.   INTRODUCTION

An Introduction specifies the scope of work and its importance and relation to previous work and the present developments. Internet of things is a technology of the future that has already started to touch our homes. Here we propose an Advanced home automation system using raspberry pi that automates home appliances and allows user to control them easily through internet from anywhere over the world.

Gas pipes play very important roles for cities, industries and thus in growing economies. So gas leakages lead to Internet losses as well as are a threat because they can also lead to fire accidents. Here we are using the LPG Gas leakage sensor to avoid gas leakage and also prevent from heavy fire accidents.

The fire detection system uses the fire sensor to detect the fire. If any fire is detected then the sensor will sense the fire and send the mail to registered email address and also the buzzer will turn on and the fire detected message is displayed on the LCD.

The surveillance system mainly beneficial for determining crime, it monitors scenarios and activities, helpful for gathering evidences and detecting thefts instantly. The system is built to monitor home, it uses PIR sensor to detect the motion, and if motion is detected the camera will capture the image and it sends that image to respective mail.

Water Level Controller will help in automatically controlling the water motor by sensing the water level in a tank. This system monitors the water level of the tank and automatically switches ON the motor whenever tank is empty. The motor is switched OFF when the overhead tank or container is FULL.

The automatic gate opening and closing technique uses the DC motor. By using the Bluetooth we can control the opening and closing the gate. If the status of motor is 10 it is open, if it is 01 then gate is closed and if it is 00 the motor will stop'
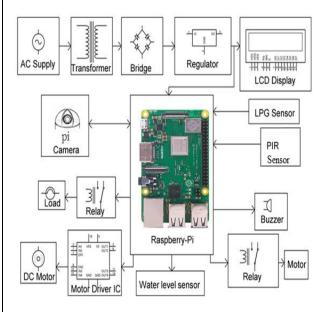
II.   BLOCK DIAGRAM

Figure 1: Block Diagram of the project

➢ RASPBERRY PI 3 MODEL B

The Raspberry Pi 3 Model B is a tiny credit card size computer. Just add a keyboard, mouse, display, power supply, micro SD card with installed Linux Distribution and you'll have a fully fledged computer that can run applications from word processors and spreadsheets to games.

As the Raspberry Pi 3 supports HD video, you can even create a media centre with it. The Raspberry Pi 3 Model B is the first Raspberry Pi to be open-source from the get-go, expect it to be the defacto embedded Linux board in all the forums.

➢ RASPBERRY PI 3 SPECIFICATIONS

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)

➢ PI CAMERA

Pi Camera module is a camera which can be used to take pictures and high definition video. Raspberry Pi Board has CSI (Camera Serial Interface) interface to which we can attach Pi Camera module directly. This Pi Camera module can attach to the Raspberry Pi's CSI port using 15-pin ribbon cable.

➢ FEATURES OF PI CAMERA

Here, we have used Pi camera v1.3. Its features are listed below,

- ✓ Resolution – 5 MP.
- ✓ HD Video recording – 1080p @30fps, 720p @60fps, 960p @45fps and so on.

- ✓ It Can capture wide, still (motionless) images of resolution 2592x1944 pixels
- ✓ CSI Interface enabled.

➢ WATER FLOW SENSOR

Effective water management involves supplying water according to the real requirement, and thus measuring water is very essential step in water management systems. There are many water flow measurement techniques as well as different types of water flow meters used to measure the volume of water flow in pipelines but these all are too costly. This article describes ideas for design and development of low cost automatic water flow meters, with the help of readily-available and low-cost water flow sensors.

➢ YF-S201 HALL-EFFECT WATER FLOW SENSOR

Accurate flow measurement is an essential step both in the terms of qualitative and economic points of view. Flow meters have proven excellent devices for measuring water flow, and now it is very easy to build a water management system using the renowned water flow sensor

YF-S201

This sensor sits in line with the water line and contains a pinwheel sensor to measure how much water has moved through it. There is an integrated magnetic Hall-Effect sensor that outputs an electrical pulse with every revolution.

YFS201

"Hall Effect Water Flow Sensor" comes with three wires: Red/VCC (5-24V DC Input), Black/GND (0V) and Yellow/OUT (Pulse Output). By counting the pulses from the output of the sensor, we can easily calculate the water flow rate (in litre/hour – L/hr) using a suitable conversion formula.

Figure 2: Water Flow Sensor

➢ PIR SENSOR

All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is invisible to the human_eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.

The term *passive* in this instance refers to the fact that PIR devices do not generate or radiate any energy for detection purposes. They work entirely by detecting the energy given off by other objects[1] PIR sensors don't detect or measure "heat"; instead they detect the infrared radiation emitted or reflected from an object.

Infrared radiation enters through the front of the sensor, known as the 'sensor face'. At the core of a PIR sensor is a solid state sensor or set of sensors, made from pyro electric materials which generate energy when exposed to heat. Typically, the sensors are approximately 1/4 inch square (40 mm^2), and take the form of a thin film. Materials commonly used in PIR sensors include gallium nitride (GaN), caesium nitrate (CsNO$_3$), polyvinyl fluorides, derivatives of phenyl pyridine, and cobalt phthalocyanine. The sensor is often manufactured as part of an integrated circuit.
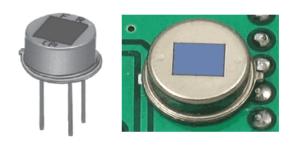

Figure 3: PIR Sensor

➢ LPG GAS SENSOR

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a **methane gas sensor** that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current.

Figure 4: LPG GAS Sensor

III.　IMPLEMENTATION

The implementation of this project mainly requires development of the hardware using sensors and raspberry pi model B then programming it to achieve the desired result. When the Linux operating system is installed on the raspberry pi and the peripherals such as monitor, key board, mouse, SD card, power supply etc, then it acts as the mini computer system.

IV.　ADVANTAGES

✓ It is a pocket friendly automation system for home to control electrical appliances with smart phone.

✓ As it has Surveillance system built in, so that we can easily identify the theft because the image is sent to respective mail.

- ✓ We can save the wastage of water because Motor will automatically ON OFF based on water status in the tank.

- ✓ Also there is fire detection system, When fire is detected it sounds the alarm.

VI. APPLICATION

- ✓ Control of home appliances using IOT.
- ✓ LPG leakage indication using the gas sensor.
- ✓ Water level controller.
- ✓ Home security system with email alert.
- ✓ Detection of Fire.
- ✓ Automatic gate opening /closing using Bluetooth.

CONCLUSION

As future work, the system design presented in this project can be expanded in a number of different aspects. For example, advanced home automation using raspberry pi can be used for various home monitoring applications. Like Control of home appliances using IOT. LPG leakage indication using gas sensor. Water level controller. Home security system with email alert. Image processing Based Fire Detection system. And analysis to provide better interfaces and experience to the user. Considering the limited storage space on the Raspberry Pi.

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