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IoT based Smart Home System for Monitoring Surrounding Condition

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ABSTRACT: Presently, It is necessary to control the home from desire location. This automation system provide to control of devices within their home and continuously monitoring the devices from remote location through IoT. The Motion sensor detects presence of person in room which help to take decision to turn on/off light. Also the system complete different jobs in smarter way such as the water tank fills the water depending upon the water level of tank by starting the motor. As considering the security of the home this system consisting the gas leakage sensor, temperature sensor for detecting the gas leakage and fire in house. Also the system consists of door on/off sensor for detection of unauthorized person entering in the home. If any problem is detected in the system then it can reports that problem by message to service center.

KEYWORDS: Door on/off sensor, Gas leakage sensor, IoT- Internet of Things, Motion detection sensor, temperature sensor, webpage

I. INTRODUCTION

The Internet of Things (IoT) is a system of correlated computing devices, object, digital machines and various sensor networks which imparted with unique identifier. It also provides the ability to send data over clouds which don't required human-to-computer or human-to-human intercommunication. So that this concept used in field of electronics and also in smart car, healthcare, smart home, energy consumption monitoring and industrial security purpose.

In today's world the human are not present in home mostly at day time so that if the change in the setting of environment condition can made change in the devices or report the condition on internet provides many advantage. The term intelligent home automation system is like this only to take the decision of environmental condition independently. The main part of smart home system is clusters of sensor which collect the surrounding data and upload in cloud storage. The smart home monitoring and security system plays important role now days because it is necessary to monitor the environment in the home continuously and also control the devices if any condition happens. The proposed smart home system contains the various sensor such as gas sensor for the detection of LPG gas, temperature sensor used for measuring surrounding temperature, for security purpose door on/off sensor used, for detecting water level in tank water sensor used and for detection motion in room PIR sensor used this various sensors are interface with the microcontroller PIC18F4520. These sensed data display on the internet to displayed on the web page. The Raspberry Pi used to transfer the data on the internet. As the main part of smart home is to access the devices from the internet proposed system also control the devices from the internet.

II. RELATED WORK

Sean Dieter Tebje Kelly, Nagender Kumar Suryadevara implement the system that contained the low cost sensing system. The total framework contains the monitoring system, information system for data aggregation. The results which obtained by the system are 97% reliable[2]. Byeongkwan Kang, Sunghoi Park, used the methodology for IoT, information aggregation of various sensors and data acquisition. Proposed system contains the tri-level context making model for smart home[3]. Lih-Jen Kau et.al developed system used for the cloud network based power management system for smart home. For this system contains the intelligent power socket module which monitor and control the electricity. the control command given by far end i.e. from internet and sent to the home gateway. This proposed architecture can easily applicable to the any home space[1].

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III. PROPOSED SYSTEM ARCHITECTURE:

The Fig. 1 gives the detail idea about the proposed system. System contained two main parts PIC18F4520 and Raspberry Pi, microcontroller and microprocessor of 8 and 32-bit respectively. The all sensors used in the proposed system are gas sensor, door on/off sensor, temperature sensor, PIR sensor and water level sensor. These all sensor are interface with the PIC18F4520. The all data which sensed by the sensor was transmitted to Raspberry Pi through PIC18F4520. The received data at UART of Raspberry Pi is store in .txt file for future use.

When the web page open on Raspberry Pi using internet then the sensor sensed data is display on the web page. All sensors values displayed in front of respective sensor name. The control button is used for controlling devices through internet. Light, fan and small motor are control by these buttons. By hitting the on and off button, all devices can control. So that for this relay driver and relay is used. The send sms message button is used for reporting the values through message.

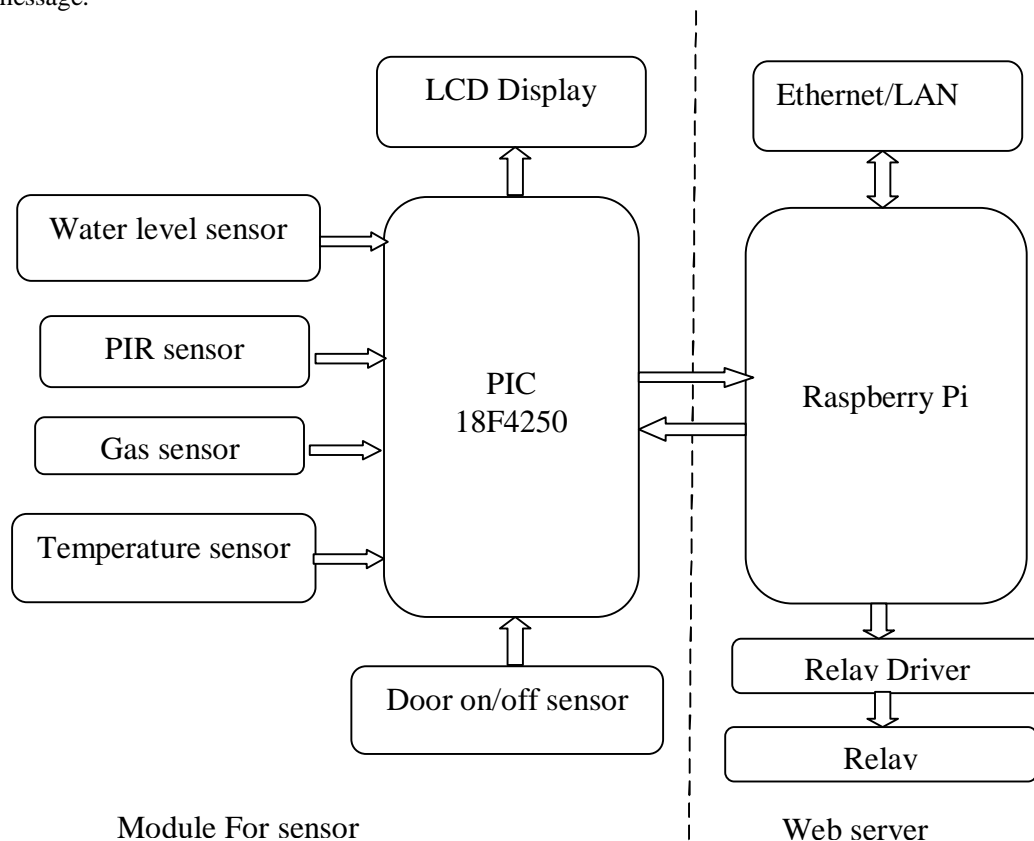


Fig. 1 Block Diagram of Proposed System

The one of the main part of the system is the connection of Raspberry Pi to the internet. Hence for connecting Raspberry Pi to the internet WiFi module is used which is connect to the Raspberry Pi. It creates the WiFi facility to the Raspberry Pi and then the Raspberry Pi connect to the near WiFi for the internet connection. In this system, the Raspberry Pi is connected to the mobile hotspot for the internet connection. Also, system requires the desktop to display the Raspberry Pi window but total setup for a computer is not to portable so that use of Laptop screen is also possible. Hence to take Raspberry Pi window on laptop screen the laptop should connect to the same network to which Raspberry Pi is connected.

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V. HARDWARE USED

The hardware which is used in the whole system contains the different sensor like temperature sensor, gas sensor, door on/off sensor, water level sensor and PIR sensor. These all sensor are interface with the PIC18F4520. The sensed data is transmitted to the Raspberry Pi through UART port. By using the Raspberry Pi these data send on the web page.

VI. METHODOLOGY

The total system flowchart is shown in Fig 2. It describes the step wise procedure carried in the system. The system starts with the initialization with all sensors connected to the PIC18F4520. After sensing all data it transmitted Raspberry Pi. The data received by initializing the UART port of Raspberry Pi. After opening the webpage sensor.shtml page automatically the received sensor data which is save in .txt file displayed in front of every sensor. The control button is used for controlling devices through the internet. Service center received a message when any part having any problem.

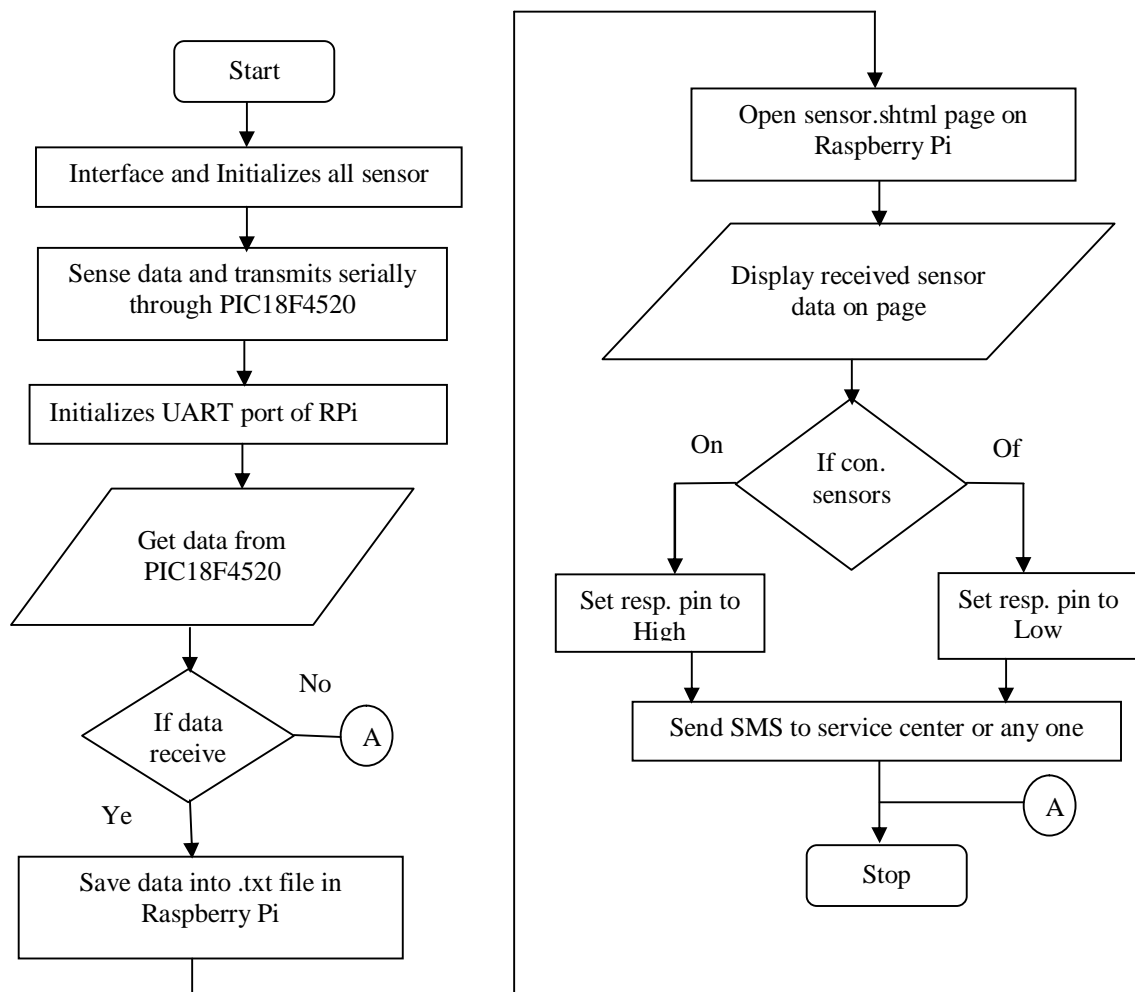


Fig 2 Flowchart of system

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VI. SOFTWARE USED

The software is used for the programming of Raspberry Pi is Python and for PIC18F4520 use MPLAB IDE v8.89. The MPLAB IDE is a software program that runs on a PC (Windows®, Mac OS®, and Linux®) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers. This software supports one click to Make, Program, Debug / Execute operation.

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages. The Python is the Open Source programming language. It does not require any specific compiler to run the program so it is called the interpreted language.

VII. SIMULATION RESULT

This section discusses the results of the system totally. This system is divided into two modules, one part is used to sense all sensor data by interfacing different sensor to the PIC18F4520 and other part is used to send the data on the web browser using the Raspberry Pi. The Raspberry Pi is used because it has a higher speed to send the data on web page. The web Page is created where all sensor data is displayed with the control button. The control button is used to control the devices from web page. The interfacing of all sensor to PIC18F4520 and connection of PIC18F4520 and Raspberry Pi is shown in Fig 3. Wifi module used for display the Raspberry Pi on the laptop screen for this the laptop should in the same network to which the Raspberry pi connected.

The actual setup of overall system is shown in the Fig. 3 For displaying Raspberry Pi window on the laptop wirelessly, WiFi module is used. To Display the Raspberry Pi window on laptop, the laptop and Raspberry Pi should present in the same network. In proposed system for internet connection mobile hotspot is used, hence Raspberry Pi and laptop should have one IP address from same network. By fulfilling this condition, the Raspberry Pi window display on laptop.

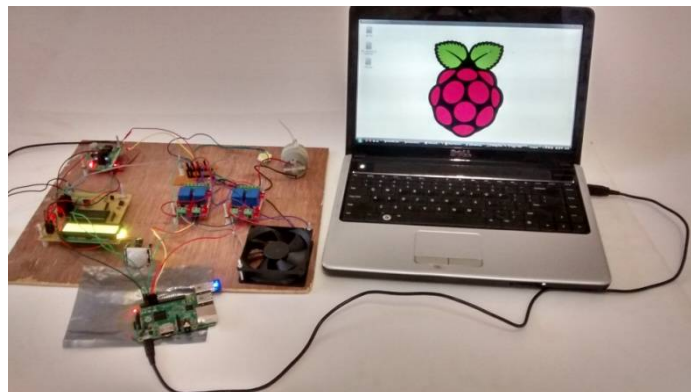


Fig. 3 Experimental setup of proposed system

The Initialization of UART port of Raspberry Pi is very important process while starting the system. For the initialization of UART three commands are used. These commands are as follows:

- Sudo pigpiod : Initialize the GPIO pin of the Raspberry Pi
- Sudo su : This command used for going to root mode from user access mode
- Python uart.py : this is the actual main file with extension “.py” this shows the file in python code. After that UART port is become get data from the PIC18F4520.

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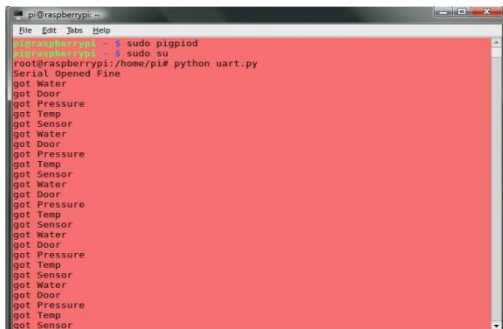


Fig. 4 Initialization of UART and Start Receiving the Sensor Data

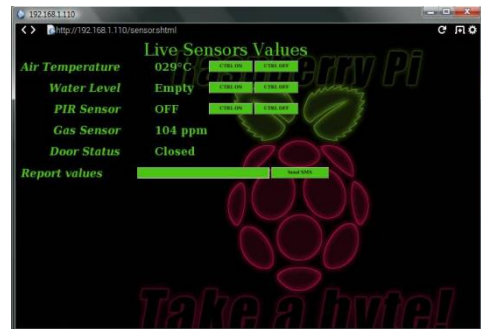


Fig. 5 Web Page to Display All Sensor Value

The Raspberry Pi gives indication “Serial Opened Fine” when serial port is properly initialize and after that the data of all sensors start receiving at UART port and it gives indication “got temp”, “got water”, “got door” like that. The Fig 4 shows the commands with receiving data at UART port of Raspberry Pi.

The Fig. 5 is the web page created for displaying the sensor value. The temperature sensor and gas sensor detect the surrounding temperature and concentration of gas in room respectively. They display the actual values on the web page.

The empty and full condition of the tank is display by the water level sensor. The PIR sensor detects the motion and gives the indication on or off. the Door sensor gives the indication of door position that is it close or open. The web page also include the text box where any message enter regarding to any problem with system happens and that can be send to service center. The “way2sms” site is used to send the message to service center. This web page can access through any mobile with one condition is that that mobile should in the same network in which the laptop and raspberry is connected.

In this system three devices are controlled through web page. These three devices are Fan, stepper motor and LED bubble. For controlling these devices different buttons are used. When any control button pressed after that respective action is taking place and display the next page as shown in Fig 6. If on button pressed then respective pin goes high and if off button pressed then respective pin goes low. The three different pin of Raspberry is used for the each devices pin 17 is used for fan, pin 22 and 27 is used for Light and motor respectively.

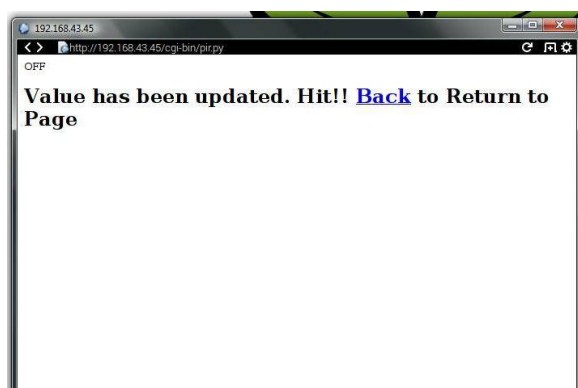


Fig. 6 Next Page after Pressing the Button

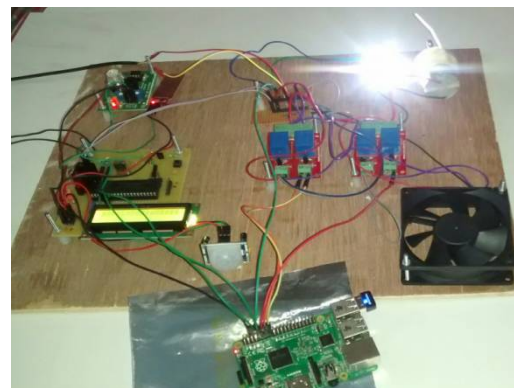


Fig. 7 LED is on when button is pressed

When the button is press as shown in above Fig.6 this is for LED then the LED is on as shown in below Fig 7. For author button also same process is happens and on or off the fan and stepper motor

The system has the facility to send the message to the service centre. After pressing “send” button message will send to the registered mobile number and the next window is open as shown in Fig 8.

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The Fig. 9 shows that revived message send by the sender reporting the sensor values and also any services required for any sensor. The message is send via the Way2SMS hence GSM is not required for this purpose. To send the message via the Way2SMS first user should login in the Way2SMS by entering the mobile number and the password which is given by the Way2SMS at the time of registration.

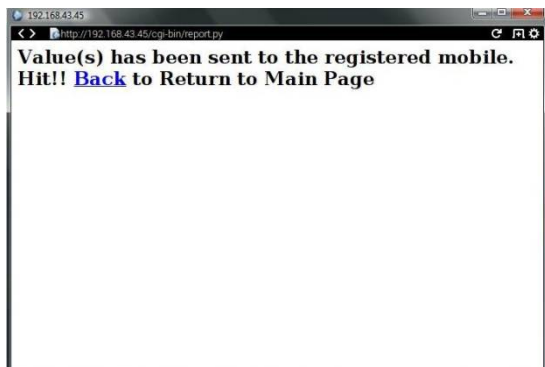


Fig. 8 After Sending the Message New Page is loaded

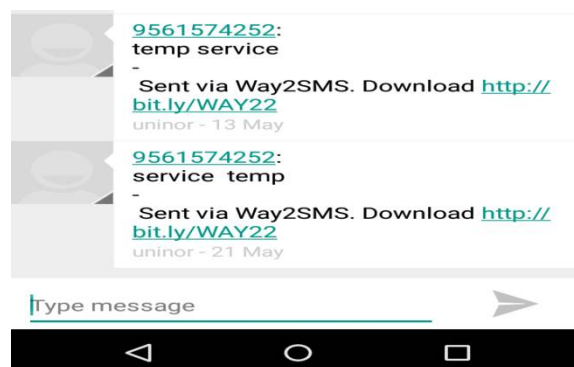


Fig. 9 Message Received Which is Sent Through Internet

VIII. CONCLUSION AND FUTURE WORK

The IoT means it is the network of machine and physical “things” which are embedded with sensor, software and network connectivity these required to exchange and collect information of surrounding. The proposed system monitors and controls the data through internet. This is called as smart home which access from the remote location. Smart home security & monitoring system plays an important role. This system based on to monitoring & controls all the parameters with the use of different sensors. All sensors are selected depending upon the characteristics and specification required for the system to give accurate result. This parameter sends to the user through the web browser.

The system contains different sensors like gas sensor, temperature, water level, door on/off and PIR sensor integrated to PIC18F4520 and Raspberry Pi is used to send the data on web page. The all sensor value is updated after every 45 seconds. The devices which present in home are also controlled through internet. Due to internet connection the connectivity provides capability of product to present outside the physical device.

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