Automated and Secure Monitoring System for Smart Home Application Using Internet Of Things

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***Abstract*—Today we are living in 21st century. It is necessary to control the home from desire location, Smart Home automation is the control of any electronic device in our home and office. It is implemented using python, OpenCV, raspberry pi and android application in a user friendly and intuitive manner. The appliances are controlled by the Raspberry pi server, which operates according to the user command received from the mobile phone. A unique door monitoring system is designed based on face detection and recognition from a camera installed outside the main door, which can be accessed from the phone using android application.**

It can send alerts to your smartphone and notify you about unforeseen events while you're away from home,such as light turned on/off ,water tank level and overflow, intruder alert, and even remotely turning off lights while you're on vacation, at work, or anywhere else. This is a one stop shop which integrates all the above features into a single unit/application.

Keywords— home automation, raspberry pi, face recognition, android application

I. Introduction

Home automation is one of the major growing field that can change the way people live. In this paper home automation systems target those are in need of luxury and sophisticated home automation platforms; others target are with special needs like the elderly people and the disabled. Home automation system is basically an environment that improvize the quality of the resident's life by providing a flexible, comfortable, healthy, and safe environment . In Home, automation systems there are various interconnected devices for controlling different functions within a house. Mobile devices facilitates a user interface in a home automation , due to their enormous portability and their wide range of capabilities. User in the house might not want to go to a central control panel, or even to the laptop, but use the mobile phone that is usually placed in closer proximity to them. When far from the house, the user might want to check its status or even schedule actions for his return.Elderly people leaving alone faces big threat from thieves attacking their houses. The proposed system has a unique door monitoring system based on face detection and recognition algorithms that will help elderly and disabled people from this kind of attacks. When system is designed for elderly or disabled persons it should be reasonably cheap, easy to configure, and easy to run with a good user interface.

II. System Architecture

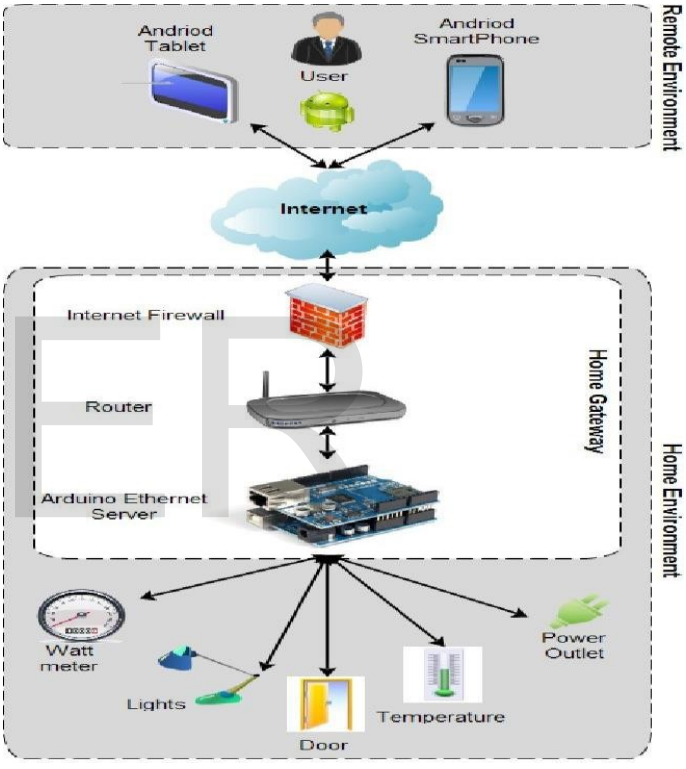


Figure 1

The system is required to be without new wiring and very easy to install. Field of home appliance network is still young, many initiatives and standardization efforts have already been made. This kind of system brought the android application and raspberry-pi into home automation implementation. The proposed system architecture incorporates a raspberry pi computer for managing the network and provision of remote access. It can be configured according to our home system. Smart home implements control and monitor of lights , fans and Water tank level.,Face authentication access, Intruder alert, are integrated.

III. System Design

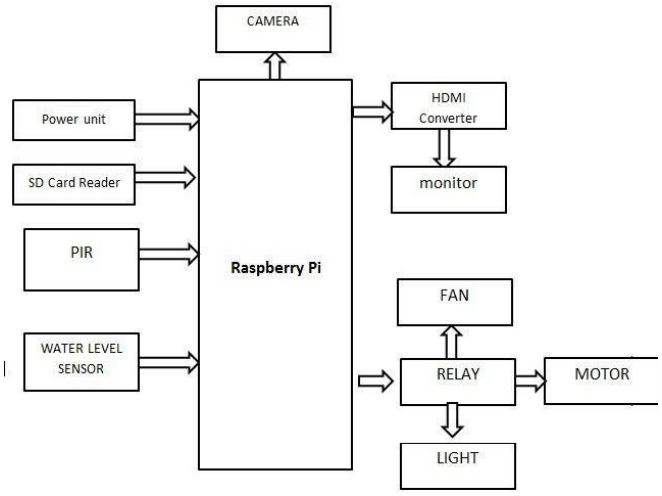


Figure 2

1. **CONTROL AND MONITOR**: Raspberry pi used to connect the sensor with relay to control and monitor lights/fans. A solid-state relay (SSR) is an electronic switching device that switches go on or off .On applying a small external voltage across sensor then it's controlled.

2. **FACE AUTHENTICATION**: To develop a security access control application based on face recognition by using OpenCV.OpenCV is an open source computer vision and machine learning software library.OpenCV was built to provide a common infrastructure for computer vision applications. The library has more than 2500 optimized algorithms. The algorithms can be implemented in detecting and recognizing faces, identify objects in different locations, human action classifications in videos, track camera movements, track moving objects, 3D models of object extractions, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image and find similar images from an image database.

3. **INTRUDER ALERT**: PIR sensor is used for motion detection of an intruder.PIR is connected to the raspberry pi that senses and data will be sent as an alert to user.

4. **WATER OVER FLOW AND LEVEL MONITORING**: Ultrasonic sensor has two openings, one is Trigger and another is Echo. Trigger makes high frequency sound waves. These sound waves are passed through the tank from top to bottom. The sound waves hit the water and are reflected back in the form of Echo waves. The Echo opening receives the Echo waves. The water level sensor RPi measures the time between Echo and Trigger. This traveled distance is directly proportional to the time.

5. **SMART HOME APPLICATION:** Android application is developed to control and monitor the smart home.High graphical user interface is provided. User friendly and authenticated.

IV. System Requirements

The system requirements is a technical specification of the software products. It is the initial step in the requirement analysis process and it lists the requirements of a particular software system which involoves functional, performance and security requirements. The purpose of software requirements specification is to facilitate a detailed overview of the software project, its appropriate parameters and goals.

1. Hardware Requirements:

- ***Raspberry Pi :***

The Raspberry Pi is a low cost single-board computer which is controlled by Debian Linux, a modified version and it is optimized for the ARM architecture.

- ➔ Processor - 64 BIT ARM CORTEX a53 running at 1.2 GHZ
- ➔ Speed - 1.1 GHz
- ➔ RAM - 1GB
- ➔ Hard Disk - 20 GB
- ➔ Floppy Drive - 1.44 MB

Figure 3

- Passive infrared sensor (PIR sensor)
- Pi camera
- GSM Moduler
- Relay sensor
- Mobile device

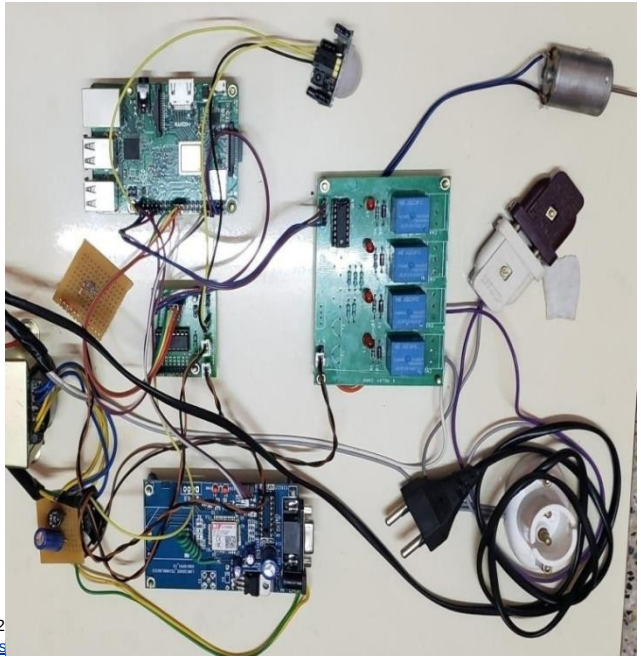
2. Software Requirements:

- Operating System - Raspberry pi
- Application - Android
- Front End - Java
- Programming language - Python , JAVA

V. Simulation and Output

1. Hardware Connectivity

Figure 4



2.Mobile Application UI

Figure 4

3.Water tank alert

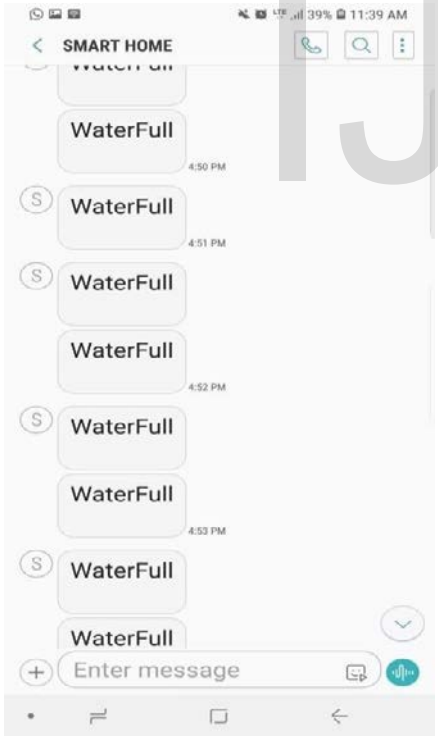


Figure 6

4.Home appliance alert

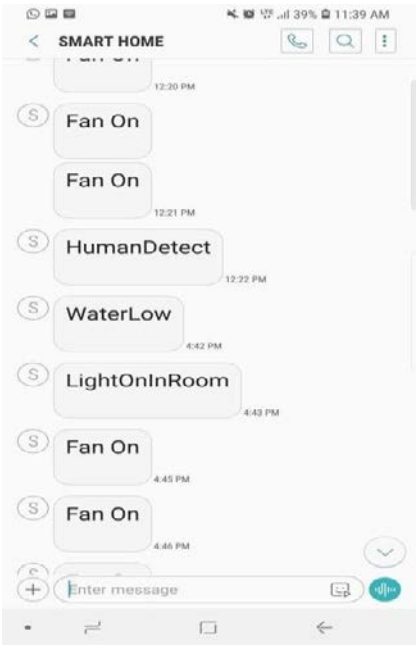


Figure 7

5.Face recognition (Authorized)

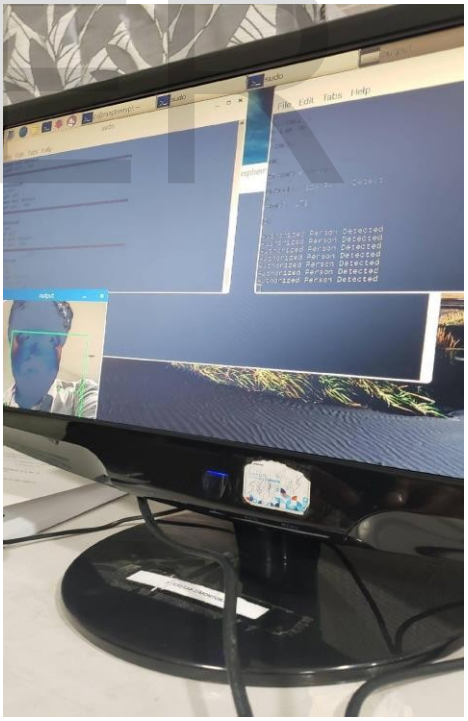


Figure 8

6.Face recognition (Unauthorized)

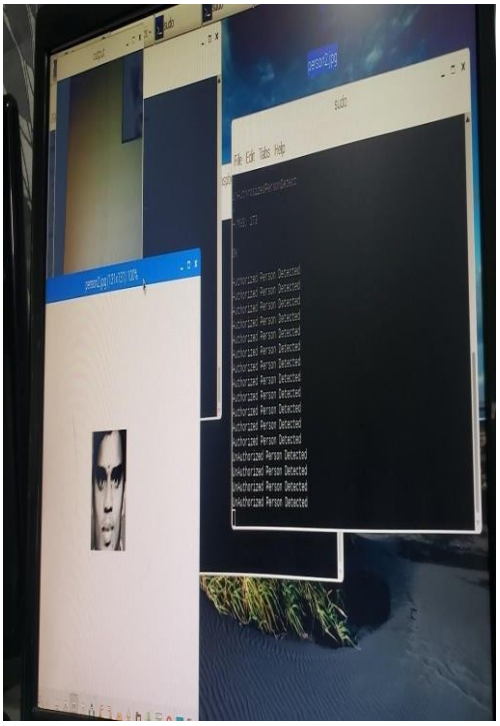


Figure 9

7.Light ON

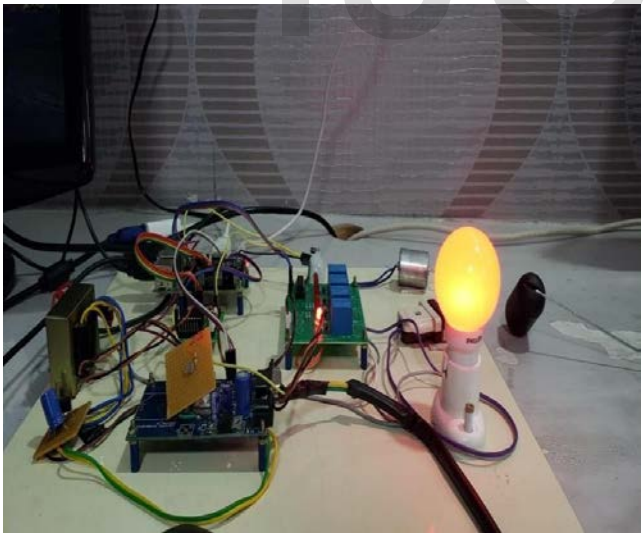


Figure 10

8.Light OFF

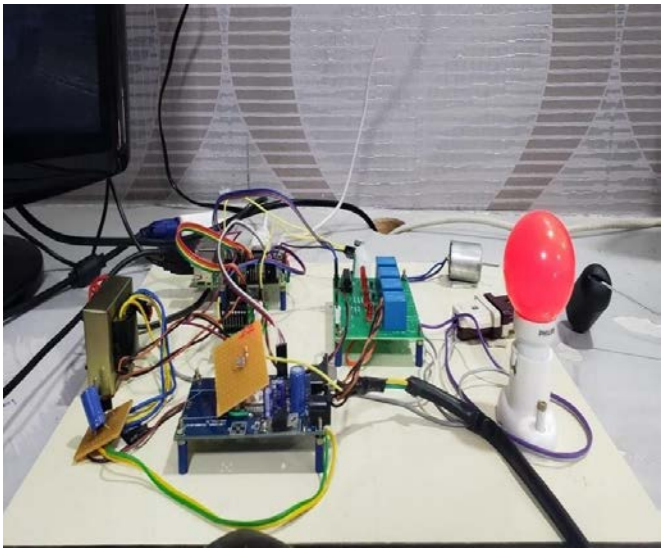


Figure 11

VI. Advantages

1. These platforms are Free Open Source Software. The overall implementation cost is very cheap and easily configurable
2. Easy to expand to control a variety of devices
3. Reduces energy consumption
4. All in one user friendly system
5. This system contain Raspberry pi as a controller so the system contain all the advantages of it
6. This is noise free system

VII. Conclusion

The main objective of the project is to control the home appliances effectively using a smartphone. This project is based on the Raspberry pi, Python, Android platform and Java. The user can send commands using an android application running on a android phone/tablet. This is a working prototype having integrated key features such as face recognition, control home appliances and monitoring water tank level. Using this as a reference,it can be further expanded to integrate many other features into a single raspberry pi unit. This project provides a secure and user friendly system.

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