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Raspberry pi Home Automation with Arduino

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ABSTRACT: Today we are living in 21st century where automation is playing important role in human life. Home automation allows us to control household appliances like light, door, fan, AC etc. It also provides home security and emergency system to be activated. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. The objective of our system is to take care of several domestic systems that may normally be difficult for those who are handicap or elderly to take care of. The proposed idea will allow a user with any android enabled device to run a piece of downloadable software on any mobile devices.

KEYWORDS: Home Automation and Security; Arduino; Embedded Systems; Android phone; Tablet.

I. INTRODUCTION

Home automation or Smart Homes can be described as introduction of technology within the home environment to provide convenience, comfort, security and energy efficiency to its occupants. The project presents a low cost and flexible home control and monitoring system using an embedded microprocessor and microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely using Smart phone application adding intelligence to home environment can provide increased quality of life. Home automation not only refers to reduce human efforts but also energy efficiency and time saving. With the introduction of the Internet of Things (IoT), the research and implementation of home automation are getting more popular.

The Internet of Things (IoT) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet, where the devices are intelligently linked together enabling new forms of communication between things and between things themselves. Building IoT has advanced significantly in the last couple of years since it has added a new dimension to the world.

II. LITERATURE SURVEY

N. Sriskanthan [1] explained the model for home automation using bluetooth via PC. But unfortunately the system lacks to support mobile technology.

Syed Anwaarullah [2] explained RTOS based home automation but failed to work with smartphone.

Muhammad IzharRamli [3] designed a prototype electrical device control system using Web. They also set the server with auto restart if the server condition is currently down.

Pradeep G [4] proposed home automation system by using bluetooth which saves lot of power and time using mechanism to save the preloaded list by not making it to setup connection all the time when required.

Al-Ali and Al-Rousan [5] presented a design and implementation of a Java-based automation system through World Wide Web. It had a standalone embedded system board integrated into a PC-based server at home.

Google and Microsoft have recently entered the home automation domain. At 2011 I/O conference, [6] Google announced Android@Home. Google's first standard for Android devices to communicate with external hardware. The Android Open Accessory Standard and the Accessory Development Kit (ADK) is the key for communicating with

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hardware and building external accessories for Android devices. Android powers hundreds of millions of mobile devices in more than 190 countries around the world.[7] It's the largest installed base of any mobile platform and growing.

III. PROPOSED SYSTEM

Pi Enabled Smart Home Devices

Raspberry Pi: A microprocessor will interface with the android module to perform the automation. A simple microprocessor will receive signals from the smartphone and it will be processed.



Fig 1 : Raspberry pi

Arduino: It is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world.

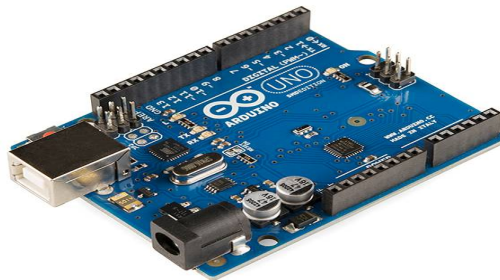


Fig 2 : Arduino

These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers.

Develop Software Interface Mobile Device: An android application to be developed using the ADT (Android Developer Tools) java platform for programs running on mobile devices that communicates between pi and home devices easily.

Integrate the Sensors to a Device: The Raspberry Pi needs to be integrated with the lighting ,motion detection, water sensor at a low cost with easy installation. After extensive research into the products and solutions currently available, the following were chosen to meet our application specific requirements.

Light Sensor: Detect whether the light got left on or not. Displays the status of light on the smart phone app.

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Fig 3 : LDR

Area Intrusion Sensor: A Pir sensor monitors a room and sets off audio alarm notification when it senses a moving body.



Fig 4 : PIR Sensor

Temperature/Humidity Sensor: Temperature and humidity is reported to the mobile app. Optionally, you can enable when temperature dips below/above some preset value. View a historical chart of temperature data.

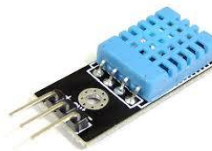


Fig 5: Dht11 Sensor

Water Sensor: It gives the details about water level in the containnner and report back with alarm.



Fig 6: Water Sensor

IV. DESIGN

System Requirement: The Android platform includes support for the Bluetooth network stack, which allows a device to wirelessly exchange data with other Bluetooth devices. The application framework provides access to the Bluetooth functionality through the Android Bluetooth APIs. These APIs let applications to wirelessly connect to other Bluetooth devices, enabling point-to-point and multipoint wireless features.

Using the Bluetooth APIs, an Android application can perform the following:

- Scan for other Bluetooth devices
- Query the local Bluetooth adapter for paired Bluetooth devices

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- Connect to other devices through service discovery
- Transfer data to and from devices
- Manage multiple connections.

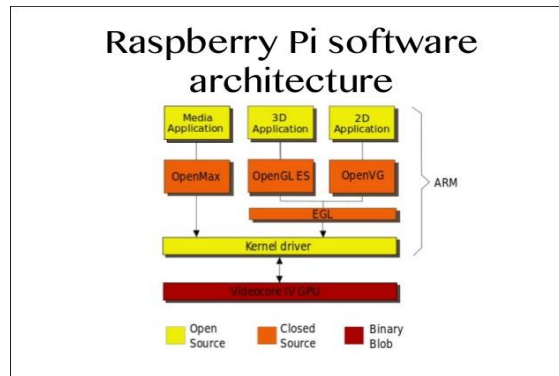


Fig 7: System Architecture

V. RELATED WORK

Data Flow Diagram:

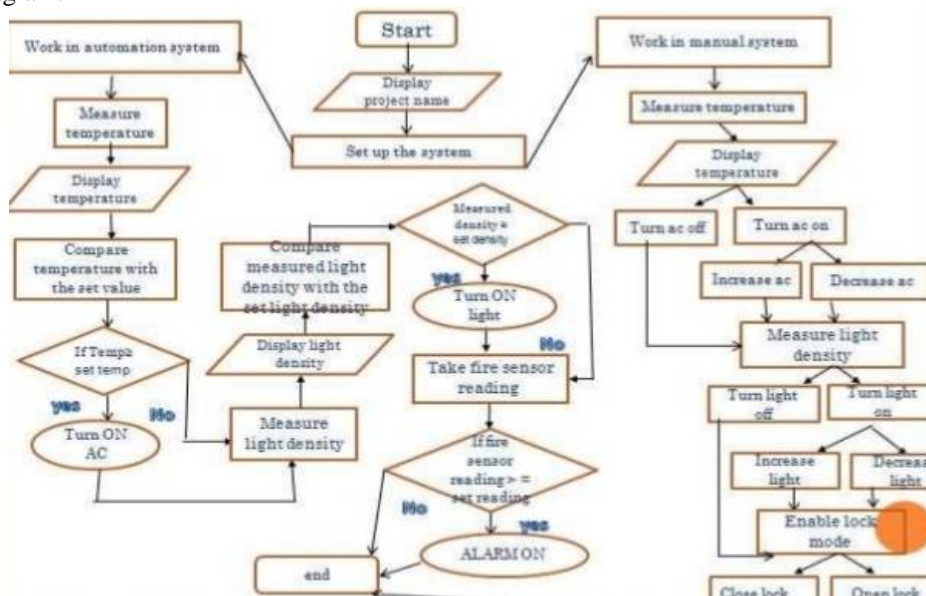


Fig 8: Data Flow Diagram

Home automation system is working with very popular android phones. It is having mainly three components; the android enabled user device, a WiFi router having a good scalable range, and a raspberry pi board. Here the users have provision to control the home appliances through android enabled device. This will improve the system popularity since there is no need for a wired connection, internet etc. The instructions from the user will be transmitted through the wifi network. The raspberry pi board is configured according to the home system and it will enable the relay circuit as per user request. The relay circuit can control the home appliances also. We can add appliances to the system also can

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add additional security features. An android application to be developed using the ADT (Android Developer Tools) java platform for programs running on mobile devices that communicates between pi and home devices easily.

Use Case Diagram:

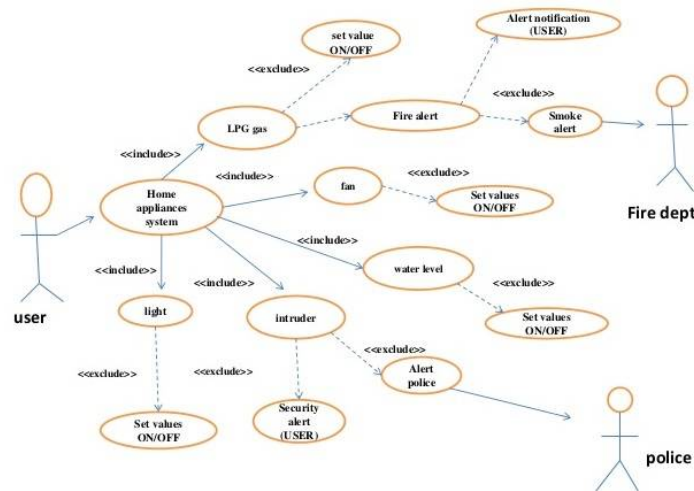


Fig 9: Use Case Diagram

Use case diagrams are intended to model the functional requirements of the system. It shows a set of use cases and actors and their relationships. It is always selected to be the start point of software design.

VI. RESULTS

Module	Module Function	Sensors Used
1. Fire Alarm	It detects fire and alarm with buzzer	LM35
2. Motion Detection	Detects Motion with alarm	PIR Sensor
3. Automatic Street Light	Sense the dark and light on	LDR Sensor
4. Light Control using App	Control light using app and change red, green, blue color.	Bluetooth Communication
5. Temperature Level Graph	Lowest temperature displays yellow light, Moderate temperature displays green color, Out of range temperature displays Red	LM35
6. Water Alarm	It senses the water level if exceeds alarm	Water Sensor

Table 1: Simulation Results with sensors

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Detailed Pic:

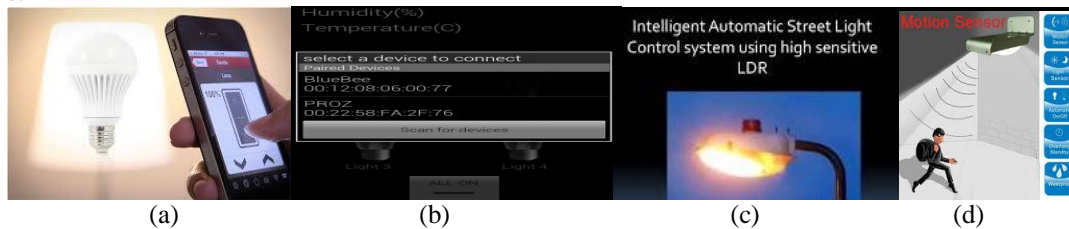


Fig 10: (a) Light control using app, (b) Temperature Control, (c) Automatic Street Light, (d) Motion Detection

VII. APPLICATION

Following are the applications of Home Automation and Security System.

- Precise and safe blind control.
- Security cameras can be controlled, allowing the user to observe activity around a house or business right from a Monitor or touch panel.
- Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user through the security system or via cell phone.

VIII. FUTURE WORK

Looking at the current situation we can build cross platform system that can be deployed on various platforms like iOS, Windows. Limitation to control only several devices can be removed by extending automation of all other home appliances. The future work is to control home automation based on RTOS based Automation.

IX. CONCLUSION

This is an ongoing project. Our prime objective is to assist handicapped/old aged people. This paper gives basic idea of how to control various home appliances and provide a security using Android phone/tab. We have discussed a simple prototype in this paper but in future it can be expanded to many other areas.

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