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Monitoring and Control System for Home Automation in smart cities using Io T

Syeda Zeba
M.Tech Student Scholar
Department of Electronics & Communication Engineering,
VIF college of Engineering and Technology,
Himayath Nagar Gandipet 'X' Road RR, India.
syeda.zeba3@gmail.com

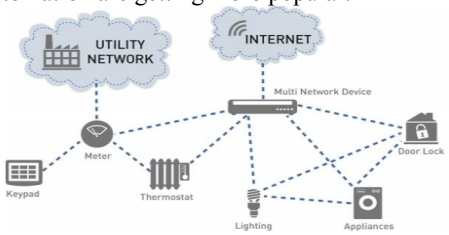
Imthiaz Unnisa Begum
M.TECH HOD
Department of Electronics & Communication Engineering,
VIF college of Engineering and Technology,
Himayath Nagar Gandipet 'X' Road RR, India.
imthiazunnisa19@gmail.com

ABSTRACT-The project proposes an efficient implementation for IoT (Internet of Things) used for monitoring and controlling the home appliances via World Wide Web. Home automation system uses the portable devices as a user interface. They can communicate with home automation network through an Internet gateway, by means of low power communication protocols like Wi-Fi etc. This project aims at controlling home appliances via Smartphone using Wi-Fi as communication protocol and raspberry pi2 as server system. The user here will move directly with the system through a web-based interface over the web, whereas home appliances like lights, fan are remotely controlled through easy website. An extra feature that enhances the facet of protection from fireplace accidents is its capability of sleuthing the smoke in order that within the event of any fireplace, associates an alerting message and an image is sent to Smartphone. The server will be interfaced with relay hardware circuits that control the appliances running at home. The communication with server allows the user to select the appropriate device. The communication with server permits the user to pick out the acceptable device. The server communicates with the corresponding relays. If the web affiliation is down or the server isn't up, the embedded system board still will manage and operate the appliances domestically. By this we provide a climbable and price effective Home Automation system.

(I) INTRODUCTION

The Internet of Things (IoT) can be described as connecting everyday objects like smart-phones, InternetTVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms ofcommunication between things and people, and between things themselves. Building IoT has advanced significantlyin the last couple of years since it has added a new dimension to the world of information and communicationtechnologies.The Internet has come a long way over the last 30 years. Old-fashioned IPv4 is giving way to IPv6 so thatevery device on the Internet can have its own IP address. Machine-to-machine (M2M) communication is on the rise,enabling devices to exchange and act upon information without a person ever being involved. The scope and scale ofthe Internet have changed as well: industry leaders predict that the number of connected devices will surpass 15billion nodes by 2015 and reach over 50 billion by 2020. The challenge for the embedded industry is to unlock thevalue of this growing interconnected web of devices, often referred to as the Internet of Things (IoT), describing itas the ultimate tool in our future surveillance. This network has the power to reshape our cities.

At the edge of the IoT are the appliances and equipment we use every day. These “things” areinterconnected across an infrastructure or backbone using combinations of, sub-GHz, Wi-Fi connectivity to provide a robust bi-directional communications link with relatively longrange, low latency for fast responsiveness, low power and a sufficient data rate to aggregate information from manyconnected devices. This infrastructure also serves as the gateway to the Internet and enables remote monitoring andcontrol of devices by other networks, utility companies and end users.Home automation or Smart Homes can be described as introduction of technology within the homeenvironment to provide convenience, comfort, security and energy efficiency to its occupants. Adding intelligence tohome environment can provide increased quality of life. With the introduction of the Internet of Things (IoT), theresearch and implementation of home automation are getting more popular.



Fig(1): Home Appliances connected to Network

II. PROBLEM STATEMENT

To develop a Smart Home Control and Monitoring Systemby harnessing the power of IoTs at low-cost whichprovides flexible and scalable architecture for homeautomation. It will provides security, energy efficiencyand ease of use with capability of controlling andmonitoring home appliances from anywhere in the world.

III HOME AUTOMATION

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The introduction of home automation in the 1970s failed to improve the lifestyles of users for severalreasons. Firstly, determining economic benefits of home automation technologies is difficult. Secondly, the costs ofimplementing smart home technology must be justified by the effects brought about by their installation. There is aneed for home automation technologies to be cost effective, easy to install and flexible with many networkinfrastructures and appliances.

In 2003, Housing Learning & Improvement network published a smart home definition offered by Integratewhich states that a smart home is "a dwellingincorporating a communications network that connects the key electrical appliances and services, and allows them tobe remotely controlled, monitored or accessed". The following section includes a brief summary of previousresearch into smart homes within the past decade.

In 1995, Welfare Techno Houses were constructed in Japan. The purpose of these experiments was toprovide health monitoring for elderly and disabled person at home by using fully automated measurements tosupport daily health care and improve quality of life. The University of Texas at Arlington has conducted theMayHome project over the past 7 years. The MayHome (Managing an Adaptive Versatile Home) is a homeenvironment that detects environment states through sensors and intelligently acts upon the environment thoughcontrollers. The sensors in the home form an adhoc network with interconnect together to make appropriatedecisions.

IV EXISTING SYSTEM

SAP laboratories in Canada with researches from the University of McGill present a wireless solution formonitoring people in need of medical assistance. The application relies on the use of cell phones and inexpensivesensors and is best suited for the elderly and homebound people. The main functions of the project is to collectsignals through a wireless sensor network using API's and the analysis for data through an adaptive architecture thatproduces realtime heath monitoring system to improve medical support for people in their homes and in assistedliving environments.

Several groups have done extensive research into the use of smart home devices for the support or elderlyand handicap people. The University ofErlangenNuremberg, Germany has described the challenges regarding smarthomes, especially for supporting the elderly and handicapped. The purpose is to compensate for handicaps andsupport the individual in order to give them a more independent life for as long as possible.

The paper does however reinforce the advantages of using a wireless standard. Bluetooth is a globalstandard for connecting a wide range of devices, it is available on most handheld devices, the technology is veryeasy to use and set up, and it provides security by encrypting data using a 128bit long shared key but thedisadvantage of system is that it has a very short range of communication.

Radio Frequency (RF) systems have become increasingly popular recently with the advancements in RFtechnology such as Bluetooth. These products offer a much more reliable short range network thenprevious Infrared devices which had interference and security issues. But RFID tags are more expensive, lessreliable and are application specific i.e. no one tag fits all.

This project will focus on Smartphones enabled systems for the smart home with focus on the Raspberry Piapplications. Although many systems have been researched and proposed, very few if any have been implemented.

This project aims to build on the previous research described to implement a wireless sensor network to monitorappliances in the house. These appliances will be controlled via a smartphone running Android OS. This approachprovides an easy to operate and cost effective approach that will benefit users to interact with Home appliancesremotely.

V BLOCK DIAGRAM

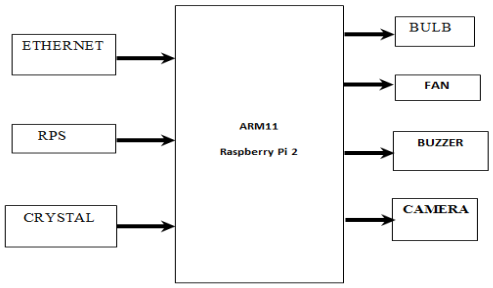

Figure (2): Block diagram of the project

VI HARDWARE COMPONENTS

ARM11 PROCESSOR-ARM is a 32-bit RISC processor architecture developed by the ARM Corporation. ARM processors possess a unique combination of features that makes ARM the most popular embedded architecture today. First, ARM cores are very simple compared to most other general-purpose processors, which means that they can be manufactured using a comparatively small number of transistors, leaving plenty of space on the chip for application specific macro cells.

RASPBERRY PI 2 BOARD

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Figure (3): Raspberry Pi 2 Board

The new processor on the Pi 2 means that you will need to update your existing SD card or create a new SD card with your operating system(Raspbian, Arch, XBMC, NooBs, etc)because you cannot plug in olderscards from a Pi 1 into a Pi 2 without upgrading with sudo apt-getupgrade on the Pi 1 first.Also, any precompiled software will not work at full speed (although supposedly the processor willbe able to run it). Still, you'll likely want to have it recompiled for the new processor! For manypeople, this isn't a big deal, but if you have a pre-created Pi 1 Model A+B+ card image, just beaware it won't work without performing an 'sudo apt-get upgrade' on the older Pi 1 before installingon the Pi 2!

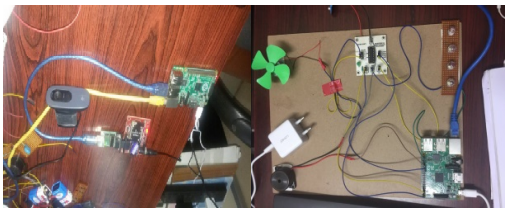


Fig (4): Required Hardware

Ethernet LAN Features:

- Bus topology, Wired LAN in IEEE 802.3 physical layer standard
- 10 Mbps, 100 Mbps (Unshielded and Shielded wires) and 4 Gbps (in twisted pair wiring mode)
- Broadcast medium– Passive, Wired connections based.
- Frame format like the IEEE 802.2

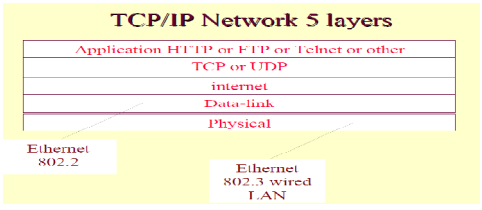
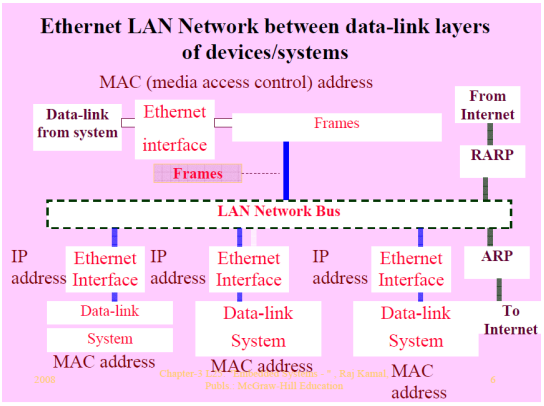


Fig (5):TCP IP network 5 Layers



UVC CAMERA-A UVC (or Universal Video Class) driver is a USB-category driver. A driver enables a device, such as your webcam, to communicate with your computer's operating system. And USB (or Universal Serial Bus) is a common type of connection that allows for high-speed data transfer. Devices that are equipped with a UVC driver, such as the Logitech® QuickCam® Pro 9000 for Business, are capable of streaming video. In other words, with a UVC driver, you can simply plug your webcam into your computer and it'll be ready to use.

WORKING PRINCIPLE-- In this project, we are giving the complete description on the proposed system architecture. Here we are using Raspberry Pi board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus. The architecture of the web server has the following layers.

- In the lower level the web server has the physical hosting interfaces used for storing and maintaining the data related to the server.
- Above the Physical hosting interface the server has HTTP server software and other web server components for bypass the direct interaction with the physical interaction with the lower levels.
- The final layer has the tools and services for interacting with the video streams which includes the Image codec and storing interfaces, connection managers and session control interfaces etc.

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Applications:
Remote device control, Automated control of home appliances, Surveillance.

Advantages:

- As ARM11 CPU is used, future modification is done easily according to our need.
- It can be modified & can be applied to other automation applications also.

FUTURE SCOPE

- The cost of ARM11 is more that's why in future we can implement this system using ARM CORTEX A8, Beagle bone etc as well as updated processors with high frequencies will work fine.
- As the storage space is also less,In future we can also record the live streaming data by increasing external memory storage.
- In future we can provide more security to data by using encryption, decryption techniques.

VII OUTPUT SCREEN SHOT

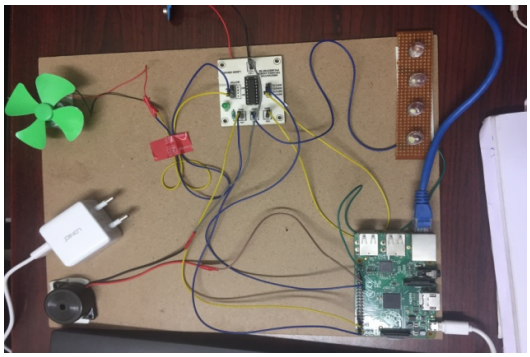

Fig 6(a): Arrangement of hardware with appliances (which are needed to be controlled)

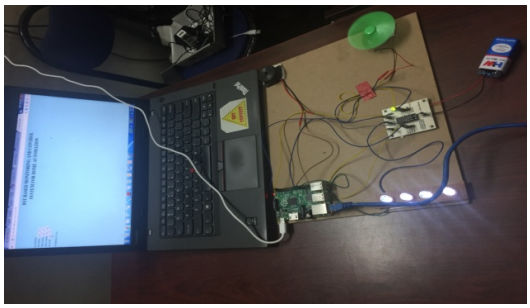

Fig6(b): Output Screenshot's
Operating the appliances using Raspberry Pi through webpage

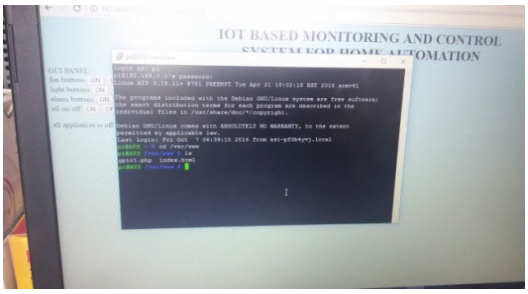

Fig 6(c): Commands given in Putty Application

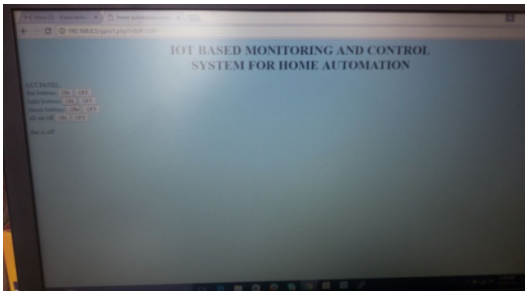

Fig 6(d): Webpage Screen (To control the appliances worldwide)

VIIICONCLUSION

The project "Monitoring and Control System for Home Automation in smart cities using IoT" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM 11 Processor board and with the help of growing technology the project has been successfully implemented.

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HOD
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