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AN INNOVATIVE HIGHLY SECURED IP BASED SYSTEM FOR INDUTRIAL APPLICATIONS USING GRAPHICAL PROGRAMING LANGUAGE (LabVIEW)

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ABSTRACT

In today's life every person is worried about their family and home safety due to increasing rate of crime. Due to this importance of surveillance systems cannot be ignored, actually it is increasing day by day. Adding to this smart home technology increases the comfort, energy efficiency and security. This paper presents a novel approach on open source and low cost solution to provide security systems in today's Smart Homes through wireless sensor network. We proposed a IP based security and home automation system using latest Raspberry Pi 2 Model B which is credit card size computer having 1GB RAM 900 MHz quad-core ARM Cortex-A7 CPU. We implemented a preliminary prototype that monitors rooms and issues a warning whenever it detects a potential hazard. Our proposal relies on low-cost cutting-edge technology and includes the following: Raspberry Pi boards, motion sensors, cameras and a central server. The server will handle the data that has been captured by sensors and send warnings through smart phones to the people in house or out of the house.

KEYWORDS: Graphical Programming Language (LabVIEW), OpenG Languages, Smart Appliances, IP Based Security System, ARM Core Processor

INTRODUCTION
A smart home can be defined as a residence equipped with computing and information technology which anticipates and responds to the needs of its occupants, by seeking to ensure their comfort, convenience, security and relaxation through the management of technology within the home and establishment of connections to the world beyond. Every time when we go out of the house we switch off the light or the electrical equipments to avoid accidents such as short circuit, firing etc. but sometimes we forget to switched them off, we have to come back home to do so. This wastes our time and creates lots of chaos and tension.

So to avoid any such kind of situation the latest technology coming up worldwide is the smart home technology. Smart home is one in which all electrical equipment around the home technologically smart or intelligent or automated with highly advanced automatic system for security in other system. Smart home is useful for everyone and can also be used in everyday life at home. Smart home is consisting of three parts- network, controlling device and home automation [2]. Network can be wire or wireless. It is used for connecting the automation to controlling devices. Controlling devices can be used for managing the system. Home automation is the devices which control the physical environment. It can be used in kitchen, home or offices etc. In past decade, there are many implementation is going for the smart home and security system to make a residential place more secure and efficient day by day. Many researches are implementing to optimize the efficiency of the smart home automation system [1].

CURRENT SCENARIO OF SURVELLIANCE BASED SECURITY SYTEMS
In today's life every person is worried about their family and home safety due to increasing rate of crime. Due to this importance of surveillance systems cannot be ignored, actually it is increasing day by day. Adding to this smart home technology increases the comfort, energy efficiency and security. The Raspberry Pi 2 Model B is a credit card

size mini-computer also known as SBC (Single Board Computer). It has 900 MHz quad-core ARM Cortex-A7 CPU with Video Core IV GPU and 1 GB of RAM. It has only power consumption of 4.0 W (Model B). To complete it as a mini desktop system and for embedded application it has [2]

- 4 USB ports
- 40 GPIO pins
- Full HDMI port
- Ethernet port
- Combined 3.5 mm audio jack and composite video
- Camera interface (CSI)
- Display Interface (DSI)
- Micro SD Card Slot

Figure 1: Model of Processor using Open G[3]

The Cambridge-based foundation originally intended it as an educational tool designed to encourage people towards programming, computing and robotics as a hobby, it also works as a standard desktop. Comparing Arduino and Raspberry Pi is just like comparing a simple calculator and fully functional Desktop System. The Arduino Board is a very low power microcontroller board having AVR architecture based Atmega Microcontrollers which provides control over hardware using general purpose pins. Using Arduino IDE we can write program (< 32Kb) and after loading it into the Arduino board, we can interface hardware like switches, sensors, LCD's, wifi module, Bluetooth module, even other microcontrollers etc.

On the other hand raspberry pi functions smoothly even while using high computational software. Ethernet support, Video and Audio processing as it has Video Core IV GPU, full HDMI support, 1GB of RAM and quite large amount of storage space allows anyone to use it as a desktop. It is operated by Linux based operating system and various other OS like Windows 10 IOT, RISC OS etc. It also allows users to develop a program within those operating systems that can control and modify the system functionality and use of available 40 GPIO pins. In Raspbian-Jessie which is Linux based latest operating system, there are some application software as SONIC-PI and SCRATCH provides very interactive programming environment enabling graphical designs, music and various sounds. Arduino and Raspberry Pi might look alike as both are tiny little circuit boards with some electronic chips and general purpose pins to make it function but both are quite different to each other. Arduino board can be

programmed with C language and the programs size maximum of 32 Kb whereas Raspberry pi supports full operating system. The raspberry pi has Python as the main programming language [3].
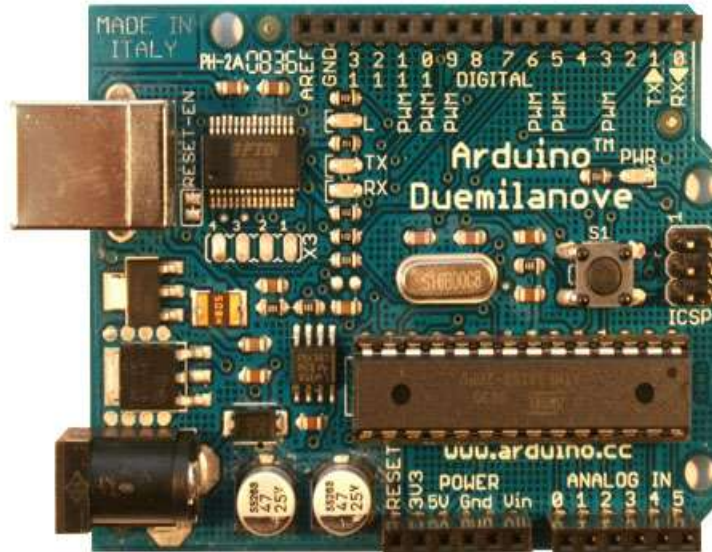

Figure 2: PCB of Arduino Processor [4]

Arduino is an open source microcontroller board having 8-bit Atmel AVR microcontroller or 32-bit Atmel ARM. It has USB interface, 6 analog input pins, as well as 14 digital I/O pins [5]. Official Arduinos have used the megaAVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega2560. The Arduino has an integrated development environment (IDE) which is a crossplatform application written in Java.

OVERVIEW OF IP BASED SECURITY SYSTEM
The figure 3 shows a system abstraction as a whole, and describes the modules covered from the mobile device module to the modules of the sensors. The mobile module communicates with the Webservice module through wifi or mobile network (e.g. 3G or 4G). The Android application configures the user preferences, such as the way he would like to be informed about an incident. These alert options can involve playing an audio, starting a vibration or displaying an image.

Thus, the user can choose a configuration to view the image of any room or place he wants. In addition, the application shows the user a list rooms that can be monitored. Once a room has been selected for monitoring, a message is sent to the Web service module which saves this information in the database. To avoid security issues, this application requests a user authentication when it starts and also all the messages exchanged between the modules via the Internet are transferred using an SSL [5].
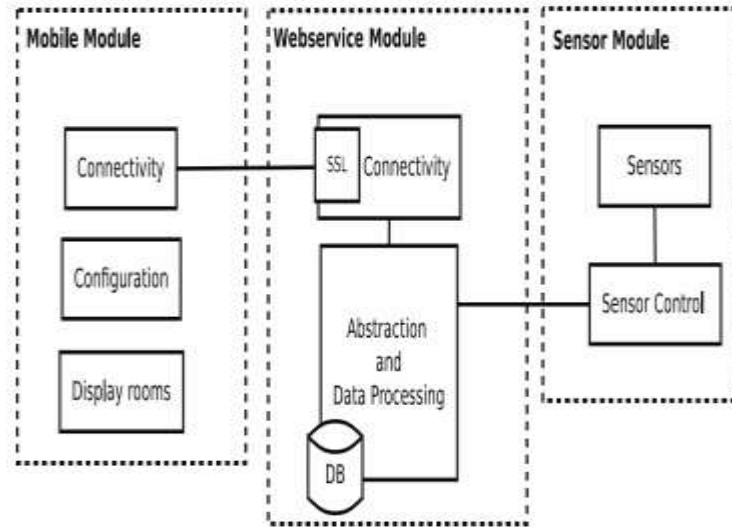
Figure 3: Block Diagram of the System [6]

The Webservice module is connected to a central computer at the user's house. This computer does not need to have a high-performance computing power, because the web services are implemented as RESTFul web services and the database server receives few connections periodically. However, it needs an Internet connection to receive requests from the user's mobile device and a wireless connection via wifi to receive the data collected by the sensors.

At this stage, we have an abstraction and data processing module, where these data are stored, analyzed and inferred, and are thus in a position to know if the events captured by the sensors are really an incident. A laptop was used as a hardware component and the software components are MySQL database, Apache CXF framework is used to create the web services, Jetty as web server and servlet container together with our Java algorithms. The sensor module controls and manages the sensors. A Raspberry Pi model B, an USB wireless network interface, a traditional Webcam and a simple presence sensor are the hardware components. For software components we used Raspbian which is a Raspberry operational system, Motion for monitoring video signals from the Webcam and a Python program to read the data from the Raspberry GPIO (General Purpose Input/Output) pins [7].

SYSTEM DEVELOPMENT

The System was divided into three phases or modules. The wireless network (wifi) was configured in the sensor module; besides this, the Motion software was also configured to capture images using the Webcam and save the pictures in a special folder. Motion software allows us to configure its output normal property so that an image can be captured in the first movement and stored in a folder (target dir). This means that this software can be used as a motion detection which writes a file every time that there is a change in the image frames. The Motion has another property called "gap" where it is possible to set a time interval in seconds of no motion detection triggers the end of an event. Thus, through the combination of Motion and Webcam, there is an easily configurable and low cost sensor that can assist the user. However, there is a concern about the efficiency of this sensor, because any frame change in the image will be reported as an event and, a single change of lighting or shade may create an event. To solve this problem, we decided to include a presence sensor and a program was prepared in Python that always writes a file into a configured folder when the presence sensor detects something moving [8].

Thus, the system will only consider a real movement when two events (one from each sensor) have been detected. This real movement was described as an incident that must be reported to the user when the environment (a room) is

configured to be monitored. The mobile module is included in an Android application. This application is a base prototype that allows the user to configure alerts (play audio, display images or vibrate the device) when an incident is detected in the users home. As shown in the sequence diagram, the user must first authenticate to the system using a *login* and a *password*. After a valid authentication statement, a menu is displayed to enable the user to choose between a set of system alerts or configure the list of monitored rooms. Once on-screen alert the users can choose the most suitable alerts for their impairments. The list of registered rooms can also be retrieved and the user can choose which room should be monitored by the system [9].

USB Camera:

USB Cameras are imaging cameras that use USB 2.0 or USB 3.0 technology to transfer image data. USB cameras are designed to easily interface with dedicated computer systems by using the same USB technology that is found on most computers. The camera model used here is USB Camera model 2.0. The accessibility of USB technology in computer systems as well as the 480 Mb/s transfer rate of USB 2.0 makes USB Cameras ideal for many imaging applications [10 - 14].

- ❖ **Light Sensor**. Determines whether the light got left on or not.
- ❖ **Gas/Fire/Smoke Sensor.** Determines when smoke, fire, or LP gas in room.
- ❖ **Temperature / Humidity Sensor.** Determines the temperature and humidity of the environment
- ❖ **Water Leak Sensor**. Determines when a water leak
- ❖ **Security - Door / Window sensor.** Can be used to monitor doors, windows. It also cans to log the time the event happened.
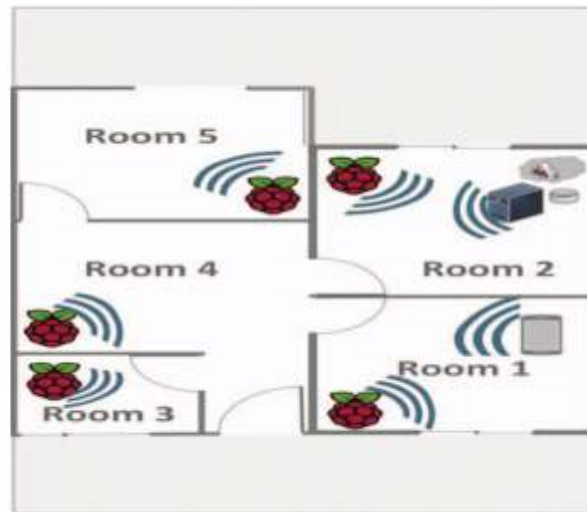

Figure 4: Schematic Arrangement of IP Based Home Security [15]

CONCLUSION

Priority for the automation is automatic or remote control of appliances and equipment in the house. But the high price of these systems, forcing seek alternative cheaper solutions that could afford each user. One of these decisions can be based on a system mini-computer Raspberry Pi. In this paper, an attempt has been made to design and implement a low cost monitoring and control system for smart house. In future work we intend to add more sensors to the prototype and control the electronic house appliances from anywhere in the world using Raspberries, Arduinos and Micro controllers.

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