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Arduino, Wi-Fi based Home Automation Systems and Security Appliances- A Review

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Abstract: *This paper presents implementation of a wireless home automation system that is supposed to be implemented in existing home environments based on Arduino Uno microcontroller, without any changes in the infrastructure. Home Automation let the user control the home appliances from his or her computer or smart devices and assign actions that should happen depending on time or other sensor reading such as light, temperature or sound from any device in the Home Automation network. In this paper, Arduino, Wi-Fi Based home automation system and also the security system appliances for smart home automation is proposed.*

Keywords: *Remote access Systems, Mobile Applications (Blynk App), Home Automation System, Wi-Fi and Arduino.*

I. INTRODUCTION

The 21st century is the era of science and technology. In keeping with the change of time with the technology of the Home has been modernized a lot. Now maximum home appliances are automated. The concept of Home Automation is first introduced in a water heater in 1889. After that, the uses of Home Automation increase day by day.

Electronic and Electrical environment with respect to this context is an environment which consists of appliances such as fans, television sets, air conditioners, motors, heater, lighting systems, etc. A remotely accessible environment is an environment in which each appliance can be remotely accessed and controlled using a software as an interface, which includes an Android application and a Web application. [2]

The home automation is a wireless home automation system that is supposed to be implemented in existing home environments, without any changes in the existing infrastructure. Home Automation lets the user control his home from his or her MobileApp (Blynk App). With Arduino and Blynk app can connect to cloud. Arduino provides an economic and efficient platform to implement the smart home automation system.

This research paper will give a simple way to make your home automated and also guide home automation devices can work with your home security system.

II. METHODOLOGIES

The Home automation systems can be operated by a Mobile App using a range of different types of switches.

A simple device, such as a light can be activated by a signal from a motion detector or can be part of a computerized home automation system. As a very basic definition, we tend to refer to home automation as anything that gives you remote or automatic control of things around the home.

A. Hardware Part

- 1) *Remote Control:* It is a component of an electronic device used to operate the device from a distance, usually wirelessly (eg. Mobile).
- 2) *Receiving Circuit:* Received the Signal and converts the information carried by them to a usable form.
- 3) *Power Supply:* Power supply is to convert electric current from a source to the correct voltage, current, and frequency.
- 4) *Microcontroller Unit:* It is a small computer on a single integrated circuit. Are used in automatically controlled products and devices.
- 5) *Relay Circuit:* A relay is an electrically operated switch. Computer type circuits to switch relatively high currents or voltages either "ON" or "OFF".

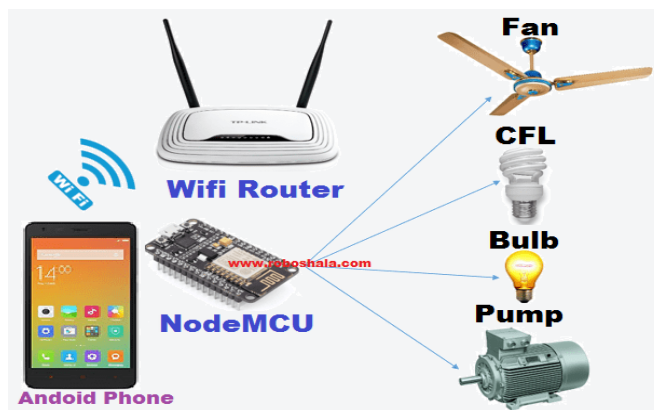


Figure.1 Block Diagram of Home Automation

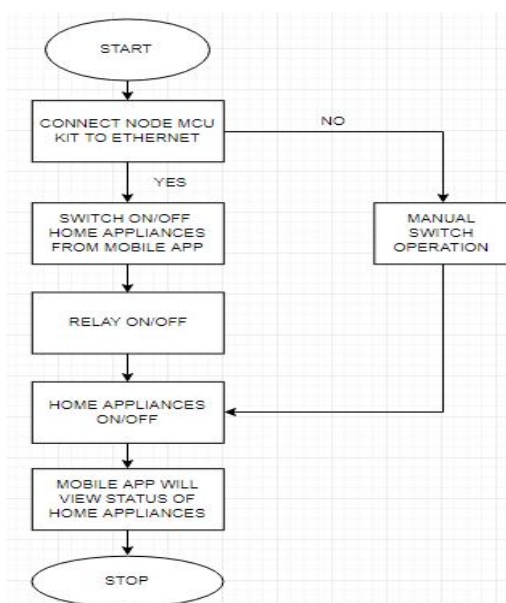


Figure.2 Flow Chart of Home Automation System

B. Working

As shown in the above figure first user will connect to the mobile application. Mobile will be connected to a Wi-Fi Router. NodeMCU Kit or Circuit will be installed to Main Electric Switching Board.

The user will click on a mobile application (Blynk App) to ON or OFF the switch. A relay will make the switching either ON or OFF for the user. With the help of google assistance user can able to command the ON or OFF by voice.

C. Relay Connections

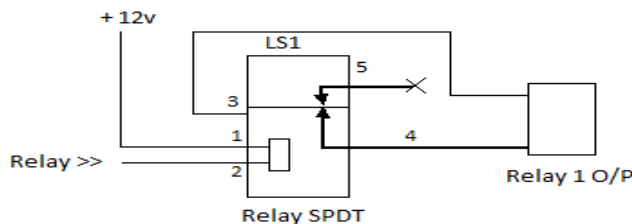


Figure.3 Circuit Diagram of Home Automation System

This is schematic for one relay, all others relays will be connected in the same way.

III.SECURITY APPLIANCES

In our smart home security system, there are mainly three parts:

- 1) *Password Protection of Central Lock*: We used password protection for the door lock to protect the unknown entrance. We used EPROM function of microcontroller and keypad.
- 2) *Fire Safety*: Alarm and fire protection. We used a smoke detector and temperature sensor to detect fire and an alarm is used with this. On the other hand, the water supply is used to extinguish the fire.
- 3) *Anti-Theft Alarm*: Touch sensor around the house as an anti-theft system. When anyone touches the sensor it switched the alarm ON.

Home Security Appliances include smart doorbells, smart locks, smart cameras, smart thermostats, smart lights, and smart smoke alarms.

A. Smart Doorbells

One of the most common and security-focused components of a smart security system are smart doorbell cameras. With Arduino and Blynk app can connect to cloud, these incorporate a small camera in the doorbell button. When someone rings the bell or approaches the door, depending on the system the doorbell sends an alert to your phone and activates the camera, letting you see a clear picture of who's there, no matter where you happen to be.

Doorbell cameras are very useful, and there are several great options, like Ring Video Doorbell, Vivint Doorbell Camera, and August Doorbell Cam. [4]

Features of Video Doorbell Camera:

- 1) High-resolution video
- 2) Motion sensing
- 3) Two-way audio

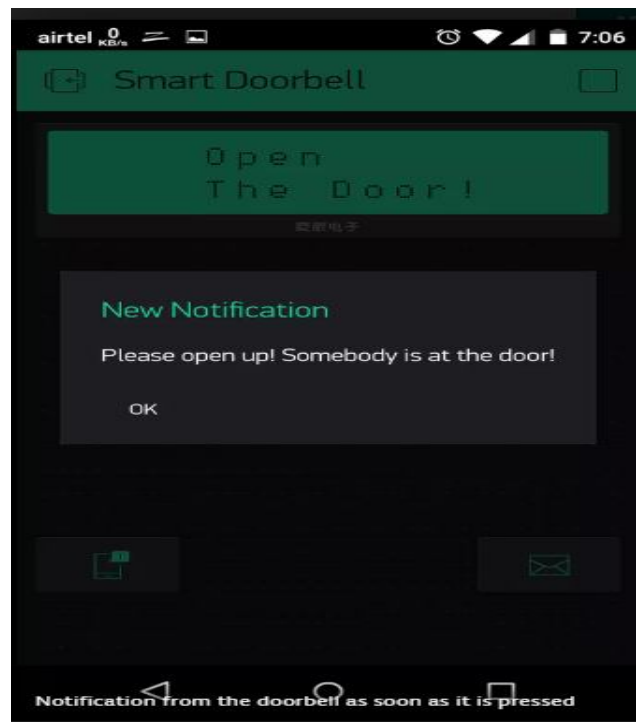


Figure.4 Blynk App for Smart Door Bell

B. Smart Locks

Smart locks are great not only for security but also for convenience. Arduino make possible to lock or unlock based on commands on Mobile App (Blynk App). What makes them smart is their ability to communicate with your smartphone via Wi-Fi or Bluetooth, allowing you to lock and unlock your door from anywhere. Many also automatically lock and unlock when they detect your phone approaching so that you can come and go without ever having to worry about whether the door is locked.

There are a couple of different styles of smart locks you can choose from. The first is more traditional, with a number pad or touchscreen where you input a code that unlocks your door. Some examples include the Samsung SHS-P718 Digital Door Lock and the Schlage Camelot Touchscreen Deadbolt.[4]

The second type forgoes the keypad and screen entirely, and it instead relies on an app on your smartphone to handle the locking and unlocking duties. Examples of these include the August Smart Lock and the Lockitron Bolt.[4]

One last thing to be aware of when choosing a smart lock is whether or not it can also accept keys. Some people feel better knowing they have this option, but not all smart locks provide a traditional key slot.[4]

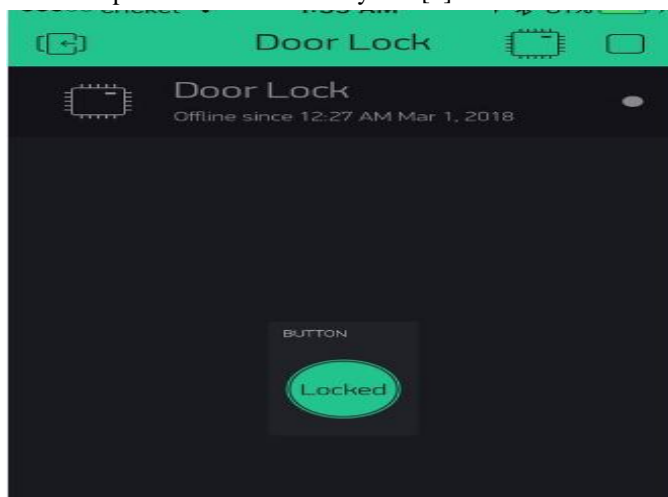


Figure.5 Blynk App for Smart Door Lock

C. Smart Cameras

Smart cameras take the traditional security camera concept and turn the dial up to eleven. With an Arduino, a homeowner can build a security camera they feel comfortable. These cameras incorporate Wi-Fi connections that allow them to be viewed and controlled remotely using a smartphone app. Many can also upload the footage to the Cloud for storage, eliminating the need for a potentially complicated on-site storage setup.

There are a lot of options in this space. Choosing one starts with knowing whether you want indoor or outdoor cameras. The main difference is construction: Outdoor cameras need to survive the elements, which usually means they are bulkier and made from tougher materials like metal. Indoor cameras can be smaller and more discreet because they aren't as likely to get beaten up or tampered with.[4]

Some recommendations for great indoor cameras are the Nest Cam and Vintage 361 HD. For outdoor cameras, check out the Amcrest QCAM and the ZOSI 960H.

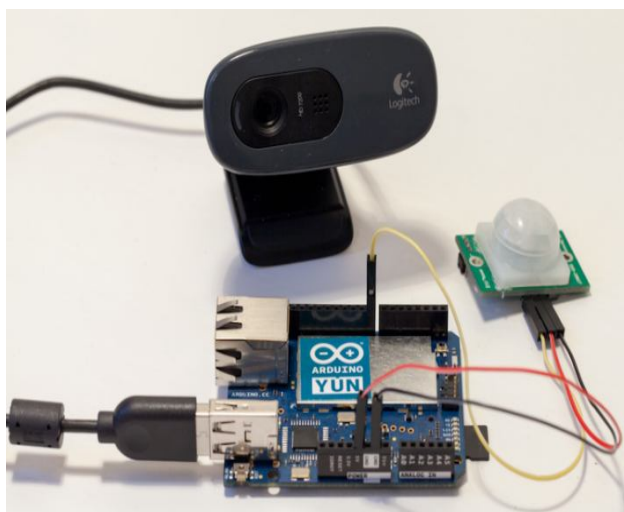


Figure.6 Arduino connected with Smart Camera

D. Smart Thermostats

Many smart home security systems include smart thermostats. These handy devices can help you save energy which is good for both the environment and your wallet. Like other smart home features, they connect to your home Wi-Fi network and are controlled by an associated app on your smartphone.

The neat thing about many of these thermostats is that they learn your climate preferences such as if you like it warmer in the morning and even what times of day you're home and away. The result is that they can work proactively to keep your home at the most comfortable temperature for you without you having to lift a finger. And they do it all with a high degree of efficiency, reducing energy consumption by 30% or more in some cases. As a final benefit, smart thermostats can send you an alert if the temperature in your home becomes excessively high or low, which could indicate a fire or a pipe freezing risk.[4]

E. Smart Lights

Smart lighting combines convenience and enhanced security. PIR Sensor and Arduino turn on the Relay ON / OFF the Light. These are Wi-Fi enabled LED lightbulbs that can be controlled from a smartphone app. You can turn the bulbs on or off either manually or on a schedule dim the bulbs or choose their color from a seemingly endless array of hues. And all this can be done from anywhere. You don't need to worry about whether you remembered to leave a light on before heading out on vacation.

There are a lot of solid choices for smart lighting, but two of the most popular are Philips Hue and Belkin's WeMo. You can purchase bulbs individually or in starter kits, making for convenient setup. They can seem a little pricey for lightbulbs, but keep in mind that they're LED bulbs so they last much longer than conventional incandescent bulbs. Philips rates its Hue bulbs at an average of 15,000 hours. [4]



Figure.7 Blynk App for Smart Lights

F. Smart Smoke Alarm

The last common home automation feature of a security system is the humble smoke alarm. This device takes the traditional smoke alarm and brings it into the digital age, with Wi-Fi connectivity and the ability to communicate and pinpoint exactly where a fire is located. The really nice thing about these alarms is that they can send the alerts to your phone so you can be aware of any issues even when you're away from home. You can also easily silence them in the event of a false alarm—who hasn't set off their smoke alarms at least once while cooking?

Top picks in this category include the Nest Protect and the First Alert Onelink. Both detect carbon monoxide in addition to smoke and alert you in a human voice rather than a screeching alarm tone.[4]



Figure.8 Blynk App for Smart Smoke Alarm

IV. LIMITATIONS

- A. System crashes due to any damage in the interconnection: If there is any damage due to rupturing of cables or the fibers the entire system gets crashed. This will not be the case of radio signals or the other signals. Here there will be a problem of signal receiving. The wiring of the system results in a crash in most of the systems.
- B. Human errors: If the human does not handle the kit safely or if he/she does not use the correct keys to perform the operations, human errors may occur. Human errors also lead to destructions of the machine. Then there will be a huge system crash.
- C. Reliability: In very rare cases, the reliability of the home automated devices varies (decreases). It depends mostly on the technology used and the advancements being done.

V. CONCLUSION

Home Automation is undeniably a resource which can make a home environment automated. Home automation system will bring more convenience and comfort to people's life. Using android application user could control and monitor the smart home environment. Arduino provides an economic and efficient platform to implement the smart home automation system. This system can be used to communicate with many numbers of devices. It minimizes the wastage of electricity and it consumes less time, also it helps the old aged and disabled people in doing the basic domestic works on their own. We think this product has a high potential for marketing in the future.

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