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IOT BASED HOME AUTOMATION USING AUDRINO

Eragouni Jashnavi, Podakanti Hema Sri
Department of Electronics & Communication Engineering
Institute of Aeronautical Engineering, Hyderabad, Telangana, India

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Abstract:

An IoT-based home automation system using Arduino enables remote control and monitoring of household devices through the Internet. By integrating sensors, controllers, and communication modules like Wi-Fi or Ethernet, the system allows automated tasks such as controlling lights, regulating temperature, and enhancing security. Users can interact with the system via mobile apps or web interfaces, making it convenient and efficient. This approach promotes energy conservation, increased comfort, and improved home management, aligning with modern smart living trends.

This paper presents a low cost and flexible home control and environmental monitoring system. It employs an embedded micro – web server in Arduino Mega 2560 microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely. These devices can be controlled through a web application or via Bluetooth Android based Smart phone app.

Home automation has achieved a lot of popularity in recent years, as day-to-day life is getting simpler due to the rapid growth of technology. Almost everything has become digitalized and automatic. In this paper, a system for interconnecting sensors, actuators, and other data sources with the purpose of multiple home automations is proposed.

This project explores the development of an **IoT-based home automation system** that integrates Arduino, Bluetooth, and a mobile application created using MIT App Inventor. The primary objective is to provide users with a cost-effective and efficient method to control and automate household appliances remotely.

The system is designed around the Arduino microcontroller, which interfaces with sensors, relays, and actuators to manage connected devices. Bluetooth technology is employed for wireless communication between the Arduino and a smartphone, eliminating the need for internet connectivity and offering reliable, short-range control. A custom mobile application developed using MIT App Inventor provides a simple and intuitive interface, enabling users to operate and monitor devices with ease.

Key Words: Arduinouno,HC05Bluetoothmodule, Home automation system, Smartphone, Smart application, Bluetooth, Relay.

1.INTRODUCTION

In today's fast-growing world, people leave their house without switching off due to busy life style or poor memory power. Such behavior does not only result in wastage but also bring potential danger to the home. We need to turn ON and OFF the switch manually which is very hectic to do every day. Owing to the above problem, an automated home control system is needed to keep the wastage and danger to the very minimum.

As we have seen in the above problem statement, we came up with the brilliant solution which makes the life easier and more reliable. We developed a circuit of an automatic on-off light using Arduino. Such that there is no need of turning on/off the switch every time. In this way we be relax as well as no wastage of electricity.

The IOTbased home automation system using Arduino stands out for its affordability, customization, and ease of use. Unlike proprietary smart home solutions, it leverages open-source technology, allowing users to modify and expand the system to suit specific needs. Its modular design integrates seamlessly with existing appliances, supports voice commands, and offers real-time control via mobile or web interfaces. The system also emphasizes energy efficiency through automated scheduling and sensor-based responses. With its DIY-friendly approach and compatibility with widely available components, this solution democratizes access to smart home technology, catering to diverse user requirements at a minimal cost.

The advent of the Internet of Things (IoT) has transformed how we interact with and manage our surroundings. Home automation, a key application of IoT, aims to create smarter living spaces by automating and controlling home appliances through technology. This project explores a practical and user-friendly solution to home automation by integrating Arduino, Bluetooth, and a mobile application developed using MIT App Inventor.

The Arduino microcontroller acts as the core of the system, enabling communication between appliances and the user. Bluetooth technology is used to establish a wireless connection between the Arduino and a smartphone, providing a cost-effective and reliable solution for local control. To further simplify the user experience, the MIT App Inventor platform is employed to design a custom mobile app, allowing users to control devices with a graphical interface.

2.Existing Method:

Wi-Fi-Based Automation (ESP8266/ESP32):

Description:

- Employs Wi-Fi modules (e.g., ESP8266 or ESP32) for internet connectivity, enabling remote access and integration with cloud platforms**.**

Key Features:

- Control devices from anywhere via the internet.
- Supports integration with IoT platforms (e.g., Blynk, ThingSpeak) .
- Higher power consumption compared to Bluetooth.

Cloud-Based IoT Automation:

Description:

• Combines microcontrollers (e.g., Arduino, Raspberry Pi) with cloud platforms to provide real-time monitoring and control.

Key Features:

• Enables remote control and data storage.

• Scalable for complex automation systems.

• Requires continuous internet connectivity.

Drawbacks of Existing method:

Wi-Fi-Based Automation (ESP8266/ESP32)

•Internet dependency due to the requirement that the Internet will access the interface between the appliance and device.

• High Power Consumption will using this method.

• Complex Setup

• Cost

Cloud-Based IoT Automation

• Internet dependency due to the requirement that the Internet will access the interface between the appliance and device.

• Security Risks

• Latency Issues

• Data Privacy

3. PROPOSED SYSTEM

As we have seen in the above problem statement, we came up with the brilliant solution which makes the life easier and more reliable. We developed a circuit of an automatic on-off light using Arduino. Such that there is no need of turning on/off the switch every time. In this way we be relax as well as no wastage of electricity.

3.1 Arduino :

Android is a mobile operating system that is based on a modified version of Linux. It was originally developed by a start-up of the same name, Android, Inc. In 2005, as part of its strategy to enter the mobile space, Google purchased Android and took over its development work as well as its development team).Google wanted Android to be open and free; hence, most of the Android code was released under the open source Apache License, which means that anyone who wants to use Android can do so by downloading the full Android source code.

3.2 ANDROID APPLICATION:

Android is a software stack for mobile devices that include operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. By providing an open development framework, Android offers developers the ability to build extremely rich and innovative applications. Developers have full access to the same framework APIs used by the core applications. Android includes a set of C/C++ libraries used by various components of the Android system. They include System C library, Media library, Surface Manager, LibWebCore, SGL, SQLite, FreeType and3D libraries

3.3 ARDUINO UNO BOARD

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again [2]. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

3.4 Relay:

An electrical switch, a method of passing something along, and a type of race. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

3.5 Bluetooth:

A class 2 Bluetooth module designed for transparent wireless serial communication. It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboards, and many more consumer applications. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is an IEEE 802.15.1 standardized protocol, through which one can build a wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

4. WHY ARDUINO?

Arduino is open source prototyping platform.

- Arduino based language is available for developing inputs and interacting with other softwares.
- Supported in all operating systems.
- Main aspect of it is less expensive than other prototyping systems available.
- You can get Arduino board with LOTS of different I/O and other interface configurations.
- The Pi is pretty much what it is and has a lot less time in the field.
- Pi - for $35 you get video, audio, Ethernet , and USB.
- That will cost you 2X that to get the same on top of an Arduino UNO.
- The Arduino UNO runs comfortably on just a few milliamps
- The Pi needs more like 700mA whereas aurdino requires less power.

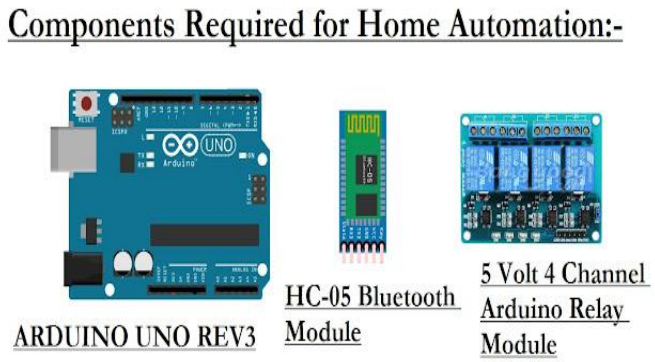

Fig-1

II. Software Design

Arduino Programming: Includes command processing and error handling.

Command Recognition: buletooth module detects pre-trained commands.

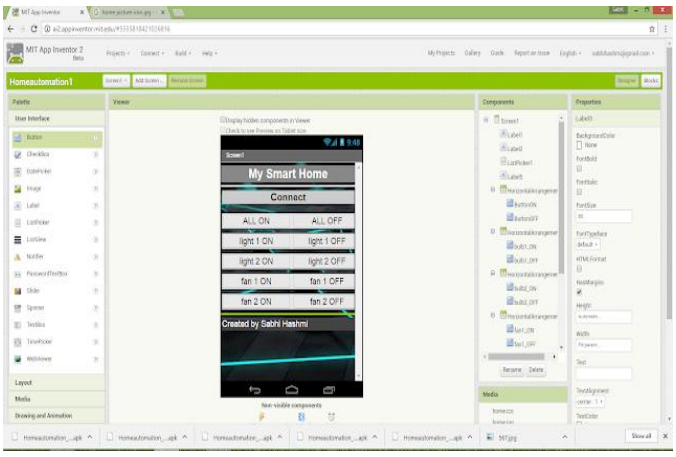

Fig-2

Applications:

- **Home Automation**: Home automation or domotics is building automation for a home. A home automation system will monitor and/or control home attributes such as lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems.
- **Energy Management**: Energy management using IoT involves utilizing interconnected sensors and devices through the internet to monitor and optimize energy consumption in real-time, allowing for efficient control of appliances, lighting, and building systems, ultimately leading to significant energy savings across homes, businesses, and industries.
- **Security Systems**: Digital transformation takes a customer-driven, digital-first approach to all aspects of business, from customer experiences to processes and operations.
- **Industrial Applications:** Industrial applications of IoT, often referred to as Industrial IoT (IIoT), primarily include: predictive maintenance, asset tracking, quality control, supply chain management, remote monitoring, process optimization, inventory management, and worker safety monitoring by utilizing sensors and connected devices to gather real-time data for better decision-making and operational efficiency across manufacturing processes
- **Elderly and Disabled Assistance**

4. LITERATURE SURVEY

1. **Title**: Bluetooth Controlled Home Automation System.
   Authors: Md. Asaduzzaman and Md. Mehedi Hasan (2016)
   Summary: Explores the use of HC-05 modules for controlling home appliances through a smartphone app. Findings: Bluetooth is a cost-effective and reliable option for local automation, but range limitations are a challenge.

2. **Title**: Energy-Efficient Home Automation Using IoT.
   Authors: M. Singh and P. Sharma (2020).
   Summary: Discusses how smart systems can monitor and optimize energy consumption.
   Findings: Bluetooth systems can effectively reduce energy consumption when paired with sensors and scheduling algorithms.
3. **Title:** Design of a Home Automation System Using Arduino.
   Author: Nathan David, Abafor Chima, Aronu Ugochukwu ,Edoga Obinna
   Summary: These integrated sensors such as the temperature sensor read temperature values, the gas sensor detects smoke and cooking gas to avoid fire outbreak.

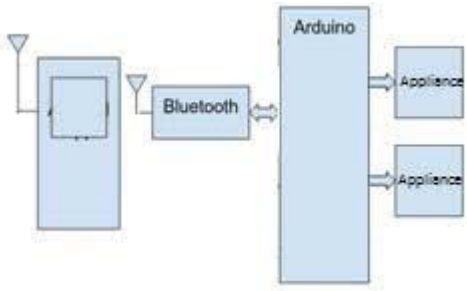

Fig-2: Block diagram

CONCLUSION

Future Scope:
Integration with Advanced Technologies:
• Integrate with voice assistants (Google Assistant, Alexa).
• Use AI and machine learning for predictive automation.
Energy Efficiency:
• Add energy monitoring for appliances.
• Integrate renewable energy sources (e.g., solar).
• Enable appliance scheduling to save power.
Mobile App Enhancements:
• Develop a dedicated user-friendly app.
• Add notifications for alerts and unusual activities.
Smart Sensor Integration:
• Incorporate motion, gas, smoke, and water sensors.
• Monitor environmental parameters like temperature and air quality.

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REFERENCES

1. N.David,A.Chima,A.UgochukwuandE.Obinna,"Design of a home automation system using Arduino", International journal of Scientific & Engineering Research, Vol. 6, pp. 795-801, june-2015
2. M. M. A. Jamil and M. S. Ahmad, "A pilot study: Development of home automation system via raspberry Pi", Biomedical Engineering (ICoBE) 2015 2nd International Conference on, pp. 1-4, 2015
3. .R. A. Ramlee, M. A. Othman, M. H. Leong, M. M. Ismail and S. S. S. Ranjit, "Smart home system using android application", Information and Communication Technology (ICoICT) 2013 International Conference of, pp. 277-280, 2013
4. N. Dickey, D. Banks and S. Sukittanon, "Home automation using Cloud Network and mobile devices", Southeastcon 2012 Proceedings of IEEE, pp. 1-4, 2012.
5. S. Folea, D. Bordencea, C. Hotea and H. Valean, "Smart home automation system using Wi-Fi low power devices", Automation Quality and Testing Robotics (AQTR) 2012 IEEE International Conference on, pp. 569-574, 2012.
6. P. S. Chinchansure and C. V. Kulkarni, "Home automation system based on FPGA and GSM", Computer Communication and Informatics (ICCCI) 2014 International Conference on, pp. 1-5, 2014.
7. M. A. Ullah and A. R. Celik, "An Effective Approach to Build Smart Building Based on Internet of Things (IoT)", Journal of Basic and Applied Scientific Research, no. 6, pp. 56-62, 2016.
8. Prof. M. B. Salunke, Darshan Sonar, Nilesh Dengle , SachinKangude, Dattatraya Gawade, "Home Automation Using Cloud Computing and Mobile Devices", Vol. 3, Issue 2 (Feb. 2013), ||V2|| PP 35-37
9. A. ElShafee and K. A. Hamed, "Design and Implementation of a Wi-Fi Based Home Automation System, "World Academy of Science, Engineering and Technology, vol. 68, pp. 2177-2180, 2012.