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Arduino Based Home Automation Using Bluetooth

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***Abstract*:** *Electronic devices and appliances have become very common in this recent year of technology especially with fast development in smartphones. In this paper, the design of Home Automation System compatibly with Local housing and good features for home automation via remote access are presented. Bluetooth Based Home Automation System Using Android and Arduino is design and implemented. In this research work a part of smart home technology which using Bluetooth in a mobile device is used,so it will cheap and efficient to use. This paper describe about home automation system which would use to enable home lighting, garage door motor, water pumping motor and smoke detection using a smart phone application with Bluetooth wireless technology. The system included three main components: an Arduino microcontroller for connecting the appliances, a Bluetooth module for signal transfer, and a smartphone with the Android application to control home appliances. Bluetooth communication technology and controlled system is that the operating range is low but it can controlled from anywhere inside of home, By using smart phone application we can control household appliances and provide security to decrepit peoples. The idea of paper is to control home appliances to avoid the dangerous of electric shock and convenience of decrepit and physically disable people, who can easily access and control the home appliances by staying at particular place and access them remotely without the help of other people. By using this system, our home automation works smartly by providing increased quality of life, and comforts to users.*

Keywords*—Bluetooth Wireless Technology, Smartphones, Home Automation System, Arduino Uno, Android, Bluetooth Module*

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I. Introduction

One of the most essential Arduino projects is this one.

The Arduino-based home automation with Bluetooth project allows users to operate any electronic equipment from their Android smartphone using the Device Control app. The Android app delivers orders to the Arduino controller through Bluetooth wireless connection. As indicated in the block diagram, the Arduino is linked to the main PCB, which includes five relays. These relays may be connected to various electrical equipment such as lights, televisions, fans, and soon. As technology advances, so do homes. Traditional wall switches are progressively being phased out in favour of a centralized control system including remote controlled switches. Currently, traditional wall switches are dispersed around the house, making it difficult for the user to get close enough to use them. It becomes even more difficult for the elderly or physically disabled to do so. A smartphone- controlled home automation system gives a cutting-edge alternative. Furthermore, home automation systems in today's market cost more than Rs. 50,000, so I wanted to create a low- cost home automation system.To do so, a Bluetooth module is interfaced to the Arduino board at the receiver end, while a GUI application on the cell phone sends ON/OFF commands to the receiver where loads are connected at the transmitter end. This technology allows the loads to be turned on/off remotely by tapping a specific place on the GUI.

II. Literature Review

Smart home automation systems have grown increasingly popular in recent years, especially with the rapid expansion of internet Web sites. Various smart home systems have been introduced with enhanced technology. The majority of the technologies are centred on using an android application to manage home automation systems, which provides a user interface for monitoring and managing their home electrical equipment through a local network or the internet.

2.1 Arduino Board

Arduino is an open-source electronics platform that uses simple hardware and software to make it easy to use. Arduino boards can take inputs - such as light from a sensor, a finger on a button, or a tweet - and convert them to outputs - such as driving a motor, turning on an LED, or posting anything online. To operate the Processing, we utilise the Arduino programming language and the Arduino Software (IDE) by delivering a series of instructions to the microcontroller on the board. Thousands of projects have used Arduino throughout the years, ranging from simple household items to true statistical apparatus. Students, amateurs, artists, programmers, and professionals from all over the globe have congregated around this open-source platform, and their contributions have added up to an enormous quantity of accessible knowledge that may be of tremendous benefit to both novices and specialists. Arduino was created at the Ivrea Interaction Design Institute as a simple tool for rapid prototyping intended for students with no previous experience with electronics or programming. As soon as it gained a larger audience, the Arduino board began to evolve in order to meet new demands and difficulties, expanding its product line from simple 8-bit boards to IoT applications, wearable, 3D printing, and embedded environments.All Arduino boards are open-source, allowing users to construct them on their own and customise them to meet their own needs. The programme is also open- source, and it is evolving as a result of contributions from people all around the world. [5].

2.2 Arduino UNO

The Arduino UNO is the perfect board for beginners who want to learn about electronics and programming. The Arduino UNO is the most popular and well-documented board in the Arduino series. The Arduino Uno is a microcontroller board that uses the ATmega328P microprocessor. There are 14 digital input/output pins (six of which may be used as PWM outputs), six analogue inputs, a 16 MHz quartz crystal, a USB connection, a power connector, an ICSP header, and a reset button on the board. It comes with everything you need to get started with the microcontroller; simply plug it into a computer with a USB connection or power it with an AC-to- DC converter or battery. In Italian, the word "uno" means "one," and it was selected to commemorate the release of Arduino Software (IDE) 1.0. The Uno board and Arduino Software (IDE) version 1.0 were the reference versions of Arduino, which have since been superseded by later releases. The Arduino Uno board is the first of a series of USB Arduino boards, and it serves as the platform's standard model.[6].

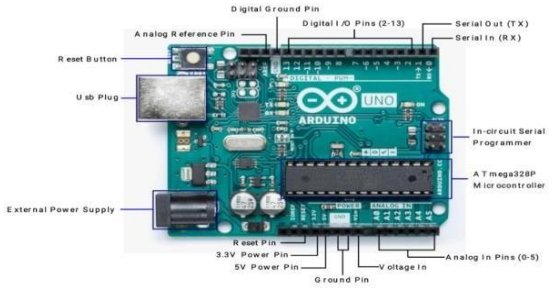

Figure 1. Arduino UNO REV3 board

2.3 Arduino Software

The Arduino IDE (Integrated Development Environment) is free software that makes code editing, compiling, and debugging easier. It's compatible with Windows, Mac OS X, and Linux. The environment is developed in Java and is based on open-source tools such as Processing. So, the Arduino IDE contains built-in functions and instructions that, while based on the Java platform, have been modified to operate on the Arduino board. Thus, the Arduino IDE is used to modify code, compile it, debug it, and ultimately burn it into the Arduino board.

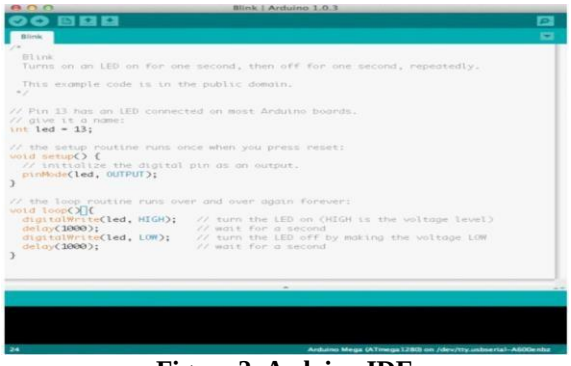

Figure 2. Arduino IDE

2.4 Bluetooth Module (HC-06)

The HC-06 Bluetooth Module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the establishment of a transparent wireless serial connection. It communicates through serial transmission, making it simple to connect to a controller or PC. The HC-06 Bluetooth module allows you to switch between master and slave mode, which means you may use it for both receiving and delivering data. The HC-06 Bluetooth module is a MASTER/SLAVE device. The factory setting is SLAVE by default. Only AT COMMANDS can change the module's role (Master or Slave), and slave modules may accept but not initiate connections with other Bluetooth devices. The user may easily utilise it as a serial port replacement to link the MCU to the GPS, as well as the PC to

your embedded project.

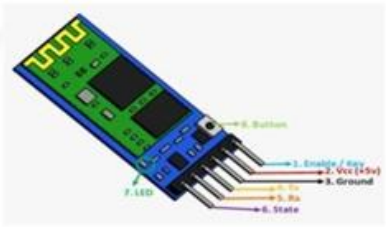

Figure 3. HC-06 bluetooth module

2.5 MIT App Inventor 2

The goal of MIT App Inventor is to create Android apps using a web browser and either a connected phone or an emulator. App Invention servers retain inventor designs and allow you to develop completely working apps without having to write any code. Mac OS X, GNU/Linux, and Windows operating systems, as well as numerous common Android phone types, are all supported by the App Inventor development environment. App Inventor-created applications may be loaded on any Android device.

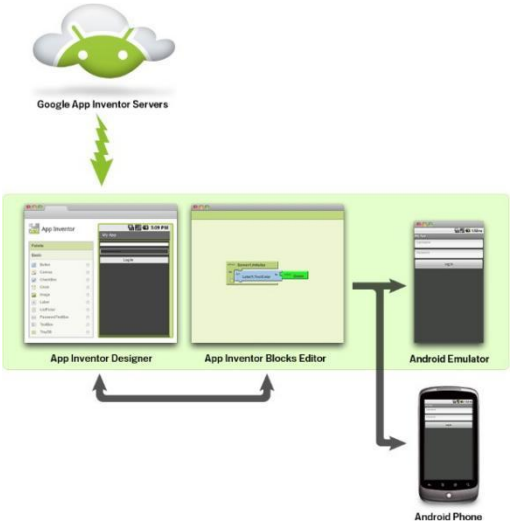

Figure 4. Function of MIT app inventor 2

III. Implementation of the Project

The open source Android platform was utilised for this Smart Home Automation System project. The Android application connects to the Bluetooth module HC-06 and operates home appliance equipment such as room lights, waterpump motor, and garage motor from any mobile device. For the sake of this project's security, the Bluetooth connection between the application and the Bluetooth device requires a password upon pairing for permitted use. After that, a confirmation message for a successful Bluetooth connection appears, followed by a list of accessible devices in the Android app that may be controlled as remote devices. This project also uses a MQ-2 gas sensor to monitor CO2 levels in the house, and it uses a speaker to sound an alert when a specific quantity of smoke is detected. Figure 1 shows a block diagram of the completed project. 5. The three components of our proposed project are as follows.

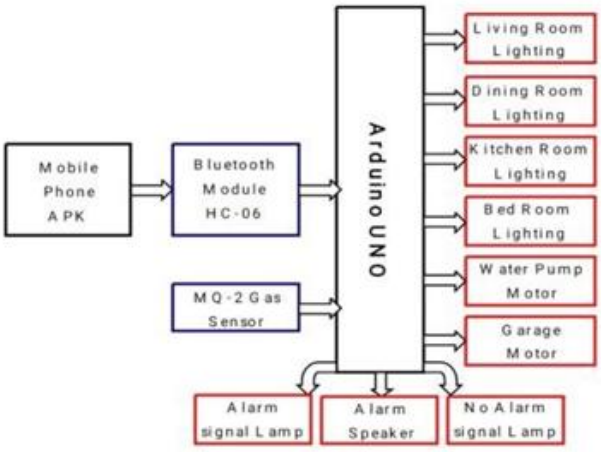

Figure 5. Block diagram of the implemented project

a) Input from Bluetooth module via android application andgas sensor.
(b) Arduino UNO microcontroller processing**.**

(c) Output of process indication and alarm.

During the initial development of our project, all of the component modules were simulated using the Proteus Design Suit version 8.0 simulator, and the functional output condition was verified. The hardware components of this project, which include an Arduino UNO, Bluetooth module, motors, gas sensor output, and room illumination controlled by an Androidapp, are illustrated in Fig. 6.

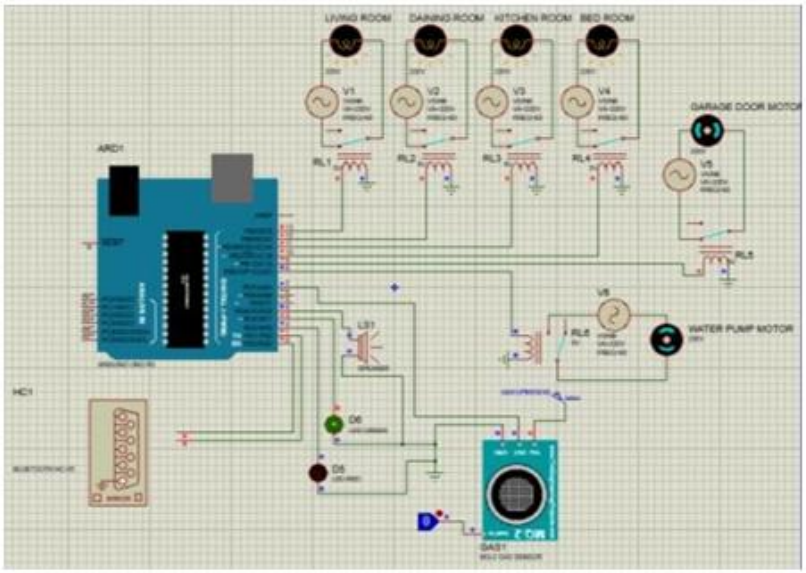

Figure 6. Simulation output of bluetooth based homeautomation system

With the assistance of a circuit diagram of the system connectivity, the connection and placement of hardware components has been elaborated.

The microprocessor and Bluetooth module are fed by the necessary DC power source, which may be obtained from a 9V battery or a computer USB connection. The Bluetooth module gets a signal from an Android smartphone, which is running the MIT app inventor application software.When programmes in the C language of the Arduino IDE are performed, the microcontroller transmits instructions to the Arduino IDE, which may control the lighting and motors in the room. This project's hardware includes an Arduino module, a Bluetooth module, and a gas sensor module. The Bluetooth module is attached to the Arduino UNO board for proper RX, TX, ground, and power pin connections. The board receives data from the Bluetooth module for monitoring and controlling the specific room's lights and motors, which is then processed, and the Arduino's output is sent to the specific hardware components for control.The Bluetooth wireless connection is utilised in this manner, and the user must be within range (15 metres) to operate the equipment. When a user sends a signal or data to the Arduino board, the appropriate Arduino pin goes high, switching the home applicant hardware on or off. Figure 7 shows the circuit design for this project, which includes the output household appliances..

Figures 8 and 9 depict the flow chart for the Arduino UNO system and the generated app preview, respectively. The hardware includes an Arduino UNO with input output ports (analogue, digital, and power), Bluetooth module, USB port, 9 and 5 volt DC input port, Relay Control Unit for household appliances, and Alarm Unit for MQ-2 gas sensor, among otherthings.

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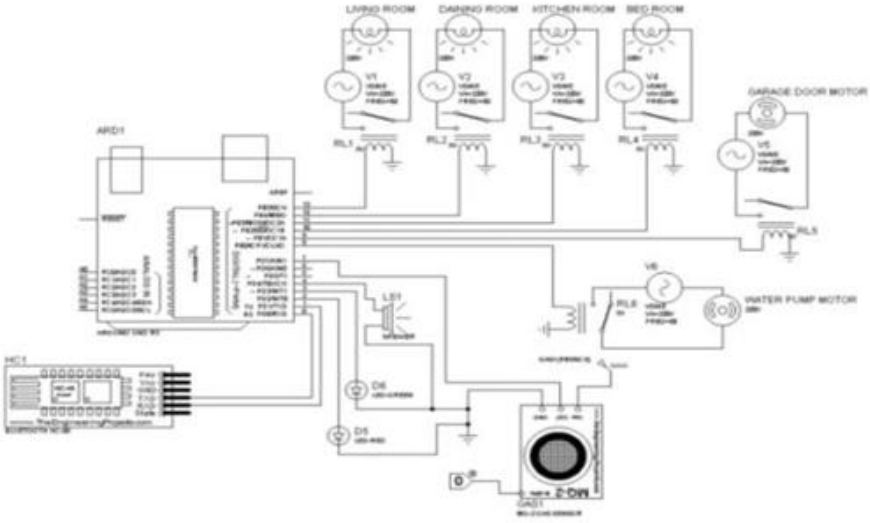

Figure 7. Circuit diagram of bluetooth based homeautomation system

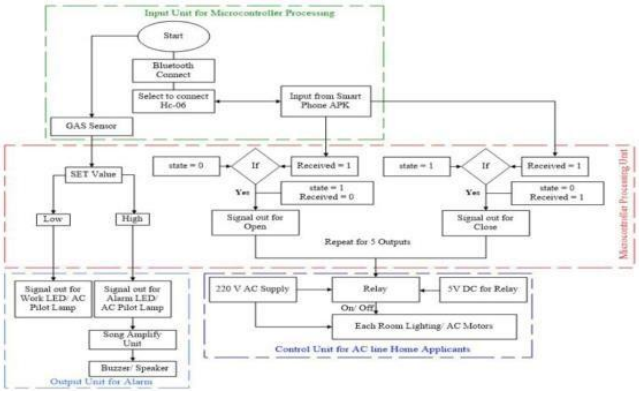

Figure 8. Flow chart of the system operation

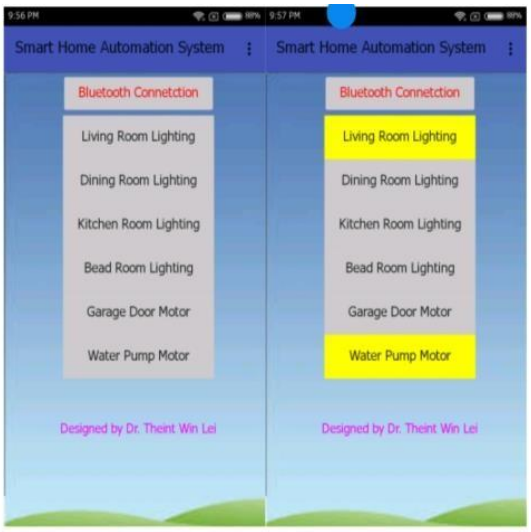

Figure 9. Created App For home Automation

System

The controller is communicated with the smart phone application using a Bluetooth module that has been set to slave mode in this project. App Inventor 2 is used to develop the application. App Inventor 2 is a visual, block-based programming language for creating Android applications. In Inventor 2, there are two sorts of components: visible and non-visible. When the app is started, the visible components of the app include buttons, text boxes, and labels. The graphical user interface (GUI) is a term used to describe them (GUI). Because non-visible components cannot be seen, they are not considered part of the user interface. Instead, they give users access to the device's built-in features. The non-visible components are the device's technology; they're like small worker bees who do tasks for the application's control. App Inventor 2 can easily construct a user-friendly GUI interface, and the block editor can easily make the appropriate function of each button from the programme without having to write any code.

The programme is loaded on a smartphone and uses a relay switch to control the Arduino UNO digital output pins 13, 12, 11, 10, 9 and 8 for room illumination and motors on/off. The switch control action of 220V AC home applications has been achieved using 5 V DC Relay units linked to pins 13, 12, 11, 10, 9 and 8. The MQ-2 gas sensor is connected to pin 7 to provide an analogue input signal of CO2 content in the room, while pins 2,3, and 4 provide the gas sensor's output. Pins 2 and 3 are connected to 2 LEDs or Pilot Lamps for the output signal of the gas sensor in normal and alert circumstances. Pin 4 is linked to a speaker via a song amplifier unit to produce a smoke detection warning sound in the room. The proposed Home Automation system has been successfully tested and run, as illustrated in Figure 10. Hardware for 220V AC lighting units, motors, and other song amplifier units for alarm systems is not included and will need to be purchased separately.

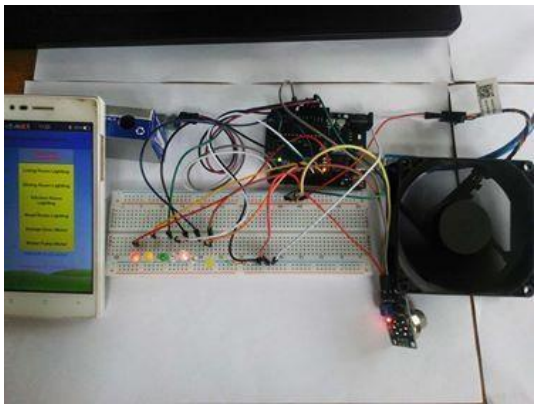

Figure 10. Test run system architecture with controlled output results

IV. Conclusion

This is a low-cost, high-efficiency project that may be used at home. This project is also a cost-effective project for elderly and physically disabled persons, with a basic and easy-to-use interface. Home appliances may be managed using this approach, avoiding the risk of electric shock while also providing convenience for consumers. It may make a home more secure by notifying people when there is a fire or a gas leak. With a few tweaks and improvements, this idea may be scaled up to commercial goods for the Home Automation System. We can add temperature sensors in the future so that it can monitor some of the ambient temperature factors around the house, and we can leverage Internet web-based technologies to increase communication. This project may also be promoted with a wireless camera in order to include additional Smart Home Automation System security features. In order to improve house security, doors and windows are also secured by installing alarm systems in the event of a burglar or sabotage.

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