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## IOT Based Home Security Smart System Using Arduino

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### ABSTRACT

*Rapid advances in technology have led to increased interest in home security systems designed to improve the security and protection of residential properties. This research paper provides a comprehensive study on the design, development and implementation of a home alarm system using Arduino. The system uses an array of sensors and an Arduino microcontroller to detect potential intruders and instantly trigger the alarm. This study demonstrates effectiveness, reliability, and economy, making it useful for home security applications. This article presents the design and implementation of a home alarm using Arduino as an IoT application. The Internet connection module for this system connects to the central power supply of the home network that can be accessed from the Internet. Use a static IP address for wireless connections. Home automation relies on a variety of applications that can be run using Google Assistant or voice recognition commands in the user's web application. Therefore, the main goal of this paper is to model our home automation safer and smarter.*

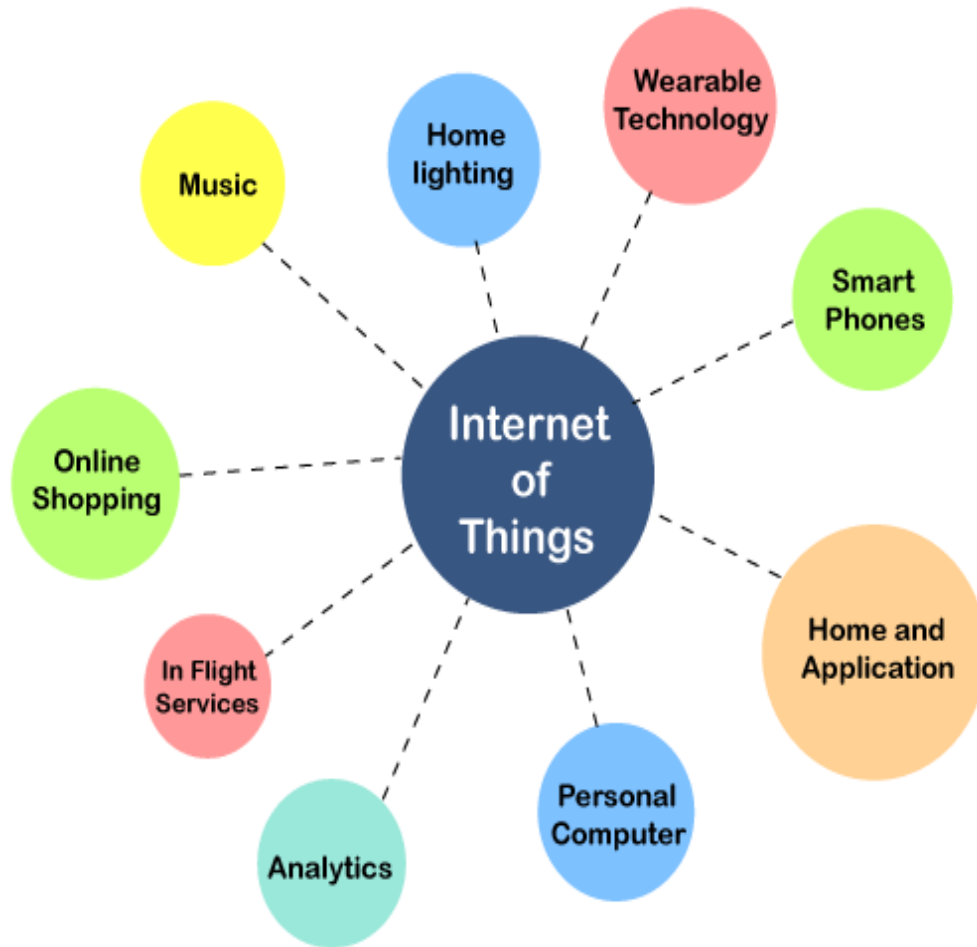
**Keywords**— Blynk Application; MQ-2 Gas sensor; PIR Sensor; Arduino; IoT

### I. INTRODUCTION

The Internet of Things (IoT) is a network of physical devices that have electronic components in their communication structure and know how to interact with one another or with the real time environment. Over the last few years, IoT-based methodology has changed the way people live their daily lives by providing advanced services. Advances in medicine, electronics, gene therapy, agriculture, smart cities, and smart homes are just a few examples of where the Internet of Things is well established [1]. In this paper we are implementing a smart security system based on IOT technology using cloud computing.

Nowadays the need for home alarm is very urgent. Considering that crime is increasing day by day, there needs to be some entity to maintain our security and safety. We are all aware of the advanced security systems available in the market, but not everyone has easy access to them [2]. Therefore, we aim to provide a solution by creating a useful electronic device that can hear the movements of intruders and sound the alarm. The main objective behind this work is that all materials contain some heat energy in the form of infrared light, which is invisible to the human eye. However, it can be detected with electronic devices. This article includes the use of Arduino, motion sensor, buzzer, LCD

screen and basic programs. The sensor detects movement within its boundaries and triggers an alarm [3]. It also sends signal to Arduino that manipulates the signal and generates an alarm and displays the detected message. With this system we can easily install a security alarm to prevent intruders in our home [4].



*Fig 1: IOT Applications*

The combination of IoT and home security makes it feasible to surveil and protect your home from anywhere in the world. The Internet of Things or Internet of Things refers to a network of interconnected physical devices that can communicate and exchange information without human intervention [5]. It is described as an “information society system” because the Internet of Things allows us to collect information from people, animals, cars, kitchen appliances and almost everything on the road. Therefore, all objects existing in the physical world can be embedded or used with various types of electronic devices (such as sensors, software and network devices) and can be assigned an IP address for the transmission of the network. Information becomes part of the IoT system [6]. The Internet of Things differs from the Internet because it utilizes the Internet cloud only to couple our everyday devices that are built into circuits and configured to interface and link using the Internet cloud. The scope of IoT applications and projects has crossed Rs 200 billion and continues to grow with transformation and growth in this area [7]. Some instances of IoT integration with home security include: using smoke detectors to detect gas or smoke and send alerts when people are away, or even remote home monitoring by monitoring home or car cameras, central locking, and numerous other implementations [8]. With the continuous development of IoT technology and innovation, IoT applications appear in almost every aspect of our lives. Thanks to IoT, companies and customers benefit [9]. Both manufacturers and consumers benefit from the rapid development of the Internet of Things. Manufacturers gain a deeper understanding of real time implementation of their product in outside world and grow their revenues by availing value-added services, thereby improving and extending the life of their products and services [10]. On the other hand, customers can integrate and manage multiple devices simultaneously on a individual device for more efficient use and enhanced customer experience.

## **II. DESIGN FLOW**

The design implemented using the combination of both software and hardware. Hence, the proposed techniques are different for hardware as well as software. The suggested design flow as depicted in figure 2, shows the steps involved in the design and development of the Home Security Alarm System. It outlines the components used, such as PIR (Passive Infrared) motion sensors, gas/smoke detectors, and other relevant sensors. Additionally, the section discusses the Arduino microcontroller's programming and logic implemented to control the system.

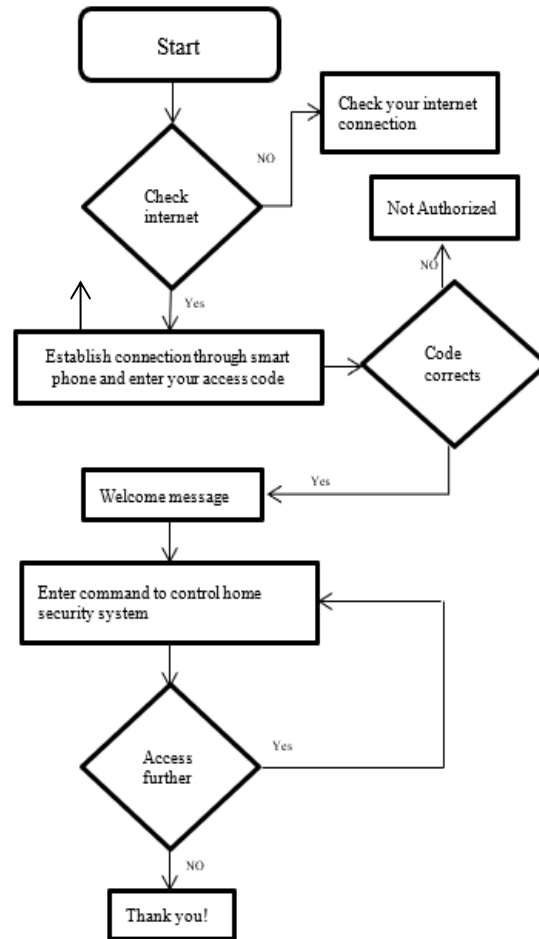


Figure 2: Flow Chart of Home Security Smart System

### A. Hardware Used

Firstly, use a passive infrared sensor (PIR sensor), which is an electronic sensor that measures infrared (IR) light emitted by objects in the visible range. They are frequently used in PIR-based motion detection. PIR sensors are often used in security alarms and automatic lighting.

PIR sensors capture space but do not provide information about who or what is moving [11]. An infrared imaging sensor is needed for this. PIR sensors are often referred to as "PIR" and sometimes "PID", which stands for "Passive Infrared Detector". The word "passive" means that the PIR device does not emit energy for detection. They work entirely by detecting infrared radiation (radiant heat) emitted or reflected by objects.

A flame sensor is a type of equipment commonly used to detect and respond to the occurrence of fire or flame. The response of the flame detector may depend on its configuration. The alarm system includes natural gas lines, propane, and fire extinguishers. This sensor is used in industrial sensors. Its main function is to ensure the proper operation of the boiler. Due to their process of detecting flames, sensors respond faster and more accurately than heat/smoke detectors [12].

The detailed pin description of flame sensor implemented is described below. It consists of four pins that incorporate the circuit implementation. When this module works with a microcontroller unit then the pins are:

Pin (VCC pin): Voltage supply ranges from 3.3V to 5.3V

Pin2 (GND): This is a ground pin Pin3 (AOUT): This is an analog output pin (MCU.IO)

Pin4 (DOUT): This is a digital output pin (MCU.IO)

The MQ2 gas sensor is an electronic sensor used to determine the concentration of gases such as liquefied petroleum gas, propane, methane, hydrogen, alcohol, smoke and carbon monoxide in the air. MQ2 gas sensors are also known as chemical resistors. It has a sensory property that refuses to change when in contact with oil. MQ2 is a metal oxide semiconductor type gas sensor that uses a change in resistance value to detect. The oil concentration in the oil is measured using the electric current distribution in the sensor. This sensor operates with 5V DC voltage. It can detect gases with concentrations between 200 and 10000 ppm [13].

These sensors are used to detect gases such as methane, butane, LPG and smoke in the air, but cannot distinguish between gases. Therefore, they cannot say what it is [14].

Arduino UNO is a microcontroller board based on ATmega328P. There are 14 input/output pins (6 of which can be used as PWM outputs), 6 analog inputs, 16 MHz ceramic resonator, USB connection, power input, ICSP header and start button. . It includes everything you need to power your microcontroller: simply connect it to your computer with a USB cable or power it with an AC-DC adapter or battery starter. You can repair your UNO without worrying too much about doing something wrong, and in the worst case scenario, spend a few dollars replacing the mold and starting over.

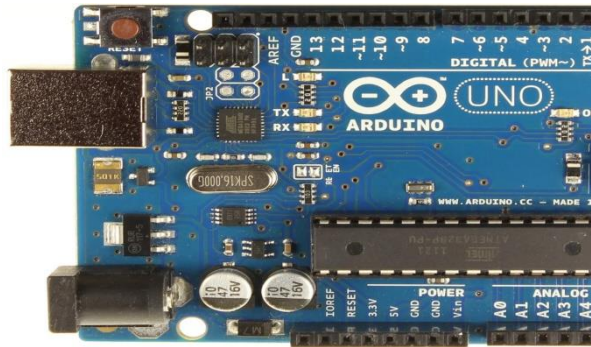


Figure 3: Arduino Board

Breadboards, solderless breadboards or prototyping boards, are building blocks used to create semi-permanent prototypes of electronic circuits. Unlike perboard, breadboards do not need to be soldered or broken so they can be reused. This is why breadboards are popular among students and the educational community as well. Breadboards can be used to model a wide variety of electronic systems, from small electronics and digital devices to complete central processing units (CPUs). Today's solderless breadboard sockets have a more tinned phosphor bronze perforated plastic shield.

Piezoelectric buzzer produces sound based on the return of the piezoelectric effect. It is essential to create pressure or strain by using the potential of the piezoelectric material [15]. These audio alerts can be used to alert the user to events related to changing actions, counter signals, or sensor inputs. They are also used in alarm circuits. No matter how the key is changed, the chime will sound the same. There is a piezoelectric crystal between the two conductors. When a potential is applied to these crystals, they repel one conductor and attract the other. This push and pull creates sound waves. Most buzzers emit a sound in the range of 2 to 4 kHz. The red lead goes to the input and the black lead goes to ground.

In general, jumpers are small metal connectors used to turn parts of a circuit off or on. They have two or more attachment points and are used to secure the board. Their job is to compose the settings of computer external peripherals such as the motherboard. Make sure your motherboard supports access control. A jumper can be set to enable or disable. A jumper is a wire with pins connected at both ends. They are used to connect two points in a circuit that are not connected to each other. You can use jumper wires to replace the circuit or check for problems in the circuit. Additionally, they are best used to bypass parts of the circuit that do not have resistors and are expected to be damaged. This includes the length of the wire or switch. Assuming all fuses are good and there is no power to the device: Locate the switch. Then use the jumpers to bypass the switch.

## WORKING

The implemented circuit connections of home security smart system is depicted in figure 4. The steps to connect the pins are as follows:

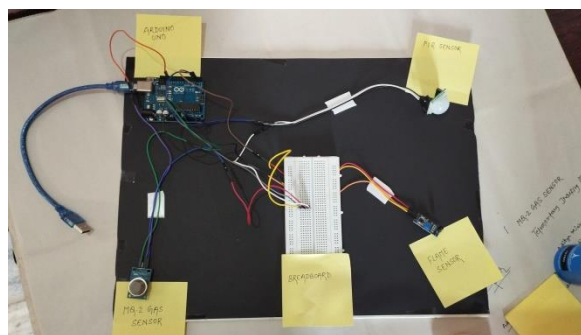


Figure 4: Setup connections for the system

Step 1: Connecting the P.I.R sensor to Arduino. Connect VCC pin of P.I.R sensor to positive terminal of Arduino (5V). Connect GND pin of P.I.R sensor to any ground pin of Arduino. Connect out pin of P.I.R sensor to Pin no. -7 of Arduino. Step 2: Connecting Piezo Buzzer to Arduino Connecting Piezo Buzzer Connect Positive terminal (Red Wire) Of Buzzer to Arduino Pin no. 10. Connect Negative terminal (Black Wire) Of Buzzer to Any Ground Pin.

Step 3: Connecting the MQ-2 Gas Sensor to Arduino. Now, connect the VCC pin of the gas sensor to the 5V. Connect the GND pin of the gas sensor to the GND. Connect the A0 pin of the gas sensor to the A0 pin of Arduino.

Step 4: Connecting the Flame Sensor to Arduino Connect the VCC and GND of the module to the 5V and GND pins of the Arduino. Then connect the D0 pin to the Arduino's digital pin 2. We will monitor the state of this pin to detect the fire.

Step 5: Connecting the 9V battery to Arduino Connect the positive terminal to the Vin terminal of the Arduino Uno and the negative one to the GND terminal.

Step 6 : Interfacing Arduino Programme:

Download and install Arduino IDE 1.0.6 from <https://www.arduino.cc/en/main/software>. Interface the discussed Arduino to your computer with the help of USB Cable. With the help of Arduino IDE, select your correct board from Tools—Boards. Select the required Port from Tools—Serial Port. Duplicate the described schematic that is represented by Web Browser to your Arduino Sketch Page. Click on Upload Icon or go to File— Upload. Finally using the Blynk app from your mobile phone and switch ON/OFF the button, now the NodeMCU is interfaced using the Blynk app via your Wi-Fi.

### III. RESULT & DISCUSSION

A home security alarm system is a series of electrical equipment and sensors connected to the main system that detects any unauthorized or forceful access in the premises and alerts using alarms, hooters, and notifications. With ever increasing cases of offensive and unlawful activities (thefts, vandalism, etc.) burglar alarm systems are perceived as security essential. The high state of insecurity among owners and a need to keep resources safe from any intrusion or damage is also driving its adoption. Historically, these systems used to be expensive due to its complex nature and with the high-end application only. But the recent developments in technology is bringing down its costs and increasing its acceptance in both residential and commercial spaces. A burglar alarm system is mainly of three types-

- a. Wired every component and electrical systems are connected through wires.
- b. Wireless Wi-Fi, Bluetooth, or any other radio technology is used as a mode of connection between appliances.
- c. Hybrid consists of a combination of wired and wireless equipment communicating with the main system. Installing a burglar alarm system is a sophisticated and complex task with virtually unlimited combination because of the large number of input devices available. They are capable of identifying movements before the actual offensive threat. But the basic concept behind each design or combination remains the same. Such kind of alarm systems can be easily used for security purposes in banks, many workplaces and even sensitive institutions such as the military. We can easily install the system in the building.

In this article, we show the construction stages of the smart home automation control unit step by step. By creating a control room, home appliances can be turned into smart devices using the Internet of Things. The working principle of the proposed model is demonstrated experimentally by connecting three lights. The proposed system has two advantages. First of all, utilizing the IoT connectivity, we can monitor and access our smart home from anywhere, which saves energy. Second, the initiative continues to help the elderly and disabled. For our future work, we hope to make our smart home smarter and add more controllers that can be used in flight situations.

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