A Minor Project Proposal on

# “Smart Home”

Submitted in partial fulfillment of the requirements for the Practical of Diploma in Computer Engineering at CTEVT.

**By**

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Phirke-8 Pokhara, Kaski ,Nepal

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**Er. Santosh Panth**


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# APPROVAL CERTIFICATE

This project proposal entitled **Smart Home** prepared and submitted by Kamal Gurung , Milan Tamang and Ronit Baniya under the supervision of the Er.Santosh Panth in partial fulfilment of the requirements for the Practical of Minor Project in Diploma in Computer Engineering has been examined and is approved for development.

Date of Evaluation: June,2023

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# ABSTRACT

This project presents the overall design of Home Automation System(HAS) with lost cost and wireless system. The project main goal is to create an intelligent living environment that enhances comfort, boots energy efficiency, reduces electricity costs, and provide security for the homeowners. The project's goal is to optimize electricity use and address Nepal's ongoing power shortage problem with a focus on energy efficiency. By automating and managing various home systems such as lights, fans and appliances,the initiative intends to decrease wastage and cut energy cost for homeowners. The project will also contain robust security elements that are appropriate for Nepal's environment. Smart locks, surveillance cameras, and motion sensors which are intergraded to enhance the safety and protection of homes. An additional crucial component of the project is the ability to monitor and control functions remotely. Homeowners can control their home's systems and facilities from anywhere in order to maintain the security and comfort of their place even when they are away.

***Keywords:*** ***Suraksha Home, Home Automation, Smart Home Security, Motion Detection, Notification System, Sensor Technology, Home Automation, Remote Control, Door Access Control, Realtime Alerts, Energy Efficiency, Mobile Application, Intelligent Living Environment, Home Safety, User Authentication, Appliance Control, Security Monitoring.***

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# LIST OF ABBREVIATIONS

IDE: Integrated Development Environment

ER: Entity Relation

IR: Infrared

PIR: Passive Infrared Sensor

RIFD: Radio-Frequency Identification

LED: Light Emitting Diode

# Chapter 1 INTRODUCTION

## 1.1BACKGROUND

Everyone has a smartphone now and wants to control everything from it. Everyone knows how to control their mobile phone in a way that is easy to use and understand. Lights, fans, switches, and refrigerators are controlled with Bluetooth-based remotes using Arduino. With most people using smartphones these days, home automation is becoming easier and more popular to design. In this device we will use his Arduino which is the most common device used for automation. Arduino is a piece of hardware that serves as a connection between your computer and your project model, allowing you to control the project model using the corresponding Arduino code.

Arduino is a microcontroller that processes information and performs logical and mathematical operations on that information, similar to the human brain. The Arduino is connected to a Bluetooth module that receives information from the user. Also connected to the Arduino is a relay that receives information from the Arduino and performs its function as a switch. Bluetooth technology is short-range wireless communication, the technology you need to create intelligence and control. This creates a personal network in your home environment and allows you to connect and monitor all these devices via a microcontroller using an Arduino and a smartphone. Home automation is the computerized or automated control of certain electrical and electronic systems in a building to some extent.

## 1.2 PROBLEM STATEMENT

Home security systems available on the market are very limited and fail to provide a comprehensive and easy-to-use solution for monitoring and controlling various aspects of your home. These systems are often not integrated, resulting in fragmented functionality and inconvenience for homeowners. Key issues include lack of real-time notifications, inefficient door access control, and limited automation capabilities. Homeowners integrate advanced motion detection, instant and reliable notifications to homeowners, safe and convenient door access control mechanisms, and a centralized mobile application that seamlessly manages lights, fans and air conditioning. You need a smart home security and automation system that overcomes these challenges by doing so. and other equipment. The aim of this project is to develop integrated and efficient solutions that enhance home security, provide comfort and give homeowners full control over their living environment. Existing home security systems have the following problems.

1. Lack of comprehensive solutions:

Current home security systems do not offer a holistic and integrated approach to addressing the various needs of homeowners.

2. Limited integration:

Existing systems cannot effectively integrate various components and functions, resulting in fragmented and disjointed solutions.

3. Delay of Notification:

Many home security systems do not provide real-time notifications to homeowners, resulting in slow response times and potential security risks.

4. Inefficient door access control:

Current solutions offer limited options for managing door access, are cumbersome, and create potential vulnerabilities and inconveniences for homeowners.

5. Control Over Devices:

Existing systems often lack the ability to control various devices such as lights, fans, and air conditioning from a central platform, limiting comfort and energy efficiency.

## 1.3 OBJECTIVE

The main objective of our project is to create a comprehensive solution for enhancing home security and providing convenient home automation system function mention below.

### 1.3.1 GENERAL OBJECTIVES

- To connect people with technology.
- To make a secure system for people.

### 1.3.2 SPECIFIC OBJECTIVES

- We develop advanced motion detection systems that accurately detect the presence of people in a surveillance area and trigger appropriate actions. The system uses advanced sensor technology and advanced algorithms to minimize false alarms, ensure reliable detection, and improve overall security.

- Design and implement a notification system that notifies homeowners in real-time when someone is detected, ensuring a faster response and increased security. Notification systems keep homeowners informed of potential security threats using messaging or mobile app notifications so they can take immediate action to maintain a safe environment.

# Chapter 2 LITERATURE REVIEW

Home automation systems revolutionize the way we interact with our living spaces, providing greater convenience, energy efficiency and security. This literature review examines various components and functions of home automation systems, focusing on similar projects in this area. The projects under discussion include Home Automation Systems from Sandeep Gupta, Home Automation Nepal (HAN), Smart Home Solutions, iDomus, Automa Home, and E-Shramik. Each project offers a unique perspective on home automation and contributes to advances in the field.

**1. Well Sandeep Gupta's home automation system:**

Well, Sandeep Gupta's home automation system is an innovative solution that allows homeowners to remotely control a variety of devices over the Internet. The system allows users to easily manage lighting, heating, air conditioning, security systems, and more. The system prioritizes comfort, efficiency and energy optimization to promote a greener and more sustainable lifestyle.

**2. Home Automation Nepal (HAN)** [1]

Home Automation Nepal (HAN) is a leading provider of home automation solutions. Our comprehensive systems offer advanced security features, scalability and professional support. HAN allows homeowners to remotely monitor and secure their homes by integrating surveillance cameras, motion sensors, and smart locks. Their expertise and market presence ensure a robust and feature-rich home automation experience.

**3. Smart home solutions** [2]

Smart Home Solutions is a leading provider of home automation systems with a wide range of features. The company's system allows homeowners to control lighting, appliances, temperature and security systems from a central hub. The smart home solution focuses on customization and personalization, allowing users to create personalized schedules and implement smart automation rules for a customized smart home experience.

**4. Eidomus** [3]

iDomus is an innovative home automation company that specializes in building smart and connected homes. The company's system integrates various devices and devices, allowing homeowners to remotely control and monitor their homes. Prioritizing user-friendly interfaces and intuitive controls, iDomus ensures ease of use for homeowners seeking a seamless home automation experience.

**5. Autohome** [4]

Automa Home offers comprehensive home automation solutions with a focus on energy efficiency and sustainability. The system allows users to optimize energy consumption by remotely managing their devices and systems. Automa Home offers customizable schedules, smart automation rules, and voice control features to enhance user convenience and control over their living spaces.

# Chapter 3 TOOLS AND METHODOLOGY

## 3.1 PRIMARY

The primary working of the project can be outlined as:

- Tasks division to team member on the basis of their interest.
- Weekly meeting to assess and propose restructuring of plan when required.
- Project documentation by team members at the end of each task.
- Regular discussion with the project to update our mentor about the progress of our project.

## 3.2 SECONDARY

Since we are building a home automation system so the Ardunio IDE would be the major development tool for us. Using Git Hub is another tool for sharing the information and code among the team.

In this project the relevant research data will be collected by investigating previous research work and existing websites and applications. Collected data will be further analyzed to resolve the existing problems in websites and applications.

Tools Used:

- Ardunio IDE
- Dia
- Visio
- Android Studio
- Visual Studio
- Xampp Server
- Github

Programming languages:

- C++
- Html
- CSS
- PHP
- Firebase
- Java

## Prototype Model : [1]

Prototyping is a general approach to develop an effective replica of any idea or software or system which needs further engineering for making it the ultimate product. The prototype model will present a mini-sized duplicate copy of your target end product which requires precise customer feedback for crafting accordingly.

The Prototyping Model is a methodology that is treated as a model for software development where a prototype - which is a premature approximated sample of the final product, is constructed and then tested. After that rework is done on that unfinished product as per requirement in

anticipation of building a suitable prototype that is, at last, attain after the entire software is developed and then it is delivered to the customer. It is a useful model for those whose project requirement is not fully known or there is a constant update required based on customer satisfaction. It can be considered as a trial-and-error method which takes place involving the developers as well as the users.

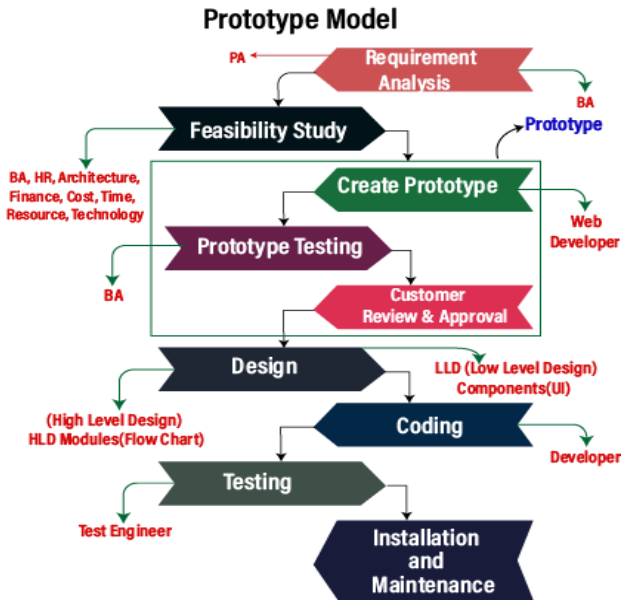


**Figure 1 Prototype Model**

The phases in the Prototype model are:

**Requirement analysis:** This model starts with collecting the requirements from the customers. And these requirements of the project should be in-details. These details are received by the Business Analyst and Product Analyst. Where Business analyst is assigned for service-based software companies, and the Product analyst is assigned for product-based software companies.

**Feasibility study**: In the next stage, the BA, HR, Architecture, and Finance teams head will sit together and talk about the cost of the product,

which resource is going to be needed, which technology is used to develop the product and how much time is required to complete the product and deliver.

**Create a prototype:** After we completed the feasibility study, we will move to our next stage, where we will be creating the prototype (sample or dummy) based on the data collects from the client, and the web developer will design the prototype.

Here, we have the following types of prototype:

- **Static prototype**
- **Dynamic prototype**

**Static prototype**

In the static prototype, we kept the entire prototype of the requirements in a word document with having all the guidelines, screenshot, and the description of how to build the software, how the completed product will look like and how it will work and so on.

**Dynamic prototype**

The dynamic prototype is parallel to the browser, but here we can't provide any details, only the functionality is there without entering the data. It is like a dummy page made out of the html with having tags and links to the various pages to the expressive features of the product.

**Prototype testing:** Once we build the prototype, the BA will test the prototype and perform one round of prototype testing.

**Customer review and approval:** Once the prototype testing is done, it will be handed over to the customer for their review and approval. If the customer is not happy with the given sample, we will change the prototype based on the customer's guidelines and feedback. This process will go on

until the customer approved and satisfied with the prototype. It is a bit time-consuming because we have to perform the changes again and again in the prototype.

**Design:** After getting the approved prototype, we will start the high level and low-level design for the final product and consider all the suggestions given by the customer at the time of the final prototype.

**Coding:** Once the design phase has been completed successfully, we move to our coding phase, where the concerned developer starts developing the product based on their programming knowledge.

Testing: After the compilation of the development phase, it is handed over to the test engineer. And the test engineer test the application functionality, and all inputs and outputs.

**Installation and maintenance:** Once our final product is developed and tested according to the final prototype, it will be deployed to the production. And the product will go through the time to time maintenance to reduce any interruption, which helps to avoid significant failures. [1]

## 3.3 ANALYSIS AND DESIGN

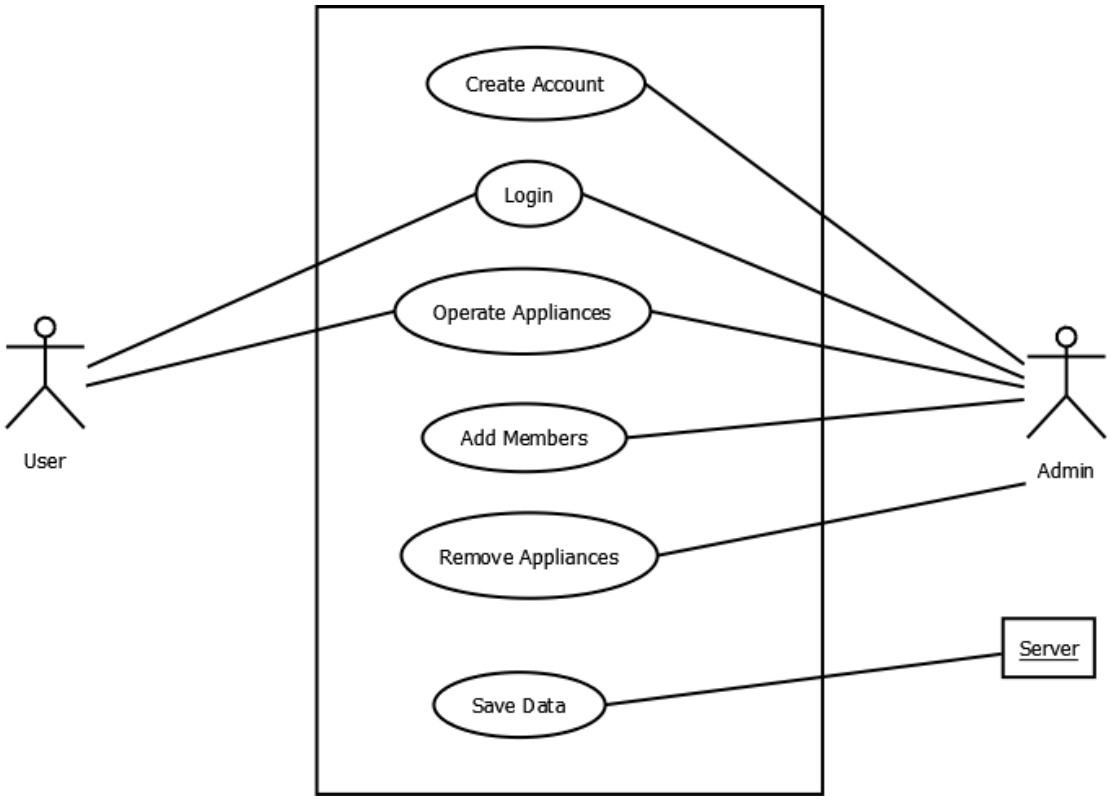


**Figure 2 Use Case Diagram 1**

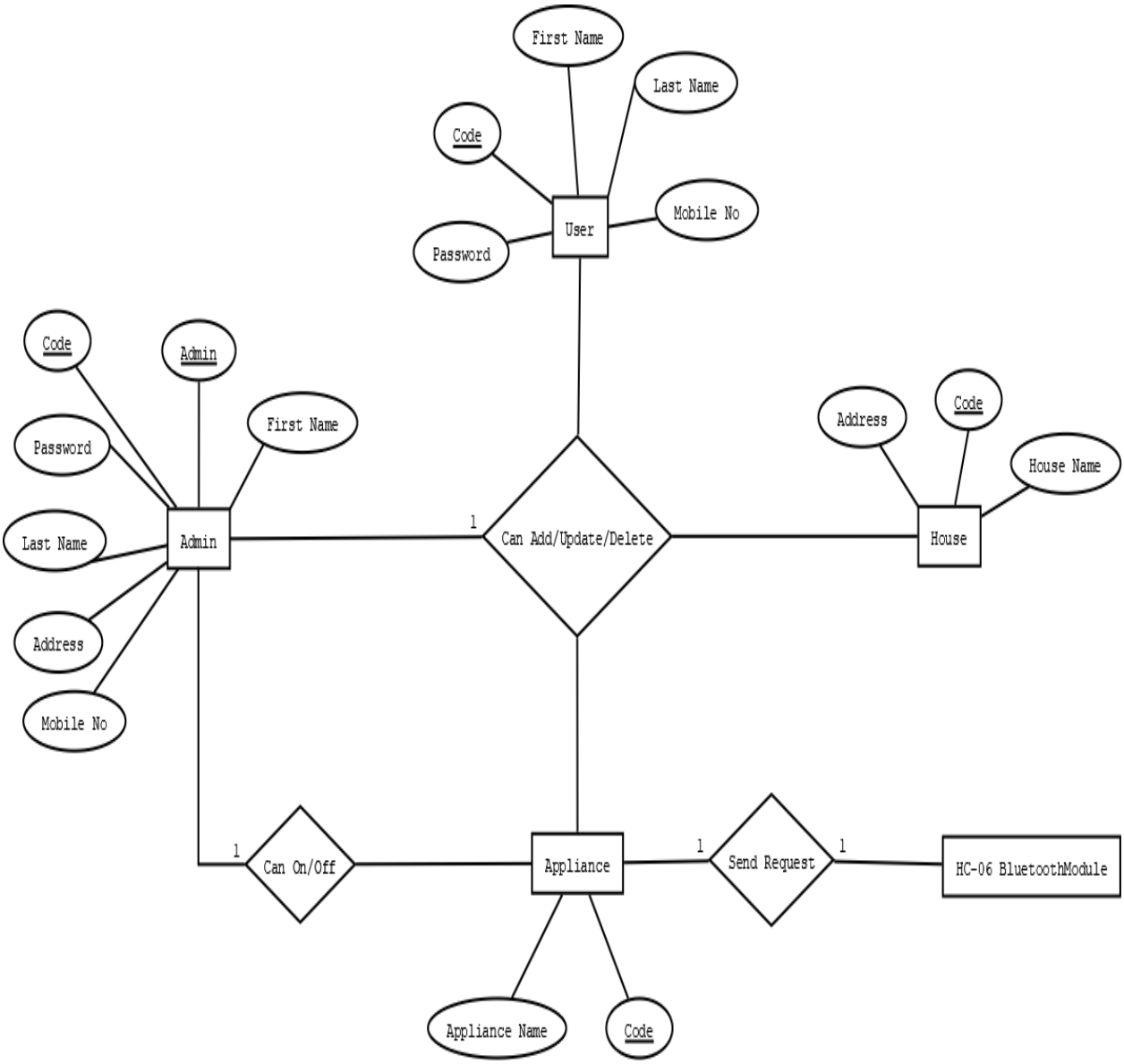


**Figure 3 ER Diagram**

# Chapter 4 DETAIL OF COMPONENTS

## 4.1. Arduino UNO [2]

Arduino Uno is a microcontroller chip dependent on the Atmega328(datasheet) with 14 computerized I/o pins, in which 6 pins can be utilized as yields, 6 pins are utilized as simple information sources It has 16 MHz clay resonator, a USB association, a power jack and a reset button. The microcontroller has 32kB of ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides serial communication capability via UART, SPI and 12C.Because of well design in the form of Arduino it is easy to understand. In Arduino we use high level of programming language like C language, C++ language etc. It is easy to understand and user friendly language. It has much advantage like multitasking, automation, time domain etc. Arduino Uno fig4 is given below.

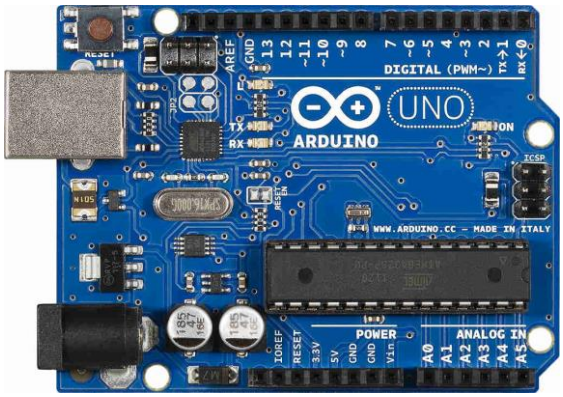


**Figure 4 Arduino Uno**

## 4.2 Bluetooth Module(HC-06) [3]

HC-06 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-06 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data. The Bluetooth module HC-06 is a MASTER/SLAVE module. By default the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project.

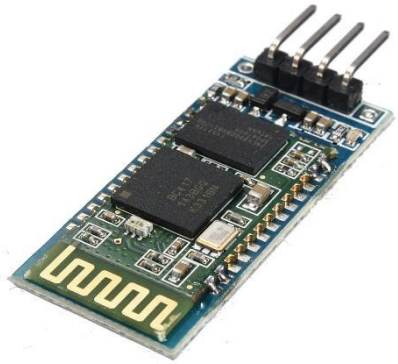

**Figure 5 Bluetooth Module**

## 4.3 Relay Drivers [3]

A relay driver circuit is a circuit type that runs a relay, therefore, contributing to an appropriate circuit function. In turn, the relay switch opens or closes, as per the circuit requirement and functioning. A relay driver circuit acts as a buffer between the control board´s intelligence and

the relatively high current drawn from the relay coil. A microcontroller typically will output a high or low logic level (3.3 or 5v for a high, and 0 volts for a low) and is used to switch on a driver transistor or integrated circuit. The working mechanism:

- A relay structure comprises a spring-loaded contact and coil that move undisturbed across a pivoted axis.
- The central pole ensures that as the relay coil receives voltage, it joins the N/C contact (Normally Closed). The connection happens because the relay coil has an electromagnetic pull that attracts the pole iron.
- Later, when you switch OFF the relay coil, the central pole disconnects from the Normally Open (N/O) terminal. It then joins the N/C switch contact terminal hence being in a default contact position.

Generally, the switch OFF and switch ON operations in a relay drive alternately switches N/C to N/O. And it majorly depends on the state of the relay coil.

**Figure 6 Relay Module**

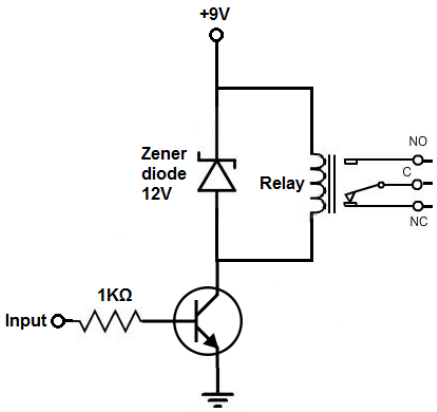


**Figure 5 Circuit Diagram of Relay**

## 4.4 Bread Board

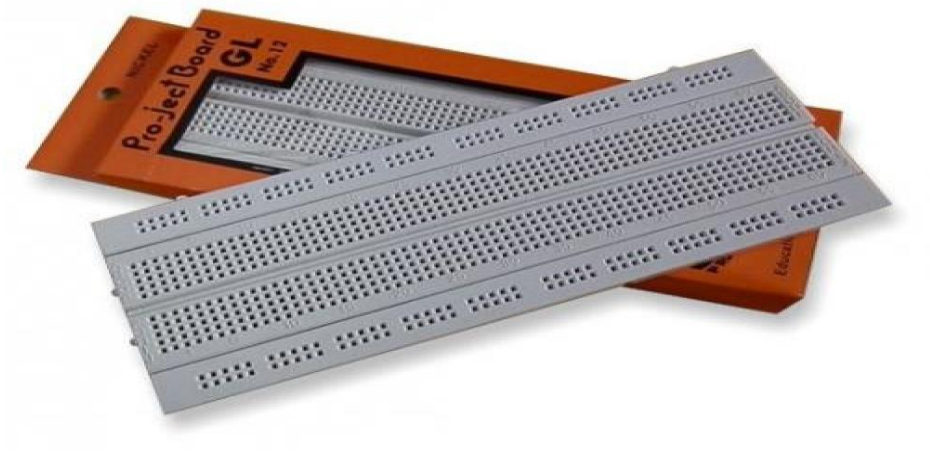


**Figure 7 Bread Board 1**

A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike a perfboard or stripboard, breadboards do not require soldering or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units.Compared to more permanent circuit connection methods, modern breadboards have high parasitic capacitance, relatively high resistance, and less reliable connections, which are subject to jostle and physical degradation. Signaling is limited to about 10 MHz, and not everything works properly even well below that frequency.

## 4.5 Circuit diagram of Bluetooth based home automation system [3]

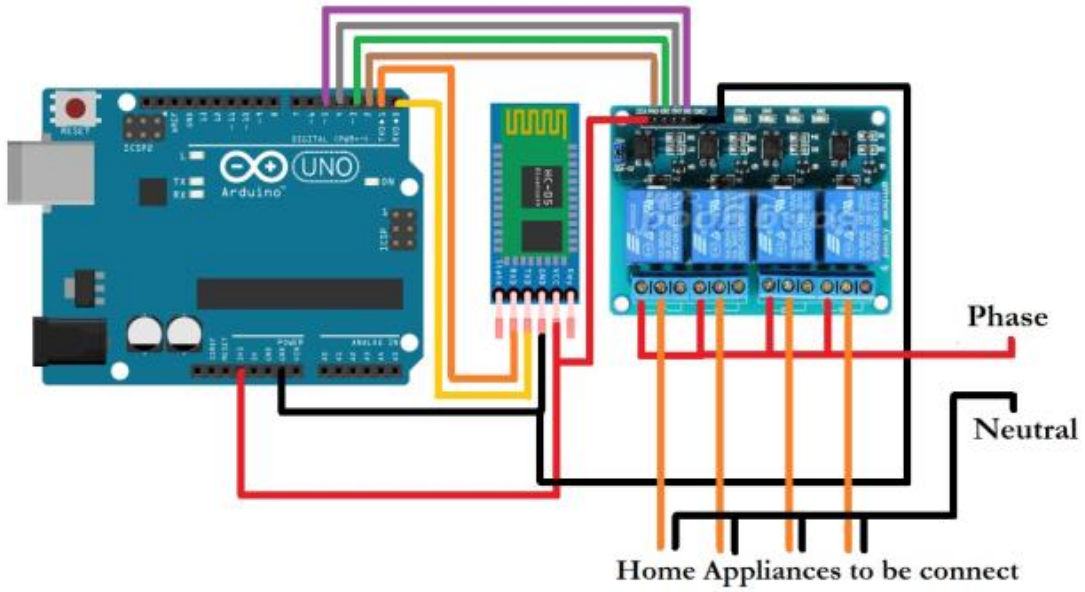


**Figure 8 Automation Circuit Diagram 1**

This project uses a Bluetooth module set to slave mode to communicate between the controller and the smartphone application. The application is created by App Inventor 2. App Inventor 2 is a visual block language for building Android apps. App Inventor 2 has his two main types of components: visible components and non-visible components. Application display components such as buttons, text boxes, and labels are visible when the app starts. These are often called graphical user interfaces (GUIs). Invisible components are invisible and therefore not part of the user interface. Instead, it provides access to the device's built-in functionality. The invisible component is the technology inside the device. They are tiny worker bees that take on the task of controlling applications. App Inventor 2 makes it easy to create user-friendly her GUI interface and Block Editor makes it easy to create the relevant functions for each button from your application without writing any programming. The application is installed

on your smartphone and controls the Arduino UNO digital output on pin number 2. 13, 12, 11, 10, 9, 8 are for interior lighting and turn the motors on and off via relay switches. A 5V DC relay unit connects to pins 13, 12, 11, 10, 9, and 8 to provide switch control for 220V AC home users.

## 4.6 RFID Modules [4]

RC522 is an RF module consisting of RFID reader, RFID card and key fob. The module operates at 13.56 MHz in the Industrial Band (ISM) and can be used without licensing issues. This module typically operates at 3.3V, so it is often used in 3.3V designs. Typically used in applications where a specific person or object needs to be identified by a unique ID. Keychain has 1 KB of memory available for storing unique data. The RC522 read module can both read and write data to these memory elements. The reader can only read data from passive his tags that operate at 13.56MHz.

The operating voltage of RC522 is 2.5V to 3.3V, so it normally operates at 3.3V and should be used with 3.3V communication lines. However, the module's communication pins are 5V tolerant, so it can be used with 5V microcontrollers such as Arduino without additional hardware. This module supports his SPI, IIC and UART communication, of which SPI is the fastest with a maximum data rate of 10 Mbit/s, so it is often used. This is because in applications, the reader module spends most of its time

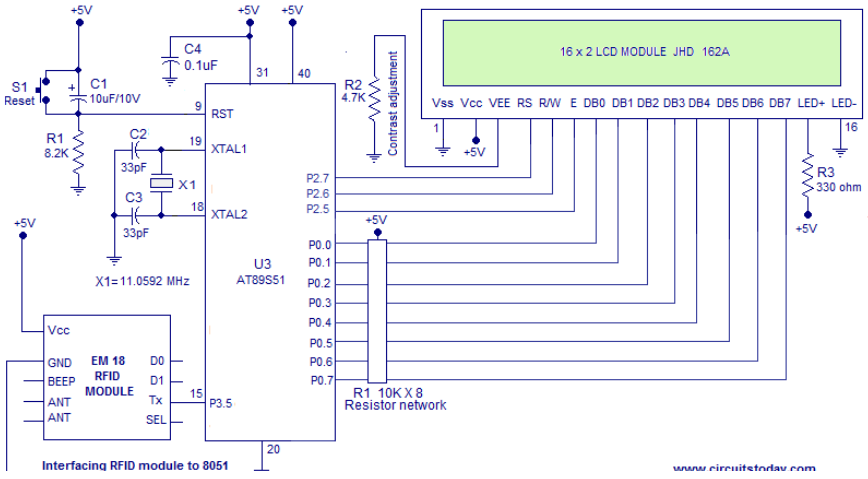


**Figure 9 RFID Circuit Diagram 1**

waiting for a tag to approach. The reader can be put into power-down mode to save power in battery-powered applications. This can be achieved using his IRQ pin on the module. The minimum current consumed by the module in shutdown mode is only 10uA. With his RC522 RFID Arduino library by Miguel Balboa readily available, this module can easily be used with his Arduino. See the GitHub page for more information on using it with Arduino.

## 4.6 Arduino IDE [3]

The Arduino IDE (Integrated Development Environment) is open source software that enables better supported code editing, compiling and debugging. Works on Windows, Mac OS X and Linux. The environment is written in Java and based on Processing and other open source software. So this Arduino IDE basically contains built-in functions and commands that run on the Java platform, but customized to run on an Arduino board. So the Arduino IDE is used to edit, compile, debug the code and burn the code onto the Arduino board.

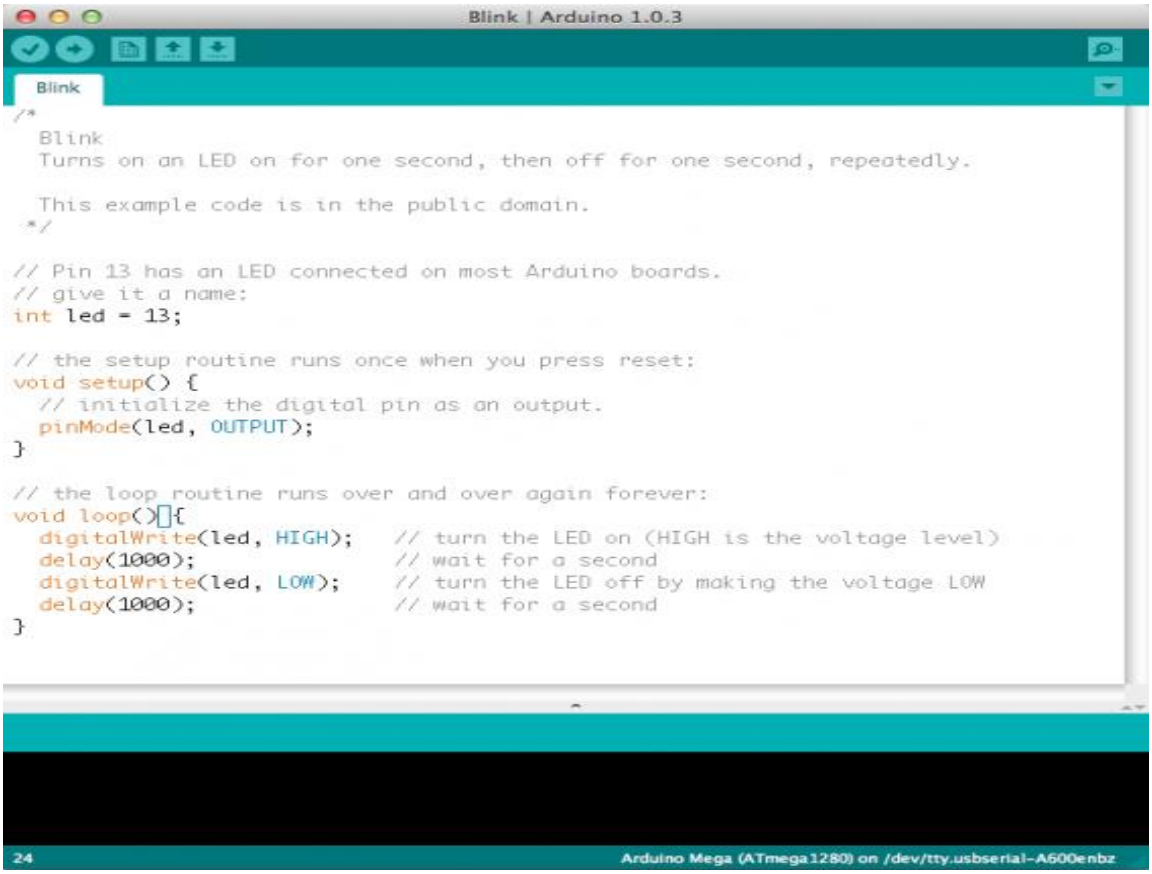


**Figure 10 Arduino IDE 1**

## 4.7 MIT App Inventor 2 [3]

MIT App Inventor is intended for developing applications for Android mobile phones using a mobile phone or emulator connected to a web browser. The App Inventor Server stores your Inventor designs and builds fully functional apps without writing any code for your project. The App Inventor development environment is supported on Mac OS X, GNU/Linux, Windows operating systems and some popular Android smartphone models. Applications created with App Inventor can be installed on any Android smartphone.

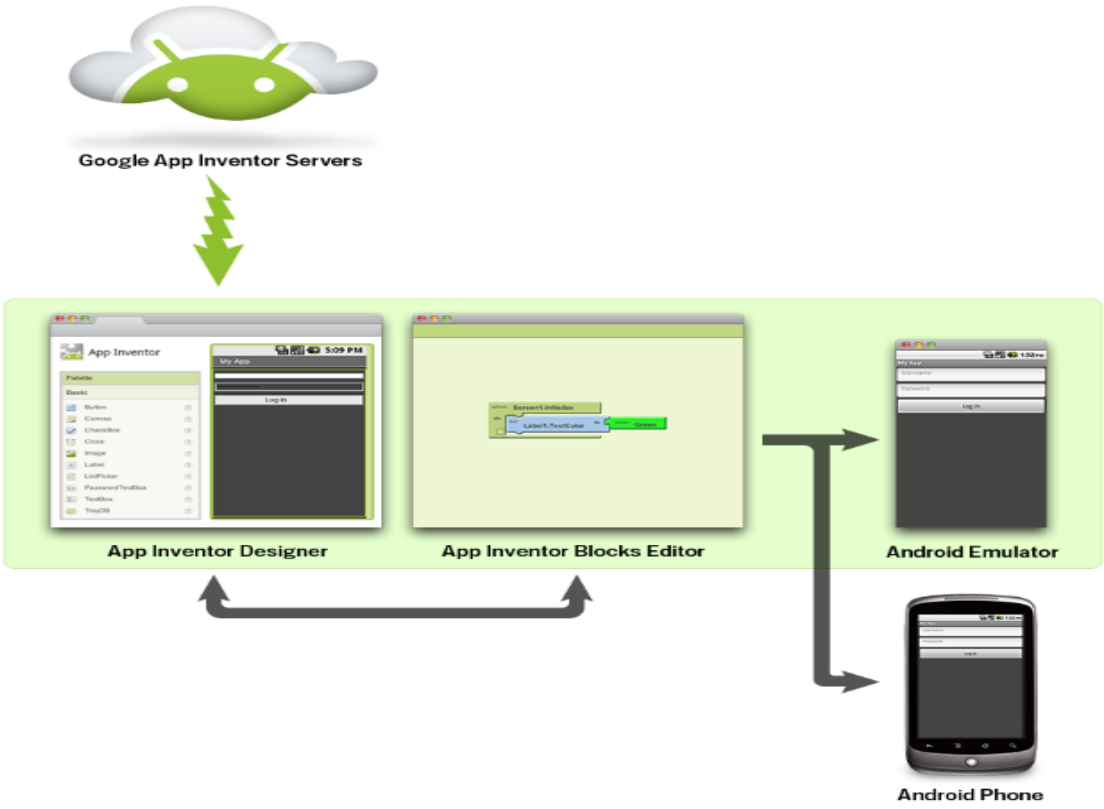


**Figure 11 MIT App Inventor 2 1**

# Chapter 5 TIMELINE CHART

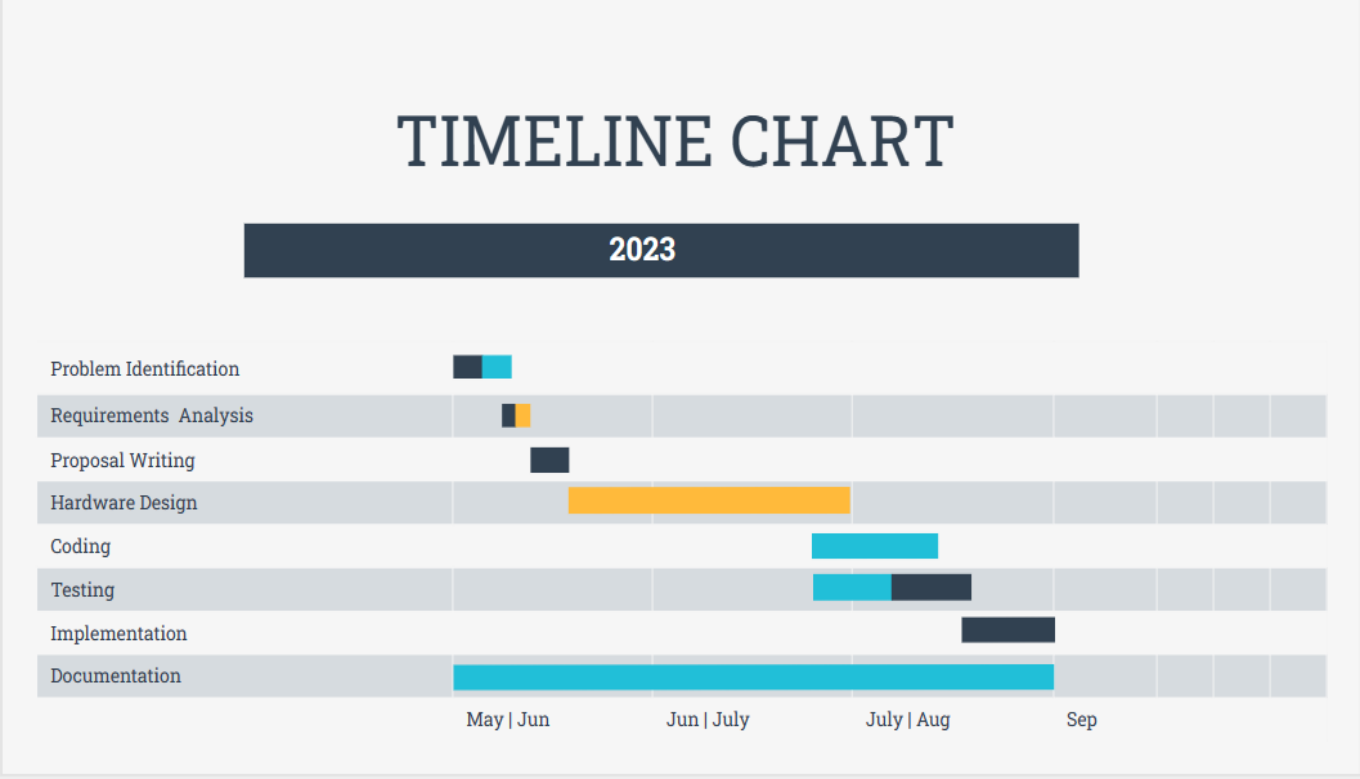


**Table 1 Gantt Chart 1**

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