EC-299
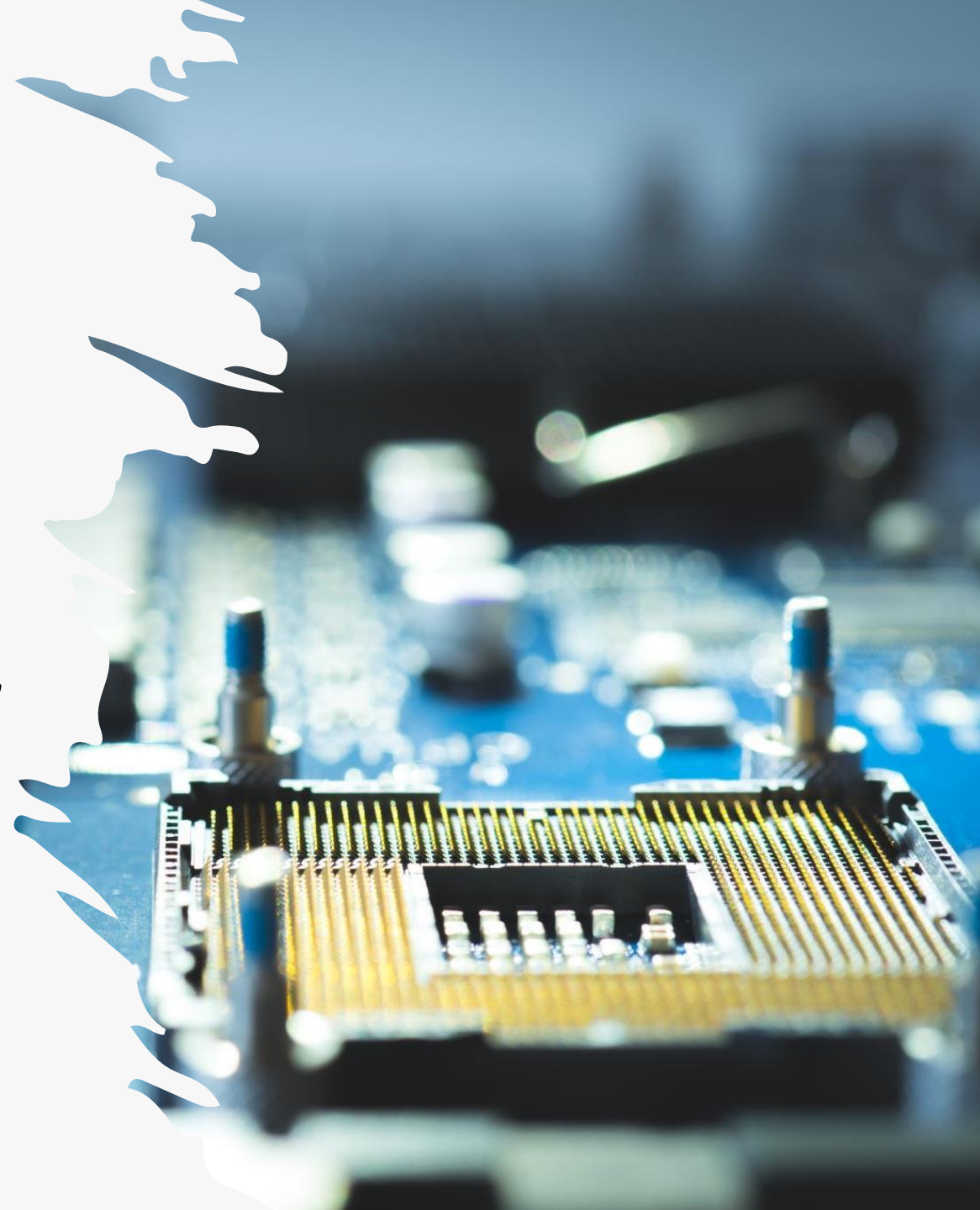# MINOR PROJECT

AUTOMATIC DOORBELL

USING ARDUINO

AUTOMATIC DOORBELL USING ARDUINO

Submitted by:

SEC-B, BATCH-7

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INTRODUCTION

Doorbells are usual signalling devices used to alert the person inside the building to open the door as someone has arrived. Classic doorbells can be seen in every house now a days, which uses simple button and when that button is pressed the bell rings. The doorbell which we are going to make is different from that. We will make a doorbell which is automatic, i.e. it will detect someone in front of it and then it will ring.

This project can be really beneficial because it's not always the case that a person can reach the doorbell, so it would be nice if it rings automatically after detecting the person. Also, there is a flexibility that you can adjust the distance according to you by doing some changes in the code you are using to drive the doorbell. We will be using ultrasonic sensor to detect the person and alerts through buzzer. As we know that ultrasonic sensors are used for distance measurement without physical contact for small distances. So it's the best thing to use ultrasonic sensor for detecting object. We also use GSM module to send SMS to the owner of the house about the arrival of the person.

COMPONENTS NEEDED

- Ultrasonic sensor(HC-SR04)

- Buzzer

- Arduino UNO(Atmega328P)

- SIM900A GSM module

- Jumper wires

- USB cable

- 12V Adaptor

- 220ohm resistors

- Breadboard

- LED(red)

ULTRASONIC SENSOR (HC-SRO4):

➤ The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar.

➤ The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. This Ultrasonic Sensor module is a transmitter, a receiver, and a control circuit. It offers excellent range accuracy and stable readings in an easy-to-use package.

➤ HC-SRO4 Ultrasonic module has 4 pins- Ground, VCC, Trigger, Echo

➤ The **Trigger** and the **Echo** pins are the I/O pins of this module and hence they can be connected to the I/O pins of the microcontroller/Arduino. When the receiver detects the return wave the **Echo** pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

➤ Ultrasonic Ranging Module HC-SR04 provides 2cm-400cm non-contact distance sensing capabilities, Ranging accuracy up to 3mm.

BUZZER:

Negative (-)   Possitive (+)

➢ The main function of buzzer is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc.

➢ Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

➢ Buzzer includes two pins namely positive and negative. The positive terminal of this is represented with '+' symbol or a longer terminal. This terminal is powered through 5 volts whereas the negative terminal is represented with '–' symbol or short terminal and it is connected to the GND terminal

ARDUINO UNO:

➢ Arduino Uno is a microcontroller board based on **8-**bit ATmega**328P** microcontroller. Along with ATmega**328P**,it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. To support the microcontroller.

➢ Arduino Uno has **14** digital input/output pins (out of which **6** can be as PWM outputs), **6** analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

➢ It is used to communicate with a computer, another Arduino board or other microcontrollers.

➢ It is an open source platform, means the boards and software are readily available and anyone can modify and optimize the boards for the better functionality

SIM 900A
GSM MODULE:

➢ This is an ultra compact and reliable wireless module.SIM900A Module allows users to send/receive data over GSM, send/receive SMS and make/receive voice calls

➢ This module uses USART communication to communicate. AT commands are used to configure the module in different modes and to perform various functions like calling,posting data to a site, etc

➢ It works on frequencies 900/1800MHz.The baud rate is configurable from 1200-115200 through AT command.

JUMPER WIRES:

➤ male to male jumper wires are used in connecting any development board's male header pin to other development boards with a male connector like Arduino.

➤ They are simple wires with connector pins at each end, allowing them to connect two points to each other.

➤ Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

USB CABLE:

12V ADAPTOR:

➢ An Arduino USB cable connects an Arduino board to a computer through a USB connection. It powers the Arduino and transfers data between it and the PC.

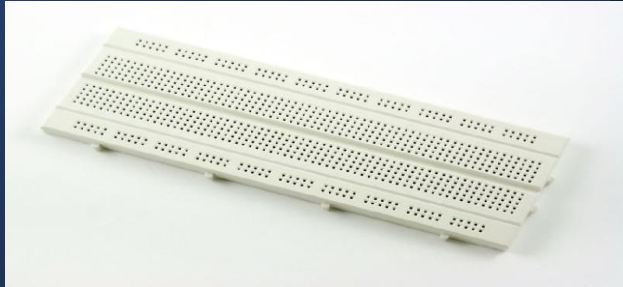➢ 12 v 1 A Power Adapter takes an AC INPUT of 100-240V and gives 12V 1A DC output.

220 OHM RESISTOR:

BREADBOARD:

LED:

➢ A Passive two-terminal electrical component that implements resistance. They act to reduce current flow, at the same time, act to lower voltage levels within circuits.

➢ A Breadboard consists of a plastic block holding a matrix of electrical sockets of a size suitable for gripping thin connecting wires, component wires, or the pins of transistors and integrated circuits(Ics). The sockets are connected inside the board, usually in rows of 5 sockets

➢ It is a semiconductor that emits IR or visible light when charged with an electric current. (Light emitting diode)

BLOCK DIAGRAM
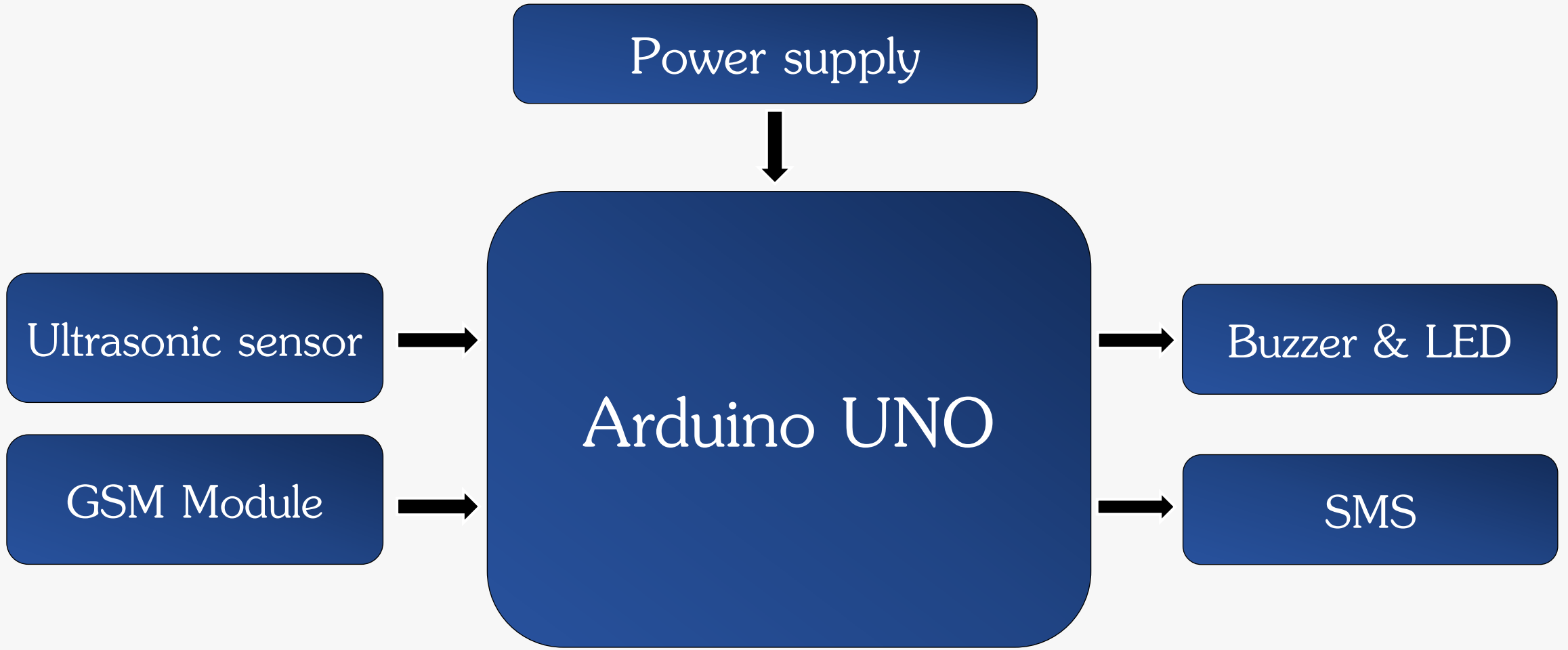
CIRCUIT DIAGRAM
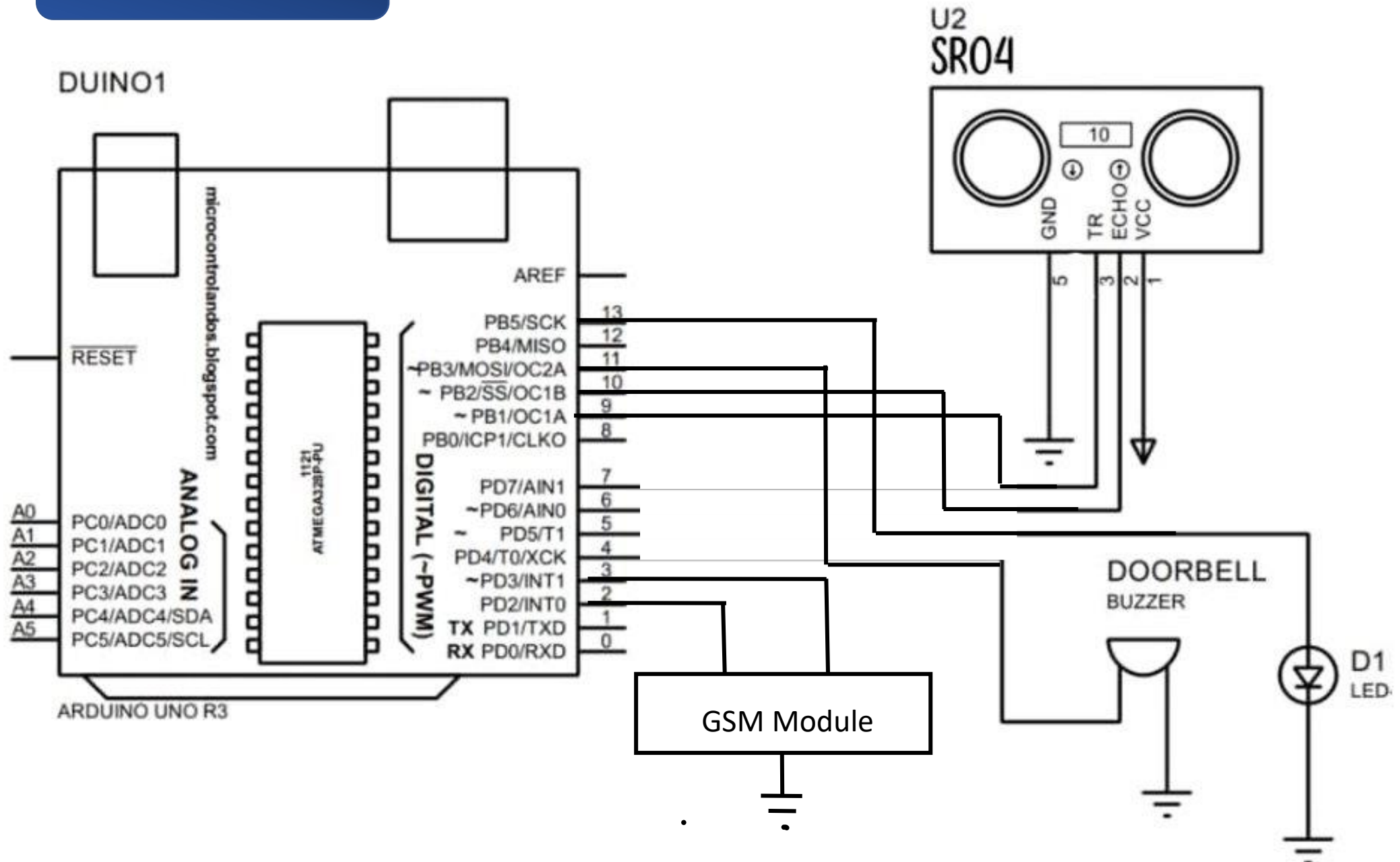
CONNECTIONS

➢ The HC-SRO4 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module need to be connected to the Ground and the 5 volts pins on the Arduino Board respectively.

➢ The Sensor Trig and Echo are connected to the Arduino Board Digital I/O 09 & 10 pins respectively. The Buzzer is attached to the Breadboard. The Buzzer long leg (+) & short leg(-) are connected to Digital 11 & Ground of Arduino Board respectively.

➢ The LED is attached to the Breadboard. The Resistor is connected to the LED long leg (+) & another leg of resistor (from LED's long leg) is connected to the Arduino Board Digital 13, The LED short leg (-) is connected to the Arduino Board GND.

➢ Now, Rx and Tx terminals of GSM module are connected to Digital 02 & 03 pins of Arduino Board respectively and Ground is connected to ground of Arduino Board.

➢ Now, Upload the code to Arduino and Give power supply to both Arduino and GSM Module for their functioning

OUR CIRCUIT
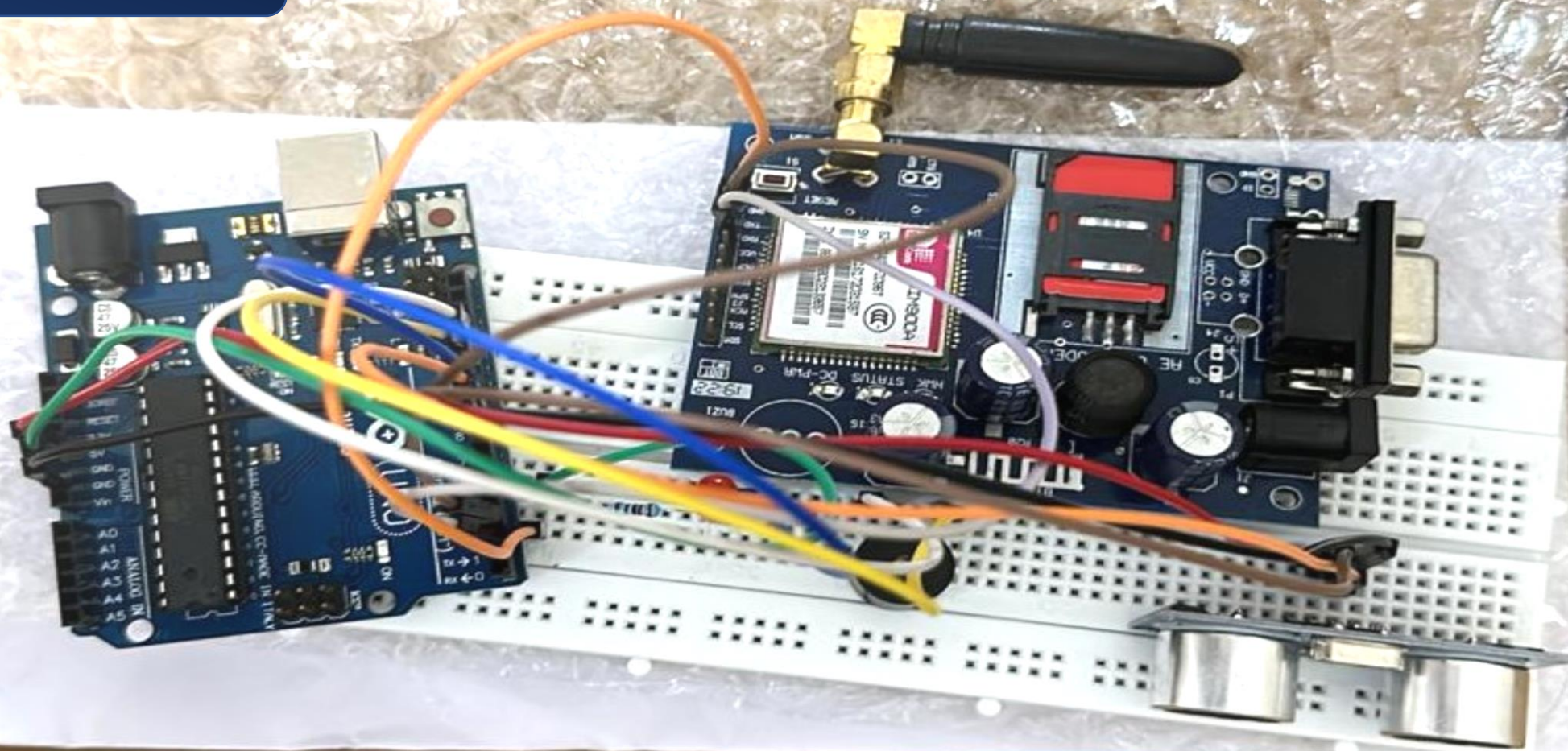
WORKING

➢ After writing the code, upload it to Arduino. Now bring any object or your hand in front of the sensor. And it will give alerts through a buzzer/LED and send the SMS to your phone.

➢ When we initialize the sensor by sending the high-level pulse for 10us, the sensor sends eight 40 kHz ultrasonic cycles and if these cycles strike any obstacle then they get reflected back to the receiver. Now, the sensor provides the time taken in moving the ultrasonic signal from transmitter to obstacle and from the obstacle to the receiver. So, we use this time to calculate the space between the sensor and the obstacle.

➢ We've set our program for 5 cm range of the sensor, so if any person is in this range will be detected and doorbell will work accordingly. If you want to increase or decrease the range then give that value of distance as distance_threshold and you are all set. But remember that the range of ultrasonic sensor is 2 cm to 400 cm so do not go beyond that. For the functioning of buzzer and LED, put HIGH in if and LOW in else so that it can turn it ON and OFF.

WORKING OF ULTRASONIC SENSOR:

➢ The sensor is composed of two ultrasonic transducers. One is transmitter which outputs ultrasonic sound pulses and the other is receiver which listens for reflected waves.

➢ In order to generate the ultrasound we need to set the Trig pin on a High State for 10 µs. That will send out an 8 cycle ultrasonic burst which will travel at the speed of sound. The Echo pins goes high right away after that 8 cycle ultrasonic burst is sent, and it starts listening or waiting for that wave to be reflected from an object.

➢ If there is no object or reflected pulse, the Echo pin will time-out after 38ms and get back to low state. If we receive a reflected pulse, the Echo pin will go down sooner than those 38ms. According to the amount of time the Echo pin was HIGH, we can determine the distance the sound wave travelled, thus the distance from the sensor to the object.

➢ To calculate the distance, we use

Distance = (Time of High Level x Velocity of Sound in Air (340M/s)) / 2

We've divided it by two because the time taken here is the total time to reach the obstacle and return back to the receiver.

WORKING OF ARDUINO UNO & SIM900A GSM MODULE:

➢ Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers.

➢ The software used for Arduino devices is called IDE (Integrated Development Environment). It can be programmed using C language

➢ A Serial monitor is provided on the IDE software which is used to send or receive text data from the board.

➢ There are two RX and TX LEDs on the Arduino board which will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer.

➢ we will need to insert the SIM card onto the SIM card tray on GSM module

➢ Once the connections are done, power on the GSM module by plugging in 12V adaptor.

➢ The Onboard Network LED will initially blink rapidly. After a few minutes, the blinking should slow down to a steady pace. This means the GSM module has successfully been registered on the mobile network and is ready to be used.

CODE

```
// Include required libraries
#include <SoftwareSerial.h>
// Define pin numbers for GSM module
#define GSM_TX_PIN 3
#define GSM_RX_PIN 2
#define GSM_BAUD_RATE 9600
// Define pin numbers for ultrasonic sensor
#define TRIGGER_PIN 9
#define ECHO_PIN 10
// Define pin numbers for LED and buzzer
#define LED_PIN 11
#define BUZZER_PIN 13
// Define distance threshold in cm
#define DISTANCE_THRESHOLD 5
// Create SoftwareSerial object for GSM module
SoftwareSerial gsmSerial(GSM_TX_PIN, GSM_RX_PIN);
```

```
void setup() {
  // Initialize serial communication
  Serial.begin(9600);
  // Initialize GSM module
  gsmSerial.begin(GSM_BAUD_RATE);
  delay(1000);
  gsmSerial.println("AT");
  delay(1000);
  gsmSerial.println("AT+CMGF=1");
  delay(1000);
  // Initialize pins
  pinMode(TRIGGER_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  pinMode(LED_PIN, OUTPUT);
  pinMode(BUZZER_PIN, OUTPUT);
  // Turn off LED and buzzer
  digitalWrite(LED_PIN, LOW);
  digitalWrite(BUZZER_PIN, LOW);
}
```

```cpp
void loop() {
  digitalWrite(TRIGGER_PIN, LOW);              // Send trigger signal to ultrasonic sensor
  delayMicroseconds(2);
  digitalWrite(TRIGGER_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIGGER_PIN, LOW);
  long duration = pulseIn(ECHO_PIN, HIGH);     // Wait for echo from ultrasonic sensor
  float distance = duration * 0.034 / 2;       // Calculate distance from duration
  if (distance < DISTANCE_THRESHOLD) {         // Check if distance is less than threshold
    digitalWrite(LED_PIN,HIGH);                // Send SMS message
    digitalWrite(BUZZER_PIN,HIGH);
    delay(1000);
    gsmSerial.println("AT+CMGS=\"+919618965787\"");
    delay(1000);
    gsmSerial.println("Someone is at the door!!!!");
    delay(1000);
    gsmSerial.write(0x1A);
    delay(1000);
    digitalWrite(LED_PIN, LOW);                // Turn off LED and buzzer
    digitalWrite(BUZZER_PIN, LOW);}
  delay(1000);}
```

APPLICATIONS

➢ As the range of the transmission is fairly large, it is suitable for large homes.

➢ This can be easily attached to the door(no wiring is required)

➢ This is used for security alerts(automatic alerting)

➢ The Wireless Doorbell implemented in this project is just a demonstration of the idea. But the idea can be extended to actual, real time wireless doorbell system.

➢ The project is suitable for homes, garages, hospitals, offices etc.

CONCLUSION

The trend towards making devices that require no human interface has been increased recently and there are a number of devices that can be made functional without human interface. One of the most common devices is the doorbell and this device is also one of the frequently used devices in our daily routine. So, we have created a non-touch doorbell using the distance sensor with Arduino Uno. The GSM Module can add an extra superpower by giving it access to extensive mobile network. We have also provided the Arduino sketch used to program the microcontroller and simulation for the hardware that we have assembled.

THANK YOU