ARDUINO BASED WIRELESS DOORBELL

DIGITAL SYSTEM DESIGN LAB
MINI PROJECT
Electronics and Communication Engineering

Submitted by

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ABSTRACT

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. We will be using a very simple circuit to implement this project.

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 then give the alert using a buzzer.

As we know that ultrasonic sensors are used for distance measurement without physical contact for small distances. So, this project can be modified by using ultrasonic sensors as they are best for object detection.

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CONTENTS

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Traditional Doorbells are wired devices and are usually fixed at one place. Wireless systems have no physical wiring connecting the doorbell button outside to the doorbell receiver or chime inside the house. Wired are becoming obsolete because of these reasons and are gradually being replaced by advanced Wireless Doorbell Devices.

We can place it anywhere we want and also the installation is pretty simple. Rather than electrical wiring, a wireless doorbell uses radio waves to transmit the signal.

1.2 MOTIVATION

• Using RF Transmitter – Receiver based Wireless Doorbell is that it is very
easy to design the circuit and implement.

• The range of the transmission is fairly large. Hence, it is suitable for large homes.

• Another advantage over Bluetooth based data transmission is it doesn’t require any smart phone or Bluetooth enabled phone or any other Bluetooth device.

• Another wireless technology which can be used for Wireless Doorbell is IR. But the problem is that its range is less and also it is a Line-of-Sight Communication.

1.3 OBJECTIVE OF THE WORK

• In this project, the mode of communication is RF, so the range is considerably large than other wireless technologies.

• Wireless doorbell is portable and can move to every corner of the house.

• Using Arduino to create simple circuits in day-to-day applications

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CHAPTER 2

BACKGROUND THEORY

2.1 HISTORY OF ARDUINO UN0

The Arduino project was started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. At that time, the students used a BASIC Stamp microcontroller at a cost of $50, a considerable expense for many students. In 2003 Hernando Barragán created the development platform Wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas. Casey Reas is known for co-creating, with Ben Fry, the Processing development platform. The project goal was to create simple, low-cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller. In 2005, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it Arduino.

The initial Arduino core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis, but Barragán was not invited to participate.

Following the completion of the Wiring platform, lighter and less expensive versions were distributed in the open-source community.

It was estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced, and in 2013 that 700,000 official boards were in users' hands.

In October 2016, Federico Musto, Arduino's former CEO, secured a 50% ownership of the company. In April 2017, Wired reported that Musto had "fabricated his academic record.... On his company's website, personal LinkedIn accounts, and even on Italian business documents, Musto was until recently listed as holding a PhD from the Massachusetts Institute of Technology. In some cases, his biography also claimed an MBA from New York University." Wired reported that neither university had any record of Musto's attendance, and Musto later admitted in an interview with Wired that he had never earned those degrees.

Around that same time, Massimo Banzi announced that the Arduino Foundation would be "a new beginning for Arduino. But a year later, the Foundation still hasn't been established, and the state of the project remains unclear.

The controversy surrounding Musto continued when, in July 2017, he reportedly pulled many Open-source licenses, schematics, and code from the Arduino website, prompting scrutiny and outcry.

In October 2017, Arduino announced its partnership with ARM Holdings (ARM). The announcement said, in part, "ARM recognized independence as a core value of Arduino ... without any lock-in with the ARM architecture." Arduino intends to continue to work with all technology vendors and architectures

2.2 HARDWARE

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in - duino

Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, or ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I^2C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the Lily Pad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino Uno is the Opti boot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable

USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila,[a] Duemilanove,[b] and current Uno[c] provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards.

Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent, but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility

CHAPTER 3

METHODOLOGY

3.1 PRINCIPLE

The Decoder IC, then decodes the serial data to parallel data and transmits the Logic '0' to Arduino. In the Arduino UNO's, it is programmed such that, whenever a Logic '0' is detected by the Arduino, the buzzer is turned on. Hence, whenever the button is pressed, the buzzer is turned on wirelessly.

3.2 DETAILED METHODOLOGY WITH WORKING

STEP 1:

Components Required-

For Transmitter

• 434 MHz RF Transmitter Module

• HT – 12E Encoder IC

• 750 KΩ Resistor

• Push Button

• Power Supply

• Connecting Wires

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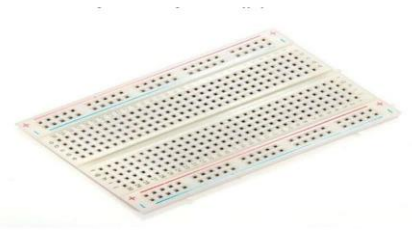
• Prototyping Board (Breadboard)



For Receiver

• Arduino UNO

• 434 MHz RF Receiver Module

• HT – 12D Decoder IC

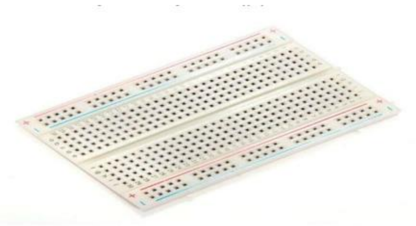
• 33 KΩ Resistor

• Small Buzzer

• Power Supply

• Connecting Wires

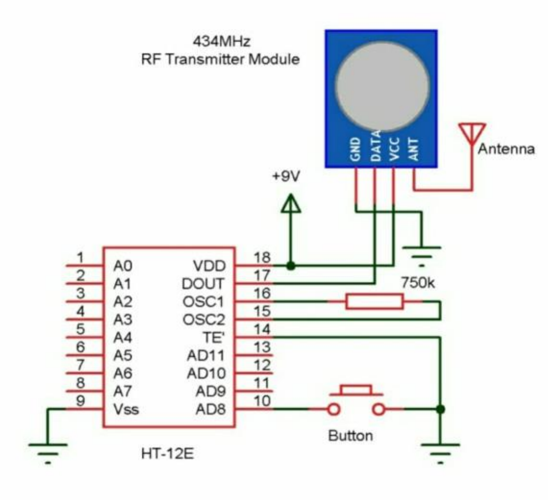
• Prototyping Board (Breadboard)

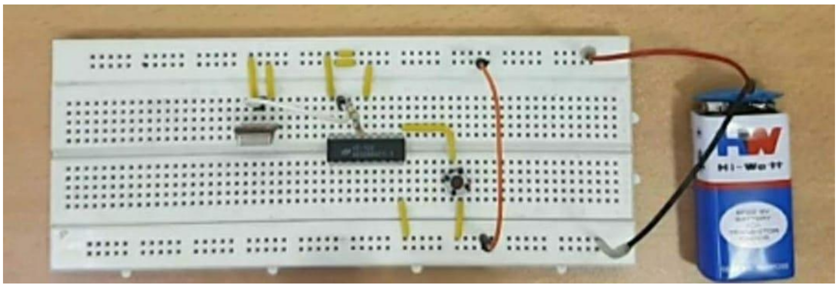


STEP 2:

DESIGN OF TRANSMITTER CIRCUIT-

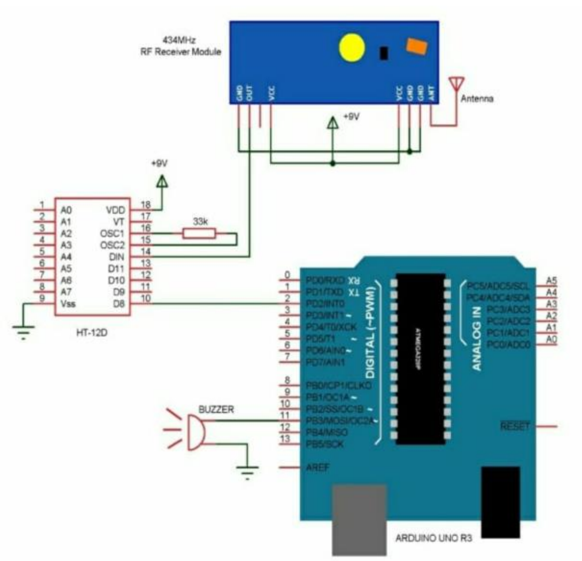
The transmitter consists of a 434 MHz RF Transmitter Module, HT – 12E Encoder IC, 750 KΩ Resistor and a push button. The design of the transmitter circuit is very simple. Pins 18 and 9 are connected to supply and ground terminals respectively. The data out pin (Pin 17) of HT – 12E is connected to data pin of the RF Transmitter Module. A 750 KΩ is connected between the oscillator pins (Pins 15 and 16) of the HT – 12E. The transmission enable pin (Pin 14) is connected to ground. A push button is connected between AD8 (Pin 10) and ground. Other connections are shown in the circuit diagram.

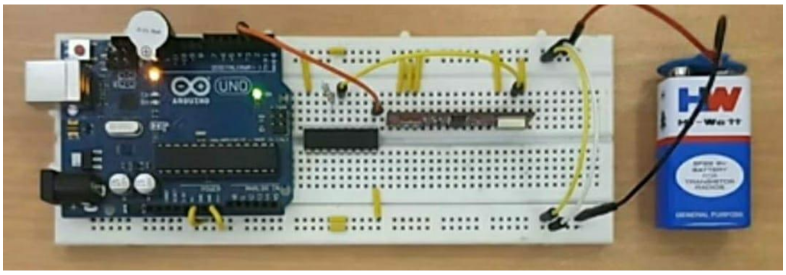




DESIGN OF RECEIVER CIRCUIT-

The receiver part of the project consists of 434 MHz RF Receiver Module, HT – 12D Decoder IC, 33 KΩ Resistor, Arduino UNO and a small buzzer. Pins 18 and 9 i.e., VDD and VSS pins are connected to supply and ground terminals respectively. The data in pin (Pin 14) of the decoder IC is connected to the data pin of the RF Receiver Module. A 33 KΩ Resistor is connected between the oscillator pins (Pins 15 and 16) of the decoder, The D8 pin (Pin 10) is connected to Pin 2 (or any digital I/O pin) of Arduino UNO. A small buzzer is connected between pin 11 of Arduino and ground.





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STEP 3:

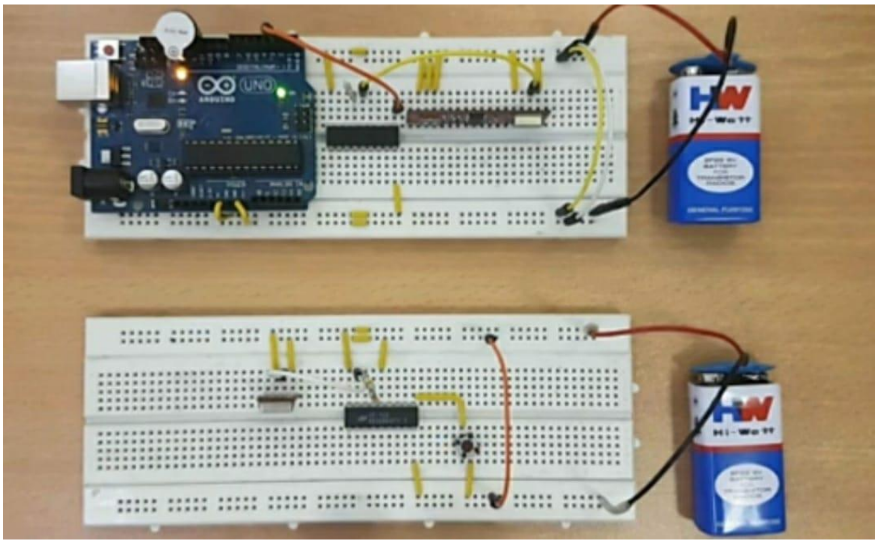
CODE IMPLEMENTATION-

```
int buz=11;
int sen=2;
void setup()
{
pinMode(buz,OUTPUT);
pinMode(sen,INPUT);
digitalWrite(buz,LOW);
digitalWrite(sen,HIGH);
}
void loop()
{
while(digitalread(sen)==HIGH);
digitalWrite(buz,HIGH);
while(digitalread(sen)==low);
digitalwrite(buz,low);
},
```

STEP 4:

FINAL STEP-

After the connections, and uploading the code on the Arduino, the final step of this project is testing the doorbell. When the switch is closed and circuit is completed from the transmitter the buzzer on the receiver circuit makes a sound.



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WORKING

The aim of this project is to design a simple wireless doorbell. The working of the project is explained here. For explaining the working of the project, all the connections are made as per the circuit diagram.

Make sure that the Transmitter Part of the Project is switched on before the Receiver Part. This is to ensure that the RF Transmitter and Receiver Modules are properly paired.

In order to ring the bell (or buzzer in this case), we need to push the button on the transmitter side of the circuit. When the button is pushed on the transmitter side, a logic ‘0’ will be detected by the Encoder IC. The Encoder IC will transmit this data serially through the RF Transmitter Module.

The transmitted data will be received by the RF Receiver Module and is given to the Decoder IC. The Decoder IC, then decodes the serial data to parallel data and transmits the Logic ‘0’ to Arduino.

In the Arduino UNO’s, it is programmed such that, whenever a Logic ‘0’ is detected by the Arduino, the buzzer is turned on. Hence, whenever the button is pressed, the buzzer is turned on wirelessly.

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CHAPTER 4

RESULT ANALYSIS

4.1 RESULT OF THE ENTIRE PROJECT

Here we will be discussing the results of this entire mini project.

Some of the results are:

1. We made the 434MHz RF transmitter circuit using HT12E Encoder IC, 750 KΩ Resistor and a push button.
2. We transferred the code implemented from the laptop to the Arduino uno using USB cable.
3. We made the 434 MHz RF receiver circuit using HT12 Decoder IC, 750 KΩ Register , Arduino uno and a small buzzer.
4. With the help of the circuit diagrams, we joined the above transmitter and the receiver using wires and grounded them where required.
5. After all of the above steps, we obtained the wireless doorbell.

   The results obtained is a very revolutionary product which can reduce any type of internal wiring, can be fixed anywhere and also the detect the presence of a person using ultrasonic sensors.
   This product is easy to install and has a larger coverage area as compared to a conventional wired doorbell.

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CHAPTER 5

CONCLUSION AND FUTURE SCOPE OF WORK

5.1 CONCLUSION

We conclude that when the switch is closed and circuit is completed from the transmitter the buzzer on the receiver circuit makes a sound and this automatic wireless doorbell is used for security purpose. It can be used not only in house hold but also in public places.

5.2 FUTURE SCOPE OF WORK

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. Since the mode of communication is RF, the range is considerably large that other wireless technologies. The project is suitable for homes, shops, garages, hospitals, offices etc.

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REFERENCES

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• https://www.fsstechnologies.com/blog/february-2020/how-do-wireless-doorbells-work#:~:text=Wireless%20doorbell%20systems%20have%20no,waves%20to%20transmit%20the%20signal

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