

USER MANUAL



This guide explains how to set up the JoyPhone and connect it to the desktop application, including instructions for both hardware and software setup.

www.joyphone.org

v1.0 January 2023

Important:

Please make sure whenever you plug in the Arduino or the SD card cable from the PCB to the PC/Laptop the mains 24V adapter must be unplugged i.e. not connected.



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Introduction

The JoyPhone is specifically designed to aid in dementia management by providing a simple and familiar way to access music that taps into long-term memory. Connected to any traditional Singapore rotary telephone, it plays songs based on a user's preferences and childhood memories. Its easy operation makes it a convenient tool for caregivers, and it even includes a reminder function. With our free build and instruction plans, as well as our free 3D print files and software, anyone can create their own personalized JoyPhone, to help improve the quality of life for those living with dementia.

How to set-up the JoyPhone V1.0

Before you can set up your hardware to use, you must have access to the hardware in order to use it. Please follow the steps below:

1. Order the fabricated PCB
2. Arrange the Components
3. Stuff the Components on the PCB
4. Phase 2: Set-Up the Software
5. Phase 3: Enclosure print and assembling
6. Interface the Hardware and Software



Phase 1: Hardware Setup

To begin the hardware setup, the first step is to obtain the fabricated PCB. Our engineers have designed the PCB and have provided you with the necessary files, known as "Gerber Files." These files can be sent to various vendors who specialize in fabricating PCBs from digital files. You can find the link to download the Gerber files [here](#).

Order the PCB for Fabrication

Once you have downloaded the file, provide it to any manufacturer of your choice, we got our services from JLCPCB. The minimum order quantity they manufacture is 5 for any PCB. Figure 1 shows the list of files that you should have once you download the Gerber Files from the link provided.

Name	Date modified
Drill_NPTH_Through.DRL	9/6/2022 8:39 AM
Drill_PTH_Through.DRL	9/6/2022 8:39 AM
Gerber_BoardOutlineLayer.GKO	9/6/2022 8:39 AM
Gerber_BottomLayer.GBL	9/6/2022 8:39 AM
Gerber_BottomSilkscreenLayer.GBO	9/6/2022 8:39 AM
Gerber_BottomSolderMaskLayer.GBS	9/6/2022 8:39 AM
Gerber_TopLayer.GTL	9/6/2022 8:39 AM
Gerber_TopSilkscreenLayer.GTO	9/6/2022 8:39 AM
Gerber_TopSolderMaskLayer.GTS	9/6/2022 8:39 AM

Figure 1: Files in the Gerber Design folder

After receiving the fabricated PCB from the manufacturer, it should resemble the one shown in Figure 2. Note that the color of the PCB can be chosen to suit your preference and it may vary from the image.

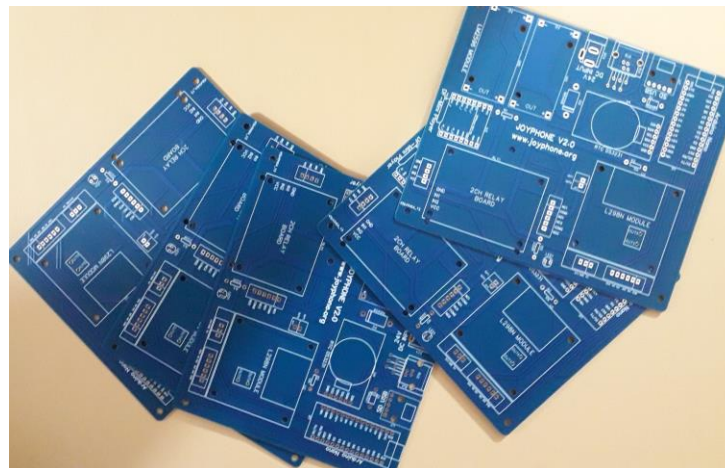









Figure 2: Fabricated PCB



Arrange the Components


Now, you have the fabricated PCBs in your hand, the next step is to arrange the components that need to be stuffed on the PCB. Below is a list of all the required components for a single PCB board:

S.No	Component Name	Component Image	Required Quantity
1	Arduino Nano with programming cable		01
2	L298 Driver		01
3	DFMini Player		01
4	Micro SD Card (2 GB memory)		01
5	DC Jack 2.1mm		01
6	LM2596 Buck Regulator Module		02
7	2 Channel Relay Module		01



8	RTC Module DS3231 with Cell		01
9	Telephone Jack RJ-11		01
10	Micro USB Adapter Module		01
11	Molex Connector 2 Pins with straight base		01
12	Creamshell Connector 3 Pins		01
13	Creamshell Connector 6 Pins		01
14	Red LED 3mm		01
15	Resistor 220 Ohms		01
16	Resistor 1 KOhms		01
17	Resistor 10 KOhms		01
18	Diode 1N5408		01



19	Dupont Wires Male to Female		01 set <i>(includes 40 wires)</i>
20	M3 Screws 0.5 inches		05
21	Micro USB Cable		01
22	24V DC ADapter (Minimum 2A)		01
23	Female Headers 40 pin Row		03



Assembling Components on the PCB

With the fabricated PCB and necessary components in hand, you are now ready to assemble them. Before starting the assembly process, ensure that you have the following tools available:

1. Soldering Iron
2. Soldering Wire (70/30 recommended)
3. Solder Paste
4. Soldering Iron Cleaner Foam
5. Cutter Plier / Wire Stripper
6. Screw Driver
7. Digital Multimeter

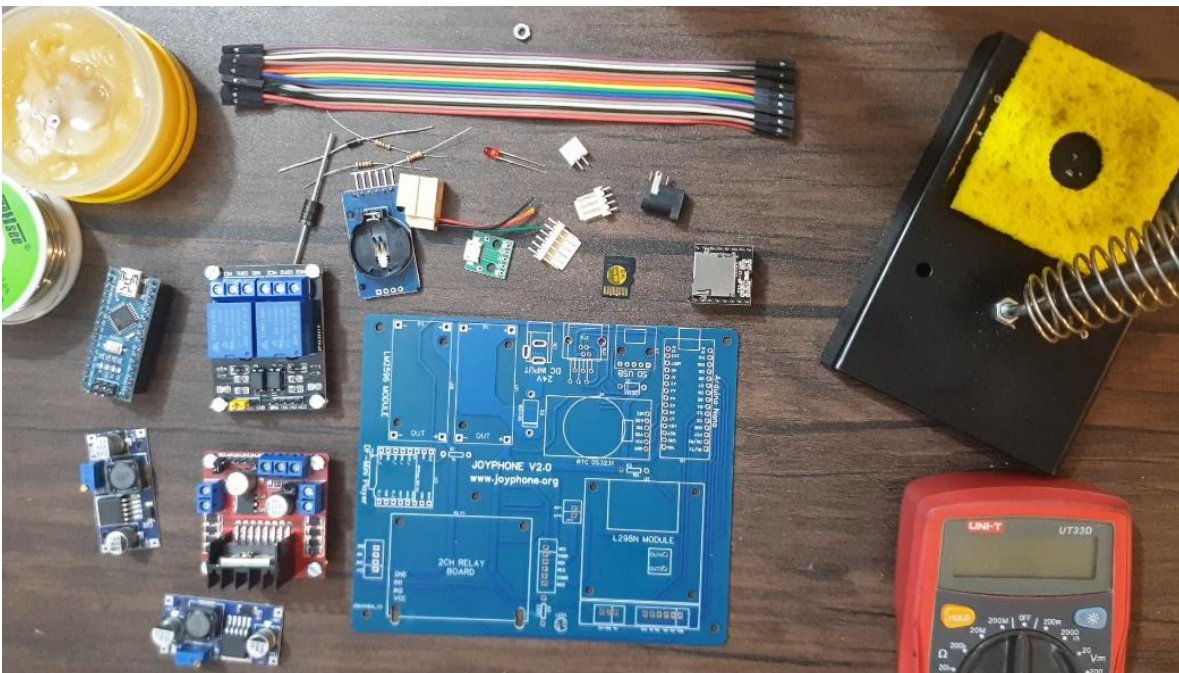


Figure 3: Stuffing setup for JoyPhone PCB

Refer to Figure 3 for an example of a proper setup for assembling the components onto the PCB. We suggest starting with soldering the smaller components first, as they can be more delicate. Then proceed to install larger components such as modules (RTC, DFMiniPlayer, L298 Module, and Arduino Nano). The PCB has markers to indicate the correct location for each component. For a detailed video tutorial on soldering the components, visit the link provided here: [Part 1](#), [Part 2](#), [Part 3](#) (youtube).



Phase 2: Set-Up the Software

With the hardware assembly complete, the next step is to download and set up the necessary software. The software can be found at the link provided [here](#). Once downloaded, ensure that the files match those shown in Figure 4. Please note that this application is compatible with Windows operating systems only.

icuin52.dll	13/09/2014 6:04 am	Application exten...	1,757 KB
icuuc52.dll	13/09/2014 6:04 am	Application exten...	1,274 KB
JoyPhoneV1.0.exe	16/01/2023 3:19 pm	Application	200 KB
libGLESv2.dll	13/09/2014 6:04 am	Application exten...	751 KB
msvcp100.dll	20/02/2011 10:51 pm	Application exten...	594 KB
msvcr100.dll	20/02/2011 12:52 am	Application exten...	810 KB
Qt5Core.dll	13/09/2014 6:04 am	Application exten...	4,016 KB

Figure 4: JoyPhone Application

Executing the Desktop Application

The JoyPhone V1.0 application allows you to perform the following tasks:

1. Storing audio files on the SD Card
2. Setting the system time on the JoyPhone hardware
3. Setting reminders (alarms) for four different times throughout the week.

To access the application, double-click on the “JoyPhoneV1.0” file. The interface should appear as shown in Figure 5. Ensure that the system time on the application window matches the current time on your PC, indicating that the software has been successfully downloaded and is running without any issues.

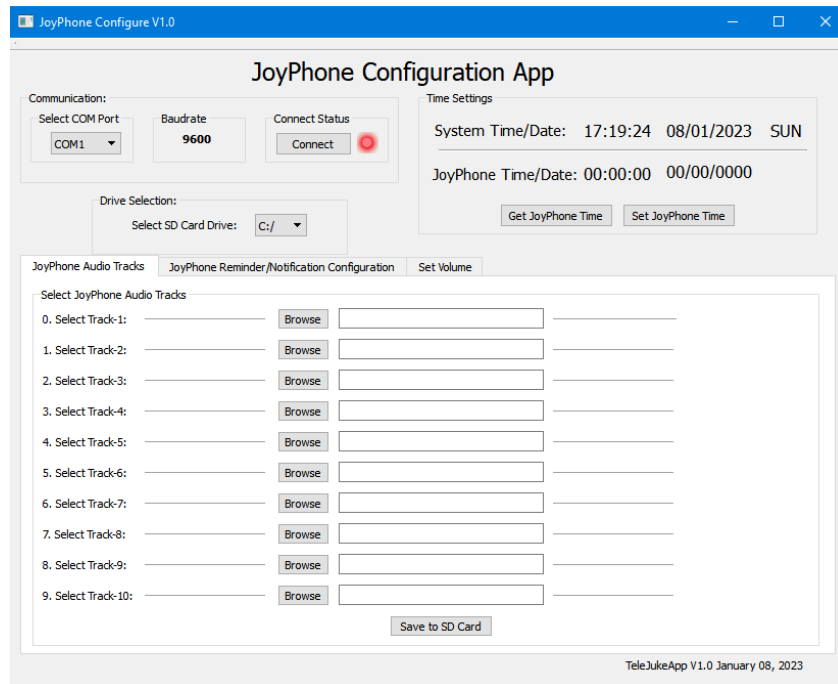


Figure 5: JoyPhone V1.0 application window

Programming the Arduino

To program the microcontroller, connect the Arduino on the PCB board to your PC with the help of Arduino cable as shown in figure 6.

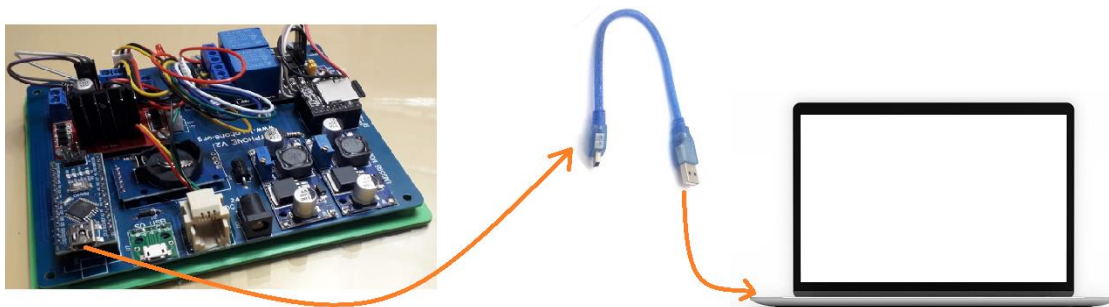


Figure 6: Connecting method of Arduino with PC for programming

After connecting the Arduino to your PC, open the Arduino IDE. If you do not have the IDE installed, please download it from the link provided [here](#). Then, download the code for the Arduino Nano from the link provided [here](#), and the files should appear as shown in Figure 7.



bellRing.ino	12/9/2022 3:08 AM
checkAlarm.ino	12/9/2022 3:21 AM
Dialler_Ringer.ino	1/2/2023 9:58 PM
EEPROMRoutine.ino	12/9/2022 2:55 AM
initializeOs.h	12/7/2022 10:02 PM
JoyPhone_V1.0.ino	1/2/2023 5:57 PM
myRtc.h	6/25/2022 6:05 PM
serialRoutine.h	12/7/2022 9:57 PM
speakerPlay.ino	12/6/2022 9:59 PM

Figure 7: Files for Arduino Program (Folder Name: JoyPhone_V1.0)

Double click and open the file with the name “JoyPhone_V1.0”, after which the Arduino IDE will open the code. In the Arduino IDE, go to Tools > Board > Arduino AVR Boards > Arduino Nano. This is shown in figure 8.

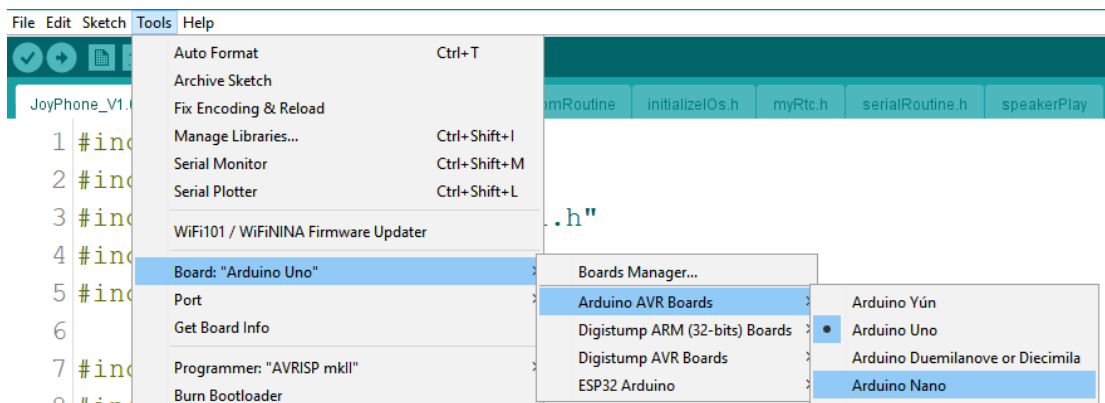


Figure 8: Selecting the Arduino Nano board

Now, go to the device manager on your PC/Laptop and look for the COM port of the Arduino Nano. As you can see in figure 9 it shows up with the name “USB-SERIAL CH340” and the COM port is COM7.

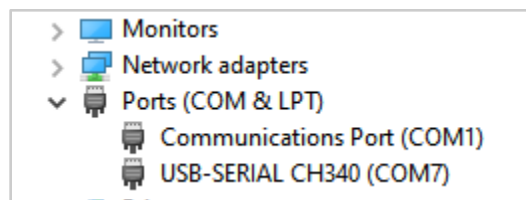


Figure 9: COM Port for Arduino Nano

Once you have located the COM port for your Arduino in the Device Manager, go to the ports menu in the Arduino IDE and select the Arduino Nano COM port from the list. In most cases, the IDE will detect the COM port automatically. In our example, the selected COM port is COM7, as shown in Figure 10.

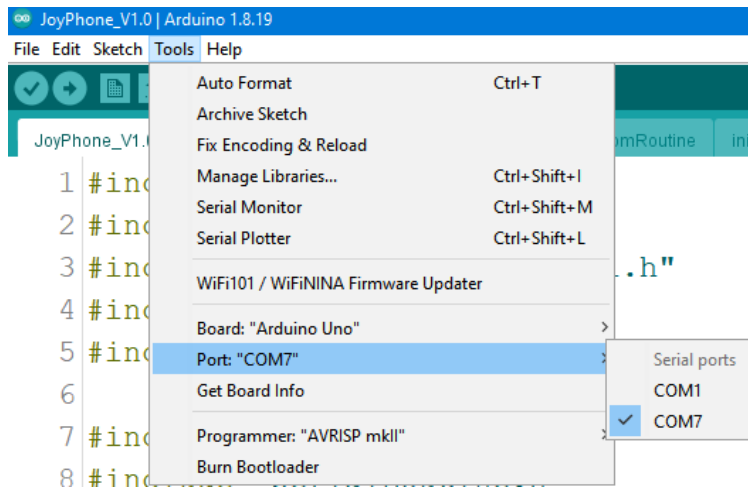


Figure 10: COM port selection

Now you are ready to upload the program on the Arduino Nano microcontroller. Click on the Right Arrow button on the Arduino IDE to upload the program on to the Arduino Nano (figure 11).

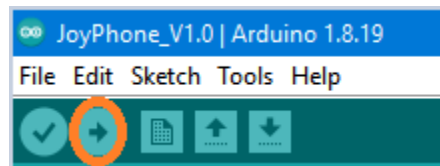


Figure 11: Upload button for Arduino

Install the SD Card

After you upload the program to Arduino, make sure to install the micro SD card in the DF Mini player module.

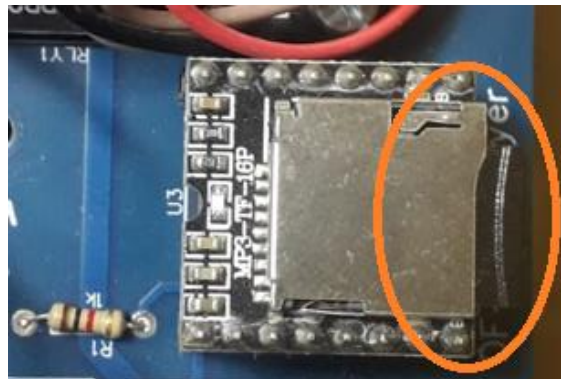


Figure 12: SD Card Installed in DFMini Player



Set the Real Time Clock (RTC) Time on JoyPhone

Open the desktop application, and under the "Select COM port" option, choose the COM port that corresponds to your device. In this example, it is set to COM 7. Once the appropriate COM port is selected, click the "Connect" button. The red light should turn green, as shown in Figure 13.

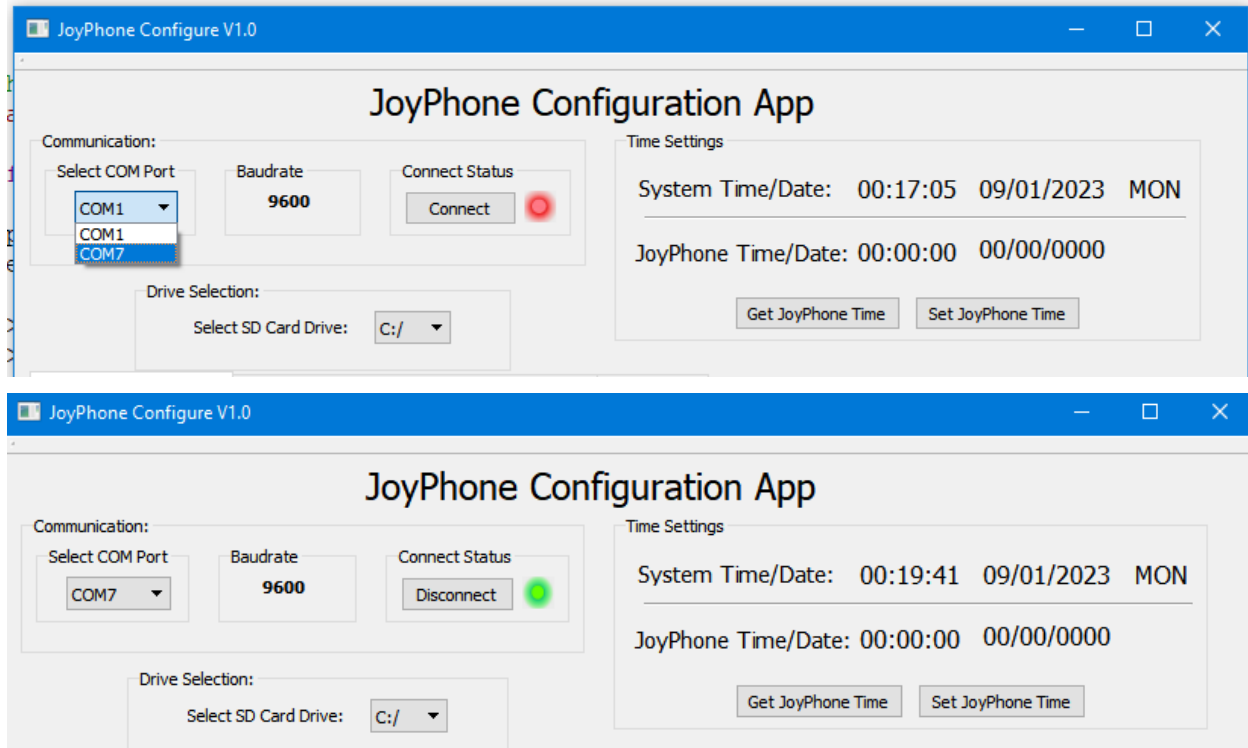


Figure 13: Selection of COM port and clicking on Connect Button

In Figure 14, under the "Time Settings" section, you will see two fields. The "System Time/Date" field displays the current time on your PC, while the "JoyPhone Time/Date" field is currently blank as the time has not been set yet.

To set the time on the JoyPhone, click the "Set JoyPhone Time" button. If the process is successful, a tick mark will appear next to the button. If the tick mark doesn't appear, check your connections and try again.

To confirm the time on the JoyPhone, click the "Get JoyPhone Time" button. The current time set on the device should be displayed.

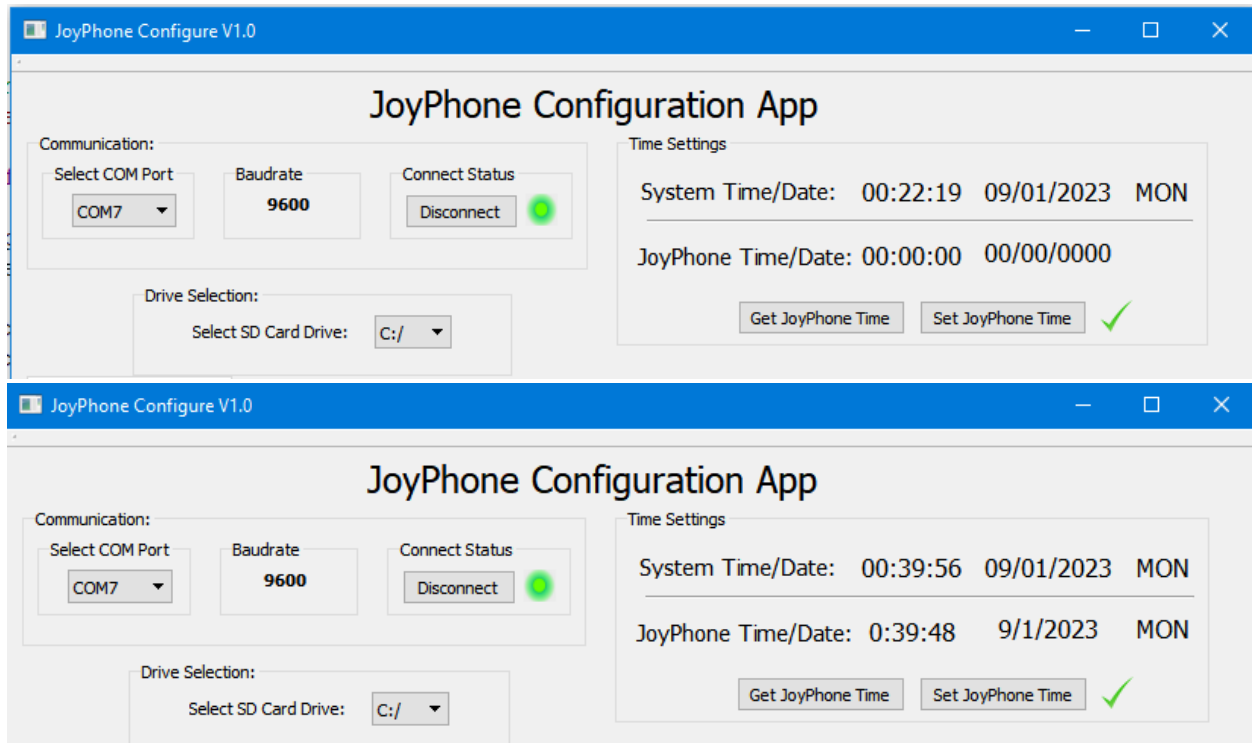


Figure 14: Setting and checking the time on JoyPhone System

Phase 3: Enclosure 3D Print and Assembling

With the electronic components assembled on the PCB, the next step is to download the 3D printing files from the link provided [here](#), and have it printed to enclose all the electronics for protection. *Before placing the PCB inside the 3D printed enclosure, make sure to program the Arduino microcontroller as it can only be accessed when the PCB is outside of the enclosure.* Figure 15 shows the design of the enclosure and Figure 16 illustrates the PCB assembled within the printed enclosure. To ensure the longevity of the enclosure, we recommend using *PLA material* for printing it.

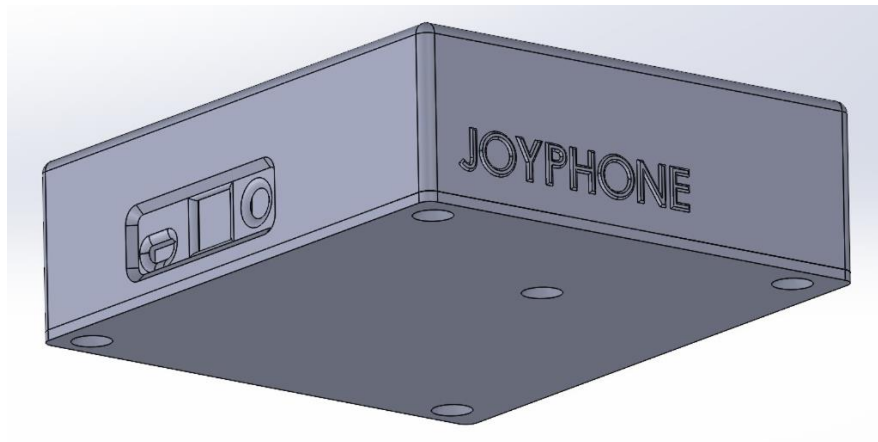


Figure 15: 3D design of the enclosure

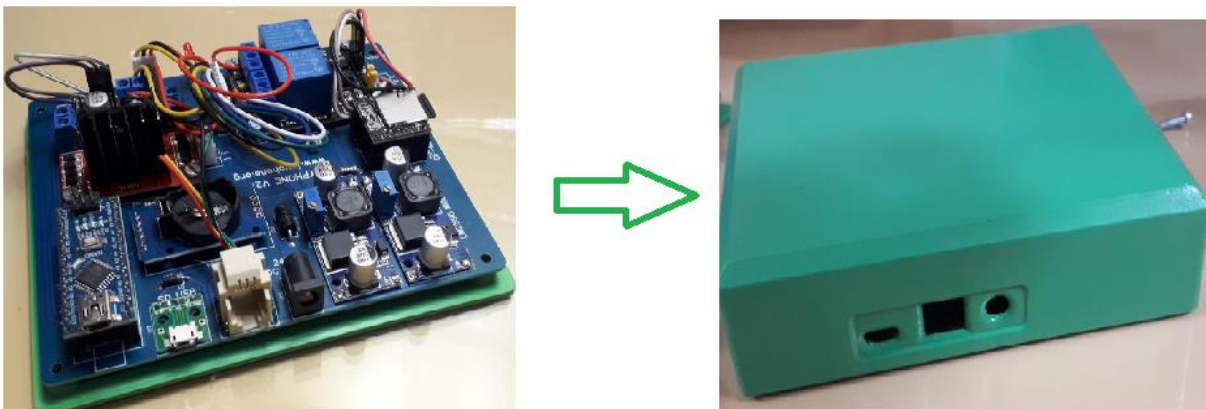


Figure 16: Assembling the PCB inside the enclosure



What Can You Do with JoyPhone V1.0?

As discussed earlier, below are the mentioned two operations that you can do using the JoyPhone V1.0.

1. Play Audio Files

The JoyPhone system allows you to play up to 10 audio files by dialing a specific number on an antique rotary telephone set, as shown in Figure 17. After the audio files have been saved on the SD card, dialing a number from 0 to 9 on the rotary telephone will play the corresponding track on the receiver. This feature is only compatible with rotary telephone sets, not touch-tone phones.



Figure 17: Antique Telephone set

2. Reminder Feature (Alarms)

The JoyPhone V1.0 allows you to set up to four alarms per week. These alarms can be set for a fixed time, seven days a week. When an alarm/reminder event is triggered, the telephone will ring, and when the receiver is picked up, it will play the specified audio file for that particular reminder time. The reminder/alarm will ring for a total of 1 minute when triggered.



How to Operate the JoyPhone?

With the hardware and software set up successfully, you are now ready to connect them together. You can use the JoyPhone to play audio files based on the dialed number on the rotary telephone or set reminders to ring and play a specific audio file. This section of the manual covers the operational methods for both scenarios. It begins by explaining how to use the JoyPhone in dialer mode, and then provides instructions on how to set reminders.

How to Play Audio Files

Step 1: Connect the JoyPhone with Micro USB Cable

Go to the link [here](#), and download the folder with the name “06”. This folder contains the audio file for the dial tone. Connect the JoyPhone V1.0 with the micro USB cable to your PC/Laptop as shown in figure 18.



Figure 18: Connection of Micro USB cable with PC

Step 2: Locate your SD Card

Go to “My Computer” or “This PC” in our windows file explorer on Windows Operating System and you should see the SD Card or Memory storage. In our case at the time of creating this document it can be seen as “**USB Drive**” with the drive letter as “**L**” ; figure 19.



Figure 19: Locate the SD Card Drive and letter.



The first and most important thing is to copy the folder “06” to the SD Card on the root location. So, the location will be “L:\06” where the drive letter “L” can be any letter in your case. Once again, this folder contains the audio file for the dial tone.

Step 3: Select the Drive Letter on Application

Now open the “Joy Phone Configurator App” and select the SD Card drive letter under the “Drive Selection” section. Figure 20 shows the selection of letter drive “L” in our case.

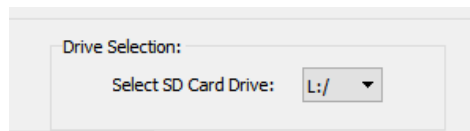


Figure 20: Selection of drive letter on the application

Step 4: Store the 10 Tracks on SD Card

Next, navigate to the "JoyPhone Audio Tracks" tab, and select the 10 tracks of your choice that you want the JoyPhone to play. The serial numbers are indexed from 0 to 9, corresponding to the respective number dialed on the telephone set.

Use the "Browse" button to select each track, and once all tracks are selected, click the "Save to SD Card" button. This process may take some time to complete.

Once the audio files have been saved on the SD card, a message stating "Process Completed" will appear, and a tick mark will appear next to each saved track indicating that the audio files have been saved on the SD card.

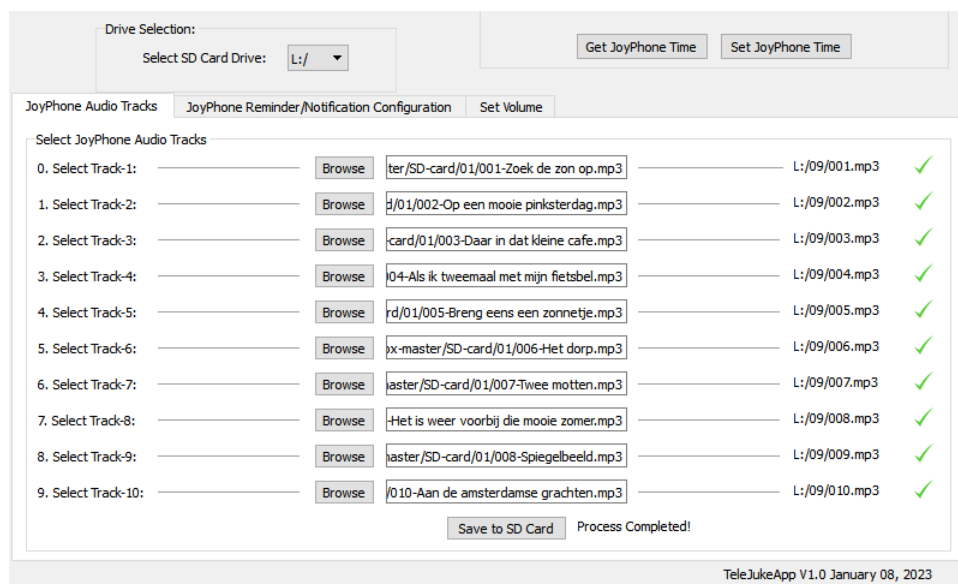


Figure 21: Acknowledgment of the SD card audio files



Step 5: Verify the SD Card Audio Files (Optional)

To verify the process, go to Windows explorer, locate your SD card and you should see a folder created with number “09”, and contains the file with names 001 to 010 indicating the 10 tracks that you just saved. Refer to Figure 22.

Name	Date modified	Type	Size
001.mp3	8/31/2021 2:28 PM	MP3 File	2,336 KB
002.mp3	8/31/2021 2:28 PM	MP3 File	1,792 KB
003.mp3	8/31/2021 2:28 PM	MP3 File	3,503 KB
004.mp3	8/31/2021 2:28 PM	MP3 File	3,914 KB
005.mp3	8/31/2021 2:28 PM	MP3 File	2,989 KB
006.mp3	8/31/2021 2:28 PM	MP3 File	4,654 KB
007.mp3	8/31/2021 2:28 PM	MP3 File	2,133 KB
008.mp3	8/31/2021 2:28 PM	MP3 File	4,206 KB
009.mp3	8/31/2021 2:28 PM	MP3 File	2,282 KB
010.mp3	8/31/2021 2:28 PM	MP3 File	2,472 KB

Figure 22: Windows explorer access to SD card audio files for verification

Note: The application renames the track to index number so don't worry about the content of the files. Whenever you want to replace any file, delete the previous folder i.e. 09 and then restart the process. Or you can also directly save the audio files with the relevant index number (001 to 010) and save it directly from the windows explorer.



How to Set a Reminder (Alarms)?

Step 1: Connection of JoyPhone with PC

In order to set the alarm on the JoyPhone, the first thing you need to ensure is that the PCB is not mounted in the enclosure. Setting the reminder requires using both the Arduino and the micro usb cable at the same time.

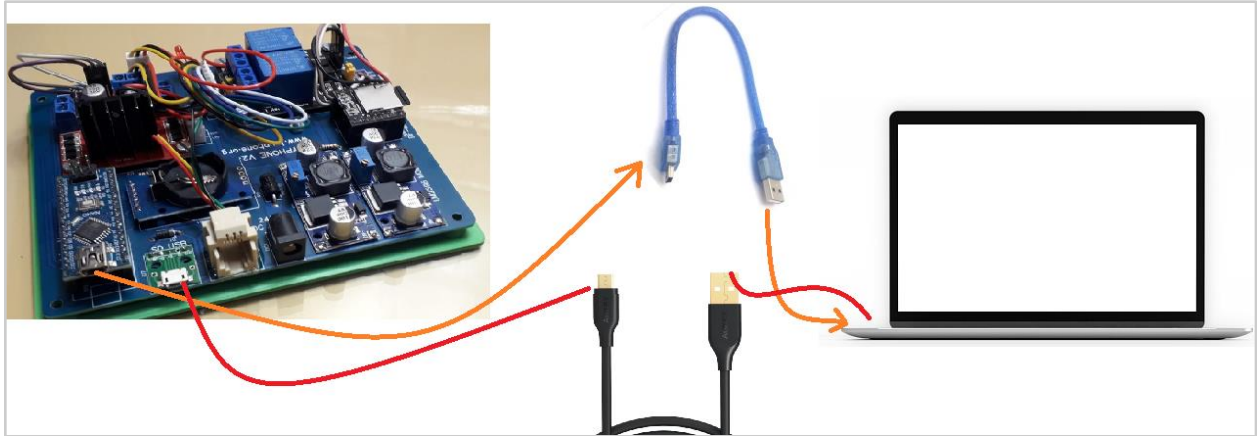


Figure 23: Connection of both Arduino and SD Card

Step 2: Settings on JoyPhone Configurator App

Open the JoyPhone configurator app and go to the “JoyPhone Reminder/Notification Configuration” tab. You can see options to set up 4 reminders on the JoyPhone. For setting each reminder the steps are the same.

1. Set the time for the reminder you want it to trigger.
2. Select the days you want the reminder to trigger. Check the mark on the check box for the days you are interested in.
3. Select the track you want to play when the user picks the receiver set on reminder triggered.
4. Click on the Set Reminder 1 button to set the reminder.
5. This will save the audio file on the SD card and set the reminder settings on the controller. A check mark will appear indicating that the reminder is set successfully (figure 24).
6. Repeat the same process for other reminders you wish to set.

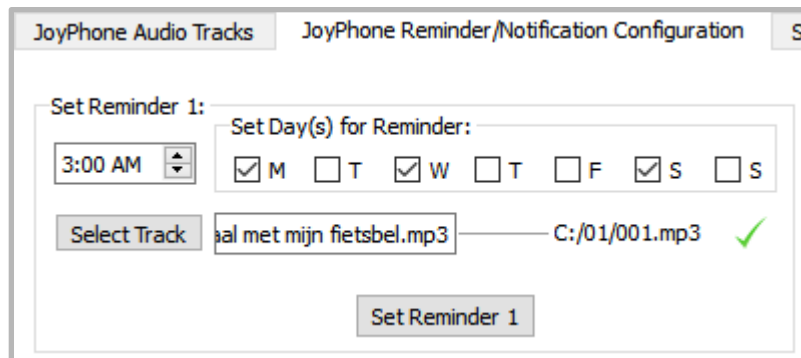


Figure 24: Reminder notification set with success.

Step 3: Reset the System

After setting the reminders on the system, disconnect the USB cables and connect the DC 24V adapter to the system. This will allow the controller to retain the set reminder schedule and ring at the designated time.

Step 4: Reminder Trigger

When the set time for a reminder is reached on the JoyPhone, the reminder will trigger. This will cause the telephone to ring. There are two scenarios for the ringing of the bell:

1. User Picks Up the Receiver Set

In this case, the ringing of the telephone will be stopped and the specified track for this particular reminder will be played.

2. User Does not Picks Up the Receiver Set

The bell will ring continuously for a period of 1 minute and will not stop until a user intervenes. If the 1-minute time frame lapses, the bell will stop ringing, and the audio file will not be played if the phone is picked up after the 1-minute time frame.