“Tech-Tex-Tunes”

A Project Report Submitted To

UKA TARSADIA UNIVERSITY

In Partial Fulfilment of the Requirements for the Degree Of

Bachelor of Technology
In
Information and Communication Technology

By

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CERTIFICATE

This is to certify that work embodied in this project entitled **"Tech Tex Tunes"** was carried out by **"Alam Sameer Jahangir"** (202203103520068), **"Dwivedi Vaibhavi Chandramani"** (202203103520157), at **C.G.P.I.T.** for the partial fulfilment of **B. Tech. Information and Communication Technology** degree to be awarded by UKA TARSADIA UNIVERSITY. This work has been carried out under my supervision and is to my satisfaction.

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ACKNOWLEDGMENT

We would like to express our sincere gratitude to everyone who contributed to the development and successful completion of Tech-Tex-Tunes project.

However, it would not has been possible without the kid support and help of many individuals. We are convey to thank our project guide **Dr.Mayank R.Kapadia**, department of Electronics & Communication Engineering, CGPIT for providing encouragement, constant support and guidance which was of a great help to complete this project successfully. We are grateful to **Dr.Mayank R.Kapadia,** Head of the EC/ICT Department, CGPIT for giving us the support that was necessary for the completion of this project.

Furthermore, we would like to acknowledge the support and collaboration of our partners and vendors who provided essential resources and technology to enhance our project's capability.

Lastly, I appreciate the efforts of my teammates and collaborators, whose dedication, teamwork, and innovative ideas made this project a reality. Together, we transformed our vision into a tangible and meaningful result.

This project would not have been possible without the collective effort of all the individuals and institutions mentioned above. Thank you for your invaluable support and inspiration.

Alam Sameer Jahangir
Dwivedi Vaibhavi Chandramani

ABSTRACT

The "Crafting Intangibles" project explores the innovative fusion of traditional textile art with modern electronic technology to create an interactive experience that engages multiple senses. This project features a touch-sensitive fabric that responds to user interaction by playing specific bird sounds, offering an immersive and educational encounter. Using capacitive touch sensors integrated seamlessly into the fabric, a microcontroller processes these inputs to trigger corresponding audio outputs, which are played through an embedded sound system. The primary objective is to provide a unique, multisensory experience that enhances user engagement, promotes environmental awareness, and offers educational insights into various bird species. The project also serves as a platform for exploring the potential of integrating digital and physical media in artistic and educational contexts. While offering numerous benefits, including innovative design and interactive learning, the project also addresses challenges related to the complexity of setup, cost, and maintenance. This interactive textile installation not only provides aesthetic and sensory appeal but also serves as a compelling example of how traditional craftsmanship can be reimagined through technology.

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1 Introduction of Tech-Tex-Tunes

1.1 Introduction

In today’s technological era, integrating traditional industries with modern advancements opens up new avenues for innovation and creativity. Surat, known as the textile hub of India, boasts a rich legacy of textile production, while Gujarat is emerging as a prominent player in the semiconductor industry. Inspired by this synergy, we have undertaken a project that merges these two domains—textile and electronics—to create an interactive experience.

This project focuses on developing a smart textile system where conductive fabrics are embedded with electronics to trigger bird sounds upon touch. By embedding touch-sensitive conductive threads into the fabric and interfacing them with a microcontroller and an audio playback module, we aim to bridge the gap between art, technology, and textiles. The result is a unique, interactive product that not only enhances user engagement but also demonstrates the potential of combining traditional textile methods with cutting-edge electronic innovation.

This project not only has applications in decorative and experiential installations but also paves the way for further exploration into smart textiles and wearable technologies. Through this initiative, we aim to showcase the harmonious coexistence of heritage industries like textiles and emerging fields like electronics, highlighting Gujarat's potential as a state driving forward both sectors.

The "Tech-Tex-Tunes" project is an innovative intersection of traditional craftsmanship and modern technology. It features an interactive textile system that responds to human touch by playing specific bird sounds. This engaging installation allows users to experience a sensory blend of tactile and auditory feedback, creating an immersive environment that bridges art, technology, and nature.

Figure 1.1: Fabric Frame

Figure 1.2: Fabric with specific bird sound

1.2 Key Features

1. **Interactive Fabric**:
   The fabric incorporates touch sensors that detect specific touch points. These sensors are seamlessly integrated into the textile, maintaining the fabric's aesthetic and tactile qualities.

2. **Sound Output**:
   Each touch point on the fabric is programmed to produce a unique bird sound. This system is designed to be intuitive and responsive, providing immediate auditory feedback upon touch.

3. **Technological Integration**:
   The project uses a microcontroller to process inputs from the touch sensors and control the audio output. The audio system includes a Digital-to-Analog Converter (DAC) and speakers to play high-quality bird sounds.

4. **Artistic and Educational Value**:
   The project serves both as an artistic installation and an educational tool. It allows users to explore and learn about different bird sounds in an engaging, interactive manner.

1.3 Motivation

The " Tech-Tex-Tunes" interactive textile project was born from a desire to blend traditional craftsmanship with modern technology in a way that engages the senses and sparks curiosity. The primary motivation behind this project is to explore the intersection of art, nature, and technology, creating a unique medium for expression and education.

Surat, known as the "Silk City" of India, is a hub for textile industries. As Gujarat emerges as a key player in the semiconductor and technology sectors, there is a growing opportunity to explore how these advancements can be applied across different industries.

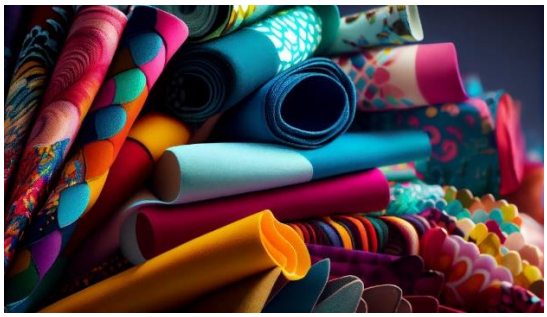


Figure 1.3: Fabric hub

The "Tech-Tex-Tunes" project is motivated by the desire to blend the rich textile heritage of Surat with the technological advancements occurring in Gujarat. By doing so, we aim to create a unique product that not only celebrates the best of both worlds but also sets the stage for future innovations in the field.

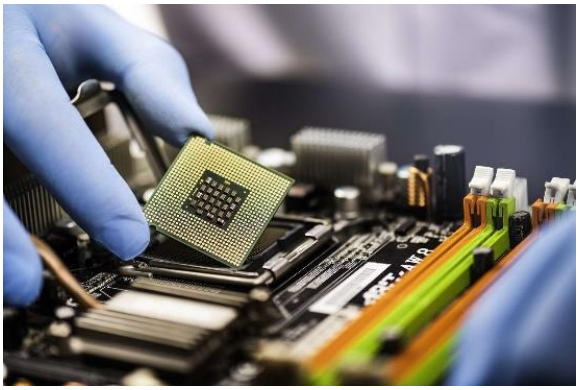


Figure 1.4: Semiconductor chip

The "Tech-Tex-Tunes" interactive textile project was born from a desire to blend traditional craftsmanship with modern technology in a way that engages the senses and sparks curiosity. The primary motivation behind this project is to explore the intersection of art, nature, and technology, creating a unique medium for expression and education.

1. **Bridging the Gap Between Art and Technology:**

   In today's digital age, there's a growing interest in combining traditional art forms with modern technology. This project seeks to honor the rich history of textile art while leveraging advanced technology to create something new and interactive. By embedding sensors and electronic components within the fabric, we aim to transform a static piece of art into a dynamic and engaging experience.

2. **Creating a Multisensory Experience:**

   Humans interact with the world through multiple senses, and this project aims to engage both touch and hearing. The tactile nature of the fabric, combined with the auditory response of bird sounds, creates a multisensory experience that is both enjoyable and educational. This approach enhances user engagement, making the learning process more immersive and memorable.

3. **Promoting Environmental Awareness:**

   Bird songs are a beautiful aspect of nature that many people take for granted. By incorporating bird sounds into the interactive textile, we hope to raise awareness about different bird species and the importance of preserving their habitats. This project serves as a reminder of the natural beauty around us and encourages people to pay more attention to the environment.

4. **Fostering Interactive Learning:**

   Traditional educational methods can sometimes be dry and disengaging. This project aims to make learning about bird species and their sounds fun and interactive. By allowing users to explore and discover different bird calls through touch, we provide a hands-on learning experience that can be particularly beneficial for children and those who learn best through interactive activities.

5. **Innovation in Design and Interior Decoration:**

   The project also explores new possibilities in design and interior decoration. By integrating technology into fabric, we create a functional piece of decor that doubles as an interactive exhibit. This innovation opens up new avenues for interior design, where functionality and aesthetics can be seamlessly combined.

1.4 Objective

The primary objective of the "Tech-Tex-Tunes" interactive textile project is to create an innovative, multisensory experience that blends traditional textile craftsmanship with modern technological advancements. This project aims to achieve the following specific objectives:

1. **Integrate Touch-Responsive Technology into Textiles:**

   To develop and integrate touch-sensitive sensors within fabric, enabling the textile to detect and respond to user interactions by playing specific bird sounds.

2. **Enhance User Experience through Multisensory Interaction:**

   To provide a unique and immersive experience by combining tactile feedback with auditory responses, thereby engaging multiple senses and creating a memorable experience for users.

3. **Promote Environmental and Educational Awareness:**

   To educate users about various bird species and their calls through an engaging, interactive medium, thereby raising awareness about biodiversity and the importance of conserving natural habitats.

4. **Explore New Avenues in Artistic and Technological Integration:**

   To push the boundaries of traditional textile art by incorporating modern technology, thus creating a novel art form that bridges the gap between traditional and digital media.

5. **Innovate in Design and Interior Decoration:**

   To create aesthetically pleasing and functional interactive textiles that can be used as decorative elements in various settings, such as museums, galleries, public spaces, and homes.

6. **Facilitate Interactive Learning and Engagement:**

   To design an interactive learning tool that is particularly effective for children and those who benefit from hands-on educational experiences, thereby making learning about nature and technology more engaging and accessible.

1.5 Application

Art Installations:
Can be used in museums, galleries, and public spaces to create immersive, interactive experiences.

Figure 1.5: Art Installation

Educational Tools:
Useful in teaching about bird species and their calls in an engaging way.

Figure 1.6: Educational tools

Home Decor:
Can be integrated into home interiors as an interactive piece of decor.

Figure 1.7: Home Decor

1.6 Summary

In summary, the "Tech-Tex-Tunes" project is motivated by a desire to innovate at the intersection of art, technology, and nature. It seeks to create a unique, engaging, and educational experience that fosters appreciation for both traditional craftsmanship and the natural world.

By achieving these objectives, the "Tech-Tex-Tunes" project aims to create a meaningful and impactful experience that not only entertains and educates but also fosters a deeper appreciation for the natural world and the innovative potential of combining art with technology.

2 Technology & Tools

2.1 Hardware

2.1.1 ESP32 Microcontroller

A powerful, low-power microcontroller with built-in Wi-Fi and Bluetooth capabilities, used for controlling the system and managing touch inputs.

ESP32 is a series of low-cost, low-power system-on-chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth.

Commonly found either on device specific PCBs or on a range of development boards with GPIO pins and various connectors depending on the model and manufacturer of the board.

ESP32 is created and developed by Espressif Systems, a Chinese company based in Shanghai, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

Features of the ESP32 include the following

1. Processors:
    - CPU: Xtensa dual-core (or single-core) 32-bit LX6 microprocessor, operating at 160 or 240 MHz and performing at up to 600 DMIPS
    - Ultra low power (ULP) co-processor

2. Memory: 520 KiB RAM, 448 KiB ROM
3. Wireless connectivity:
    - Wi-Fi: 802.11 b/g/n
    - Bluetooth: v4.2 BR/EDR and BLE (shares the radio with Wi-Fi)

The specs listed below belong to the ESP32 WROOM 32 variant.−

- Integrated Crystal− 40 MHz
- Module Interfaces− UART, SPI, I2C, PWM, ADC, DAC, GPIO, pulse counter, capacitive touch sensor
- Integrated SPI flash− 4 MB
- ROM− 448 KB (for booting and core functions)
- SRAM− 520 KB
- Integrated Connectivity Protocols− WiFi, Bluetooth, BLE
- On−chip sensor− Hall sensor
- Operating temperature range− −40 − 85 degrees Celsius
- Operating Voltage− 3.3V
- Operating Current− 80 mA (average)

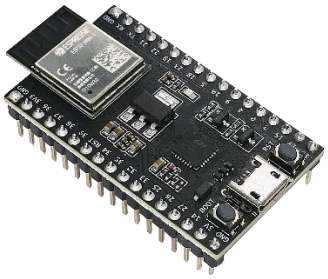


Figure 2.1: ESP32 Microcontroller

2.1.2 DFPlayer Mini MP3 Module

A compact MP3 player module used for playing pre-recorded bird sounds stored on an SD card.

DFPlayer Mini supports a maximum sampling rate of 48kHz and 24-bit DAC output, ensuring high-quality audio playback. The module seamlessly integrates hardware decoding for MP3, WAV, and WMA formats, and is also capable of supporting a maximum of 32GB TF card storage with FAT16 and FAT32 file systems through software.

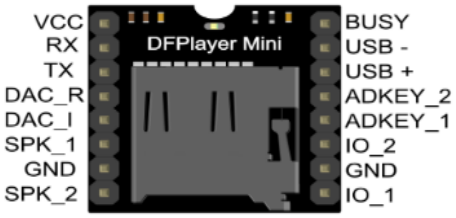


Figure 2.2: DF player Mp3 module

2.1.3 Conductive Thread

Special thread with electrical conductivity, used to create touch-sensitive areas on the fabric. Conductive thread is a fiber that conducts electricity. Because it is thin and flexible, like ordinary thread, conductive thread traces can take many shapes and connect to a variety of conductive materials and components. Conductive thread is particularly useful for creating sewn circuits (also known as soft circuits or e-textiles) in applications that combine circuitry and textiles with the use of a needle.

Conductive thread to enable the seamless integration of electronics into fabrics. Conductive thread, which is made of materials that allow the flow of electricity, served as a vital element in connecting various components without the need for traditional wiring. Its flexibility and durability made it ideal for embedding circuits directly into textiles, ensuring a lightweight and aesthetically pleasing design.

By using conductive thread, we were able to create an innovative and functional setup where electrical signals could travel through the fabric itself. This approach not only simplified the overall design but also opened possibilities for creating wearable or fabric-integrated electronics. The use of conductive thread showcases the potential for merging technology with traditional crafts, pushing the boundaries of creativity and practicality.

Figure 2.3: Conductive thread

2.1.4 Speaker

A small speaker connected to the DFPlayer module for audio output, producing the bird sounds. Aside from air, sound can even pass through solids and liquids, with speakers that we listen to having transmitted through the air as the medium. Every time an object vibrates, the air particles surrounding it moves.

Figure 2.4: Speaker

2.1.5 Power Supply

This project utilizes an SMP (Switch Mode Power Supply) as the primary power source, efficiently converting a 220V AC input into a stable 5V DC output. The SMP ensures reliable power delivery, making it suitable for running low-voltage electronic components in the setup. Its compact design and high energy efficiency are ideal for integration into modular systems, such as the 3D-printed framework, enabling smooth operation of devices like microcontrollers, sensors, or speakers. The choice of a 5V DC output aligns with common requirements for modern electronics, ensuring compatibility and steady performance.

Figure 2.5: Power Supply

2.1.6 Wires and Connectors

Used to establish connections between components such as the ESP32, DFPlayer, speaker, and touch sensors.

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

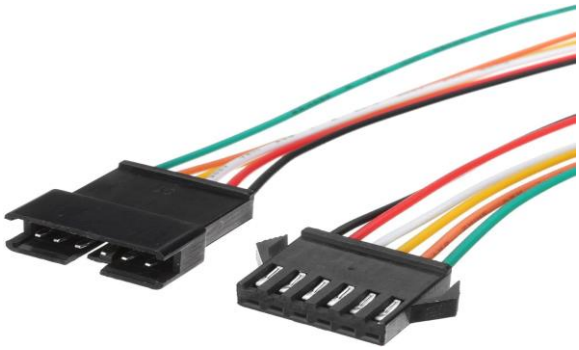


Figure 2.6: Wires $ Connectors

2.1.7 Micro SD Card

Stores the MP3 audio files (bird sounds) to be played by the DFPlayer module.

SD and micro SD card modules allow you to communicate with the memory card and write or read the information on them. The module interfaces in the SPI protocol.

To use these modules with Arduino you need the SD library. This library is installed on the Arduino application by default.

Figure 2.7: micro SD Card

2.1.8 Textile Materials

Cotton, silk, satin, or polyester fabrics used as the base material for embedding conductive thread and creating the interactive design.

Figure 2.8: Materials

2.1.9 Microcontroller (Arduino Uno)

In this project, the microcontroller acts as the central processing unit, reading inputs from the touch sensors and triggering the appropriate audio output. It is programmed to recognize specific touch patterns and correlate them with pre-recorded bird sound.

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

Arduino is an open-source electronics platform designed for creating interactive and innovative projects. It is based on easy-to-use hardware and software, making it accessible to beginners while also being versatile enough for advanced users. The hardware consists of microcontroller boards, such as the Arduino Uno, Mega, or Nano, which act as the "brains" of a project.

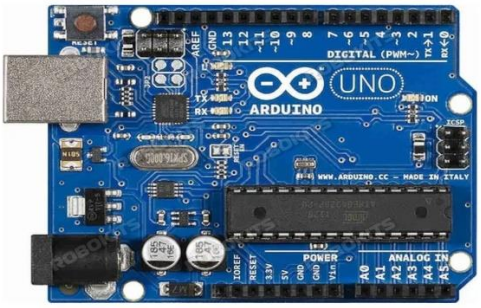


Figure 2.9: Arduino Uno

2.2 Software

2.2.1 Arduino IDE

In this project, the Arduino IDE was used to program the ESP32 and Arduino Uno microcontroller for detecting touch inputs, controlling the DFPlayer Mini module, and playing bird sounds based on user interaction with the fabric.

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Figure 2.10: Arduino IDE

2.2.2 Sound Editing Software (Audacity)

It enables trimming, noise reduction, and format conversion of audio files to ensure compatibility with the DFPlayer Mini MP3 module.

An integrated development environment (IDE) is a software application that helps programmers develop software code efficiently. It increases developer productivity by combining capabilities such as software editing, building, testing, and packaging in an easy-to-use application.

Figure 2.11: Sound Editing Software

It enables trimming, noise reduction, and format conversion of audio files to ensure compatibility with the DFPlayer Mini MP3 module.

High-quality and appropriately formatted MP3 files enhance the realism of the bird sounds played when the fabric is touched.

2.3 Summary

In summary, this project utilizes an ESP32 microcontroller to detect touch inputs through conductive thread integrated with the fabric samples. The touch signals trigger an audio response, which is processed and played via a DFPlayer Mini module connected to a speaker. The microcontroller was programmed using Arduino IDE, while audio files were edited and prepared using Audacity software. This seamless integration of hardware and software enables an interactive and informative user experience.

3 Flow Chart & Circuit Diagram

3.1 Flow chart:

Flowcharts can be used to describe a variety of processes, including: manufacturing, administrative, service, and project planning.

Flowcharts are often categorized as high-level, mid-level, or low-level. A high-level flowchart might describe a company-wide process, while a low-level flowchart might describe a detailed process at the working level.
Some common symbols used in flowcharts include:

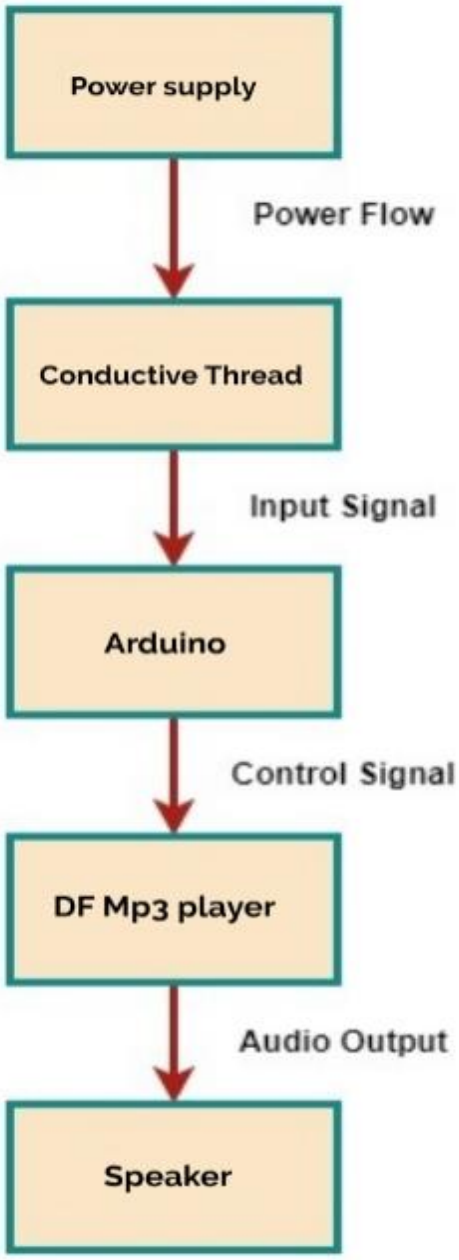


Figure 3.1: Flow Chart

Here's an explanation of each component and the flow:

1. Power Supply:
   - Provides the electrical energy required to power the entire system.

2. Conductive Thread:
   - This could act as a sensor or connector to transmit input signals to the Arduino. Conductive threads are often used in wearable technology to detect signals, such as touch or motion.

3. Arduino
   - The Arduino microcontroller processes the input signal received from the conductive thread. It serves as the control unit, determining the output based on the programming logic.

4. DF MP3 Player:
   - A DFPlayer Mini module, typically used with Arduino, acts as an audio player. It receives control signals from the Arduino and plays the corresponding audio files stored on a micro SD card.

4. Speaker:
   - The speaker converts the audio signals from the DF MP3 Player into sound, providing audio output for the user.
   - Power Flow: Powers the entire circuit.
   - Input Signal: Sent by the conductive thread to the Arduino.
   - Control Signal: The Arduino sends control signals to the DF MP3 player based on its programming.
   - Audio Output: The speaker produces sound from the DF MP3 player.

3.2 Block Diagram:

A block diagram is a simplified graphical representation of a system, showing its main components and their interconnections. It uses labelled blocks to represent functional units, such as input, processing, and output, and arrows or lines to depict the flow of signals, data, or power between these units. This abstraction allows for a high-level understanding of the system's structure without delving into detailed circuit-level design.

In an Arduino-based system, for example, a block diagram might include the following components:

1. **Power Supply Block:** Indicating the power source, such as an SMP (Switch Mode Power Supply) providing 5V DC to the Arduino and other components.
2. **Conductive Thread:** The use of conductive thread showcases the potential for merging technology with traditional crafts, pushing the boundaries of creativity and practicality.
3. **Processing Block:** Represented by the Arduino microcontroller, which processes the input signals using programmed logic and determines the appropriate output actions.

4. **Communication Block:** Representing DfMP3 module player communication with Arduino Uno using I2C protocol.
5. **Output Block:** Representing devices is speaker that produce sound based on the processed signals.

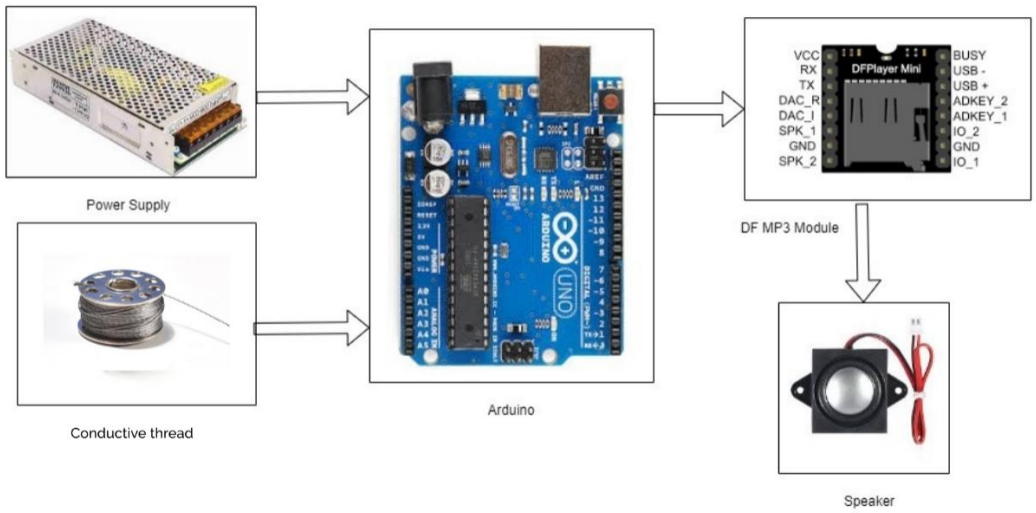


Figure 3.2: Block Diagram

3.3 Circuit Diagram:

A circuit diagram, also known as an electrical diagram, elementary diagram, or electronic schematic, is a graphical representation that simplifies an electrical circuit. It serves as a visual tool for the design, construction, and maintenance of electrical and electronic equipment.

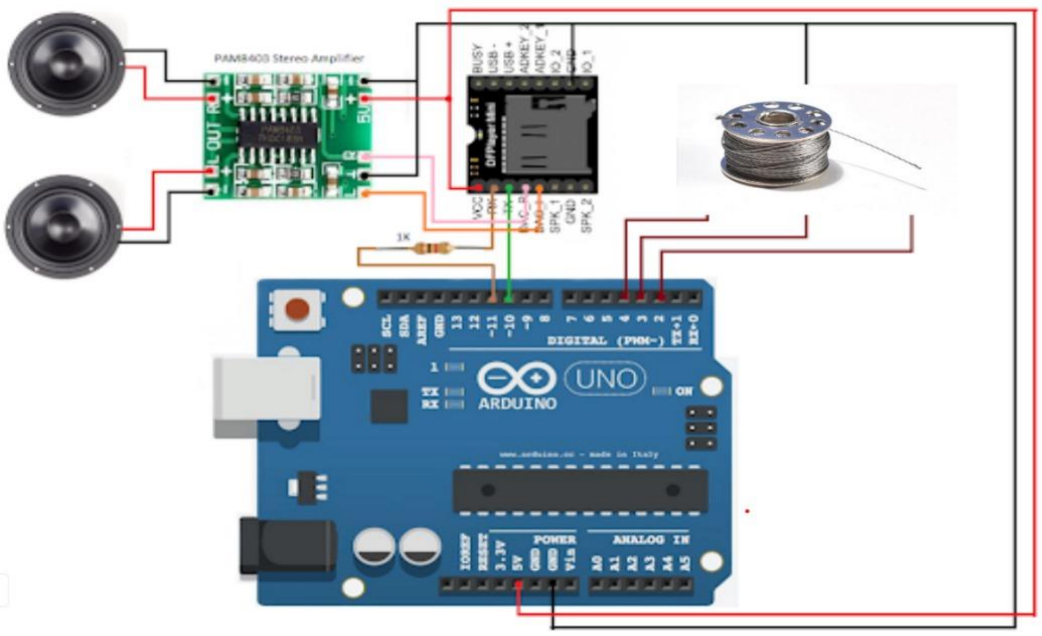
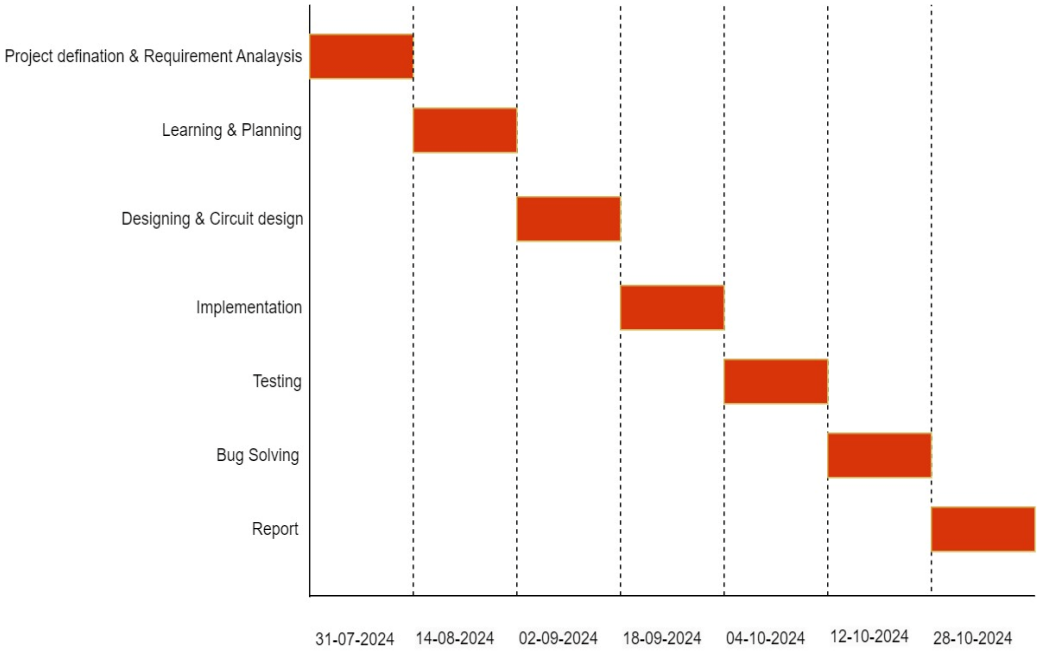


Figure 3.3: Circuit Diagram

3.4 Project Timeline Chart



	Report	Bug Solving	Testing	Implementation	Designing & Circuit design	Learning & Planning	Project defination & Requirement
series	28-10-2024	12-10-2024	04-10-2024	18-09-2024	02-09-2024	14-08-2024	31-07-2024
duration	16	8	15	16	16	15	7

Figure 3.4: Timeline chart

3.5 Summary:

In Summary, the circuit design seamlessly integrates a power supply, conductive thread, an ESP32 microcontroller, a DFPlayer Mini, and a speaker to create an interactive system. The power supply provides energy to the ESP32, which acts as the core controller of the circuit. Conductive thread, stitched into the fabric, serves as a touch sensor. When touched, it sends an input signal to the ESP32, which processes the signal and triggers the DFPlayer Mini.

The DFPlayer Mini, preloaded with audio files on a microSD card, communicates with the ESP32 via serial connections (TX/RX pins). Upon receiving the control signal, it retrieves and plays the corresponding audio file. The audio output is sent to the speaker, which amplifies and delivers the sound to the user. The components are connected with a shared ground, ensuring smooth power flow and proper communication. This integration of tactile sensing, microcontroller programming, and audio playback creates an efficient, interactive experience.

4 Implementation & Result

4.1 Implementation

The microcontroller was programmed using the Arduino IDE. The code was designed to play the associated bird sound files.
Bird sounds were carefully edited and formatted for compatibility with the microcontroller's audio output module.

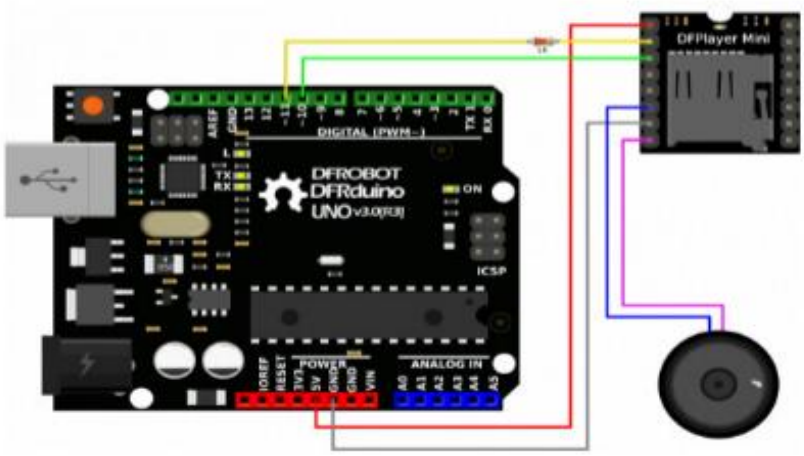


Figure 4.1: Circuit Connection

- Microcontroller (Arduino Uno) connection with DF MP3 module
- RX (Receive) Pin - 10 pin
- TX (Transmit) Pin - 11 pin
- VCC: Connect this pin to the 5V pin on the Arduino to power the DFPlayer Mini.
- GND: Connect this pin to the GND pin on the Arduino.

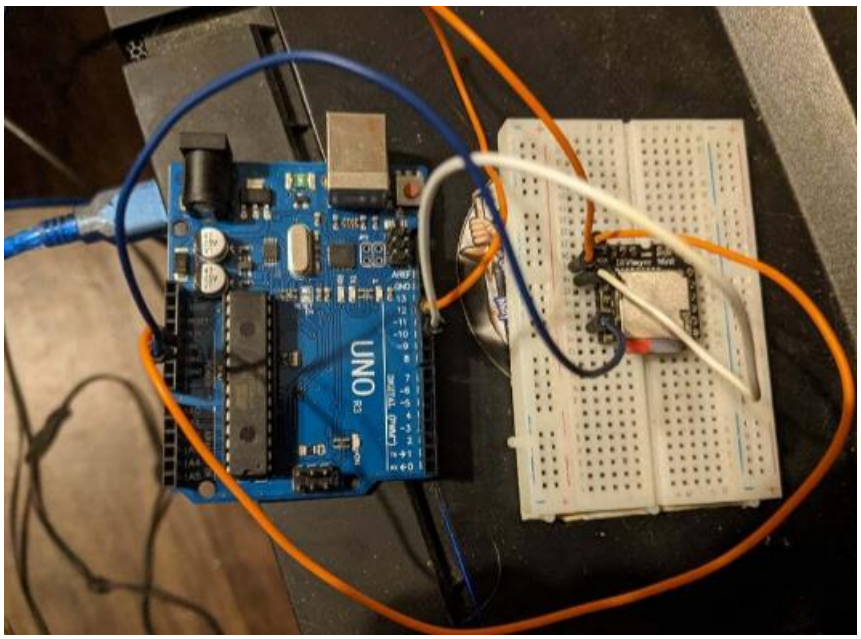


Figure 4.2: Arduino Circuit

- DF MP3 module connection with speaker
- VCC: Connect to 5V for power
- RX: Connect to D2 via a 1K resistor
- TX: Connect to D3
- SPK_1: Connect to the speaker's red wire for positive polarity
- GND: Connect to GND for ground
- SPK_2: Connect to the speaker's black wire for negative polarity

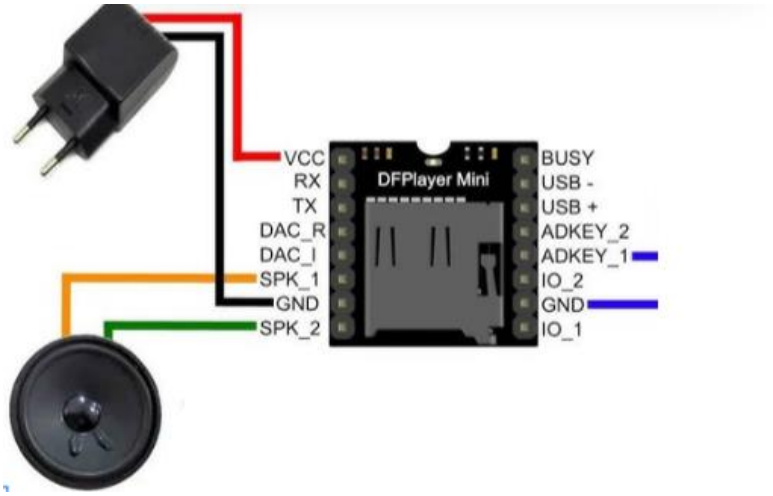


Figure 4.3: Circuit DF Module

In this project, we make our own custom PCB was created using a zero PCB board to integrate an ESP32 and Arduino Uno microcontroller and a DFPlayer Mini module for controlling audio playback based on touch inputs.

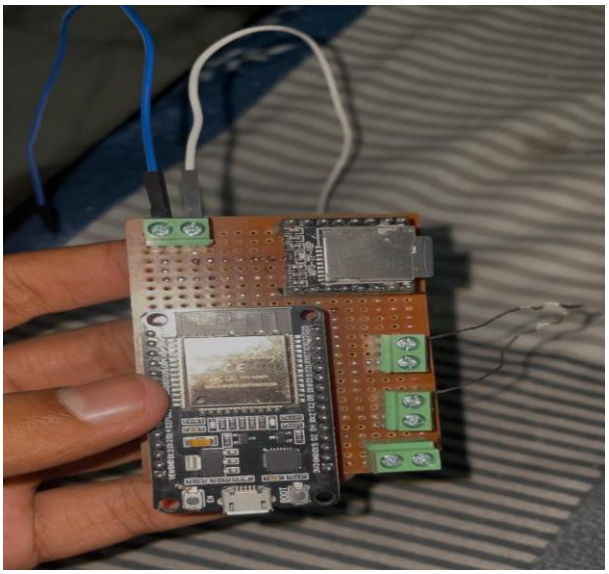


Figure 4.4: Circuit DF Module

The ESP32, acts as the central processor, while the DFPlayer Mini handles audio playback. The setup is connected to a speaker, demonstrating the output functionality. The blue LED

on the DFPlayer Mini indicates its active state, showcasing a successful power supply and operation. This configuration is ideal for IoT or interactive audio applications.

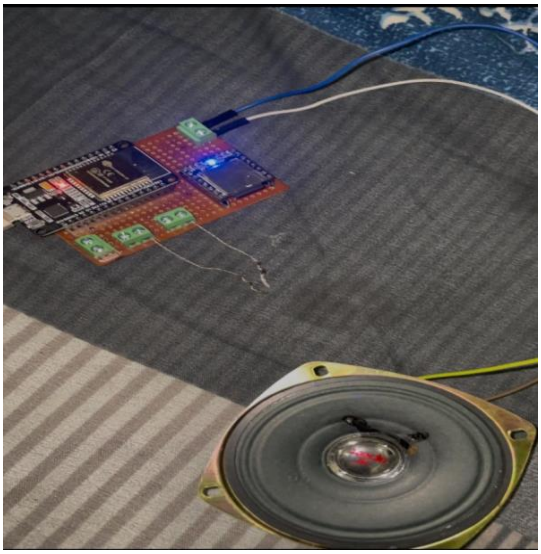


Figure 4.5: ESP32 Connection with Speaker

Figure 4.5 shows a custom-designed circuit built on a zero PCB, integrating an ESP32 microcontroller and a DFPlayer Mini MP3 module. The circuit includes terminal blocks for secure and easy wire connections, allowing external components such as conductive threads or sensors to interface with the system. The ESP32 handles the logic, while the DFPlayer Mini is used for audio playback functionality. This setup is compact, cost-effective, and specifically designed for the interactive textile project, demonstrating a seamless combination of hardware design and prototyping skills.

The Arduino Uno serves as the central controller for processing inputs and managing outputs, while the DFPlayer Mini handles audio playback functionality. This compact and versatile setup demonstrates the integration of modular electronics with custom prototyping, making it ideal for applications in interactive projects.

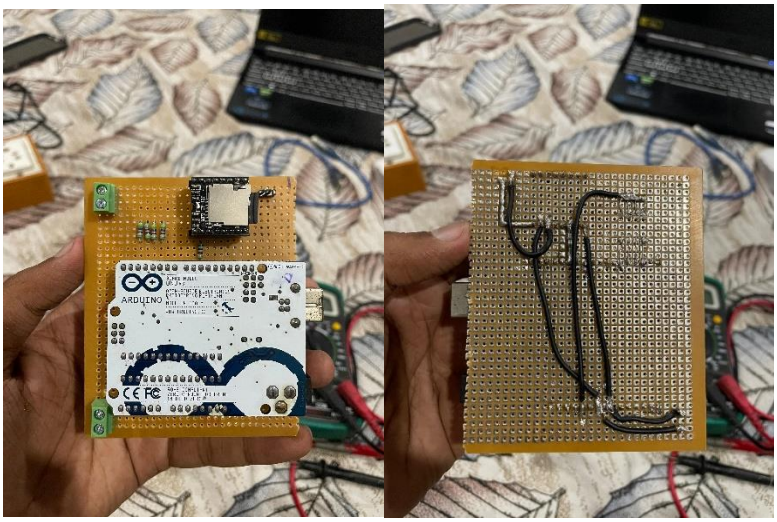


Figure 4.6: PCB Circuit

Figure 4.6 shows a custom-designed circuit built on a zero PCB, integrating an Arduino Uno microcontroller and a DFPlayer Mini MP3 module. The circuit includes terminal blocks for secure and easy wire connections, allowing external components such as conductive threads or sensors to interface with the system. The Arduino Uno handles the logic, while the DFPlayer Mini is used for audio playback functionality. This setup is compact, cost-effective, and specifically designed for the interactive textile project, demonstrating a seamless combination of hardware design and prototyping skills.

Figure 4.7: 3D designed Plates

Figure 4.7 a circular frame-like component, likely made of plastic or a similar material, with a transparent or semi-transparent texture. It looks designed to be compact and portable, possibly part of a prototype or functional electronic project.

This 3D-printed model consists of two circular discs with central holes, designed with precision and simplicity in mind. The discs appear to be made of a lightweight polymer, likely PLA or ABS, offering both durability and flexibility for various applications. Judging by their dimensions 15–20 cm in diameter, they could serve as structural supports.

Figure 4.8: 3D Printed Prototype

This 3D-printed model consists of two circular discs with central holes, designed with precision and simplicity in mind. The discs appear to be made of a lightweight polymer, likely PLA or ABS, offering both durability and flexibility for various applications. The clean-cut central holes suggest their use in alignment, mounting, or as part of a rotational or mechanical assembly. Judging by their dimensions, approximately 15–20 cm in diameter, they could serve as structural supports or platforms in a larger setup, potentially integrating with other components like electronics or shafts.

Figure 4.9: Design Khatli Work

To create the bird design on the fabric, a custom **handmade embroidery** technique was used, incorporating **Khatli work**. This traditional art form involves intricate stitching to form detailed and vibrant patterns, which were carefully crafted to depict a bird on the fabric. The combination of **embroidery and Khatli work** not only adds a unique aesthetic appeal to the project but also enhances the tactile experience of the fabric, allowing it to trigger sound output upon touch, as part of the interactive design. This process reflects the fusion of craftsmanship and modern technology.

To complement the intricate embroidery and Khatli work, conductive thread was strategically integrated into the design. This innovative addition transformed the fabric into an interactive medium capable of transmitting electrical signals when touched. The conductive thread seamlessly blended with the handcrafted design, preserving its artistic value while enabling the fabric to serve as a functional interface. This harmonious blend of traditional craftsmanship and modern technology demonstrates a creative approach to bridging the gap between art and engineering, making the fabric not just visually appealing but also technologically advanced.

To create the bird design on the fabric, a custom handmade embroidery technique was used, incorporating Khatli work.

4.2 Result

Figure 4.10: Final Product with bird sound

The parrot embroidery and sparrow includes an embedded touch-sensitive conductive thread. When the parrot is touched, it triggers a realistic bird sound playback, simulating the sound of a live parrot and sparrow.

The device is equipped with a built-in speaker that delivers clear, lifelike parrot sounds, enhancing the sensory experience.
This product integrates capacitive touch technology with audio playback functionality, making it not just a decorative item but also an engaging interactive gadget.

Figure 4.11: Final Product with fabric

This product is an interactive textile-based educational designed to provide detailed information about different fabric types through touch-triggered technology. It is a perfect blend of tactile experience and digital learning, offering an innovative approach to fabric education.

The project includes multiple fabric samples, each equipped with touch-sensitive sensors. When a fabric is touched, the system outputs detailed information about the fabric, including:

- Name of the fabric.
- Manufacturing process.
- Key properties and characteristics.
- Popular uses and historical or cultural significance.

This interactive fabric product is an ideal tool for classrooms, workshops, exhibitions, and stores, where it can enhance user engagement and promote deeper understanding of textile materials. It demonstrates the effective use of technology to bridge the gap between physical touch and digital information.

4.3 Advantages

- Educational Value:
  It serves as a unique educational tool, teaching users about bird species and their sounds in an interactive and memorable way. This can be particularly beneficial for children and educational institutions.

- Innovative Use of Technology:
  The integration of capacitive touch sensors and audio output into fabric demonstrates innovative use of technology in art and design. It showcases the potential of combining traditional crafts with modern electronics.

- Versatility:
  The system can be adapted to play different sounds or even trigger visual effects, making it versatile for various applications, from art installations to educational exhibits.

- Environmental Awareness:
  By featuring bird sounds, the project promotes awareness of biodiversity and the importance of preserving natural habitats, aligning with conservation efforts.

4.4 Challenges

- Complexity of Setup:
  The integration of electronics into fabric requires careful design and execution, which can be complex and time-consuming. It also requires specialized knowledge in both electronics and textile design.

- Limited Sound Quality:
  Depending on the quality of the speakers and audio output system used, the sound quality may not be optimal, which could affect the overall user experience.

4.5 Summary

In Summary, the product is crafted with a combination of traditional hand embroidery and modern interactive technology. The centrepiece, featuring a parrot motif, is meticulously embroidered onto fabric, incorporating conductive threads to enable touch sensitivity. The embroidery is designed to seamlessly integrate with the technological components, ensuring both functionality and aesthetics.

When the embroidered parrot is touched, the conductive thread detects the touch signal, which is processed by an ESP32 microcontroller. This triggers an audio playback system powered by the DFPlayer Mini module, playing realistic bird sounds through an attached speaker. The programming for the microcontroller was done using Arduino IDE, while Audacity was used to edit and prepare the audio files. The final product combines art and technology to create an interactive, sensory experience.

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Conclusion

This project “Tech-Tex-Tune” demonstrates the seamless integration of traditional textile craftsmanship with modern technology to create an interactive and innovative fabric design. By using conductive threads, handmade embroidery, and Khatli work, we developed a unique system where touching the fabric produces bird sounds, enhancing the sensory experience. This fusion of textile artistry with electronics and automation opens up new possibilities in smart textiles and interactive art. It also highlights the potential for innovative applications in industries such as fashion, interior design, and education. Through this project, we have successfully combined creativity and engineering to bridge the gap between tradition and technology.

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