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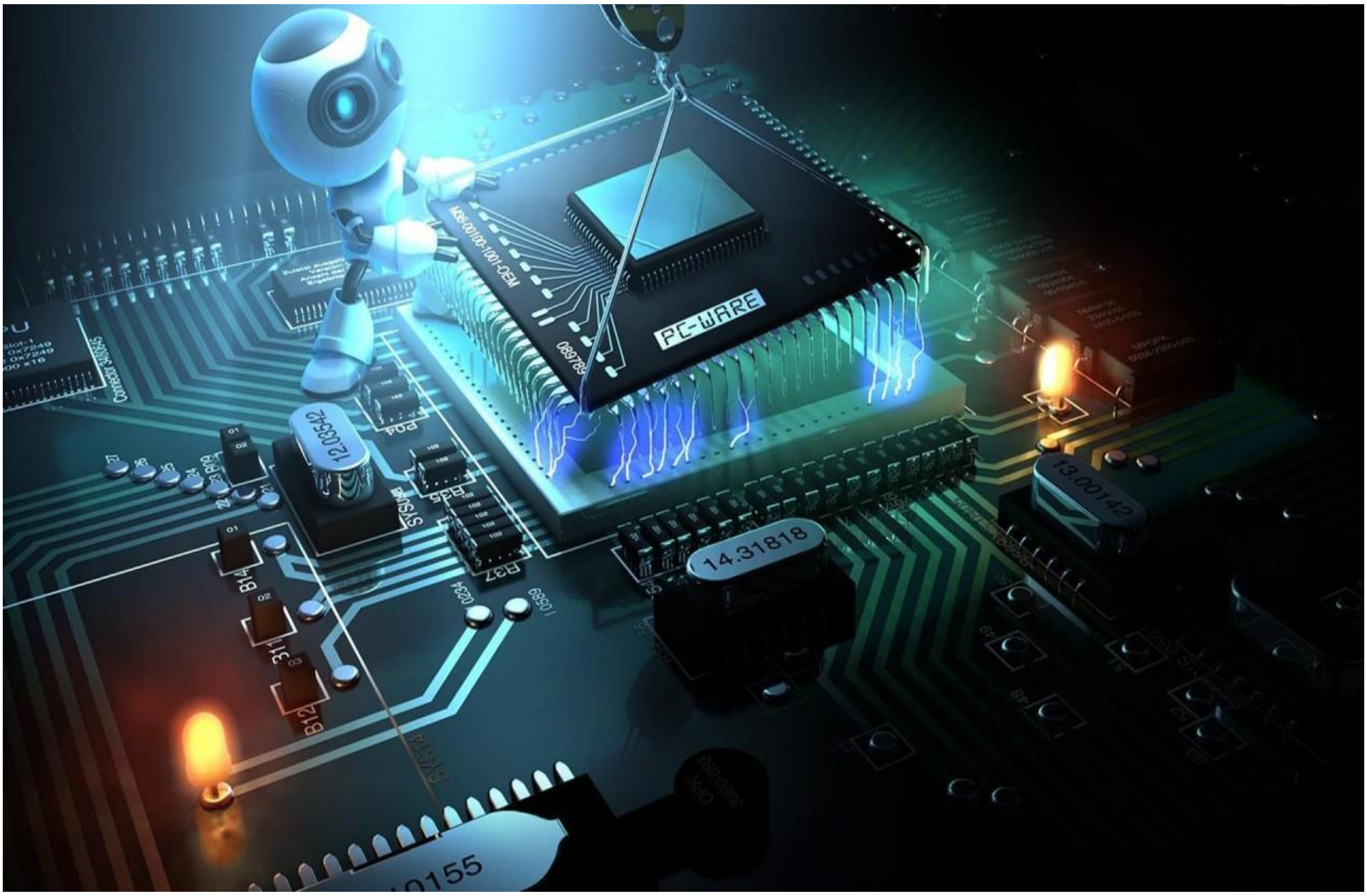
ECE SPECTRUM

Volume 02- (Yearly Technical Magazine)



ISO 9001 : 2015 Certified Institution

CODE:URCE

USHA RAMA

COLLEGE OF ENGINEERING AND TECHNOLOGY

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ABOUT ECE DEPARTMENT

The Department of Electronics & Communication Engineering aims to impart value-based technical education and train students to become well-rounded engineers. Since its inception in the academic year 2008-09 with an initial intake of 60 students, the department has grown significantly. The current intake of the ECE department is 180 students. The department boasts faculty strength of 53 well-qualified, experienced, and dedicated postgraduates, including 11 doctorates, with some faculty members currently pursuing Ph.D.'s in various streams.

VISION OF THE DEPARTMENT

To be a pioneer in Electronics and Communication Engineering and research, promoting entrepreneurship and delivering innovative solutions to societal needs

MISSION OF THE DEPARTMENT

M1: To provide a strong foundation in Electronics and Communication Engineering, preparing students to tackle emerging technological challenges.

M2: To drive research in Electronics and Communication Engineering that delivers innovative solutions to societal needs.

M3: To promote lifelong learning, empowering students to adapt to the evolving technological advancements

Program Educational Objectives (PEO's):

The following are the Program Educational Objectives (PEO's) for Electronics & Communication Engineering Under-Graduate Program.

PEO 1: Exhibit continuous growth in technical expertise and leadership within the engineering field, while upholding professional ethics.

PEO 2: Communicate effectively and manage resources skillfully as members and leaders of the profession

PEO 3: Commit to continuous learning and adapt to emerging technologies to meet the evolving needs of society.

Program Specific Outcomes (PSOs):

PSO1: Develop electronics and communication systems in VLSI, embedded systems, signal processing, and RF communications using advanced tools.

PSO2: Apply ECE knowledge to design, develop, and test systems, considering societal, environmental, ethical, and economic factors.

Program Outcomes (POs):

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

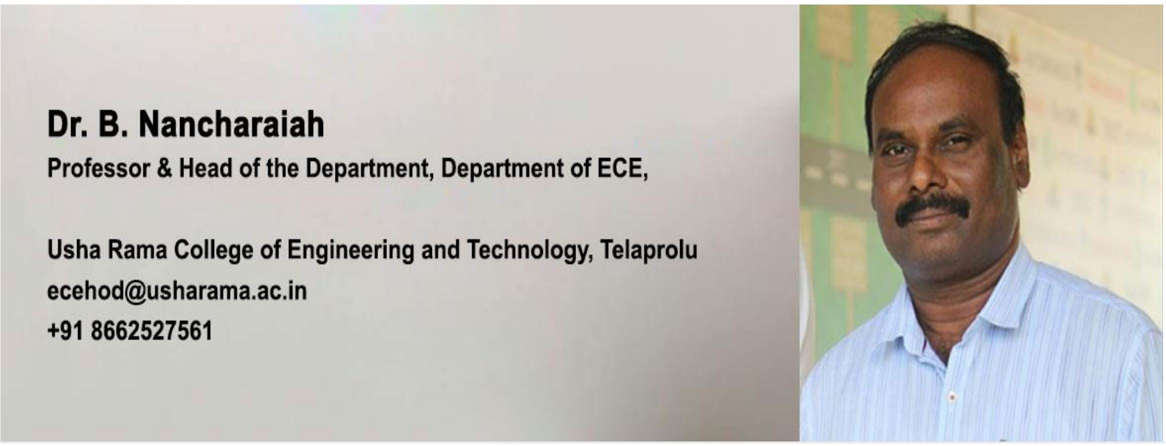
Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

MESSAGE FROM HOD



Dr. B. Nancharaiah received his B.E. degree in Electronics and Communication Engineering in 1999 from SRKR Engineering College, Bhimavaram, affiliated to Andhra University, India. He obtained his M.Tech degree in Electronics and Communication Engineering in 2003 from Pondicherry Engineering College, Pondicherry Central University, India. He earned his Ph.D. degree in Wireless Communications and Networks in 2017 from JNTUH, Hyderabad, India.

Dr.B.Nancharaiah has been working as Professor and HOD in the Department of Electronics and Communication Engineering at Usha Rama College of Engineering and Technology, Telaprolu, Andhra Pradesh, India, since June 2018. With 23 years of teaching experience, he is a Life Member of ISTE and Fellow of IETE. He has published over 70 papers in reputable national and international journals and conferences. He is the author of two textbooks: Metaheuristic Algorithms in Wireless and Mobile Ad Hoc Networks and Antenna and Wave Propagation. His research interests include wireless communications, networks, and IoTs.Our department is committed to providing quality education and training to our students, enabling them to excel in their chosen careers. We strive to create a stimulating learning environment that fosters innovation, creativity, and critical thinking. Our faculty members are dedicated professionals with expertise in their respective areas, and we are proud of our strong industry partnerships that provide opportunities for internships, projects, and placements.

Best regards,

Dr.B.Nancharaiah

Head, Department of Electronics and Communication Engineering

Message from the Editorial Team

We are excited to present to you the third issue of the ECE Department's Technical Magazine for the academic year 2021-2022.This edition is a reflection of the talent, dedication, and hard work of our students, showcasing their remarkable achievements in both co-curricular and extra-curricular activities.

The primary goal of this magazine is to highlight the innovative projects, research, and technical skills exhibited by our students. We believe that the exchange of knowledge and experiences plays a key role in shaping the future of technology and engineering.

We would like to extend our sincere gratitude to the Management and our esteemed Principal for their unwavering support and encouragement, which have been instrumental in the success of this initiative. We hope this magazine continues to inspire and inform, fostering a spirit of collaboration and innovation within the ECE department.

Chief Editor : Dr. B.Nancharaiah, Professor& HOD.

Faculty Advisors : Dr M.V.Srikanth ,Dr.A.Suneel Kumar,Associate Professors.

Student Editors : A. Usha Ramya-II ECE Bhogadi Meghana- II ECE

1. Table of Contents:

1. 3D LED Cube

Abstract:

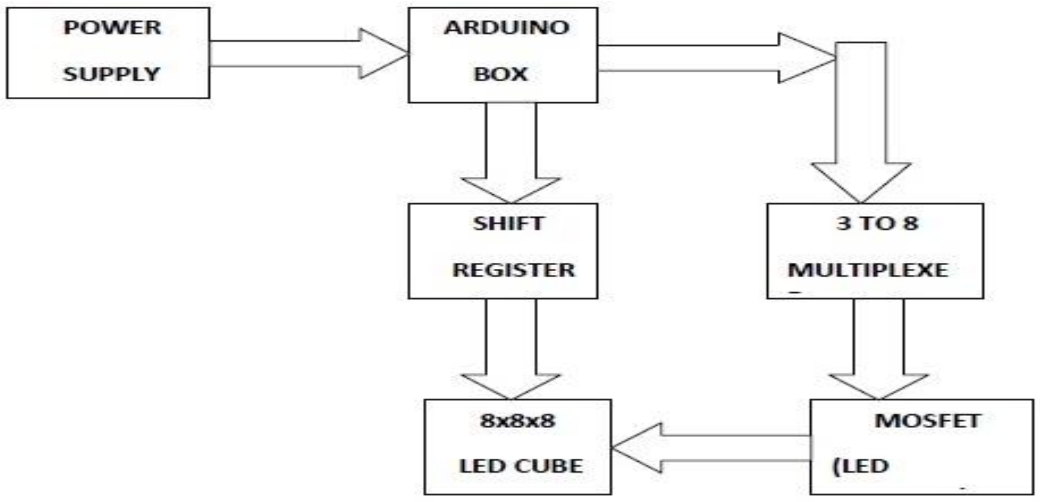
The 8x8x8 3D LED Cube Display is a visually captivating project designed to showcase dynamic light patterns and messages using 512 LEDs arranged in a cube structure. Unlike conventional 2D displays, this cube adds depth (Z-axis) to create three-dimensional visual effects. Built using stainless steel rods and controlled by an Arduino programmed in C via AVR Studio and PonyProg2000, the cube displays pre-defined animations stored in memory. Powered by a 5V, 2A supply, the cube offers a unique and eye-catching method of visual communication with potential applications in advertising, toys, and artistic installations.

Introduction:

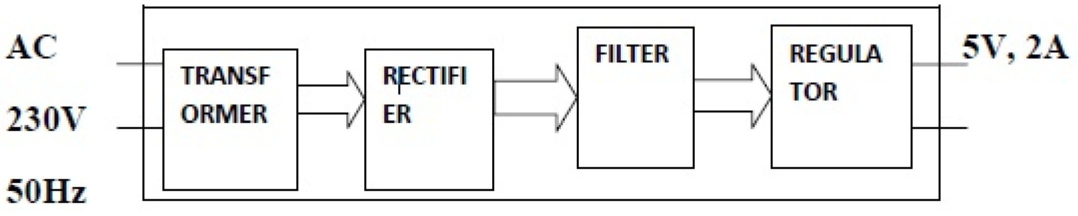
The 3D LED Cube represents a step forward from traditional 2D LED displays, evolving from early 3x3x3 designs to more complex versions like the 8x8x8 used in this project. While earlier cubes used simple microcontrollers like the PIC16F690, modern versions employ powerful AVR-based controllers such as the Atmega16 or Arduino. Each LED (voxel) is individually addressable, enabling complex 3D animations through C programming. The cube not only serves as a technical challenge but also as a practical tool for learning microcontroller interfacing and programming.

Proposed System:

Block diagram:



Explanation :



Power Supply

A 5V, 2A DC power supply is derived from a 230V, 50Hz AC source using a bridge rectifier and voltage regulator. It powers the entire LED cube circuit.

Arduino Uno

The Arduino Uno, based on the ATmega328P microcontroller, has 14 digital I/O pins, 6 analog inputs, a 16 MHz crystal oscillator, USB interface, power jack, ICSP header, and reset button. It is used to control the LED cube and upload the pattern code.

MOSFET (IRF540)

The IRF540 is an N-channel power MOSFET with low on-resistance and built-in ESD protection. It is used for switching the LED cube layers efficiently.

D-Latch (74HC595)

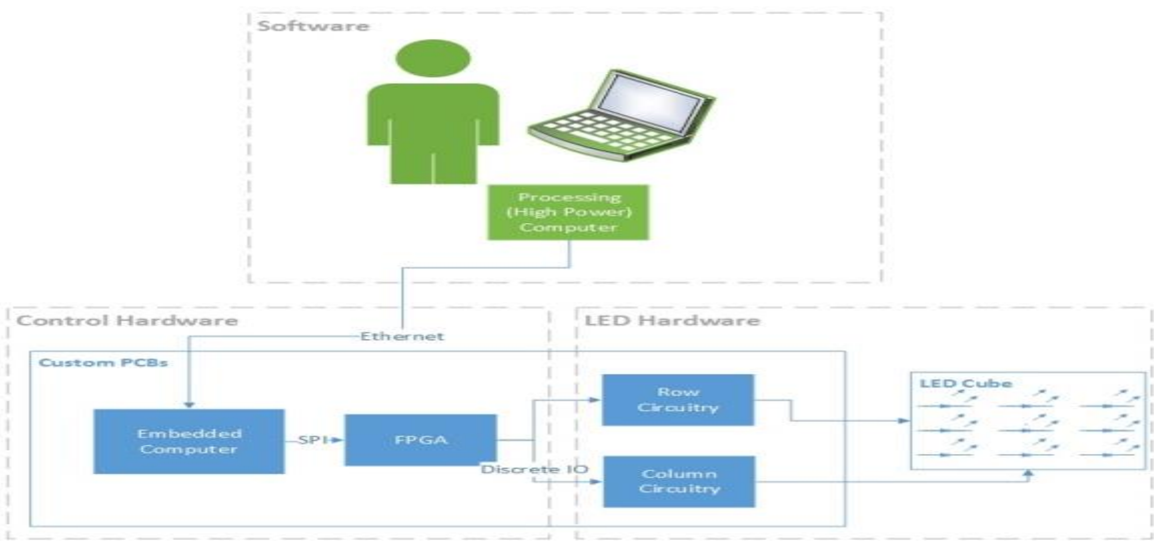
The 74HC595 is an 8-bit serial-in, parallel-out shift register with a latch and 3-state output, used to expand the Arduino's output pins for controlling multiple LEDs in the cube.

3D LED Cube Structure

The 8x8x8 LED cube consists of 512 LEDs arranged in layers and columns, built using stainless steel rods. Anodes of each column and cathodes of each layer are grouped, allowing individual control via transistors and shift registers.

High-Level Design

The 3D LED cube's system consists of user input, control processing, and visual output. A user inputs animation commands through a GUI. These commands are sent to an embedded processor, which then controls the FPGA. The FPGA drives the row and column circuits to update the cube's LEDs frame-by-frame, creating the desired 3D animations.



LED Cube Construction

The LED cube is built plane-by-plane using 18-gauge pre-tinned copper wire with a 6mm pitch. Each 10x10 LED plane is assembled on a plywood jig with screws for precise spacing. LEDs are soldered to the wire structure, tested, and then stacked vertically using a wooden jig for alignment. Once all planes are in place, the complete 10x10x10 cube is attached to its base.

Working

The 8x8x8 LED cube uses 512 LEDs arranged in 3D. It operates using **persistence of vision** and **multiplexing**, lighting one layer at a time rapidly to create 3D animations. 64 anode columns and 8 cathode layers are controlled using shift registers and transistors. Only one layer is active at a time, reducing the number of required I/O pins and wiring.

Applications

- 3D visualizations
- Advertisements
- Object modeling
- 3D displays

Results

The project successfully established a working design for a 3D LED cube with precise control via an embedded processor and FPGA. It provided valuable hands-on experience in hardware, software, and system integration, going beyond classroom learning.

Conclusion

The 8x8x8 LED cube project was completed successfully, offering insights into PCB design, soldering, and debugging. It has strong potential for future development and applications in toys, advertising, and education.

2. Android Camera Car

Abstract:

This project focuses on implementing real-time video streaming on Android devices using an embedded Android platform based on the Linux Kernel. A custom "tablet" device is designed to stream video from a motor car, offering a first-person driving view. The tablet runs smoothly, providing high-quality video streaming under good network or CPU conditions. The system also allows smooth control of the car. This project is useful for studying video conferencing and tablet hardware design, covering both software and hardware development.

Objectives

Hardware:

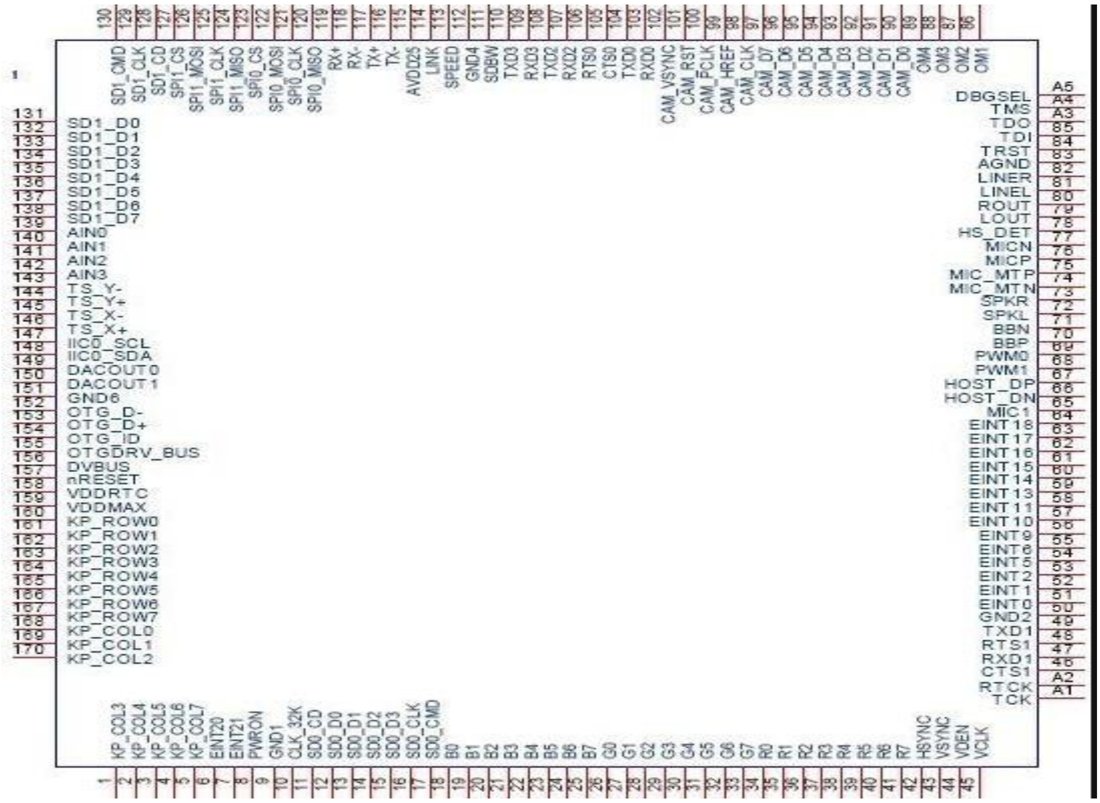
- Learn hardware design, soldering, schematic drawing, and PCB layout using Altium DXP.
- Design motor driver modules for car and robot arm control.
- Study and redesign ARM-controlled boards (REAL6410 & E210COREV2).
- Design ARM-controlled board based on core board E210COREV2.

Software:

- Study and modify camera and Wi-Fi drivers.
- Work with Linux Kernel, Android OS, and U-Boot for embedded platforms.
- Port OS and drivers to custom ARM board.
- Write C programs for LPC1768 to control motors and robot arm.
- Develop Android apps for:
    - Streaming camera video to Android devices.
    - Recording video on SD card.
    - Sending control commands to the car via Wi-Fi/3G.

Core Board E6COREV3

- ARM-11 CPU, 667 MHz
- 256 MB mDDR RAM, 1 GB NAND Flash
- Audio support via WM9713 codec
- Advanced 8-layer PCB design for EMI protection
- Tested in industrial environments
- Supported by Samsung China, Wolfson, SanDisk, MPS



Core Board E6COREV3 Diagram

Arm Controlled Board for E6COREV3

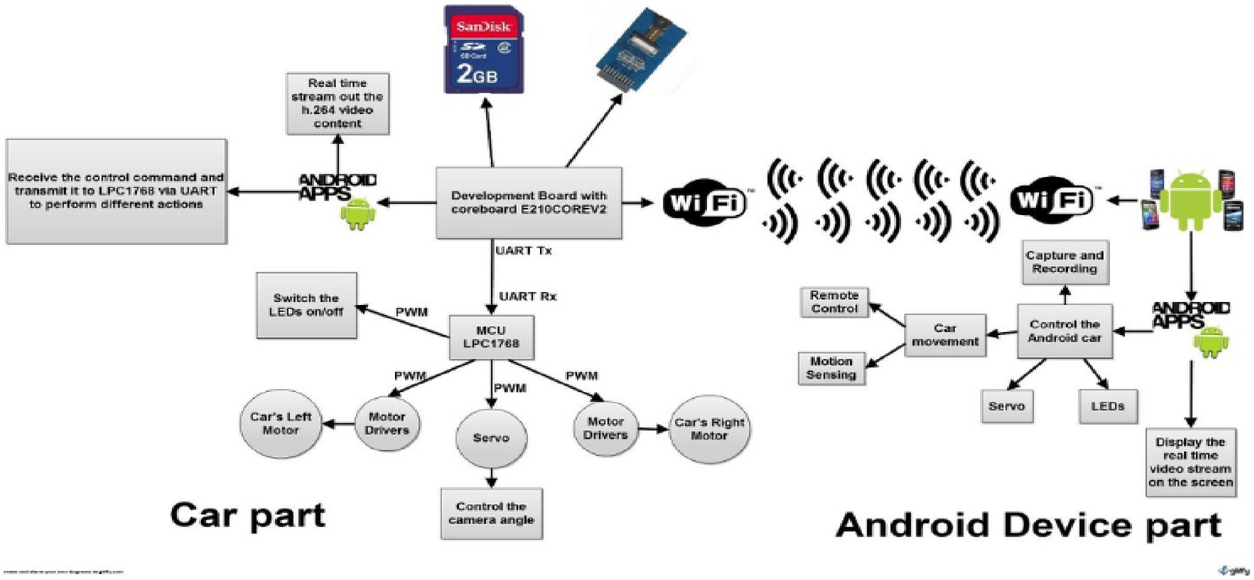
Key ports used in the project include USB OTG, USB Host, RS-232, SD Card, UART, Camera, SPI, MIC, Wi-Fi, and RGB LCD. Modules used: 3G, Wi-Fi, Camera, 7-inch Touch Screen

LPC1768 Microcontroller

A 32-bit ARM Cortex-M3 MCU with 100MHz CPU, 512KB Flash, Ethernet, USB, CAN, multiple UART/I2C/SPI, ADC/DAC, PWM, timers, and debugging interfaces.

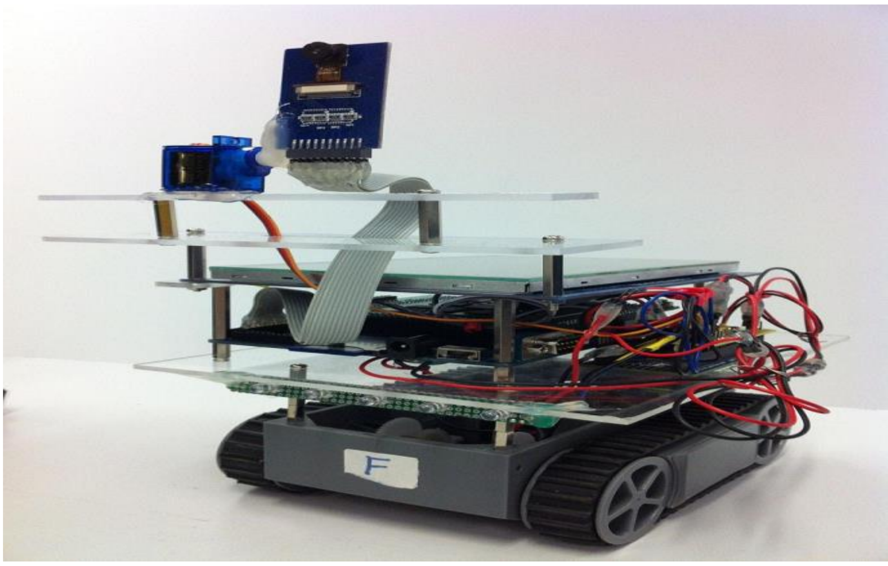
System Overview

The Android Camera Car connects to Wi-Fi and displays its IP. The user connects via an Android app by entering the IP to remotely control the car—actions include photo capture, video



Android Camera Car App Functions (Arm Controlled Board)

- Receives control commands from client
- Sends video packets to client
- Sends commands to LPC1768 to control motors, servo, LEDs
- Displays current commands and Arm Board IP



Conclusion :

This project involved multiple development tasks, including designing schematics for ARM11 and Cortex-A8 boards, creating a PCB layout for the adaptor board, modifying the camera driver, integrating and customizing Android applications for both the ARM board and mobile devices, and programming motor driver control. These components collectively contributed to the successful implementation of the ARM-controlled system.

3. Arecanut Tree Climber and Pesticide Sprayer

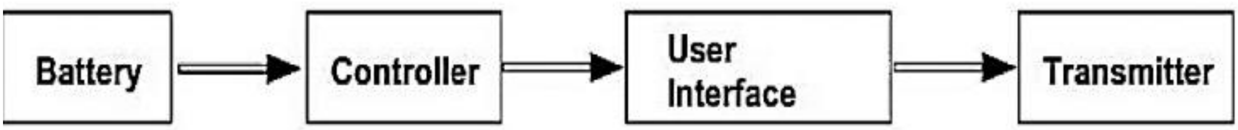
Abstract:

This project, inspired by Krishi Vigyan Kendra, Brahmavar, developed a robot to climb arecanut trees and spray pesticide, reducing labor and time. The robot uses an X-frame with conical rollers driven by DC motors controlled remotely. It sprays pesticide via rotating nozzles powered by electric pumps. Arduino Uno controls motor directions. The robot is portable, accurate, and user-friendly. Future improvements include adding a nut cutter, weight reduction, computer vision, automation, and better wheels.

Introduction:

Areca nut (Areca catechu), also known as betel nut, is a major commercial crop in India and South-East Asia. India leads global production, with Karnataka producing over 62% of the country's output. The tree thrives in well-drained soils like clay loam and laterite. Areca nut farming requires significant organic and chemical fertilizers, with trees taking 4 to 8 years to bear fruit and living up to 60-100 years. The trees grow 60-70 feet tall and about 15 cm in diameter.

Block Diagram



Battery:

A 9V battery is used to supply power to the controller.

Controller:

The controller is Arduino Uno ATmega328PU processor.

User Interface:

It consists of push buttons to control the movement of robot and sprayer.

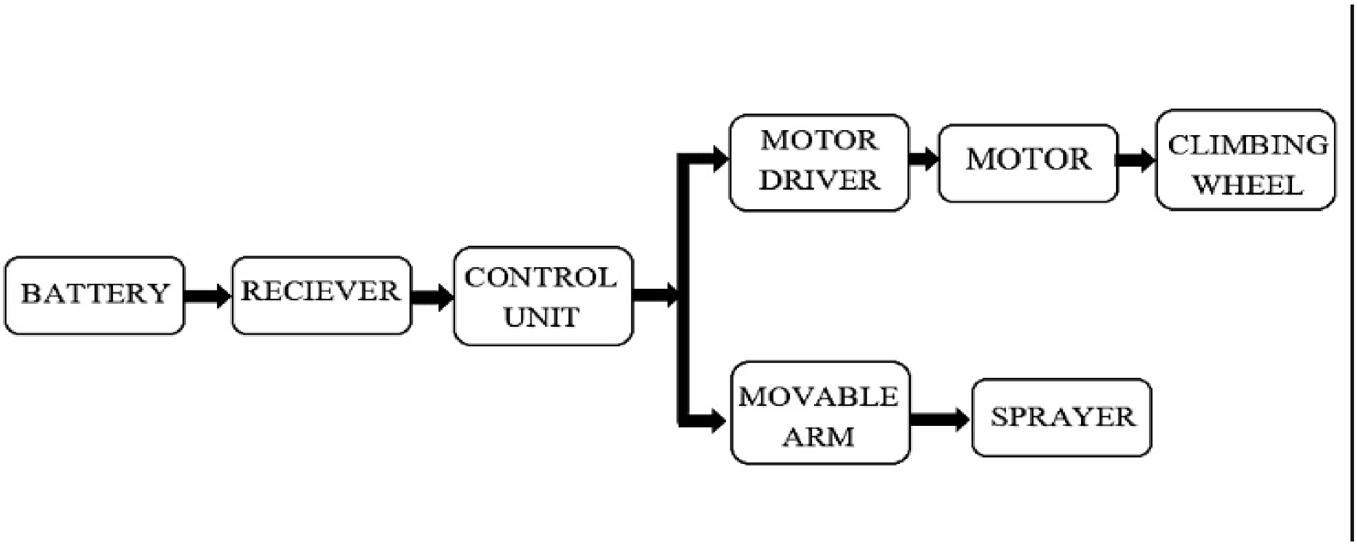
Transmitter:

A 433 MHz transmitter sends the signal to the receiver through an antenna.

Battery

12V, 42 AH battery powers the control circuit and motors.

Block Diagram of Receiver



Receiver

Receives signals from the transmitter.

Control Unit

Arduino Uno (ATmega328PU) controls climbing motors and stepper motor for spraying nozzle.

Motor Driving Unit

Uses ULN2803 IC and 12V relays in H-Bridge configuration to drive DC motors forward and backward.

Movable Arm

Two 12V, 100 RPM DC motors attached to the spraying nozzle for pesticide application.

Motor

12V high-torque geared DC motor drives the rollers for climbing.

Sprayer

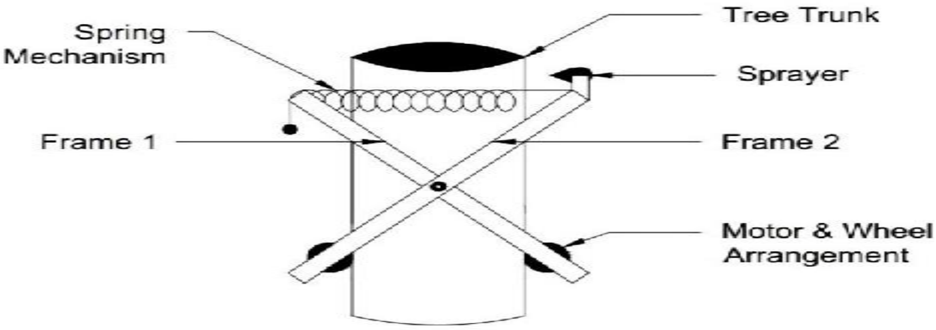
Sprays pesticide in fine droplets at high speed onto the arecanut branches.

Climbing Wheel

Conical rubber-covered wheels provide grip on the tree.

Mechanical Fabrication

Robot has an ‘X’ frame with two conical rollers at the bottom connected to motors, made of stainless steel, weighing 8 kg.



Result:

The robot efficiently sprays pesticide on arecanut trees, easily attaches and detaches using springs, and operates on a 12V 42 Ah battery. It climbs quickly, stays stable without slipping, and sprays pesticide within a 15-20 meter radius. After spraying, it smoothly descends. The flow of pesticide is controlled by a solenoid valve, and all functions are remotely controlled, reducing time and labor dependence.

Advantages:

1. Replaces labor-intensive spraying with a cost-effective, eco-friendly electric system.
2. Compact and user-friendly.
3. Easy to assemble and operate remotely.
4. Saves time and reduces labor dependency.

Conclusion:

The arecanut climber and pesticide sprayer is a safe, efficient, and reliable robot that helps farmers spray accurately without wasting pesticide. It's easy to operate remotely, tested successfully, and reduces risks of manual climbing. The unique 'X' frame design and Arduino control make it cost-effective and user-friendly.

4. Artificial Vision for the Blind

Abstract:

Bionic eyes use microchips to restore vision for the blind by mimicking damaged retinas. This technology combines electronics and biotechnology to offer hope for visually impaired individuals.

Introduction:

Vision provides most of our environmental information. Millions are visually impaired worldwide, and existing aids like canes have limitations. Artificial Vision converts scenes into audio descriptions to help the blind better understand their surroundings.

Requirements:

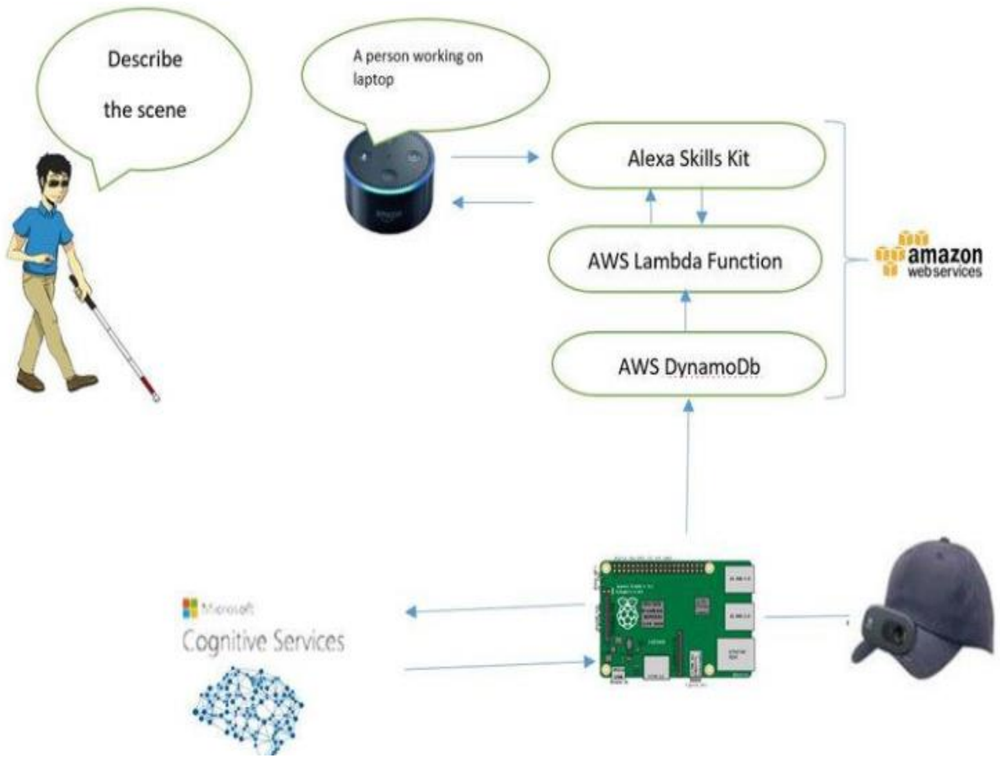
Software: AWS, Alexa Skill Kit, Microsoft Azure, Python

Hardware: Alexa Echo, Raspberry Pi, USB webcam, power bank

Methodology:

A webcam captures images sent to cloud APIs for recognition. The data is stored and retrieved via Alexa, which describes the scene to the user.

Block Diagram:



ADVANTAGES:

To provide the artificial vision for the blind and visually impaired.

It acts as a third eye.

Provides assistance using Raspberry Pi for the blind.

Scope for Future work:

- Face and emotion recognition.
- Text to speech for reading books.
- Indoor navigation with visual SLAM
- Outdoor navigation with GPS
- Traffic light colour interpretation

Conclusion:

We would like to conclude that the proposed system is completed successfully, as we stated earlier in a problem statement. This paper proposes an enhanced assisting electronic aid using latest technology like Amazon web services, Amazon Alexa and Raspberry Pi for the visually impaired people. This project will successfully implement the object detection and provide a clear information to a blind people. Hence, it can be concluded that this project is able to play a great contribution to the state of the art and will play a great role to assist the blinds to walk easily. Though being advantageous in several aspects, like providing artificial vision and assistance for visually impaired people by using advanced emerging technologies like AWS and MS cognitive services, it has some limitations of yearly and monthly subscription

5. ATM Security Using Eye and Facial Recognition System

Abstract:

Although ATMs have simplified banking, they are vulnerable to fraud. Many security breaches occur during transactions. This paper proposes integrating a Face Recognition System to enhance verification and improve security in banking.

Introduction:

Technology has improved customer convenience in India, with ATMs making money transactions easier. However, ATMs relying only on cards and PINs are prone to theft and fraud, such as card theft, PIN hacking, and account misuse. Using face recognition can reduce such risks by providing faster and more reliable identity verification.

Face Recognition Systems:

Face Recognition Systems (FRS) automatically identify individuals from images or videos by matching facial features against a database. With proper lighting and training, the system stores verified images to improve accuracy over time, reducing false negatives and enhancing security for banking transactions.

How Do They Work:

The system maintains a database of faces and performs face recognition through three main components:

- **Face Detector:** Identifies and isolates the facial region from the background in an image.
- **Eye Localizer:** Locates the eyes to better determine the face's position.
- **Face Recognizer:** Searches the database to find a matching face.

Methodology:

The system uses an open-source facial recognition program based on local feature analysis for verification. Algorithms extract facial features such as the size and position of the nose, eyes, cheekbones, and jaw to identify and match faces. Some algorithms compress facial data to save only the essential features for detection.

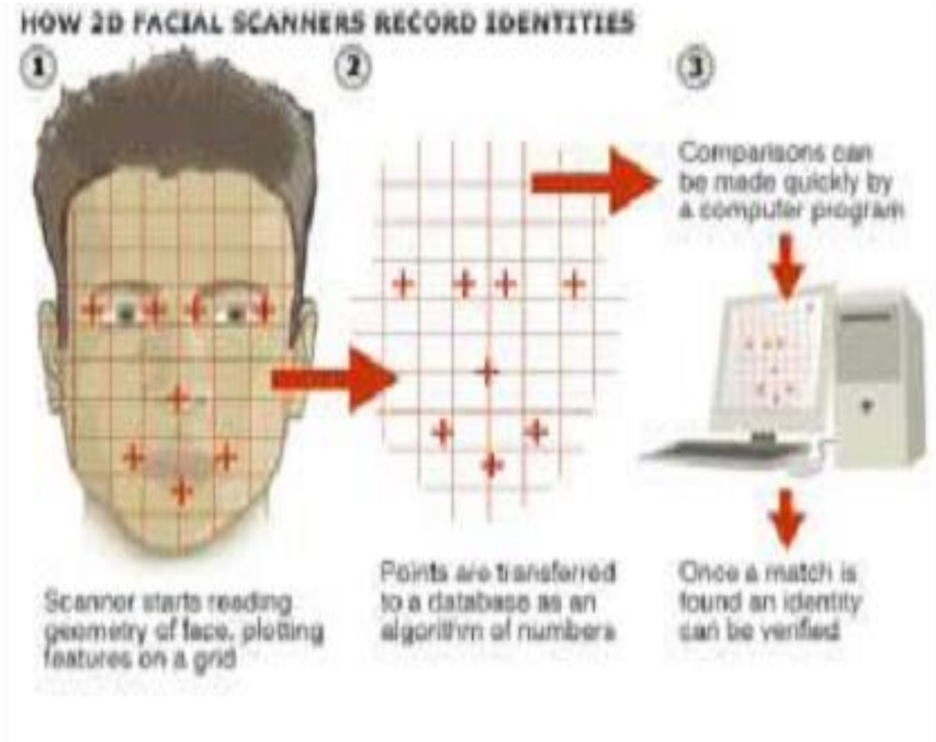
Techniques and Methods:

Face recognition techniques include:

- 2-D
- 3-D
- Surface Texture Analysis

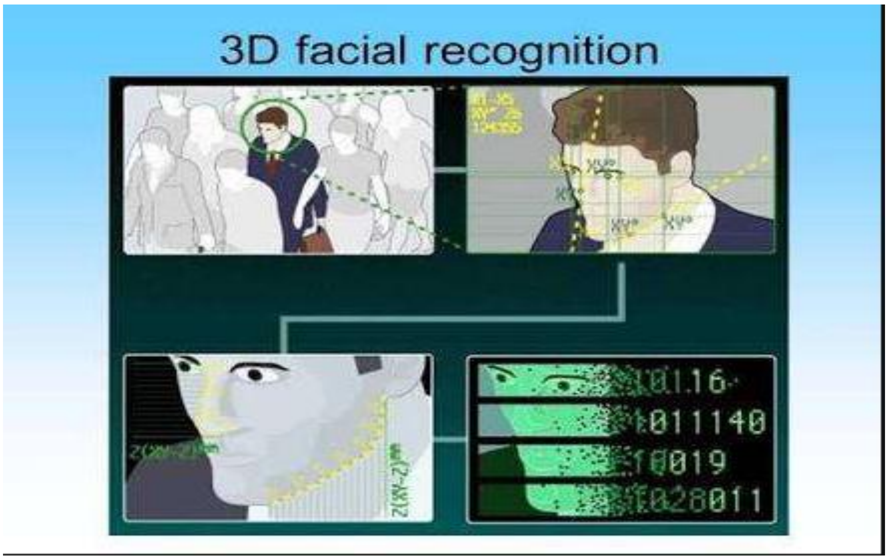
2-D Technique:

This traditional method analyzes facial features in two dimensions—like nose width, eye distance, jawline, and cheekbones. It is less accurate as changes in facial expression, lighting, or head position can affect results.



3-D Technique

The 3-D face recognition method uses facial features like eye sockets, nose, and chin contours for identification. Unlike 2-D, it works accurately even if the face is turned up to 90 degrees and is unaffected by lighting or facial expressions.



IRIS RECOGNITION:

Bank United of Texas was the first in the U.S. to use iris recognition at ATMs, allowing cardless, password-free access. This biometric method captures a photo of the customer's eyes and uses unique iris patterns for identification. It is fast, highly accurate, and reliable since the iris is stable, unique, and protected inside the eye yet visible externally

Customers simply look into the camera as it scans their iris, which is more unique than fingerprints. This eliminates the need for PINs or passwords, reducing the risk of theft if a card is lost or stolen.

Conclusion:

An ATM model using facial verification enhances security and helps prevent unauthorized transactions. Combining 2D and 3D facial recognition strengthens identification, and using both adds an extra layer of protection during authentication.

6. Automated Rubber Tapering Machine

Abstract

Rubber tapping extracts latex from rubber trees by making a downward half-spiral cut on the bark. Skilled labor is scarce, so an automated rubber tapping machine is designed to perform this task precisely and improve latex yield using a timed control feature.

Introduction

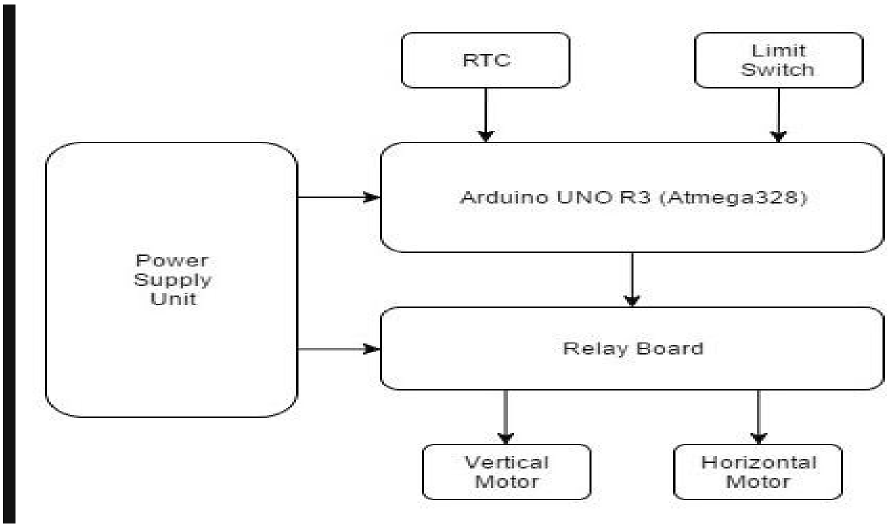
Natural rubber is harvested from latex tapped from rubber trees, mainly grown in tropical Asia. Rubber tapping is done early in the morning to collect latex before it coagulates. The demand for rubber remains steady, but skilled tappers are becoming scarce. Automation can help maintain production.

Objectives

To automate the tapping process, enabling even unskilled workers to perform tapping without damaging trees. The machine aims to address labor shortages and improve tapping efficiency.

Methodology

A mechanical device with vertical and circular rods mounts on the tree using belts. Two DC motors controlled by an Arduino manage precise 2D movement of the tapping blade. A relay board controls motor speed and direction. A real-time clock module schedules operation. Limit switches define blade travel limits.



Hardware Requirements

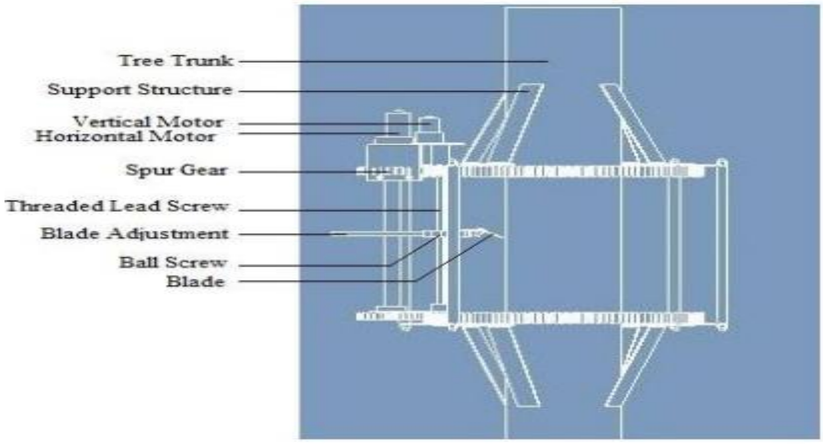
Arduino UNO R3, Relay Board, DC Geared Motors, RTC module, Limit Switches, Tapering Blade, Power Supply.

Software Requirements

Arduino IDE for programming and Creo Pro 3D CAD for mechanical design.

Rubber Tapering Components

- **Arduino UNO R3:** Controls vertical and horizontal motor movements for the tapering blade.
- **Relay Board:** Uses four relays in bridge configuration to control motor speed and direction; operates at 12V supply with 5V control signals.
- **Vertical Motor:** 200 rpm geared motor for vertical blade motion.
- **Horizontal Motor:** 60 rpm geared motor for horizontal blade motion.
- **Real-Time Clock:** Schedules the tapping operation timing.
- **Limit Switch:** Defines start and end points for blade movement.
- **Power Supply:** 12V DC to power Arduino and relay board.

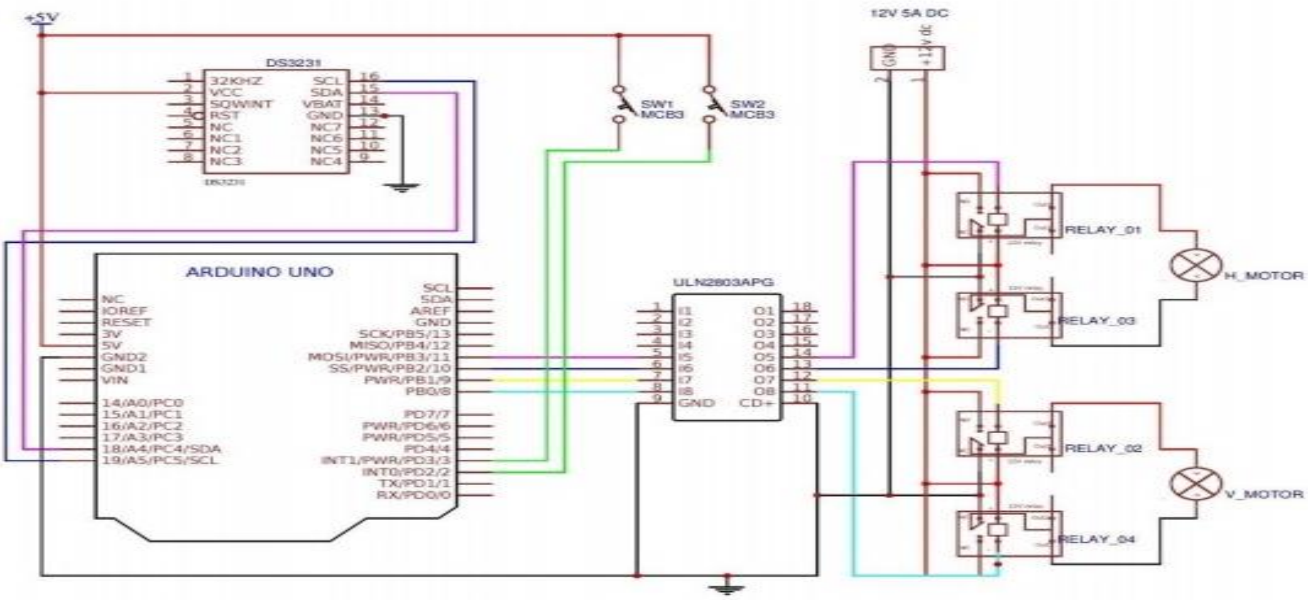


Schematic Model

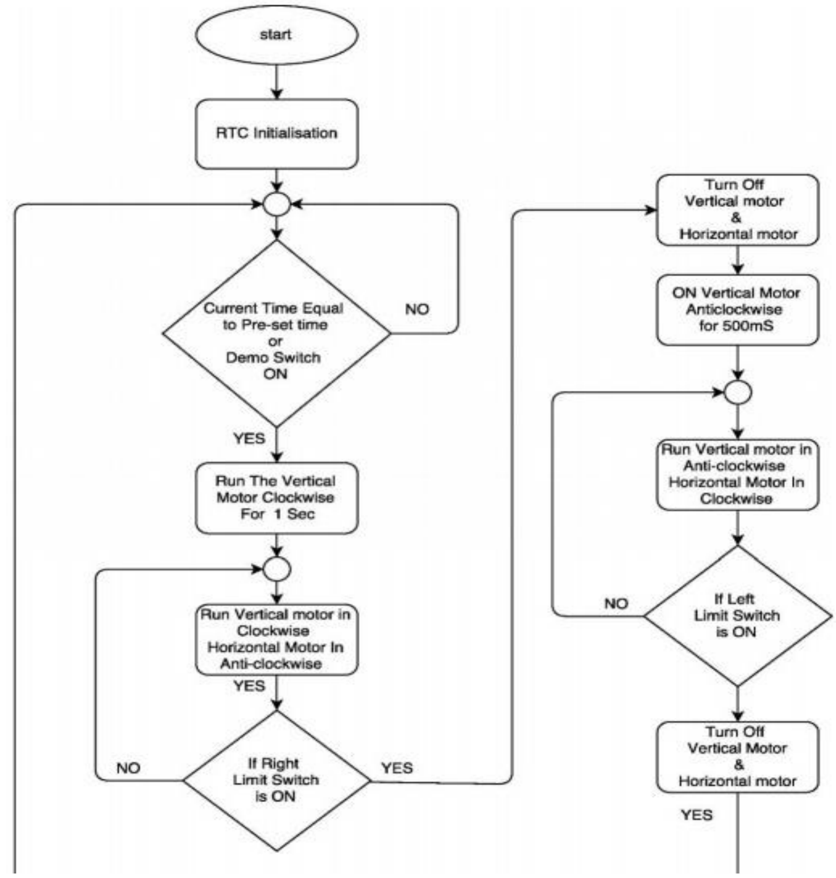
The automated rubber tapering machine includes vertical and horizontal motors, spur gears, a threaded lead screw, a ball screw, a tapping blade, an adjustable blade rod, and supporting rods

Working Principle

The machine uses motors to move the blade horizontally and vertically, making a precise spiral cut on the tree bark to extract latex automatically.



Flow Chart



Operation Steps:

1. RTC initializes and sends time to Arduino.
2. Arduino compares current time with preset time.
3. If times don't match, keep checking.
4. When times match, run vertical motor clockwise for 1 second.
5. Run vertical motor clockwise and horizontal motor anti-clockwise.
6. Check right limit switch; if OFF, continue step 5.

Results:

The machine taps a tree in 20–30 seconds, faster than skilled labor (40 seconds). Installed on all trees, it drastically reduces tapping time. Using RTC allows tapping during peak latex flow (3–6 A.M.), maximizing yield. The prototype successfully demonstrated automated tapping on a rubber tree.

Conclusion:

The agricultural sector faces a significant labor shortage, especially for skilled tasks like rubber tapping. The "Automated Rubber Tapering Machine" offers a reliable, efficient solution by automating this skill-intensive process, increasing latex yield compared to manual tapping.

7. IOT Based Smart Public Distribution System

Abstract:

The Public Distribution System (PDS) in developing countries like India ensures essential commodities reach economically weaker sections. However, manual processes often lead to fraud and inefficiencies. This project proposes an IoT-based Smart Public Distribution System that uses fingerprint authentication, Android-based commodity selection, and automated ration dispensing to improve transparency and efficiency. The system also maintains transaction records to minimize corruption.

Introduction:

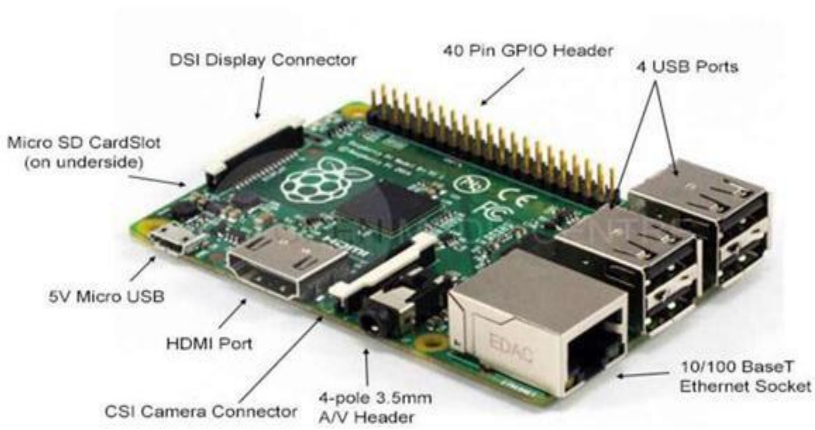
The government distributes subsidized food and fuel to low-income groups through ration shops. However, many shop owners engage in fraud, depriving rightful beneficiaries. This project introduces an automated system with fingerprint-based authentication, mobile-based commodity selection, and automated dispensing to counter such malpractices and ensure fair distribution.

Objective

- Ensure secure and reliable ration distribution using biometric authentication.
- Prevent fraud and misuse of ration cards.
- Eliminate manual data entry and reduce time complexity.
- Protect subsidized goods from entering the black market.

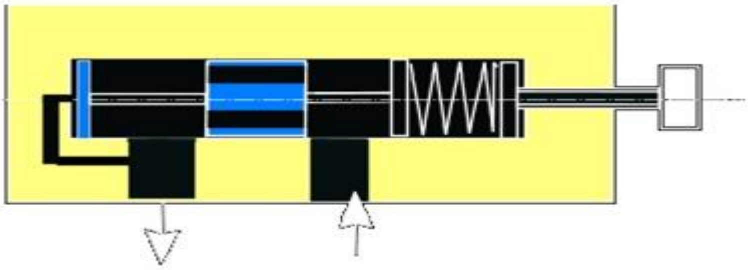
Methodology

Hardware Tools:



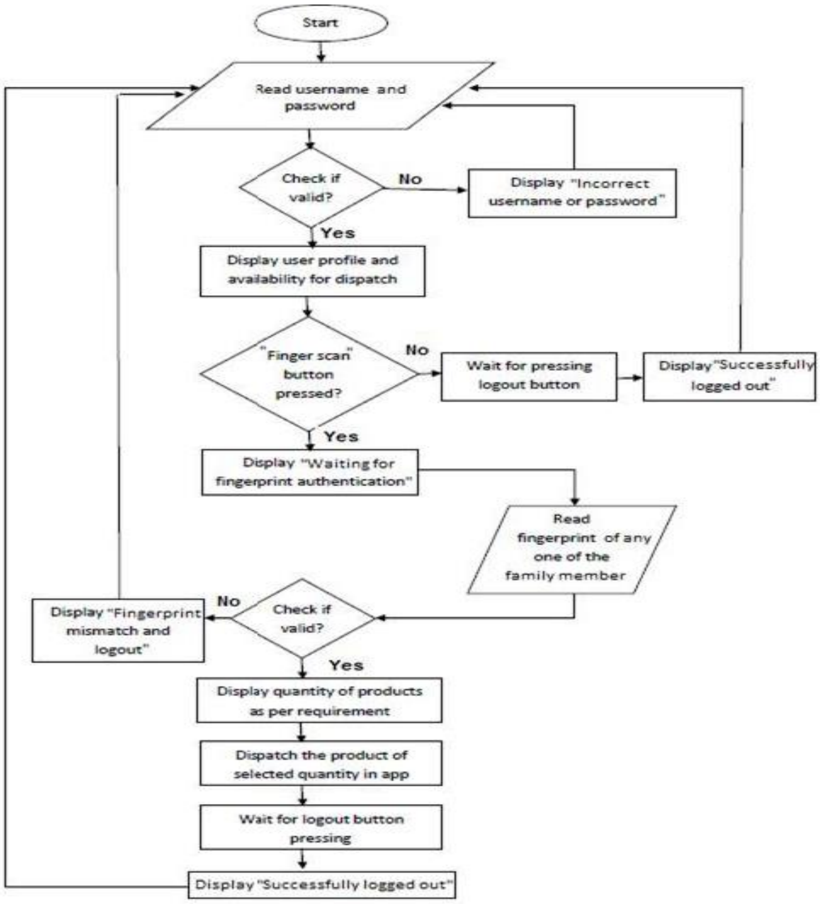
1. **Fingerprint Module:** Captures and verifies the user's fingerprint using a minutiae algorithm.
2. **Raspberry Pi:** Serves as the system controller, managing user data, authentication, and communication with the database.

3. **DC Motor:** Controls the opening and closing of the valve for dispensing commodities.
4. **Hydraulic Valve:** Regulates the flow of oil based on motor control, ensuring accurate dispensing to users.



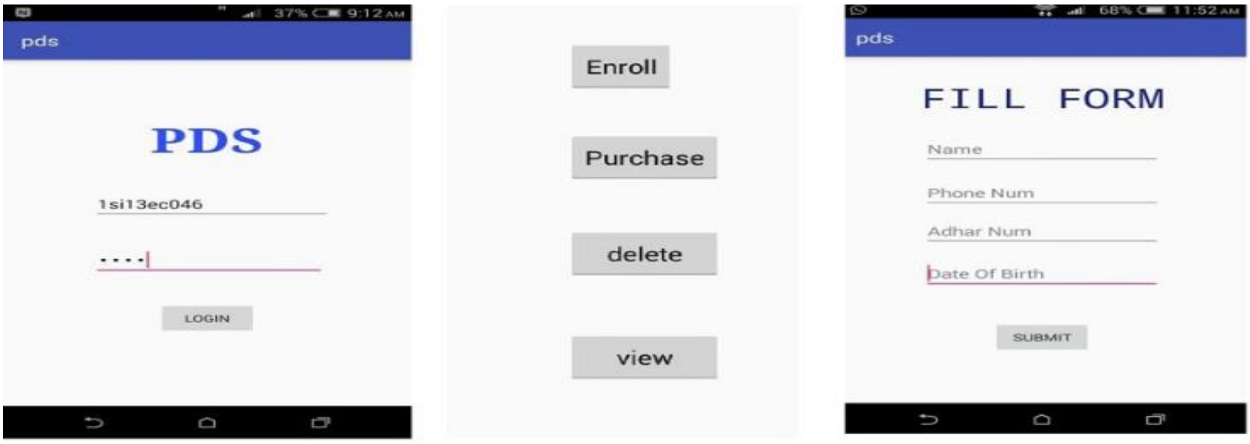
Flowchart system

The system begins with the user logging into the app using their ID and password. If the ID matches the database, the user's profile and transaction history are displayed. The user then scans their fingerprint for authentication. Once verified, they select the commodity and quantity. If valid, the system automatically dispenses the item. If authentication fails, the system waits for valid input.



Results

The system interface includes a login page (Figure 4a) where users enter their ID and password. After logging in, users can choose from options like purchasing commodities, enrolling or deleting fingerprints, and viewing their profile (Figure 4b). Fingerprint enrollment is done by selecting the "Enroll" button.



When the user selects **purchase** on the app, the system requests fingerprint authentication. If matched, it displays "Template found"; otherwise, it shows "No match found".

Snapshot shows fingerprint matching.

Conclusion

The IoT-based Smart Public Distribution System automates ration distribution using secure fingerprint authentication, reducing fraud and protecting rightful beneficiaries. The Android app for selecting commodities enhances convenience and accuracy, lowering corruption and supporting the economy. With minimal manual effort and all data stored digitally, this system effectively curbs malpractices and benefits the public.