IoT Based Smart Currency Counter through Digital Image Processing (DIP) and Wifi Module

A project report submitted in partial fulfilment of the requirements for the 5TH semester of the degree of

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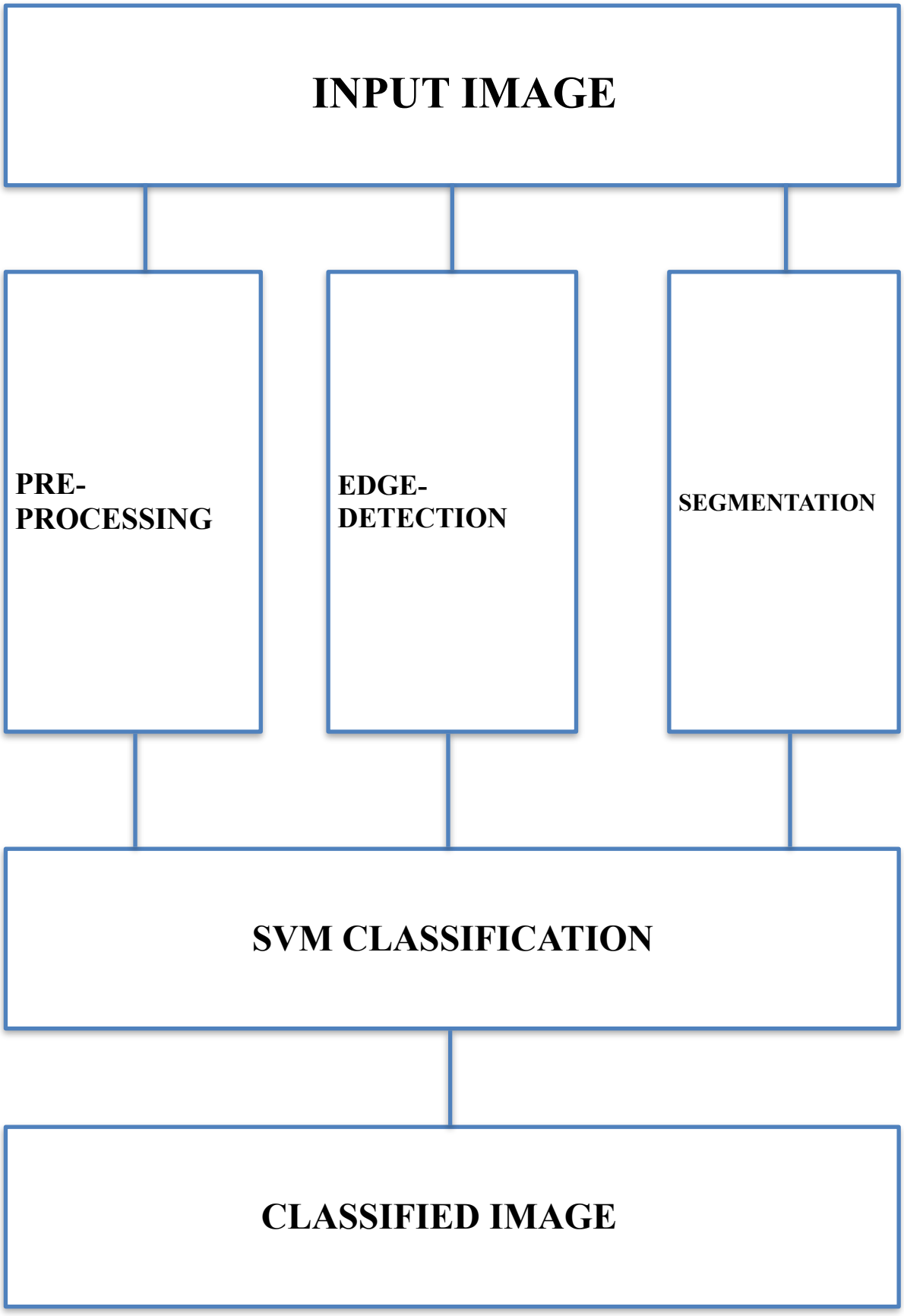
IoT Based Smart Currency Counter through Digital Image Processing (DIP) and Wifi Module

- The "IoT Based Smart Currency Counter through Digital Image Processing and WiFi Module" is a sophisticated project that combines cutting-edge technology to create an automated currency counting system.
- This system utilizes a camera module to capture images of currency notes, ESP8266 for image processing and logic implementation, and a WiFi module for connectivity and remote monitoring.
- The digital image processing algorithms, inspired by those used in ATM machines, analyze the captured images to identify currency notes and determine their denominations.
- The Arduino calculates the total value of the recognized currency notes and displays it on a connected display module.
- Through the integrated WiFi module, the system can communicate the total count to a cloud server or a remote user interface, making it possible to monitor and manage the currency count remotely through a web interface or a mobile app.
- The project showcases the convergence of hardware, software, and networking, enabling a seamless and efficient method for accurately counting and tracking currency.

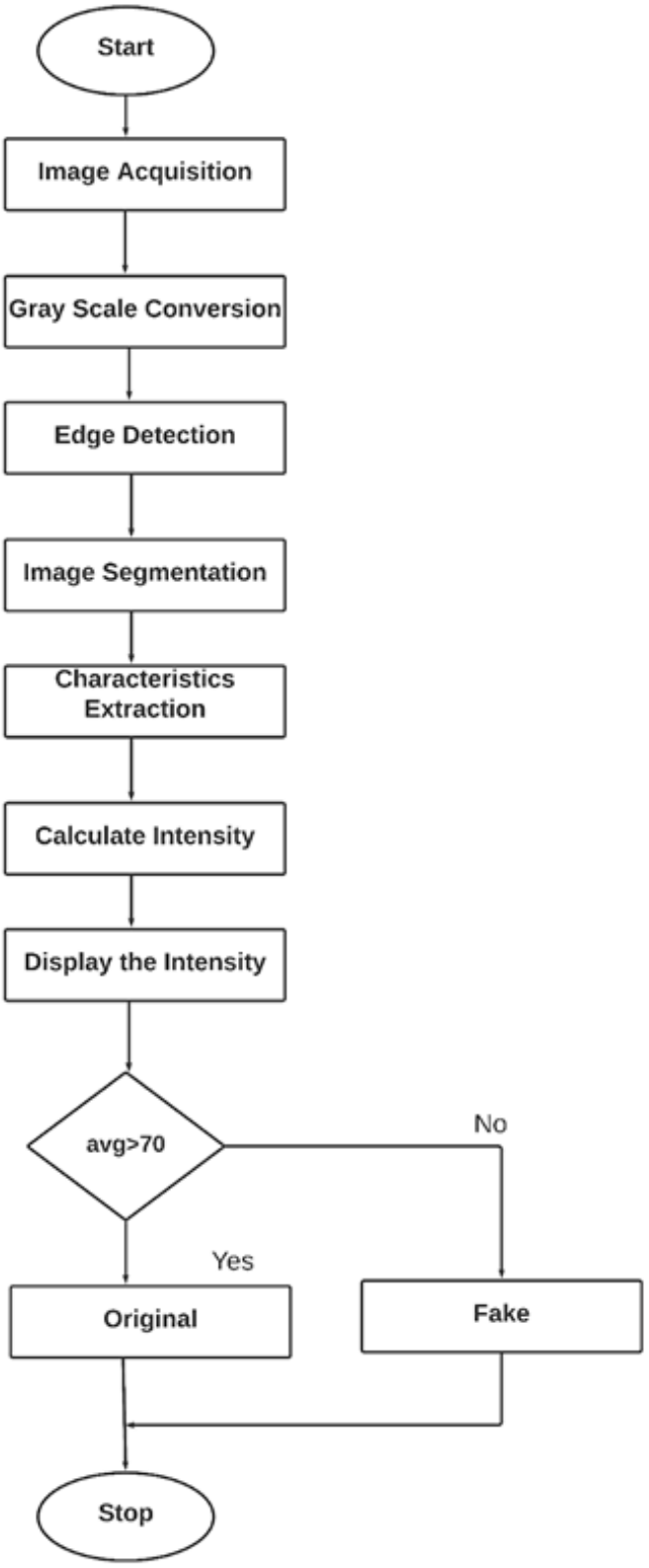
OVERVIEW OF THE PRINCIPLES INVOLVED:-

- **Image Processing**: Utilizes techniques from digital image processing to segment, analyze, and identify currency notes within captured images.
- **Pattern Recognition**: The currency recognition algorithms employ pattern recognition principles to estimate the denominations based on visual features.
- **IoT Connectivity:** The WiFi module enables IoT capabilities, allowing the system to connect to the internet, communicate data, and interact with remote devices.
- **Data Transmission**: Data transmission involves principles of networking and communication, with the Arduino sending data to a remote server or user interface.
- **User Interaction**: The user interface provides a way for users to interact with the system, access information, and potentially trigger actions remotely.
- **Automation**: The system automates the process of currency counting, making it more efficient and accurate compared to manual counting methods.
- **Integration**: This project integrates hardware components (camera, Arduino, WiFi module), software algorithms (image processing, currency recognition), and networking protocols (WiFi communication) to create a functional and user-friendly currency counting system.

BLOCK DIAGRAM

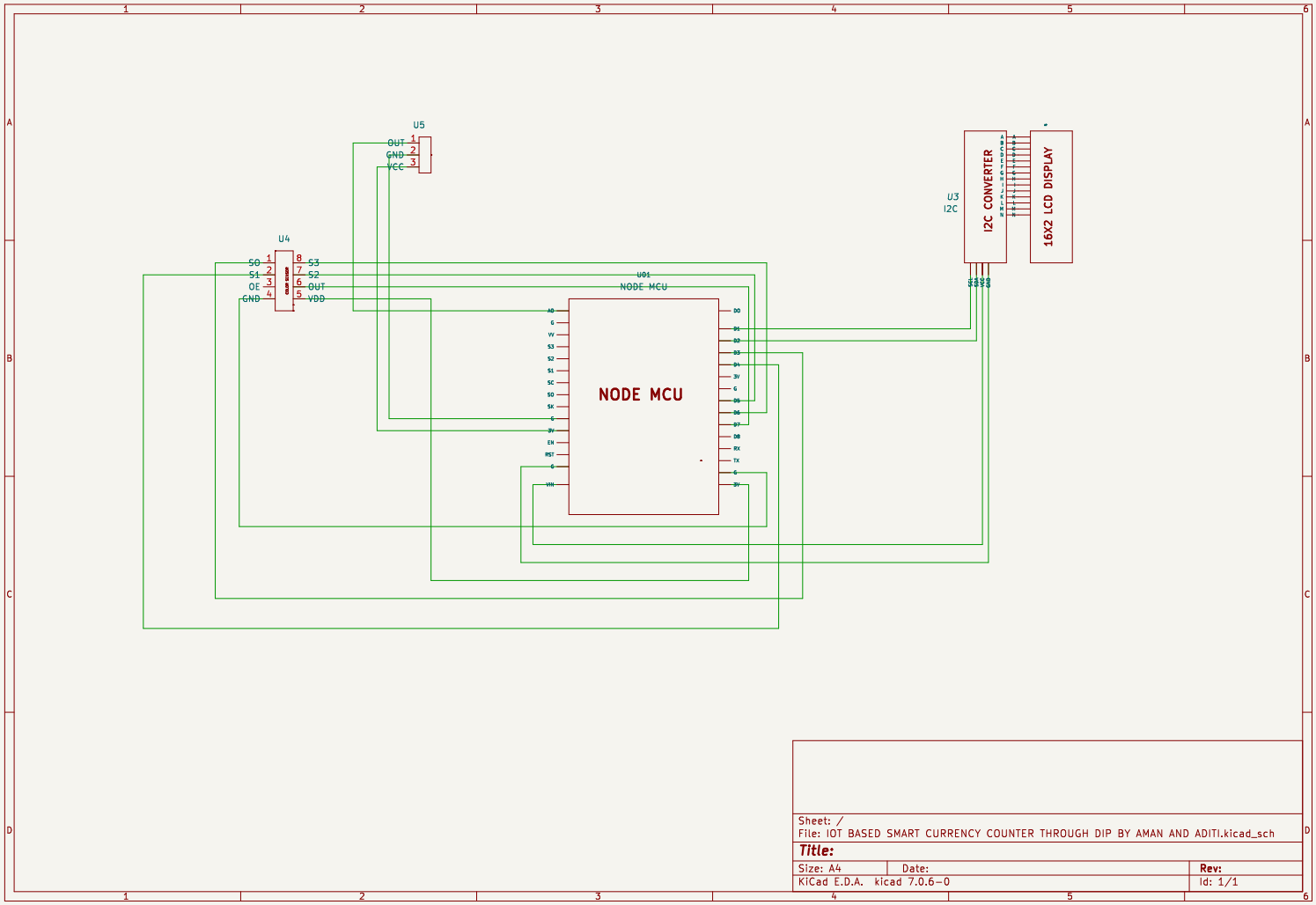


FLOW CHART:-



An IoT-powered Smart Currency Counter Flow Chart

CIRCUIT DIAGRAM:-



IOT Based Smart currency counter circuit Diagram

COMPONENTS REQUIRED: -

- **ESP8266 NodeMCU**
- **TCS230 Colour sensor**
- **IR sensor**
- **Breadboard**
- **Power supply Module**
- **16*2 Alphanumeric LCD**
- **Jumper Wires**
- **ESP 32 CAM (OV7670)**
- **I2C Converter**
- **UART Converter**
- **Dual Shaft Motors**
- **Motor Driver**
- **5V DC Adaptor**
- **USB Cable for Node MCU**
- **USB Cable for Camera Module**

COST OF COMPONENTS: -

S.No.	COMPONENTS NAME	COMPONENTS PRICE
1	ESP 8266	260/-
2	TCS230 Color Sensor	550/-
3	ESP 32 with Camera Module (OV7670)	410/-
4	Power Supply Module	250/-
5	IR Sensor	90/-
6	Breadboard	90/-
7	16*2 Alphanumeric LCD	215/-
8	I2C Shield for 16*2 LCD	150/-
9	Jumper Wires	150/-
10	Power Supply Module	200/-
11	UART Converter	170/-
12	Dual Shaft Motors	240/-
13	Motor Driver	180/-
14	5V DC Adaptor	100/-
15	USB Cable for Node MCU	120/-
16	USB Cable For UART	90/-

➢**Total Project Cost:- 3265/-**

APPLICATION:-

1. **Retail and Banking:** Smart currency counters can be employed in retail stores and banks for accurate and efficient currency counting**.**

2. **vending Machines:** Currency counters integrated with vending machines can provide real-time data on cash transactions, ensuring that the machine is stocked with sufficient change.

3. **Casinos:** Casinos deal with large amounts of cash. Smart currency counters can help casinos accurately count and verify the cash flow in real time, reducing the risk of errors and theft.

4. **Cash Collection and Transport:** Companies involved in cash collection and transportation can benefit from IoT-based currency counters. The counters can provide updates on the amount of cash collected, making the process more secure and transparent.

5. **Currency Exchange:** Currency exchange centers can use IoT-enabled currency counters to provide real-time exchange rates and accurate currency counting for customers**.**

6. **ATMs:** Smart ATMs can incorporate currency counters to ensure that deposited cash is accurately counted before being credited to the account. This reduces the chances of disputes over deposit amounts.

7. **Ticketing and Payment Kiosks:** Automated ticketing and payment kiosks can use smart currency counters to process cash transactions quickly and accurately, improving customer satisfaction.

8. **Event Management:** During events or festivals where cash transactions are common, IoT currency counters can streamline the process, minimize errors, and provide real-time insights into the cash flow.

9. **Small Businesses:** Small businesses handling cash can benefit from the accuracy and automation provided by IoT-based currency counters. This can help in efficient cash management and reduce human error.

10. **Auditing and Compliance:** For financial auditing and compliance purposes, smart currency counters can provide accurate records of cash transactions, reducing the chances of discrepancies.

11. **Charity and Fundraising:** Organizations involved in charity and fundraising events can use IoT currency counters to keep track of donations and funds raised in real time.

ADVANTAGES:-

An IoT-based Smart Currency Counter with Digital Image Processing (DIP) and Wifi connectivity offers:

1. **Accuracy:** DIP ensures precise currency counting and recognition.
2. **Efficiency**: Automation speeds up the counting process.
3. **Real-Time Monitoring:** Wifi enables instant updates and remote access.
4. **Enhanced Security:** DIP detects counterfeit notes, and Wifi ensures secure data transfer.
5. **Data Analytics**:Integration with Wifi allows for comprehensive reporting and insights.
6. **Remote Management:** Wifi facilitates updates and maintenance.
7. **Integration:** Connects with financial systems for seamless interoperability.
8. **Cost Savings**: Reduces manual counting, labor costs, and on-site maintenance needs.
9. **User-Friendly:** Intuitive interface for easy operation.
10. **Scalability:** Adaptable to future expansions or upgrades.

DISADVANTAGES:-

IoT-based smart currency counters utilizing Digital Image Processing (DIP) and Wi-Fi connectivity come with certain drawbacks:

1. **Security Concerns**: Risks related to data security and potential hacking vulnerabilities.

2. **Reliability Issues:** Dependence on Wi-Fi connectivity and sensitivity to image quality for accurate counting.

3. **Cost Considerations:** Higher initial implementation costs and ongoing maintenance expenses.

4. **Power Consumption:** Increased energy requirements for continuous operation.

5. **Compatibility Challenges:** Potential difficulties in integrating with existing financial systems.

6. **Privacy Concerns:** Issues related to user privacy, particularly with camera-based image processing.

7. **Regulatory Compliance:** Complexities in adhering to financial regulations and privacy laws.

8. **Technology Obsolescence:** Rapid evolution of IoT technology may lead to the system becoming outdated quickly.

FUTURE SCOPE:-

The future scope of an IoT-based smart currency counter, integrating Digital Image Processing (DIP) and WiFi connectivity, involves:

1. Improved Accuracy and Authentication:
- Enhancing currency counting precision and counterfeit detection.

2. Real-time Data Analytics:
- Enabling instant insights into currency usage patterns for informed decision-making.

3. Remote Monitoring and Management:
- Allowing centralized management and troubleshooting, reducing downtime.

4. Blockchain Integration:
- Adding transparency and security to currency transactions.

5. Interconnected Financial Ecosystem:
- Creating a seamless network with other IoT devices for streamlined currency circulation.

6. User-Friendly Interfaces:
- Developing intuitive interfaces for consumers and financial professionals.

7. Energy Efficiency and Sustainability:
- Implementing eco-friendly features and renewable energy sources.

8. Global Currency Tracking:
- Facilitating international trade and currency exchange with WiFi-enabled tracking.

9. Regulatory Compliance:
- Aligning with evolving financial regulations and security standards.

10. User Education and Adoption:
- Promoting trust in the technology for widespread user acceptance.

SOCIETY BENEFIT:-

1. **Precision and Speed:** IoT and Digital Image Processing (DIP) ensure accurate and rapid currency counting.

2. **Cost Efficiency:** Automation reduces manual processes, cutting down operational costs.

3. **Advanced Security:** Real-time monitoring and alerts enhance security against fraud and unauthorized access.

4. **Real-time Monitoring:** WiFi connectivity enables remote access for immediate monitoring and management.

5. **Improved Customer Experience:** Faster and more reliable transactions enhance overall customer satisfaction.

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