

Developing an on-air hand doodle system for succeeding secure Aadhar biometric scheme for aging society

Final - Review

Team Members

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Batch No. 31 - Individual Contribution

<p>Srividya Adiga - 1DS19CS168</p> <p>Hand Detection, Draw Function, Erase, Save Function, Integrating drawing, voice with django backend framework.</p>	<p>Srujana G - 1DS19CS171</p> <p>Register & Login page, Database connection for django framework, Kalman Filter.</p>
<p>Chaithra V - 1DS20CS405</p> <p>Kalman Filter, Comparison Function, Testing, Voice Recognition for registering users.</p>	<p>Priyanka M - 1DS20CS417</p> <p>Admin login, Forgot password Page, Profile Page, Voice Recognition for registered users, Testing.</p>



Introduction

- Authentication is a significant issue in system control in computer-based communication.
- Human face recognition is an important branch of biometric verification like fingerprint, Iris, Retina.
- On-Air writing is a method which can replace the traditional method of interacting with the typewriter with having no requirements for a touchpad/touchscreen kind of surface.
- Passwords are a form of authentication which provides the platform for security.
- This system which enable the users to write the characters on screen using camera and having no extra hardware or sensor cost can be beneficial to the users.



Problem Statement

- Since everyone is reliant on smart devices today and there is a chance to tamper their information, so there are numerous authentication techniques that can be quite tricky for using. Therefore, we are presenting a new technique based on gestures and movements called the on-air hand doodle system.
- Drawing is used as one form of password since graphical passwords are easier for humans to remember than typing passwords. Passwords are a form of authentication that provides the platform for security but there can be cases where these are vulnerabilities and multi-factor authentication is preferred. In addition to drawing, on-air writing or drawing needs commands to govern the process, such as drawing, erasing, and saving.



Objectives

The authentication is the important aspect in every application. This authentication process includes all the traditional based techniques to secure the data or information.

- Its objective is to replace text passwords and biometrics by on-air hand drawn doodles which are more easy to remember.
- Free hand-drawn symbols passwords without being restricted to the size, grid, or orientation as it is on-air drawn.
- This project proposes the use of lightweight CNN that is trained on an artificial image dataset to overcome the challenges faced in dynamic hand gestures.
- To solve the problem of zigzagging on-air drawn path Kalman filter is used by tuning its parameters for smooth sketch of the hand-drawn doodle.



Literature Survey

Sl No	Paper Name	Algorithm/Techniques	Performance	Advantages	Limitations
1.	RF-Wri: An Efficient Framework for RF-Based Device-Free Air-Writing Recognition	Software defined radios (SDR), Discrete Wavelet Transform(DWT) filters and letter segmentation algorithms.	95% accuracy in the classification of all air-written letters and recognition approaches.	Letter segmentation processes increase the quality of the collected data.	The large-scale movements are used and this will decrease the recognition accuracy.
2.	WiWrite: An Accurate Device-Free Handwriting Recognition System with COTS WiFi	Commercial off-the-shelf(COTS) , Self paced dense convolution network(SPDCN), CNN and COIS wifi hardware.	This will avoid handwriting and mainly overcome blurred vision and neurological diseases in the people.	A Wi-write and CSI division scheme is used to reduce amplitude noise.	Fine-grained finger tracking for automatic retain of low noise data.
3.	In-Air Continuous Writing Using UWB Impulse Radar Sensors	radio ultra-wideband (IR-UWB) radar-based , Kalman filter, State-of-the-art algorithm and CNN.	Accuracy was improved by 8.2% for 10 characters.	It allows combining of characters written midair with and without artifacts.	The localization algorithm is used for preprocessing before transferring into tangent ratio data along a time axis.
4.	Hand Gesture Recognition Model using Standard Deviation-based Dynamic Time Warping Technique	Dynamic Time Wrapping used for recognition of letters, Leap motion and Sequence matching algorithm.	Dynamic Time Wrapping helps to display letters in two dimensional values.	The combination of leap motion and Sequence matching algorithm will solve the misclassifications between letters in dynamic time Wrapping.	Guessing of letters and hand gestures and supporting Dynamic Time Technique.



5.	Research on Conscious Interactive Angle of Pen in 3D Contactless Air-Drawing and Writing	Three dimensional pen interaction ,penrole angle and yaw angle and row angle.	Rolling angle was - $135^{\circ} < D < 20^{\circ}$ and $20^{\circ} < D < 135^{\circ}$ with angle of resolution 10° with Task time, error rate and missed number of target areas are used for performance.	Efficient because Here we are considering 2 variables, angular width(W) and angular distance (D) to evaluate the performance.	These techniques are hopeful but still in carry stages of design. This needs small adjustment and formal assessment.
6.	Challenge-Response Authentication using In-Air Handwriting Style Verification	Challenge-response (CR),The MoCRA system,support vector machine (SVM).	The result shows that MoCRA can authenticate one of 24 subjects with an average equal error rate of 1.18%.	It rejects the pretenders with the error rate of 2.45% and also attackers who are writing multiple times.	Challenge-response can be used even if the communication channel is insecure.
7.	Wearable Air-writing Recognition System employing Dynamic Time Warping	Inertial Measurement Unit (IMU),TTL-USB conversion interface,DTW is a classical algorithm.	Good performance and have high accuracy especially under the limitation of time and sample size.	This air-writing system has great potential for people with disabilities.	To improve the recognition and accuracy.
8.	MicaPen: A Pen to Write in Air Using Mica Motes	MicaPen,Micaz motes,accelerometer MTS310 sensor board and MICAz sensor .	Characters written in cursive which will be different from recognizing strokes. This also incorporates MicaPen.	This concept is used for various hand gestures and sign-language recognition in real world applications.	Low-cost and used by only disabled who don't have fingers or limbs.
9.	AirNote – Pen it Down!	Smart wearables,deep learning techniques ,RCNN and SSD.	Faster RCNN was much better in terms of accuracy as compared to SSD.	Useful to senior citizens or people who don't like using phones.	Handwriting recognizer and lack in solving the pen-up and pen-down issue.



10.	Visual Gesture Recognition for Text writing in Air	CNN,Gaussian blurring and threshold algorithm	The accuracy which was attained using the system was 86.9%.	Interaction with other applications, and used to unlock the smartphone as a password by drawing.	The problems associated with accuracy are stroke shape of word and complicated background.
11.	BioTouchPass: Handwritten Passwords for Touchscreen Biometrics	Support Vector Machines (SVM) and Gaussian Mixture Models (GMM),RNNs algorithms and DTW	This approach achieves good results with EERs 4.0%.	This approach achieves good results with EERs and 4.0% when considering imitation attacks, outperforming other traditional biometric verification traits.	Improved by scaling the dataset to include lower, uppercase characters with complex deep learning
12.	A Sketch Classifier Technique with Deep Learning Models with Embedded System	CNN,deep neural network, Principal components analysis (PCA) ,Radial basis function(RBF),K-nearest-neighbors,SVM.	System recognition rate is above 98% on average.	We use the deep learning model and simplify the parameters to achieve the high-performance result.	For reducing the number of parameters,computation, Handwriting recognition.
13.	A Captcha-Based Graphical Password With Strong Password Space and Usability Study	Clicked on Object to Draw Pattern (CODP) and Click on an Object to Select Secrets (COSS),CSAV algorithm.	Unlock the smartphone's pattern and provide a strong password space.	Graphical passwords schemes CODP and COSS schemes which can overcome the shoulder surfing attacks.	They need a separate graphical scheme for integration of the CaRP, Pass-Go and BDAS graphical password.
14.	A CNN Based Framework for Unistroke Numeral Recognition in Air-Writing	CNN,sensor Kinect, LEAP Motion, Hidden Markov Model (HMM) and Gated Recurrent Units (GRU).	Framework achieved 97.7%, 95.4% and 93.7% recognition rate.	System is able to recognize isolated unistroke numerals of multiple languages.	Pre-trained CNN for performance improvement through fine-tuning on air-writing data.



System Diagram

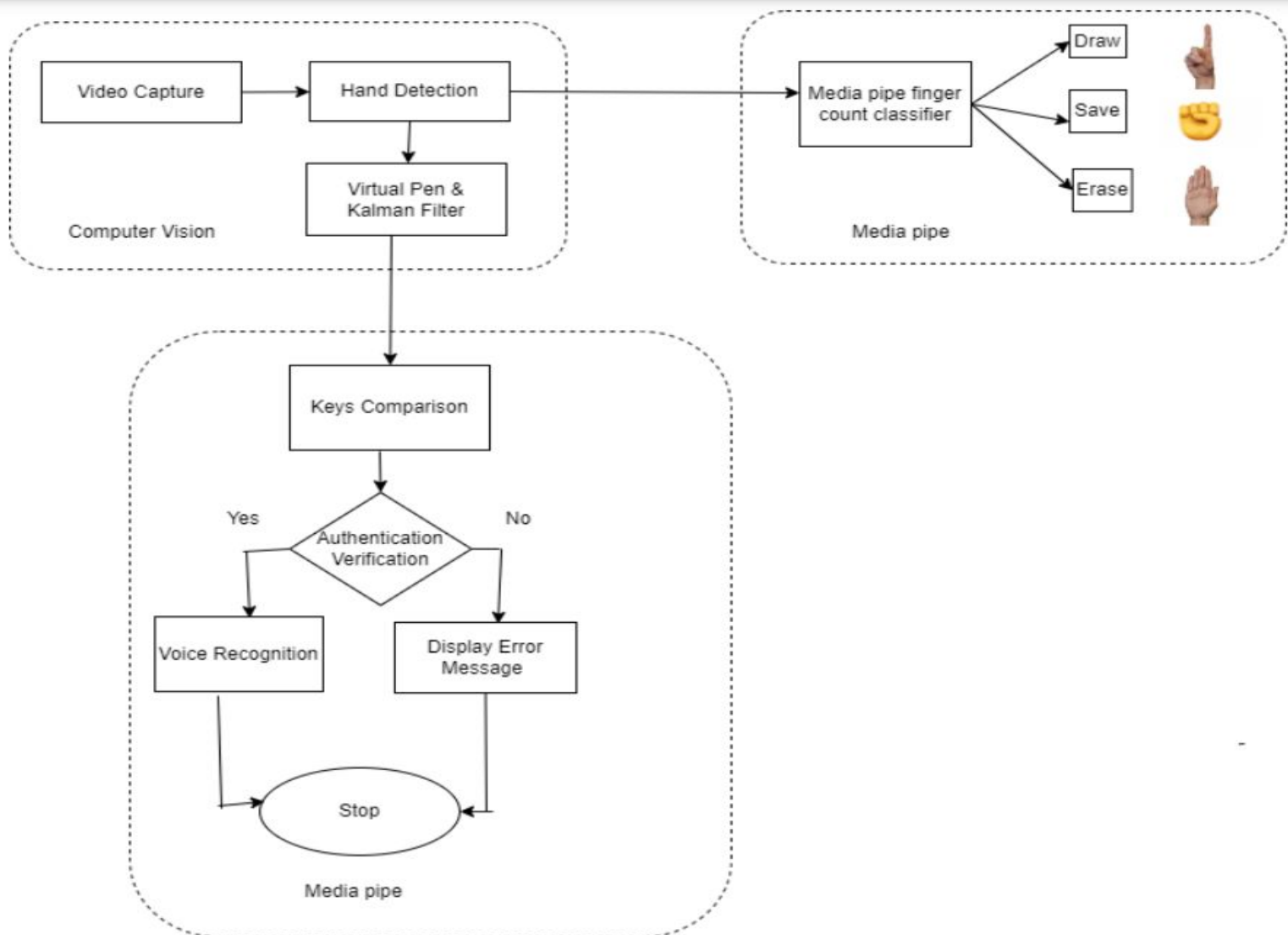


Fig 1: Main modules involved in on-air Doodle authentication system



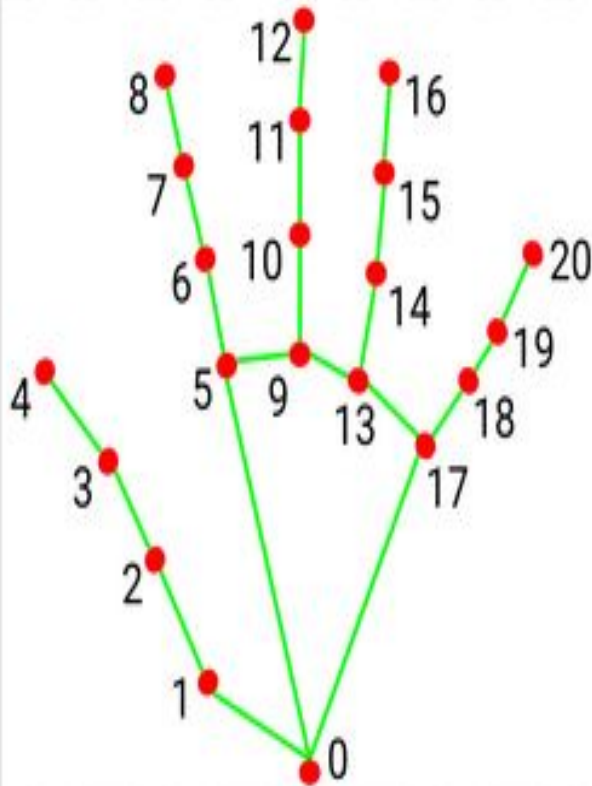
Modules

➔ Back End

- **Computer Vision:** This part trains computers to capture and interpret information from image and video data. Take information from digital images, videos and other visual inputs and also take actions or make recommendations based on that information.
- **Hand Detection:** with the help of computer vision the hand will be recognised to create the virtual pen and draw.
- **Kalman filter:** This algorithm will help us to estimate the state of a system based on observations or measurements. And prediction is done based on object.
- **Open Cv:** This library is used for computer Vision for accessing input from image and video processing.
- **Mediapipe:** This is the open-source framework, used for media processing and provides the orientation of the hand detection.



Mediapipe Hand Landmarks



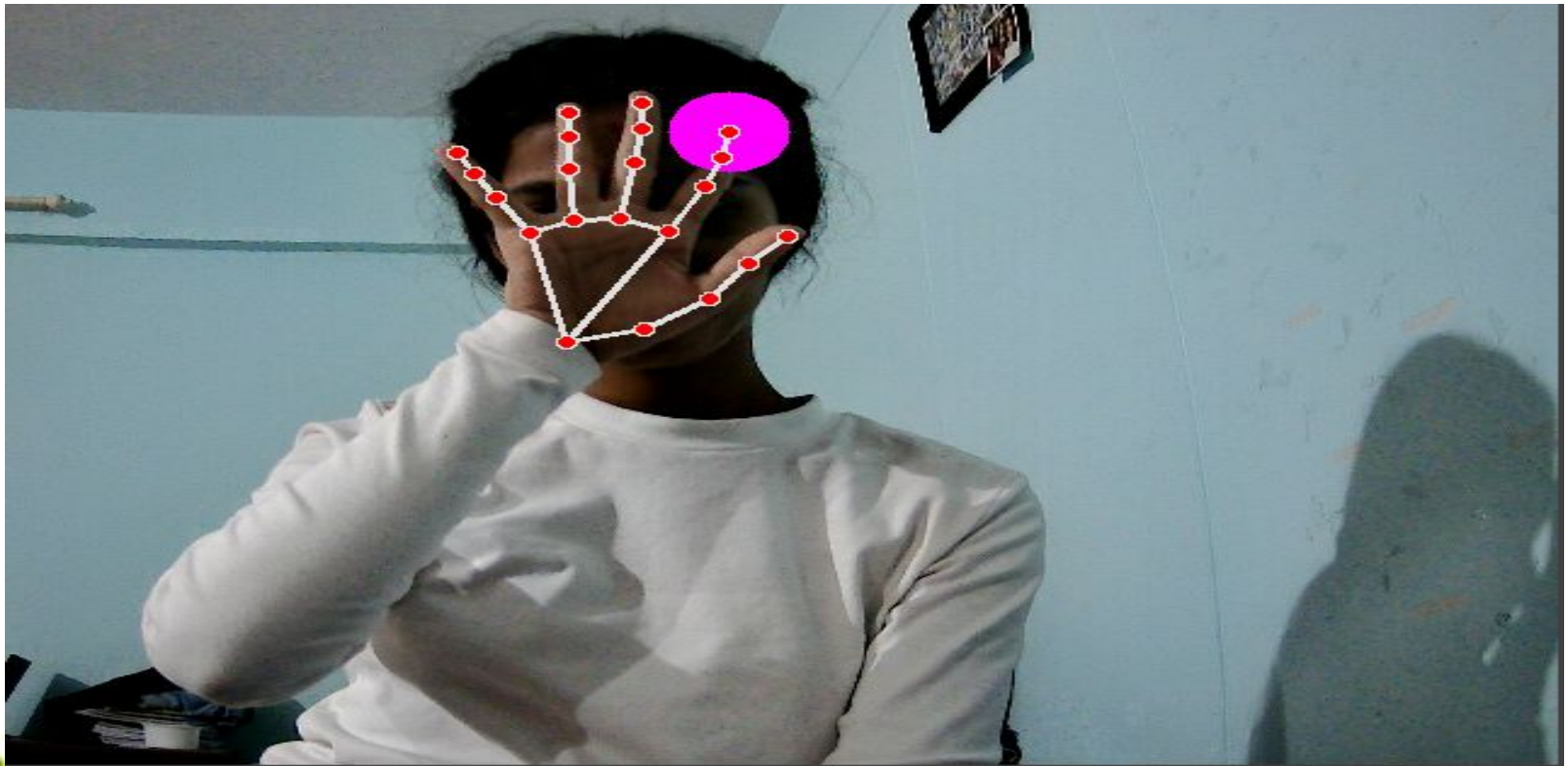
- | | |
|-----------------------|---------------------|
| 0. WRIST | 11. MIDDLE_FINGER_D |
| 1. THUMB_CMC | 12. MIDDLE_FINGER_T |
| 2. THUMB_MCP | 13. RING_FINGER_MCF |
| 3. THUMB_IP | 14. RING_FINGER_PIP |
| 4. THUMB_TIP | 15. RING_FINGER_DIP |
| 5. INDEX_FINGER_MCP | 16. RING_FINGER_TIP |
| 6. INDEX_FINGER_PIP | 17. PINKY_MCP |
| 7. INDEX_FINGER_DIP | 18. PINKY_PIP |
| 8. INDEX_FINGER_TIP | 19. PINKY_DIP |
| 9. MIDDLE_FINGER_MCP | 20. PINKY_TIP |
| 10. MIDDLE_FINGER_PIP | |

1,543 x 53



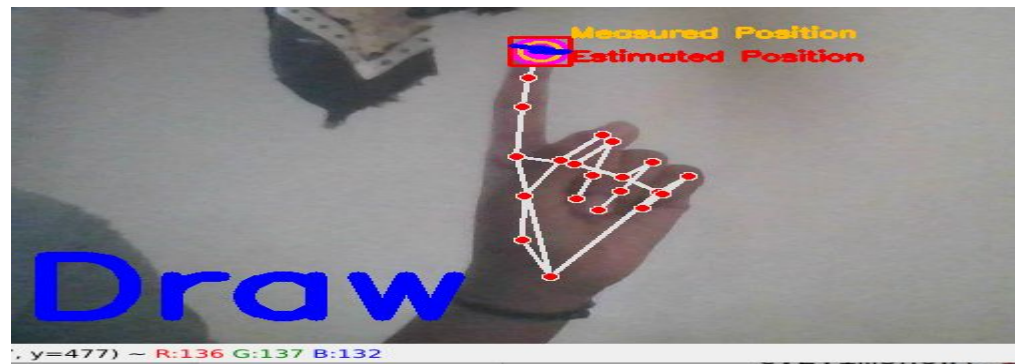
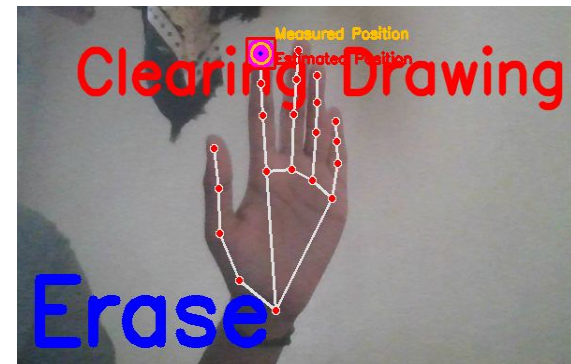
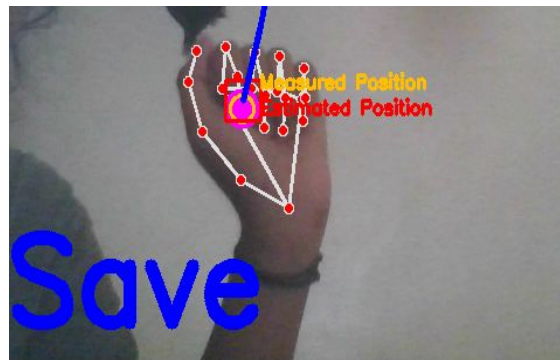
Input

Hand Detection



Preprocessing

We have used the Mediapipe Library tool to configure pre-built processing pipelines to get immediate, engaging, and output for image.



Algorithm

- Computer Vision is used for hand detection and creation of virtual pen. Virtual pen is picked up by hand when the hand is in front of the camera..
- Image enhancement is the procedure of improving the quality and information content of original data before processing.
- The next step is, drawing the image in on air which includes background data. To get accurate image we use Kalman filter.
- Kalman filter is the existing methods that are in use for estimate the state of a system based on observations or measurements .

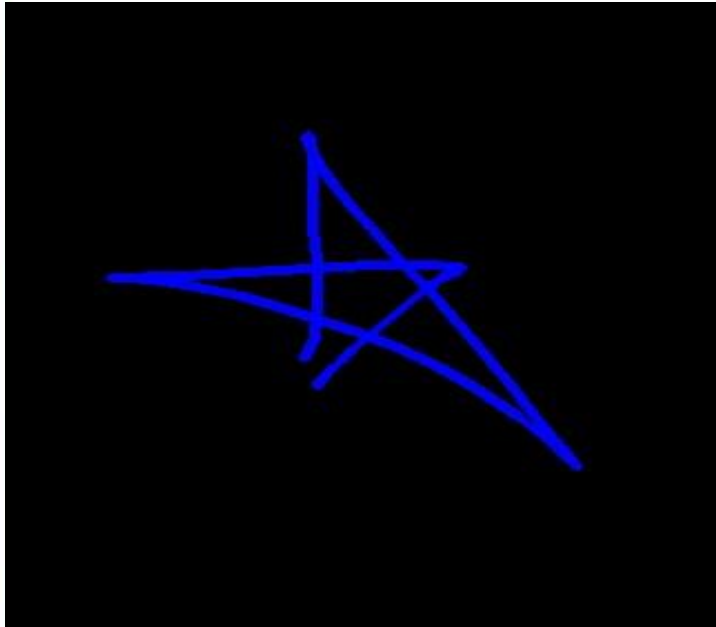


Algorithm

- Kalman filter is an algorithm to smoothen the hand-drawn symbols on the air such that accuracy of the system increases.
- In Authentication first the symbols are drawn to login, which are then extracted and decrypted and matched with the keys already present to verify the identity of the user.
- MFCC-Mel-frequency cepstral coefficients(MFCC): Input to the base model will produce much better performance than directly considering raw audio signal as input. MFCC is the widely used technique for extracting the features from the audio signal.



Output - Used for debugging and testing



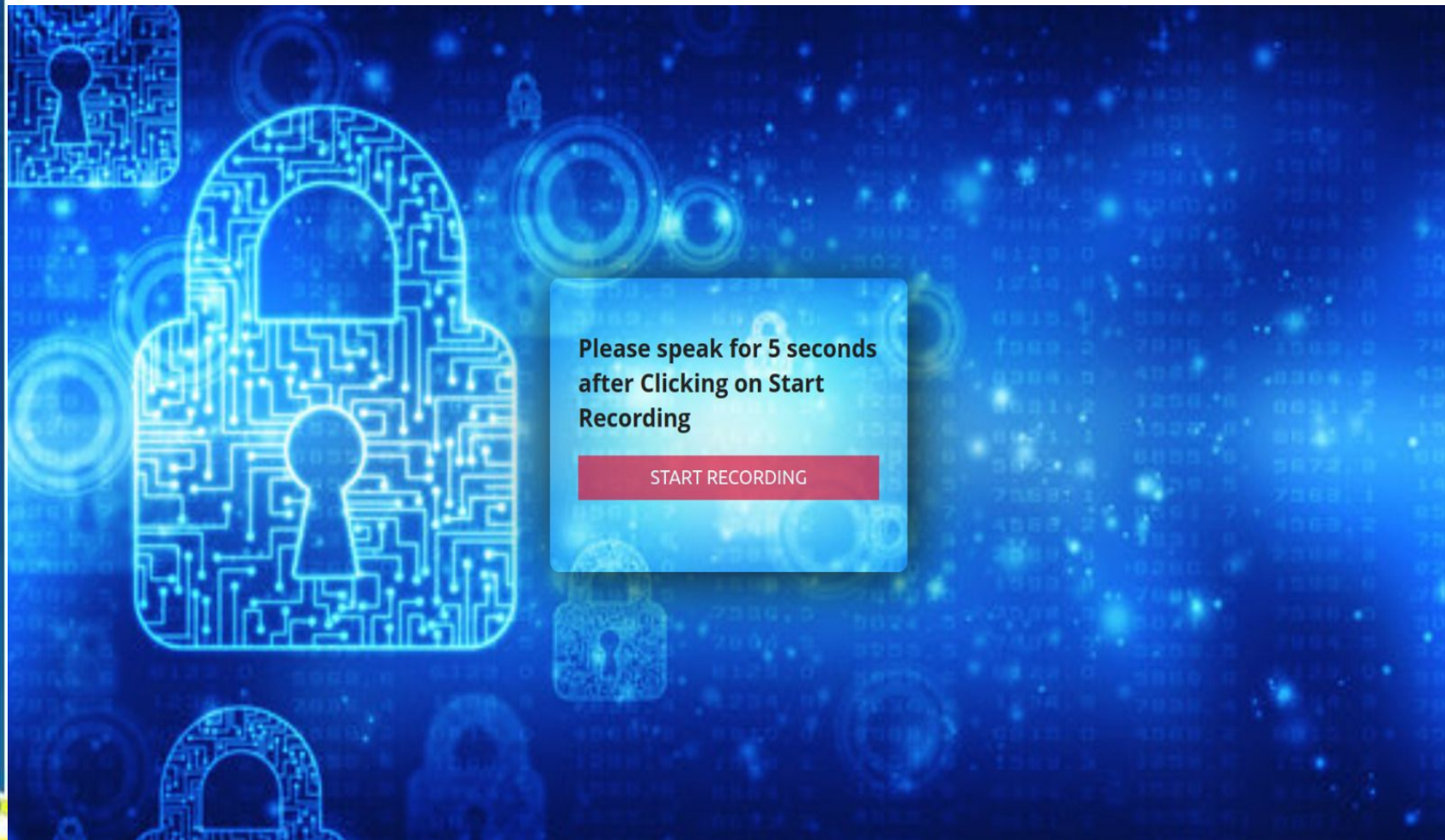
Saved output



Drawing



Front End - Output - Admin login Page



Front End - Output - User Register/Login



Front End - Output - User Login



The image displays a user login interface on a blue background with a circuit pattern and binary code. A large, glowing padlock icon is on the left. The login form is a semi-transparent box in the center-right. It contains the title 'USER LOGIN', a label 'Ration Card No' above a text input field, two red buttons labeled 'REGISTER' and 'SUBMIT', and a link 'Forgot password?' at the bottom.

USER LOGIN

Ration Card No

REGISTER

SUBMIT

[Forgot password?](#)



Front End - Output - User Register Page



The registration form is displayed on a blue background with a circuit pattern and a large padlock icon. The form fields are as follows:

- First Name**:
- Last Name**:
- Ration Card No**:
- Phone Number**:
- Hint Question:**
- Enter the answer**:

Buttons: SUBMIT, RESET, LOGIN



Front End - Output - User Forgot Password Page



The image shows a web page for a 'FORGOT' password feature. The background is a dark blue gradient with a large, glowing yellow padlock icon in the center, filled with a circuit pattern. To the right of the padlock is a white form titled 'FORGOT' in bold. The form contains the following elements: a label 'Ration Card No' above a text input field with the placeholder 'Enter RC no'; a label 'Hint Question:' above a dropdown menu; a label 'Enter the Answer' above another text input field; a red 'SUBMIT' button; and a red 'LOGIN' button. The background also features faint, glowing binary code and other padlock icons.

FORGOT

Ration Card No

Enter RC no

Hint Question: ▼

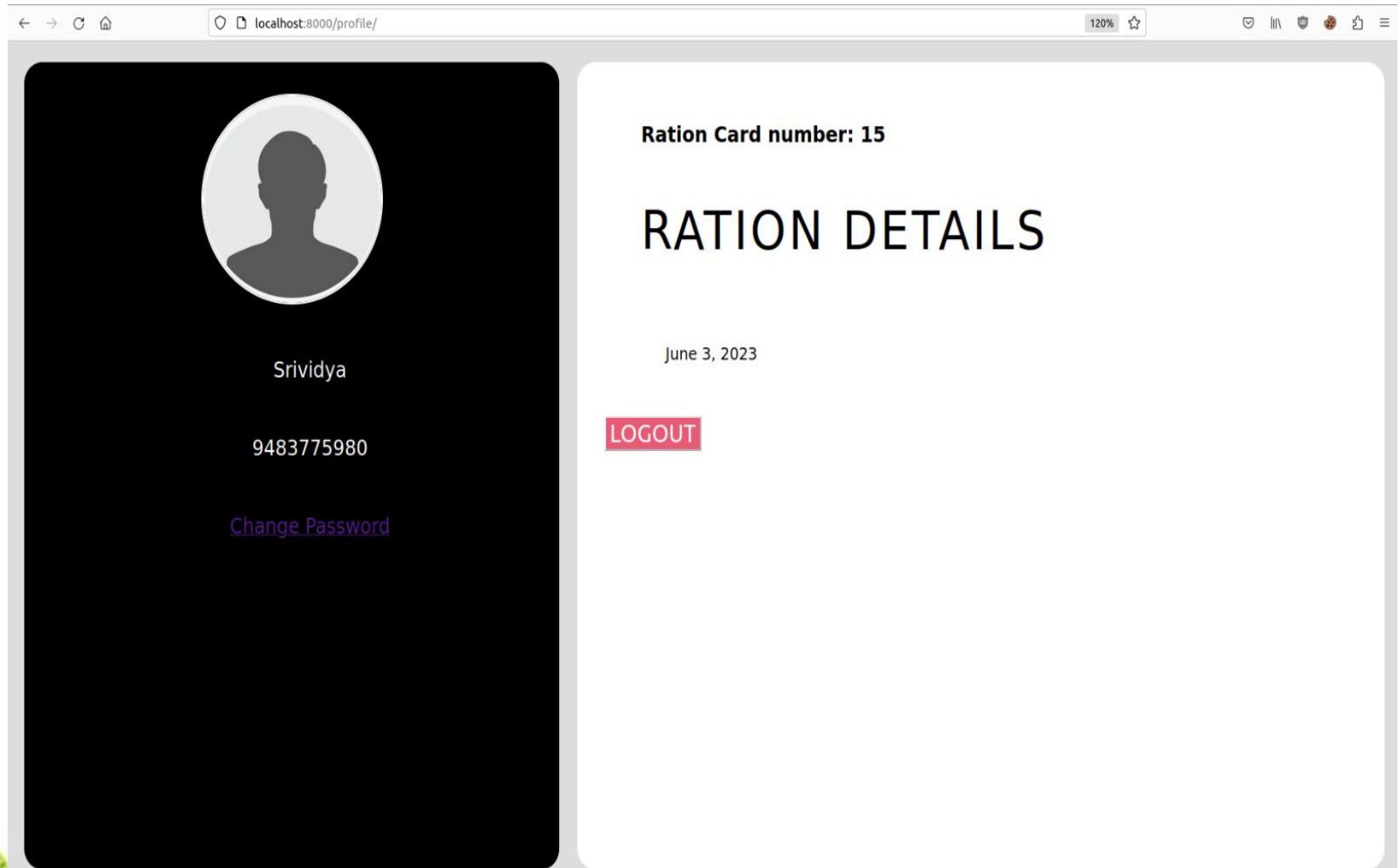
Enter the Answer

SUBMIT

LOGIN



Front End - Output - User Profile Page



Applications



Fig.1 : Public Distribution System



Fig.3: Employee Attendance monitoring

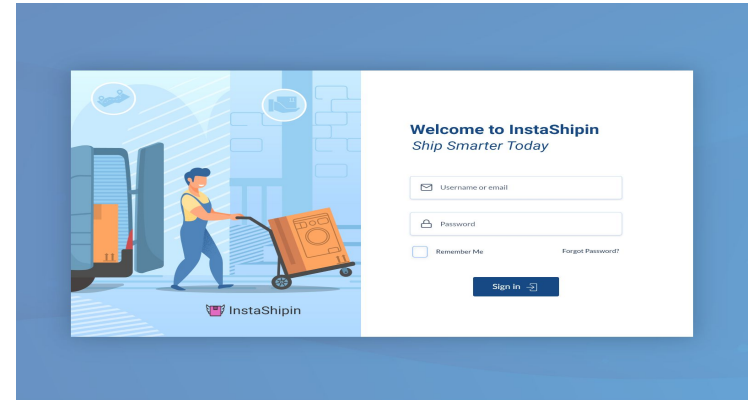


Fig.2: E-Commerce website login page

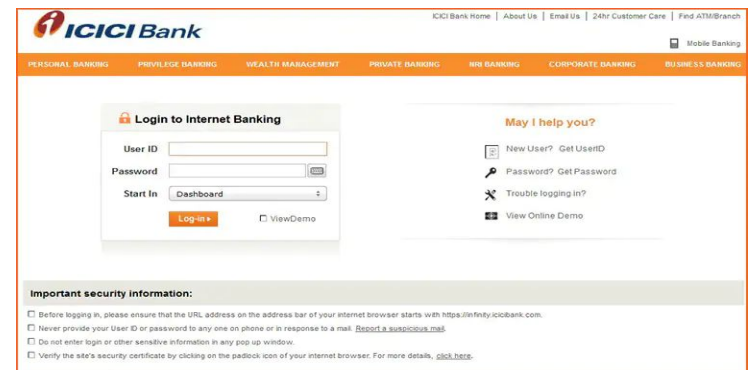


Fig.4: Bank Authentication



Conclusion

The goal of our project was to create an accurate end to end system, utilizing the passwords as doodle infrastructure along with our processing framework and an end user web-based portal to display the report of the password detection. For the same, we came up with a five stage process, starting with the frames being extracted from the video, through the code for objection detection, our custom collision detection algorithm and our self-trained classifier to classify the images as correct doodles, to finally displaying the results of the classification process to a web platform that would be made available to admin and users in the Ration Distribution.

The proposed system was demonstrated the acceptability and significance of the suggested authentication technique using usability factors like accuracy, efficiency, and user satisfaction. The suggested approach is safe and resistant to dangers from physical observation. This technique is completely independent of any depth camera or motion sensor, making it suitable for managing future on-air writing. The voice based authentication is mainly overcome the security factors occurred by doodle system. The both techniques will help the applications secure and safe with there efficient usability.



Future Enhancement

- There are other strategies that we can incorporate into this improved system in addition to air writing and hand recognition. We created this method by incorporating voice recognition and doodling for verification; however, in addition to these, we can also integrate an OTP module, Iris recognition.
- For the forgot password module, we have added a hint question option in this suggested system so that it can be replaced by an OTP verification that is delivered to the user's registered mobile number.
- Additionally, we can create a web application that would function as a standalone programme rather than hosting it on a web server.



Future Enhancement

- Additionally, we added a speech recognition system to the current system by speaking random sentences, allowing us to improvise by adding a language and audio-based captcha.
- The current system can be improved by not allowing the user to take ration more than once and also restrict the user such that he/she can't attempt to login more than a number in a fixed period of time on a session basis e.g max 3 failed attempts for login for 24 hours time period.
- For physically challenged group, there should be an option to select which of the two authentication he wants to select to select between voice, iris, hand doodle or OTP and based on that he should be authorized.

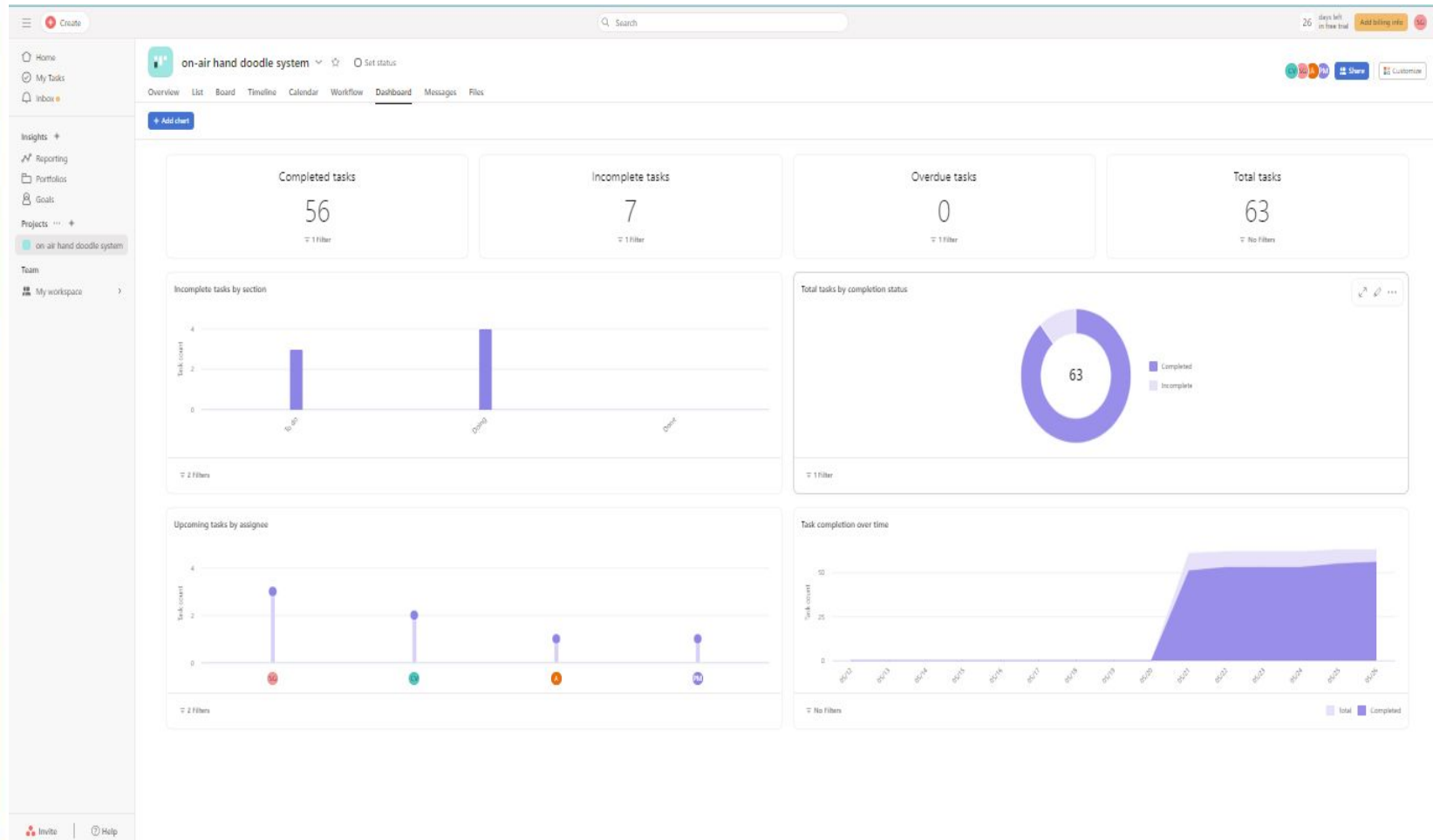


Co-guide Meet Details - Suggestions

- Our Coguide recommended implementing 2 factor authentication using OTP/Iris recognition during our 1st and 2nd meet.
- In our third interaction he told us to implement voice recognition module rather than iris due to lighting conditions constraints.



Project Tracker



Project Tracker

The screenshot displays a web-based project tracker interface. At the top, a navigation bar includes a 'Create' button, a search bar, and a '25 days left in free trial' notification with an 'Add billing info' link. A left sidebar contains navigation links for Home, My Tasks, Inbox, Insights, Reporting, Portfolios, Goals, Projects (with a sub-link for 'on-air hand doodle system'), and Team (with a sub-link for 'My workspace'). The main content area is titled 'on-air hand doodle system' and features tabs for Overview, List, Board (selected), Timeline, Calendar, Workflow, Dashboard, Messages, and Files. Below the tabs are filters for Filter, Sort, and Hide. The 'Board' view shows three columns: 'To do', 'Doing', and 'Done'. Each column contains task cards with details such as task name, priority (Medium, High), status (On track, At risk), and assigned user (CV, SG, PM). The 'To do' column has one task: 'Working on Implementation Paper' (Medium, On track, CV, 5 Jun). The 'Doing' column has three tasks: 'Integrating the system and testing end to end flow' (High, At risk, SG, 23 May - Today), 'Final Year Report' (Medium, On track, PM, 23 May - 9 Jun), and 'Final Project Report' (Medium, On track, CV, 18 May - 9 Jun). The 'Done' column has four tasks: 'Generating Random sentences and audio recording' (High, At risk, CV, 17 - 24 May), 'Integrating voice recognition for admin module' (High, On track, SG, 18 - 26 May), 'Profile Page' (High, On track, PM, 19 - 25 May), and 'Database connection - Connect the django framework with mySql database' (High, On track, A, 18 May - Today). A 'Comparison function: drawing and from db' task (High, At risk) is partially visible at the bottom. Each task card includes a '+ Add task' button. At the bottom of the sidebar are 'Invite' and 'Help' links.

Project Tracker Interface for "on-air hand doodle system".

Navigation: Home, My Tasks, Inbox, Insights, Reporting, Portfolios, Goals, Projects, Team.

Project: on-air hand doodle system

Team: My workspace

Project Status: 25 days left in free trial. Add billing info.

Project Overview: Overview, List, Board (selected), Timeline, Calendar, Workflow, Dashboard, Messages, Files.

Project Board Columns:

- To do**
 - Working on Implementation Paper (Medium, On track, CV, 5 Jun)
 - + Add task
- Doing**
 - Integrating the system and testing end to end flow (High, At risk, SG, 23 May - Today)
 - Final Year Report (Medium, On track, PM, 23 May - 9 Jun)
 - Final Project Report (Medium, On track, CV, 18 May - 9 Jun)
 - Kscst Synopsis and PPT (Medium, SG, Monday)
 - + Add task
- Done**
 - Generating Random sentences and audio recording (High, At risk, CV, 17 - 24 May)
 - Integrating voice recognition for admin module (High, On track, SG, 18 - 26 May)
 - Profile Page (High, On track, PM, 19 - 25 May)
 - Database connection - Connect the django framework with mySql database (High, On track, A, 18 May - Today)
 - Comparison function: drawing and from db (High, At risk)

Footer: Invite, Help



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THANK YOU!



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