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Harnessing IoT for Intelligent Attendance Tracking

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ABSTRACT

This abstract provides an overview of an Attendance Monitoring System that leverages IoT, Cloud, AI, and ML technologies to enhance efficiency and accuracy in tracking attendance records. The system integrates IoT-enabled devices, such as biometric sensors, RFID/NFC scanners, or facial recognition cameras, to capture attendance data in real-time. These devices are strategically placed at key entry points, classrooms, or workspaces, ensuring a seamless and non-intrusive attendance recording process. Attendance data is securely stored in the cloud with the real time data process. By using these advanced technologies of IOT, cloud, AI and ML the data is secured and accessed by the authorized people. This attendance monitoring system brings transparency in the workspace and improves organizational efficiency and productivity.

KEYWORDS

RFID Radiofrequency identification module),Camera module, Biometric (fingerprint sensor),cloud, AI, Raspberry Pi 3 Model B

I. INTRODUCTION

The effective attendance management is essential. Conventional approaches frequently show to be laborious and prone to mistakes. By utilizing cutting-edge technology, the IoT-based smart attendance system described in this study seeks to transform conference attendance tracking. This attendance system containing of real time monitoring data. The proxy of attendance can't be done in this system. The data is highly confidential, and data is authorized. The architecture of proposed system is equipped with smart devices. By using IoT the data can be monitored anywhere and any place. There are two phases in this type of system to monitor the real time data monitoring of the person. The data is stored in the cloud.

II. EXISTING TECHNIQUES

Bawar Ali Abdalkarim: Development of Attendance system in characteristic methods include face recognition, ID and password, and QR codes. The development overcomes many false informations, proxy attendance, indicating false signs and manual data entry into the systems.[1]-[2]
Khawala Alhanaee, Mitha Alhammadi , Nahala Almenhali , Maad shatnawi : Development in identification of face and this played a major-key role in the access and management of the attendance ccontrol system. This made the rate of accuracy and prediction is very high performance and tough.[3][4].

Ezekiel Promise Sochima, Onate egerton Taylor, Fortune B.Deedam: After using many technological ideas came up with the face recognition and this gives the exact accuracy and strict monitoring of a person in the area. This development made measurement of the face & mark the attendance in the database.[5]-[10].

A technique for tracking attendance was proposed in 2006 by Bernie DiDario, Douglas Ahlers, and Michael Dobson. The system has wireless communication and identifying tags. features, such as scanners to identify each prospective participant's tag as they enter a certain room [11].

Sirovich and Kirby (1987) established the concept of representing human faces using principal components; It was utilized for face recognition and detection by Turk and Pentland (1991). It compares a face's features with those of known individuals in order to identify the owner of the feature. First, a principal component factor called the "eigenvector" is found by PCA, after which the set of distinctive feature images called the "eigenface" are located [12]-[13].

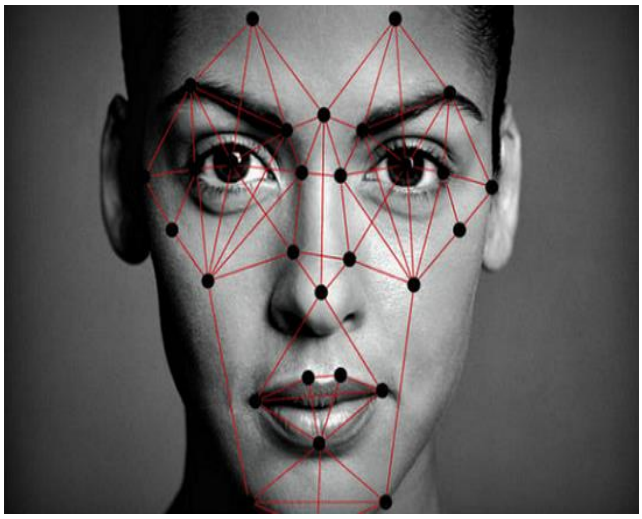
III. METHODOLOGY

The proposed system is purely image processing in which each frame is captured from the live video feed of the webcam.
The image processing is done through OpenCV library which is an open source library for both python, C++ and Java interfaces. Windows, Linux, Mac OS, iOS, and Android are all supported. There are 2500 efficient algorithms in this collection that work with pixels of the picture using vector operations.

Face recognition is supported by the Face_Recognizer class library in OpenCV. This may be used from the command line or Python to recognize and work with faces. It's a very basic library created with dlib's cutting-edge deep learning-based facial recognition technology. The dlib is an open-source, cross-platform software library that has been implemented on multiple computer platforms. The model's accuracy is 99.38%. With the help of this, with a folder of photos, you may use the command line to perform face recognition on them by typing the straightforward face recognition command line program.

The face recognizer library finds faces in the input. It can also identify faces in an image and determine how many faces are available based on our criteria.

This library generates an encoded image which contain 128 measurements of the input video. These 128 measurements will classify each face.



The Fig.1 show the 128 measurements of the input image. These measurements vary for different faces.

Devices - Here we are using two different systems in which one system is used for marking the attendance (Marker) and the other is for removing the attendance (Demarker).

Database Setup - Database is a collection of data in which images and information of the people is stored. The database developed by Google is used in this project. The firebase database has an advantage of real-time in which data can be updated without reloading the website. Hence firebase real-time database is used for storing and updating the attendance of the person. The database is very much simple and robust. The database requires authorization credentials to modify the data present in the database.

Face Recognition- As images are present in the database. Each image is sent to face recognition classifier in which the classifier generates unique encoded images for each image. Each face has each 128 measurements which are differ for one another.
The input for the live webcam is fed to face recognition classifier the classifier identifies the face present in the image and generate its encoded image.

RFID - RFID(Radio Frequency Identity) works on the principle of radio frequencies. The type of reader used in this system is MFRC522 different types of RFID Tags can be read through this reader. Each tag contains the UID(Unique Identity) number of each person.

The Fig.2 shows the RFID reader and tag.
When tag is scanned by RFID reader the reader sends the UID number to the main control.

At first the user need to scan their RFID tag then the reader reads the data(UID) present in the tag. Using this UID number the system fetches the data of the person from the database. The information such as Name, Branch, Photo are fetched by the system. The photo from the database is sent to face recognition classifier. The classifier generates the encoded values(128 Measurements) of the image and compare these measurements with the images from the live webcam. If the probability of matching is high, then The

database is updated (incremented) with the person's attendance If the person whose attendance is marked on that day is seen in on demarker system during the college hours then the attendance is removed(decremented) for that person.

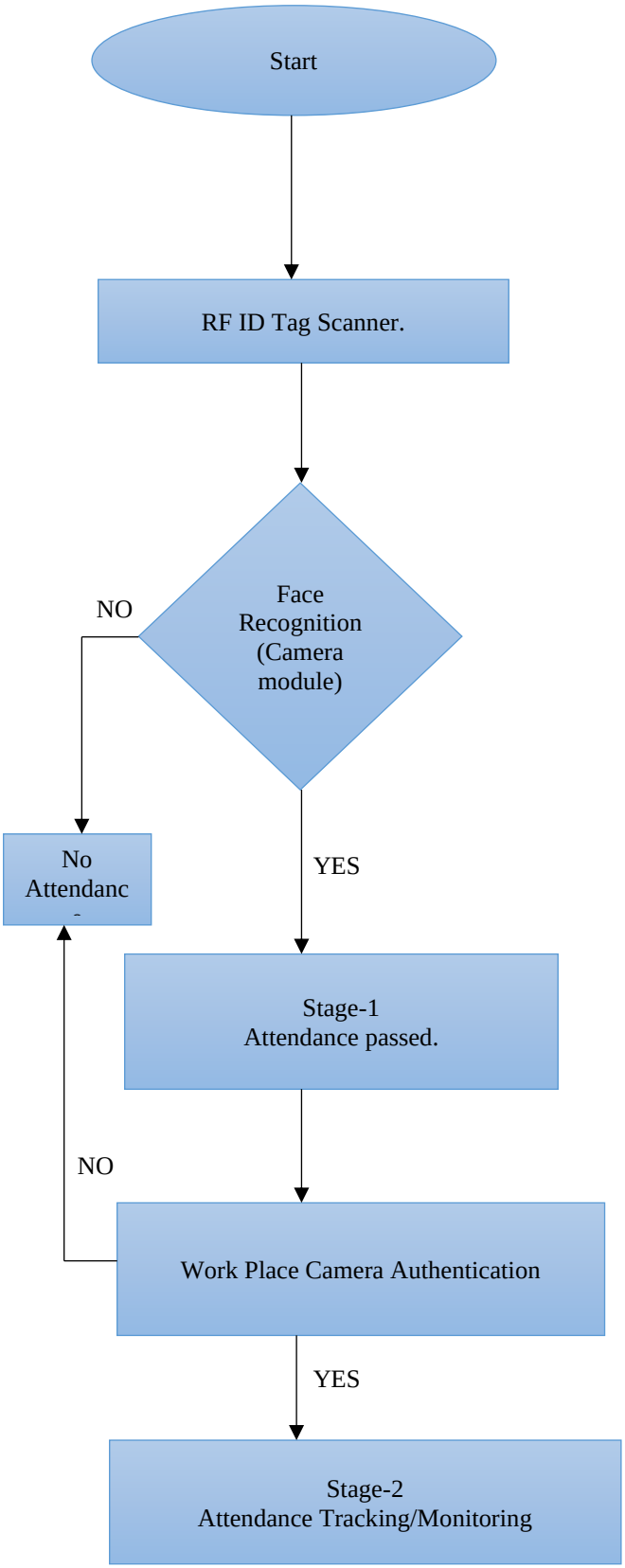


Fig3. Flow Chart

IV. FLOW CHART

IV.1 RF I'd Tag Scanner-In this phase, the persons I'd is fetched with the data base and mark the phase-1 attendance. Individual persons data is stored in the cloud initially.

IV.2 Face Recognition- In this phase, the data is cross verified with the initial stage and the data base. If the face is matched and verified with the data then the attendance is marked, if not it marked as a "No Attendance."

IV.3 Data Base-At the beginning, the individual person data is collected and stored in the data base. This is the initial stage of the system. Every single person will differ by different Id's. This data is accessed by authorised persons of the organisation.

V. HARDWARE SETUP

The Systems hardware consists of an-

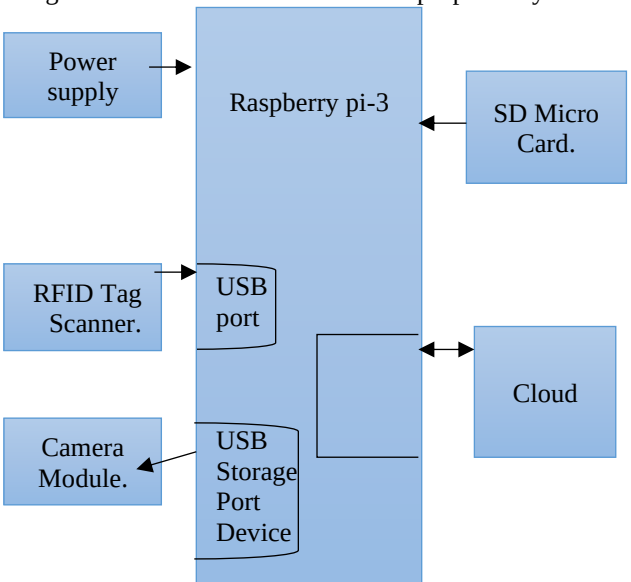
V.I Raspberry Pi 3- Raspberry Pi 3 model B was used in this system. It is equipped with ARM cortex-A72 CPU with four 1.5 GHz cores and 64 bits. It is a single board computer which can perform image processing. Raspberry Pi OS was booted into the chip.

V.II MFRC522 Reader- It is a rf reader which can read data from rfid tags. It is mainly used at 13.56MHz for contactless communication. The MFRC522 reader is compatible with NTAG and ISO/IEC 1443 A/MIFARE. This device can read data and also can write data into RFID tags.

V.III Camera Module-This module will capture the moments of the person in the form of video, and this will transforms in the form of images by dividing the video.

V.IV Display Unit-This unit will have a 7-segment display, which shows the percentage, status of the attendance of a person over a workspace.

Fig.V.1 Displays the hardware Utilized in system block diagram. The Raspberry Pi 3 serves as the system's brain. External power supply is provided to the pie. Fetching, real time tracking/monitoring of the person and generation of the attendance are the phases of the purposed system. During the database creation and discovery process, we use a camera module to capture images. To save data, the SD card must be linked as external storage. Pi has a display connection.
Image.V.2 Tells the Schematic for the purposed system.



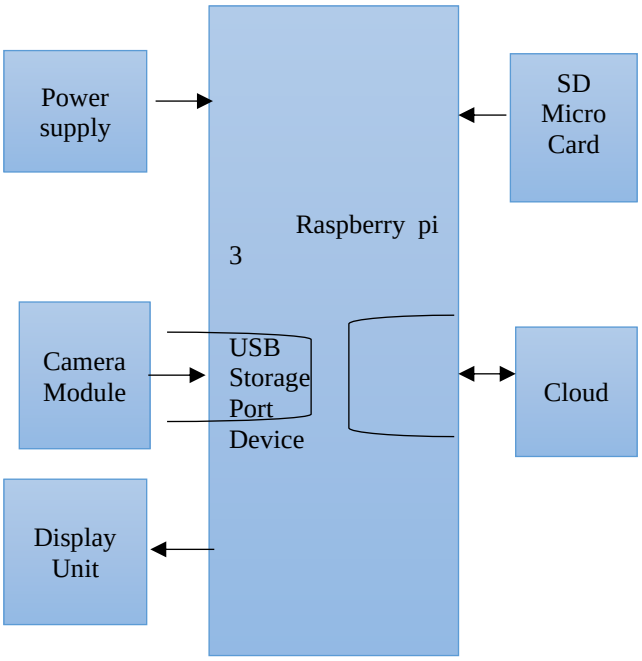


Fig.V.1 A schematic of the intended system.

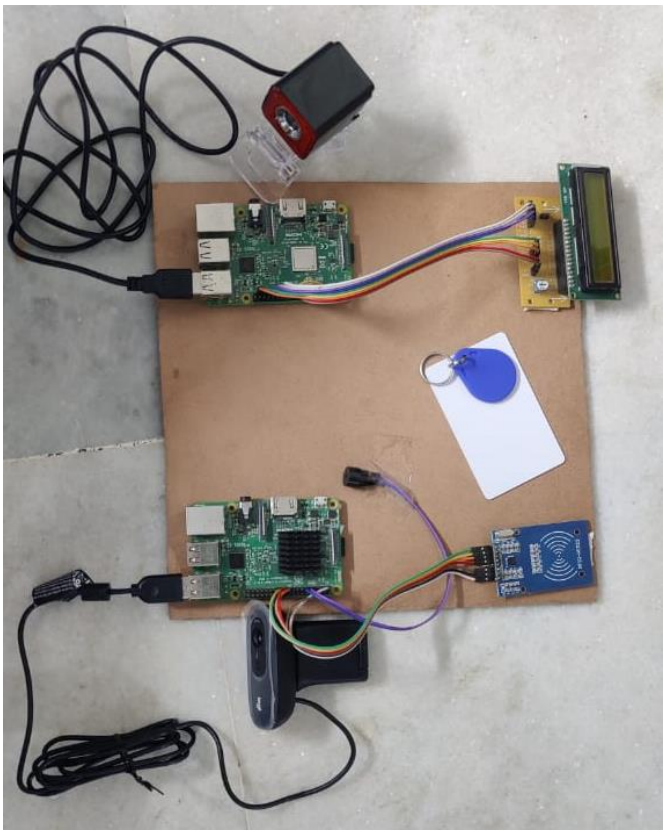


Fig.V.2 The Schematic setup model of the System.

VI. RESULT

The results obtained by the purposed system are following pictures.

Fig.VI.1. Camera module will take the single picture of each person and stores in the cloud for the creation of data base and further processing.

Fig.VI.2. RFID tag is scanned at reader and verified with the details of the data base and if details are matched marks the attendance if not "No Attendance"

Fig.VI.3. Displaying the status of the attendance of a person and removing the attendance.

Fig.VI.4 The data can be retrieved by the authorised persons of the organisation. By providing the details of a person like Rf I'd tag number to the database then, the data will be displayed. The complete data of the person will be stored in cloud and it is safe and secure, it can be accessed by the authorised people if the organisation.

Fig VI. 1 Image creation for database**.**

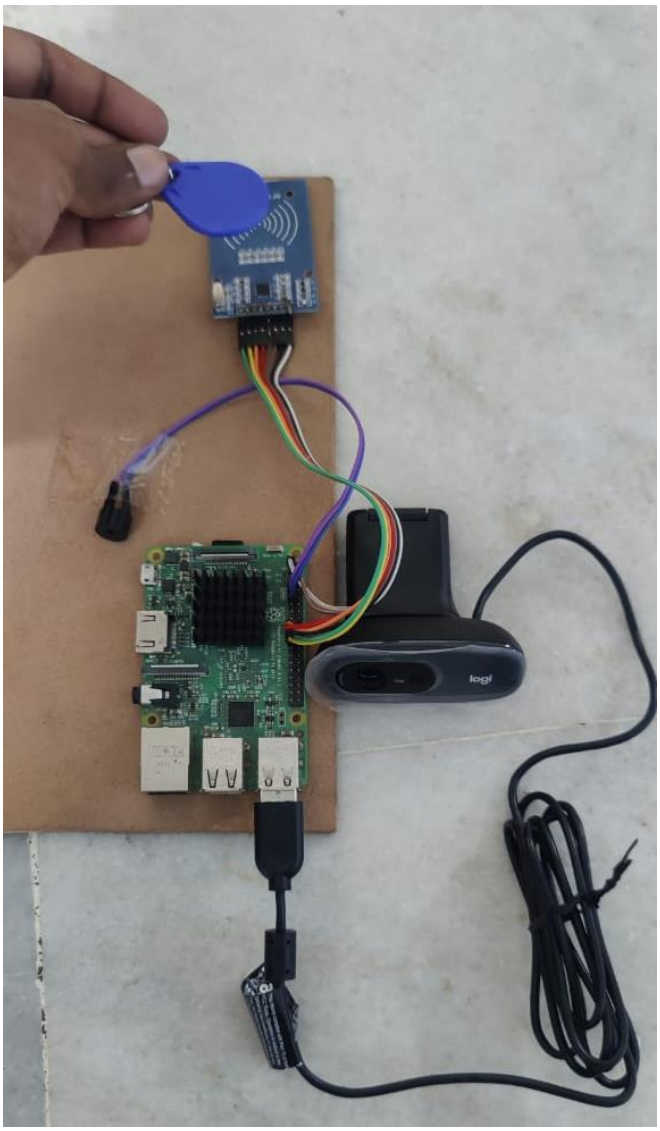


Fig.VI.2.a RFID tag is scanned at reader.

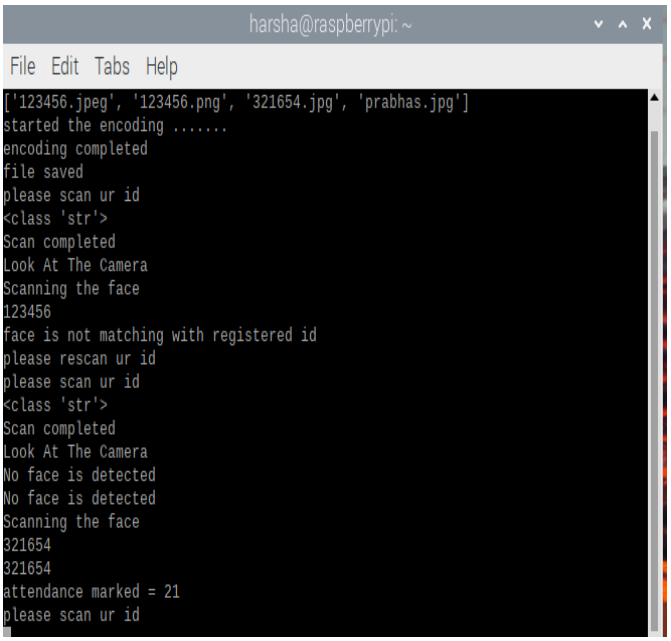


Fig.VI.2.b Verifying with details with data base and marking attendance.

Fig.VI.3.a Displays the status of the attendance of a person.

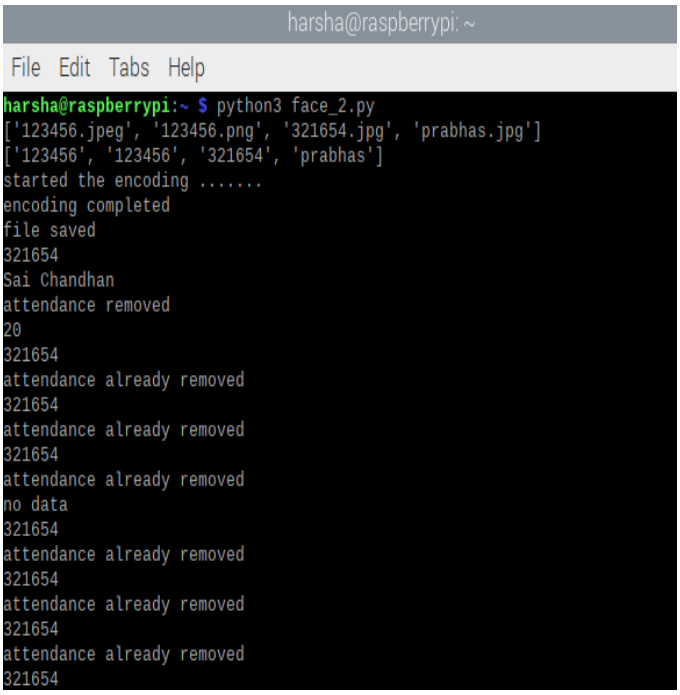


Fig.VI.3.b. Removing the attendance of a person.

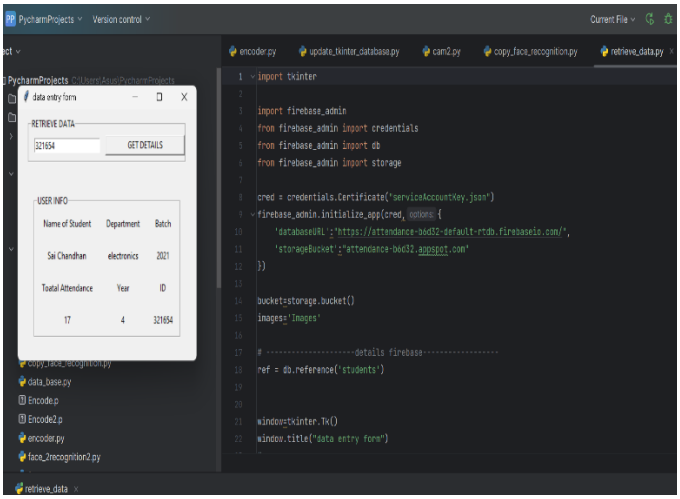


Fig.VI.4. Retrieving the data of a person from data base.

VII. CONCLUSION AND FUTURE SCOPE OF THE SYSTEM

From the analysis we can improve the monitoring of the person over the workspace in more efficiently and smartly. The effective and real time tracking of the person will be monitored by the authorised persons of the organisation and the rate of accuracy of the attendance of a person is high compared with other systems. The system data can be stored in the cloud safely and securely. For robust monitoring we can add Iris Scanner, Voice recognition in further stages. When it comes to SMART-cities, classrooms, libraries, hostels. We can access it in smarter manner by improving it by RF I'd Tag and Iris scanner and by Facial recognition. For the monitoring of the attendance in more advanced manner a QR code over the workspace, This code will work only in the area of work space i.e., it calculates the X,Y&Z-axis of the work space and within the limit it will be provided.

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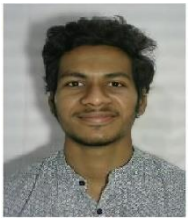

Kotha Sai Chandan, a 2024 Electronics and Communication Engineering graduate from B V Raju Institute of Technology, specializes in embedded systems, IoT, and digital signal processing. With hands-on experience as a Hardware Engineer at Inkers Technology Pvt Ltd, Sai Chandan has contributed to cutting-edge technology solutions. They have developed innovative projects such as a Harnessing IoT for Intelligent Attendance Tracking System and are proficient in tools like STM32CubeIDE, MATLAB, and Python. Through technical projects, workshops, and hackathons, Sai Chandan has honed their expertise and aspires to drive advancements in automation and smart technologies by bridging research, development, and real-world applications.

K. Mani Raj, a 2024 Electronics and Communication Engineering graduate from B V Raju Institute of Technology, specializes in embedded systems, IoT, and digital signal processing.Developed innovative projects such as a Harnessing IoT for Intelligent Attendance Tracking.