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STUDENT RECOMMENDATION SYSTEM AN OCR-BASED CERTIFICATE DETECTION APPROACH

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Abstract: During their eight semesters of study, engineering students at APJ Abdul Kalam Technological University (KTU) must accrue 100 activity points. These points are awarded based on participation in workshops, internships, startups, extracurricular activities, and other engagements, with each activity credited according to KTU's prescribed guidelines. Currently, certificates serve as proof of participation and completion, which are manually uploaded by officials after submission to the respective department. To streamline this process, we propose an OCR-based system that leverages text recognition and image processing technology. This system will automate certificate verification and data entry, reducing manual effort and ensuring seamless integration with the university portal.

Keywords: Text Recognition, OCR, NLP

I. INTRODUCTION

Many universities encourage students to engage in both curricular and non-curricular activities to enhance their overall learning experience and skill development, and they are specifically encouraged to participate in both curricular and co-curricular activities to foster holistic growth and practical exposure. National initiatives, technical workshops, entrepreneurship, innovation, internships, NCC or NSS, cultural programs, sports and games, industrial visits, etc. are all ways to earn activity points. These points differ depending on the course and the college. At the conclusion of the BTech program, each student must receive 100 points. The pupils receive two credits out of the 100 Activity Points they have accrued. The activity point requirement for lateral entrance students starting in the third semester is 75. In the KTU portal, colleges enter the activity points that students have earned on a semester-by-semester basis and the consolidated points on an academic year-by-academic-year basis. Students must manually enter all of the certificate details and present their certificates to the appropriate faculty members as verification. For our teachers, this is a difficult and time-consuming task. With the aid of OCR and processing algorithms, this project seeks to address this issue by automating the initial step of allocating distinct activity points to each student's certificate value. The capacity of a computer system to automatically read text from photographs is facilitated by text recognition. Faculty members must first scan the certificates, after which the system will automatically identify the text and award each student with the activity points they have earned. This approach reduces the amount of time and physical labor needed to type the material.
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II. LITERATURE REVIEW

Text classification techniques include certificate categorization. Different approaches to text categorization are covered in this literature overview. Term Frequency (TF), Word2Vec, Term Frequency-Inverse Document Frequency (TF-IDF) and Global Vectors for Word Representation (GloVe), and are standard feature extraction methods [1]. We look at the specifics of their technical implementation and categorize these approaches into weighted word techniques and word embedding. Tests using various kernels for Support Vector Machine (SVM) models have shown that term-frequency modifications have a major effect on SVM performance [2]. Using Random Forest algorithms, the problem of learning from text data with class imbalance is investigated in [3]. We present a supervised version of the TF-IDF approach in [4], which extracts documents from the recognized category while computing the standard inverse document frequency (IDF) factor. This modification guarantees that phrases that are commonly used in a category are not undervalued. In [5], a limited one-pass clustering approach is combined with KNN to provide an enhanced KNN algorithm for text classification. This approach significantly lowers text similarity computations and outperforms state-of-the-art classifiers like KNN, Naïve Bayes, and SVM, according to empirical results on three benchmark datasets. For many Natural Language Processing (NLP) tasks, neural network techniques like Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) are also successful.

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RNNs are more suited for modeling sequential information, whereas CNNs concentrate on feature extraction utilizing N-grams at higher levels. The performance of these two Deep Neural Networks (DNNs) for a range of NLP tasks is assessed in an article in [6], which aids in identifying the best method for specific situations. In [7], a new approach to brief text modeling is put out that combines CNN and semantic clustering. Initially, the method finds semantic cliques in embedding spaces using a rapid clustering algorithm. These cliques then supervise the detection of multi-scale semantic units, adding outside knowledge to the text-processing pipeline. The Error-Correcting Output Coding (ECOC) method is modified in [8] to introduce a multi-label text categorization strategy. This technique increases the effectiveness of ECOC for multi-class issues by using a cluster of binary complementary classifiers. To improve multi-label classification performance, a weighted posterior probability is also calculated. The fine-tuning of BERT-like architectures with unlabeled data in a generative adversarial context is extended by the authors of [9] with GAN-BERT. According to experimental results, this method achieves good performance in a variety of sentence categorization tasks while drastically reducing the amount of annotated data required (down to 50–100 examples). [11] examines implementation details for text categorization in biological applications.

III. GENERAL BACKGROUND OF THE PROPOSED SYSTEM

3. 1 Recognition of Text

With text recognition, a computer system may automatically learn to read text from images. To extract text from a picture, we employ optical character recognition, or OCR. Optical character recognition and readers are used in many applications. This OCR converts scanned text from a document into handwritten, printed, or typed machine-encoded text. A picture is taken out of the document using Tesseract and OpenCV. More than 100 languages can be read by the open-source Tesseract engine. Any image format, including PNG, JPEG, and GIF, can be read by it. Hewlett-Packard was involved in its development. Photographs with integrated text can be read and recognized by tesseracts. Its design was worked on by Hewlett-Packard. Any image format, including PNG, JPEG, and GIF, can be read by it. It is also commonly used to process scanned documents, among other things. To integrate Tesseract into C++ or Python programs, we need to leverage its API.

3.2. Elements

3.2.1 Arduino Uno

The ATmega328P microprocessor serves as the foundation for the Arduino UNO microcontroller board. It has fourteen digital input/output pins, six of which are analog inputs and six of which are PWM outputs. In addition, the board has a reset button, an ICSP header, a power jack, a USB port, and a ceramic resonator operating at 16 MHz. Furthermore, the Arduino enables serial USB communication between a Python program and the RDIF card reader.

3.2.2 RFID unit

Every student has a unique identification ID that we assign using an RFID module. Digital data stored in RFID tags or smart labels can be read by radio waves using Radio Frequency Identification (RFID) technology. RFID, like barcoding, uses a scanning device to capture data from a tag or label and stores it in a database. The ability of RFID tags to be read without a line of sight, however, is a major benefit over barcode systems, which need direct alignment with an optical scanner. An RFID tag or smart label, an RFID reader, and an antenna are the three primary parts of an RFID system. An antenna and integrated circuit in the RFID tag send data to the RFID reader, sometimes referred to as an interrogator. After that, the reader transforms the radio waves into useful information that is transmitted through a communication link to a host computer system. For later analysis, the gathered data is kept in a database. The digital data is automatically transferred and captured when students put their RFID tag close to the reader.

3.2.3 MySQL database

We employ a database, which is a structured collection of data made for simple updating, maintenance, and retrieval, to effectively organize and manage student information. Student data is organized in tables, rows, and columns in relational databases, and indexing makes it possible for SQL or NoSQL searches to retrieve the data quickly. Users can control read/write access, create reports, and keep an eye on usage via a database management system (DBMS). Certain databases adhere to the ACID (Atomicity, Consistency, Isolation, and Durability) principles to guarantee data consistency and trustworthy transactions. SQL (Structured Query Language), a standardized programming language, is used to handle relational databases.

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IV. EXPLANATION OF THE PROPOSED SYSTEM

Students must turn in their certificates to the appropriate faculty members, who manually enter the certificate details, in order for the KTU site to record the activity points that they have accrued over the course of a semester. Teachers find this process to be taxing and time-consuming. The suggested approach cuts down on the amount of time and human labor required to type the text. This method greatly benefits professional college teachers because it does away with manual input. By employing optical character recognition (OCR) and a processing algorithm to allocate activity points to each student based on the value of their certificates, this study seeks to introduce automation.

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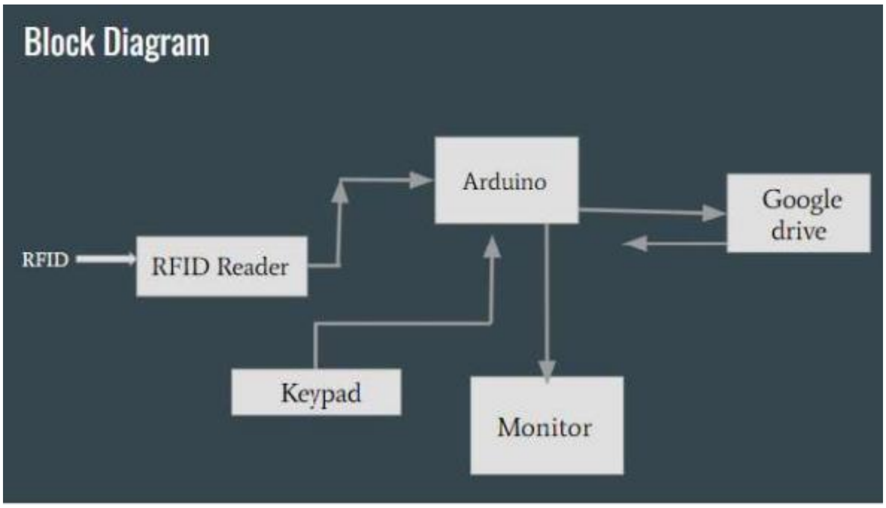

Figure 1 Block diagram of the proposed system

The block diagram for the suggested system is shown in Figure 1. The software component is prepared once the required OCR packages (such as Tesseract), a MySQL database connection, and RFID module integration have been loaded and set up in the Python code. Additionally, the necessary connections are made in order to prepare the hardware configuration. The following is the user process: Consider a student, "X," who should obtain the appropriate KTU points but requires the scanned photos of their credentials (in JPEG format). It is necessary to copy these scanned photos to a drive's "Certificates" folder. Before copying the certificates, make sure the folder is empty. The files for text recognition will be retrieved from this folder by the software. The student's profile is then automatically retrieved from the database when they swipe their RFID card. After that, each certificate is scanned separately, and information is retrieved from the database using pre-specified keywords found in the MySQL activity table. The words in the certificates are displayed to the user in a dialog box verifying whether the recognition was successful once the system has identified them. Which activity is linked to the certificate and the accompanying points are specified in the dialog.

The question, "Would you like to continue?" is then displayed to the user. (Y/N). If the recognition is accurate, the user hits "Y" to continue. The user can change the details by pressing "N" if the recognition is unsuccessful. The user can change the activity name, type (IIT, NIT, or KTU), and associated points by inputting "e" in the event of an error. When the certificate is vague about its affiliation with IIT, NIT, or KTU, another problem could occur. In these situations, the user can choose the appropriate choice (0 or 1) depending on the pertinent points once the system shows the IIT/NIT and KTU scores. The overall activity points for the student are shown on their profile on the website when all certificates have been processed. A list of all activity points and the associated activities attended is visible to both the user and the administrator. For documentation needs, a printout of the data can also be produced.

V. RESULTS AND DISCUSSION

A screenshot of the findings for a single student is displayed in Figure 2. With all of their information and details saved in the database, the system enables the recovery of activity points for various students

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Figure 2 Activity points results for a single student

VI. CONCLUSION

In conclusion, the proposed OCR-based automation system offers an efficient and scalable solution to the current manual process of certificate verification for KTU's activity point system. By leveraging modern text recognition and image processing technologies, it not only minimizes administrative effort but also ensures accuracy, transparency, and faster integration with the university portal—ultimately enhancing the overall student experience and institutional efficiency.

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