

# Automated Enhanced Learning System using IOT

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**Abstract**— In current scenario engineering students are facing problems in grasping the subjects, henceforth level and quality of education is regularly declining. One of the probable cause of this decline in quality of education is students are not able to understand and comprehend the subject. A solution to this problem is proposed in this paper. It is based on the theory of three preferential learning style of an individual namely visual, auditory and kinesthetic (VAK Theory). So the present approach is based on classifying the students based on their learning styles and allotting them assignments as per their preferential learning styles accordingly. The proposed system put forwards an IOT based system which will automatically categorize students, keep the record of their performance, assignment, submission history etc. This will help in reducing manpower of faculty member and enhance the performance of students from 5 to 42% by custom designing activities as per the innate learning style.

**Keywords**— IOT, learning style, VAK theory

## I. INTRODUCTION

Learning styles play an important role in grasping and understanding power of an student. If the activities, assignments, tutorials etc. are designed as per the preferential learning styles of the student it can result in significant improvement in grasping and understanding the subject by the student. Fingerprints are formed in the womb of the mother and they can be utilized to identify the learning style of the student. There are four general patterns of fingerprint i.e. whorl, loop, arch, and accidental as shown in figure 1. Ridges on the skin of palm and toes begin to form in after 13<sup>th</sup> week embryo grows in maternal body. The formation of these patterns i.e. dermal lines will complete during the 24<sup>th</sup> week. Once fully developed the dermal patterns remains unchanged for the whole life. The formation and analysis of these patterns is correlated with development of brain and learning style of an individual.



Figure 1 General types of fingerprints

Figure 2 shows the typical characteristics of fingerprint.

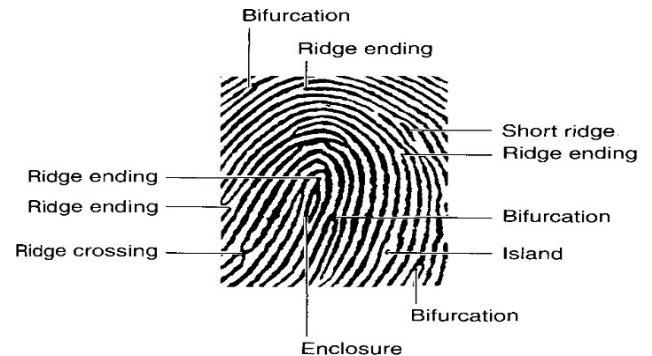


Figure 2 Characteristics of fingerprints

## A. Learning Styles: VAK Theory

Most people have certain method or approach which is better than other approaches of interacting with and processing information. The three main learning styles are [1]

- (i) Visual
- (ii) Auditory
- (iii) Kinesthetic

While designing the assignments an educator has to keep in mind the preferential learning style of that group of students and customize the assignment. For example, for auditory group the assignment may ask them to summarize their responses to lectures they have heard or they may be asked to listen audio lectures and give oral tests. Whereas for visual group their assignments may involve explanation with illustrations, diagramming, reading maps, drawing, sketches, preparing notes etc. In the same line group with kinesthetic as preferential learning style should be given assignments involving physical activities, practical exam rather than written, use role-plays, flash cards and similar activities.

Rest of the paper is divided into different sections for the ease of understanding. Section II focuses on the related work done in this field. Section III depicts the proposed model and section IV provides the results and discussion. At the end, conclusion of the work has been given along with the future scope in section VI.

## II. RELATED WORK

M. D. Roca et. al. [2] in their paper titled “Preferential complementary learning style-type indicator” described an automatic system which employed a web application based Indicator Test of identifying preferential learning style of the students however their work was solely focused upon preferential styles of learning, but they did not discussed

anything about VAK theory. They also analyzed that the learning style of a student resulted in time saving during the assessment of the student rather than using conventional methods such as questionnaire. Their model was known as Preferential Complementary Learning PCL. PCL focused on one's personality and learning ability, identifying the individual as a whole. P. Gounon and X. Dubourg [3] in their work represented a model to prepare tutoring activity for learning environments. They begin by process a tutoring activity, then they conferred model structured in 3 parts: the tutor, the taught person and also the tutoring designs. D. Whittington and T. Dewarin [4] their work titled "A strategy for studying learners using advanced learning technologies," proposed a technique to study the behavior of learners using advanced learning. They explained that the Myer Brigg technique for identifying personality of learner is useful when investigating learner behaviors in an online learning scenario. Later in 2016 J. J. Maldonado, et. al. [5] in their work proposed a technique especially in the current scenario where Massive Open and Online Courses (MOOCs) are gaining rapid popularity and transferring knowledge is challenge, as the student/learner has to understand the topic without the support of a teacher. They further suggested that each student has his own learning style and designing MOOCs in accordance to learning style of participant may help him better grasp the subject.

From the above literature survey, it can be concluded that each individual has its own preferential learning style and on the basis of this a novel model is proposed in section 3.

### III. PROPOSED MODEL

The proposed model require that the data of the total number of students is entered into the database. The faculty member has to design assignments and prepare them as per the three categories of learning style that is visual, auditory and kinesthetic (read / write) [6, 7, 8]. The proposed system will check the fingerprints of each student and analyze its learning style. Each student will be categorized into one of the three learning styles and put into 3 groups. Finally a database of all the students will be prepared according to their learning style and students will be categorized into 3 groups. Whenever an assignment is due the student has to put his finger on fingerprint scanner and IOT based system will automatically identify the student, check his submission history and automatically allot the assignment as per the pre-stored group in database. Proposed system will not only improve the productivity by saving lot of time of faculty member which otherwise wasted in maintaining records, submission details, assignment history of the student, marks etc. But will also enhance the overall learning experience of the student by modifying the assignments as for the learning strength and interest [9, 10, 11].

#### A. Automated assignment allotment and validation system

In proposed system all the students database will be prepared according to their learning styles and group accordingly. The proposed system will not only distribute/ assign the tutorials to the students but will also keep the record of the progress, marks scored, assignment submission history etc. On the basis of the record of two consecutive semester an analysis of the improvement in grasping the subject can also be done. The analysis and validation process of proposed system is shown in figure 3.

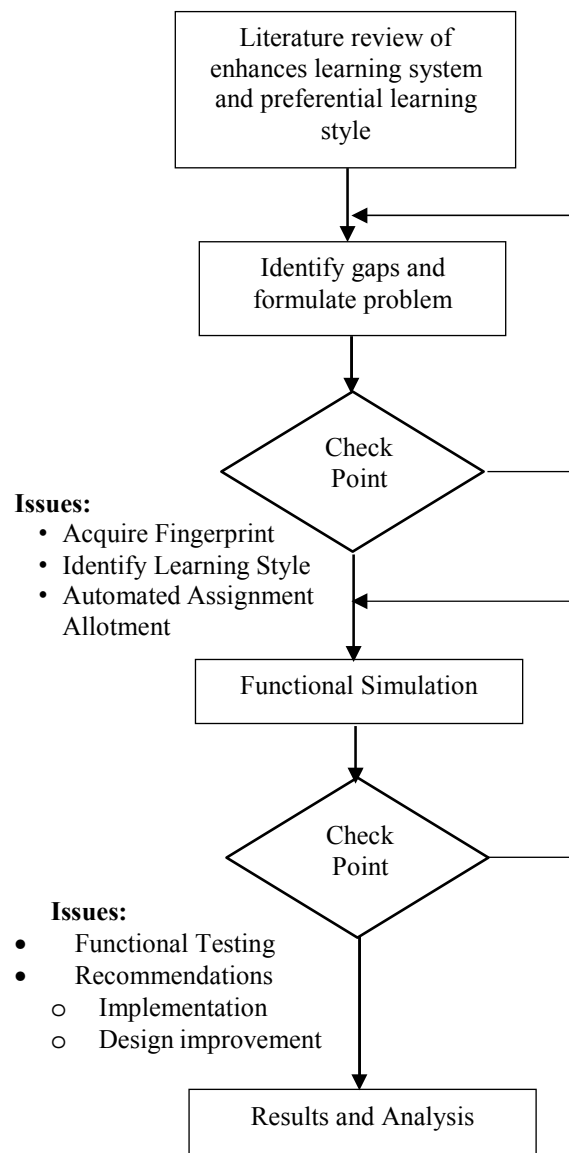


Figure 3 Analysis and validation process flow of proposed design of automated enhanced learning system

#### B. Experimental setup

The proposed system is implemented using Arduino Uno interfaced with IOT module. The figure 4 shows the fingerprint sensor (FPM10A fingerprint module) and Arduino board with necessary pin descriptions.



Figure 4 Main components of proposed model

Whereas figure 5 shows the complete IOT based experimental setup to implement the proposed model.

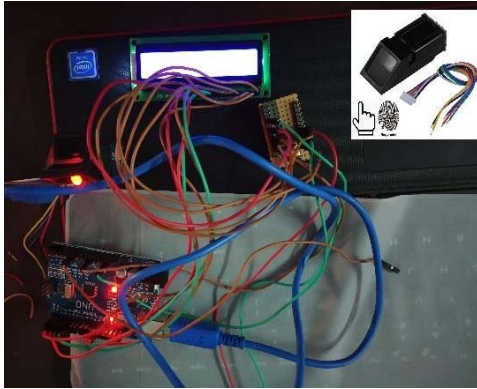


Figure 5 Experimental setup of proposed model

#### IV. RESULTS & DISCUSSION

A list of 20 engineering students were taken and the setup was used to acquire their fingerprints and classify them according to their learning abilities.

Table 1 Sample fingerprint of students and fingerprint type

S.No.	Name	Fingerprint	Type
1.	Aalekh		Loop
2.	Akshat		Loop
3.	Aryan		Loop
4.	Ashutosh		Whorl
5.	Avichal		Loop
6.	Dipali		Whorl
7.	Ishan		Whorl
8.	Kartikay		Arch
9.	Kirti		Whorl

10.	Kushagra		Loop
11.	Monika		Loop
12.	Muskan		Loop
13.	Nihit		Whorl
14.	Praneel		Loop
15.	Rajan		Loop
16.	Ritvik		Loop
17.	Samarth		Whorl
18.	Samriddhi		Loop
19.	Sudhakar		Loop
20.	Vanaya		Whorl

Students categorized as per the learning styles into 3 groups as given in table 3.

Table 2 Learning styles strengths

S.No.	Name	Visual	Auditory	Kinesthetic
1.	Aalekh	33.14	27.43	39.43
2.	Akshat	29.35	37.88	32.76
3.	Aryan	28.66	36.66	34.68
4.	Ashutosh	30.94	40.75	28.30
5.	Avichal	25.97	42.86	31.17
6.	Dipali	43.60	30.40	26.00
7.	Ishan	32.84	36.94	30.22
8.	Kartikay	42.33	39.68	17.99
9.	Kirti	26.97	40.45	32.58
10.	Kushagra	42.33	39.68	17.99



11.	Monika	30.94	28.30	40.75
12.	Muskan	32.26	34.84	32.90
13.	Nihit	35.71	32.14	32.14
14.	Praneel	29.35	38.53	32.12
15.	Rajan	33.14	27.43	39.43
16.	Ritvik	34.05	23.50	42.45
17.	Samarth	34.84	32.91	32.25
18.	Samriddhi	30.65	40.54	28.81
19.	Sudhakar	30.58	40.93	28.49
20.	Vanaya	19.40	60.45	20.15

The groups as per learning styles are shown in figure 6.

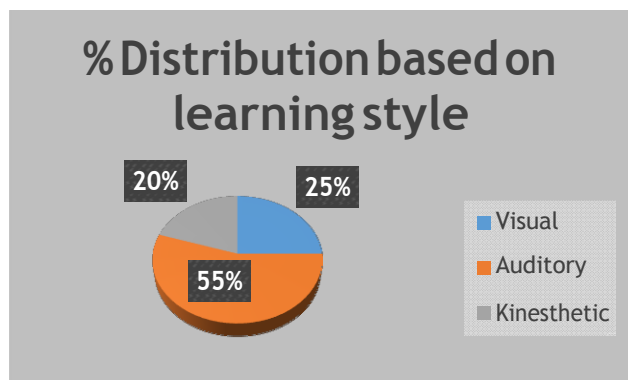


Figure 6 percentage distribution of students into groups (VAK) based on their learning style

With the help of proposed system depicted in figure 5 the data acquired from fingerprint scanner (table 1) was analyzed and the students were divided into three groups as per their preferential learning style.

Figure 6 gives the percentage distribution of students as per their preferential learning style. After analysis expected percentage improvement in the performance of students is shown in figure 7. It can be observed that there is 5 to 42% increase in the performance of the students.

From results depicted in figure 6, the preferential learning style of a sample of 20 students can be analyzed and it is evident that majority of the students are of Auditory type whereas rest of the students are almost equally divided in to kinesthetic and visual type of preferential learning style.

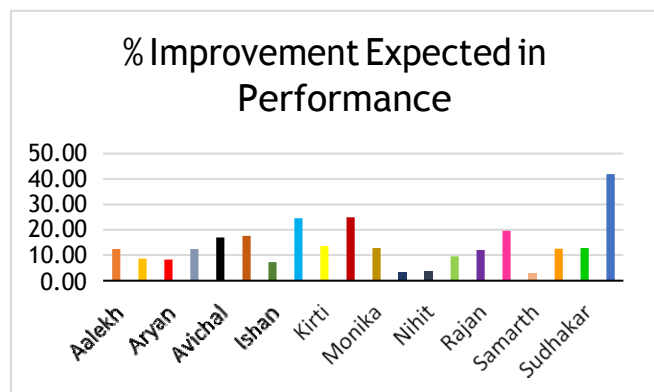


Figure 7 Percentage improvement expected in performance of students

By adopting automatic assignment allotment system for assigning the tutorials to the students, there is substantial increase in the performance of the students. In figure 7

performance of the group with auditory learning style increases to 42% whereas the performance of group with other two learning styles varies from 5% to 40%.

## V. CONCLUSION

IOT based DMIT for assignment allotment system based on learning abilities of engineering student is very helpful for assigning student subject assessments. This will enhance the learning experience of the students. Students will be able to learn, understand and correlate subject in better way. The proposed technique will improve the quality and level of Engineering education leading to better contribution of Engineering graduates to society. By the proposed approach the faculty member can easily assign the tutorials/ home assignments to the students depending upon their innate learning style. The proposed system can be further improved by training the software and providing the feedback of learning from the students.

## VI. FUTURE SCOPE

As the focus of universities and higher regulatory bodies is shifting towards promoting the massive online open courses (MOOCs), online tutorials, video lectures and other online e-learning options. The proposed method of enhancing learning experience of individual on basis of preferential learning style can become an important element. As this will help them in understanding, grasping and building a knowledgebase of subject without the help of an educator. The proposed system if adopted will become a game changer.

## ACKNOWLEDGEMENT

We owe our sincere feelings of gratitude to MIT Group of Institutions, Moradabad. We are also thankful to mentors for their support, guidance and suggestions, which helped us a lot to write the paper.

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