

V-Tech

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Department*



**Academic year
2018 - 19
Issue - II**

Preface



We are delighted to present the second issue of the research journal V-Tech for the academic year 2018-19, by continuing with the trend set in our previous issue. This magazine is a compendium of research articles by the teachers in their field of interest as well as current/upcoming areas which help in expanding the knowledge base of faculty members.

This issue deals with assorted aspects of the field of Information Technology. Emerging technologies such as 3-D bio printing, Machine Learning, Artificial Intelligence and Neural networks, Microarray are examined in this issue. Starting with established technologies in embedded systems like multicore chips, raspberry pi without monitor, this issue also gives an overview of some of the current trending IOT products which are gaining popularity in the market like smart jewellery, next generation shoes, 3-D pens, etc. This issue also covers some areas of general and educational interest like blended learning, Intelligent Apps, use of Python for financial analysis, smart jugglers, etc.

I hope you will find this endeavour thought provoking and informative. It will help all the readers in enriching their IT knowledge and hopefully strike a chord in at least one area where they can take a deep dive for their research activities.

Prof. Makarand Deshpande
Adjunct Professor

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3D Bio Printing



Bio printing is an extension of traditional 3D printing. Bio printers work in almost the exact same way as 3D printers, with one key difference. Instead of delivering materials such as plastic, ceramic, metal or food, they deposit layers of bio material that may include living cells, to build complex structures like blood vessels or skin tissue. Bio printing can produce living tissue, bone, blood vessels and, potentially, whole organs for use in medical procedures, training and testing. Every tissue in the body is naturally made up of different cell types. So the required cells (kidney cells, skin cells and so on) are taken from a patient and then cultivated until there are enough to create the 'bio-ink', which is loaded into the printer.

In bio printing, there are three major types of printers that have been used. These are inkjet, laser-assisted, and extrusion printers. Inkjet printers are mainly used in bio printing for fast and large-scale products. One type of inkjet printer, called drop-on-demand inkjet printer, prints materials in exact amounts, minimizing cost and waste. Printers that utilize lasers provide high-resolution printing; however, these printers are often expensive. Extrusion printers print cells layer-by-layer, just like 3D printing to create 3D constructs. In addition to just cells, extrusion printers may also use hydrogels infused with cells.

3D Bio Printing Process

3D bio printing generally follows three steps, pre-bio printing, bio printing, and post-bio printing.

Pre-Bio Printing

Pre-bio printing is the process of creating a model that the printer will later create and choosing the materials that will be used. One of the first steps is to obtain a biopsy of the organ. Common technologies used for bio printing are computed tomography (CT) and magnetic resonance imaging (MRI). To print with a layer-by-layer approach, tomographic reconstruction is done on the images. The now-2D images are then sent to the printer to be made. Once the image is created, certain cells are isolated and multiplied.

Bio printing

In the second step, bio inks are placed in a printer cartridge. These bio inks are often

adopted from existing hydrogel biomaterials and derived from natural polymers such as gelatines, alginates, fibrin, chitosan, and hyaluronic acids that are sensitive to their processing conditions. The bio ink filaments are often deposited at or below human body temperature and under mild conditions to preserve bio ink printability.

Post-Bio Printing

The post-bio printing process is necessary to create a stable structure from the biological material. If this process is not well-maintained, the mechanical integrity and function of the 3D printed object is at risk. To maintain the object, both mechanical and chemical stimulations are needed. These stimulations send signals to the cells to control the remodeling and growth of tissues. In addition, in recent development, bioreactor technologies have allowed the rapid maturation of tissues, vascularization of tissues and the ability to survive transplants.

Bio printing technology could provide the opportunity to generate patient-specific tissue for the development of accurate, targeted and completely personalised treatments. In research facilities and hospitals around the globe, advancements in 3D printing and, more particularly, bio printing are providing new options for treatment and scientific study. Indeed, bio printing has the potential to be the next big thing in health care and personalised medicine.

Snehal Tandale

Assistant Professor

A Review on Next-Gen Shoes



Nowadays when the generation is becoming smarter, we are surrounded with gadgets like smart phones, smart watches, smart home appliances, etc. The world is becoming more and more techsavvy. So why not our shoes?

Whether you're a gadget enthusiast, sneaker collector, health enthusiast, athlete, or simply a daily user who wants a well designed pair of shoes, the Smartshoe's features fit a wide range of uses and people. Different companies and manufactures are launching their Smartshoes in market for GenNext.

Digisole have hardware and software technologies engineered directly into the shoe itself, creating an interactive smartshoe that is constantly evaluating and providing the user with personalized feedback. The lightweight next-gen shoe design boasts of auto-lacing and temperature regulation.

Xiaomi, another big player in the market, has developed chip-laden MiJia smart shoes. These shoes are easily connected to Xiaomi's MiFit app to detect speed, distance, calories, hours slept, and even weight. By just shaking the shoes, one can connect and synchronize the data with the app. Moreover, these sporty looking shoes possess a long battery life.

Shoes by Altra IQ feature razor-thin, lightweight sensors and transmitters to provide data for each foot individually. Moreover, they provide live coaching feedback, including impact rate, landing zone, distance, pace, contact time, and cadence. The coaching can be made audible depending on the preference of the runners. Altra IQ shoes communicate directly to the company's iFit app on smartphones. App screen settings are easily customizable with feedback relayed in real time.

Smart shoes require a reliable system for data acquisition, data transmission, storage, and data analysis. A wide variety of sensors are used to acquire data for smart shoes:

- Pressure sensors are used to provide information on the distribution of body weight mid-gait.
- Internal status sensors are used to provide information on battery and memory capacity.
- Inertial-magnetic measurement units made up of an accelerometer, a gyroscope, and a magnetometer are used for gait analysis.

- Satellite navigation systems such as GPS, GLONASS, and GALILEO are used to provide information for the real-time location.
- Ambient environmental sensors, including atmospheric pressure, light, and sound sensors, are used for acquiring data from altitude-dependent activities and the surrounding environment.

Besides sensor recording, data acquisition systems often have cloud-based transmission abilities. Raw sensor data is processed to get relevant information using algorithms. The data is further segmented using sequential model-based approaches, template-based approaches, multidimensional subsequencing, and a dynamic time warping approach. Activity patterns can be extracted and analyzed for personalized feedback, visualization, and various health applications.

These Smartshoes manufactured by different companies are made, taking into consideration the need of today's user. Some of the features are discussed below.

HEALTH ANALYTICS - Movement sensors analyze pronation, supination, propulsion levels, impact force, fatigue, posture, steps, calories, and more creating precise data that prevents injuries and improves your health.

SMART CONNECTIVITY – Bluetooth connectivity enables personalized coaching recommendations, walking pattern analysis, and more in real-time via smartphone app based on activity data.

SNEAKER DESIGN - Next gen shoe design includes auto-lacing, temperature regulation with heating, and more. The Smartshoe is designed into an ultra-light, premium leather.

Amraja K. Shivkar

Asst. Prof.

Blended Learning-An Emerging Trend in E-Learning



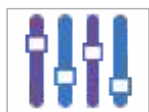
Blended learning is a formal or non-formal education program that combines educational materials in the form of online digital media with traditional classroom methods. In Blended learning a student learns:

- **Part Online** - In part online, with some element of control over the time, place, path, or pace of their learning.
- **Part Away From Home** - In part in a brick-and-mortar location away from home.
- **Along a Learning Path** - The modalities along a student's learning path are connected to provide an integrated learning experience.



Why Blended Learning?

Blended learning has the potential to break the century-old factory model of education and unlock:



Customized Learning: Online learning offers individual data, timely feedback, and flexible pathways.



Competency-based Learning: Control over pace means students advance based on mastery, not time.

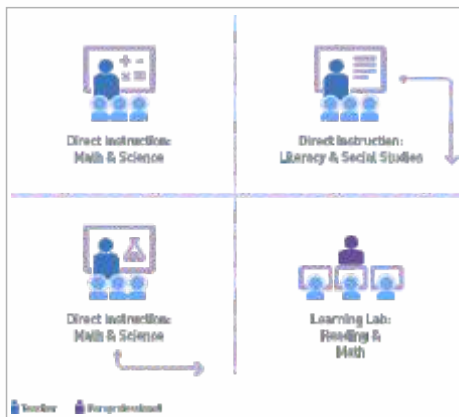
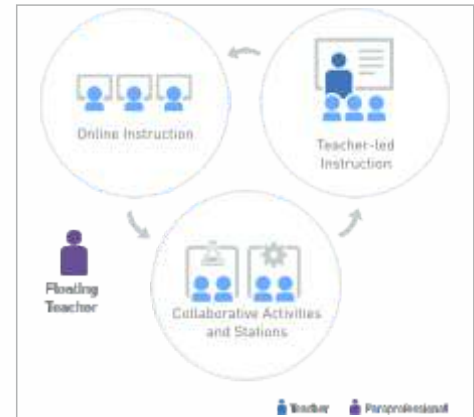


Anytime, Anywhere Learning: Technology opens up a world of opportunities and allows students to reach beyond the classroom.

Blended Learning Models:

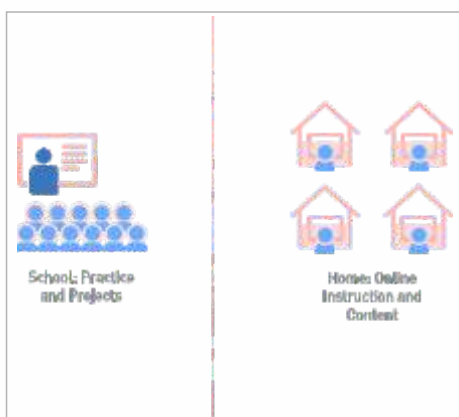
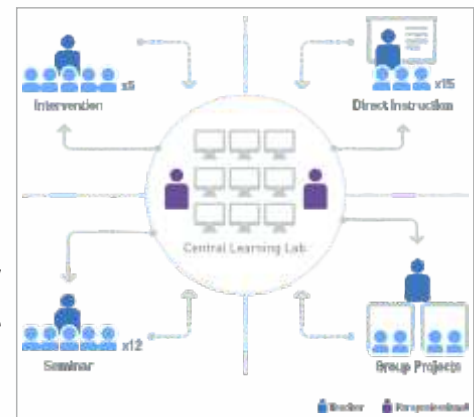
Blended learning can be implemented in many unique ways, generally using a combination of one or more of the following models.

- Station Rotation** : The Station Rotation model allows students to rotate through stations on a fixed schedule, where at least one of the stations is an online learning station. This model is most common in elementary schools because teachers are already familiar rotating in “centers” or station.



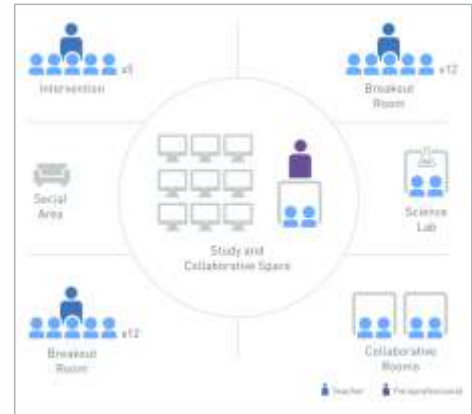
- Lab Rotation** : The Lab Rotation model, like a Station Rotation, allows students to rotate through stations on a fixed schedule. However, in this case, online learning occurs in a dedicated computer lab. This model allows for flexible scheduling arrangements with teachers and other paraprofessionals and enables schools to make use of existing computer labs.

- Individual Rotation** : The Individual Rotation model allows students to rotate through stations, but on individual schedules set by a teacher or software algorithm. Unlike other rotation models, students do not necessarily rotate to every station; they rotate only to the activities scheduled on their playlists.



- Flipped Classroom** : The Flipped Classroom model flips the traditional relationship between class time and homework. Students learn at home via online coursework and lectures, and teachers use class time for teacher-guided practice or projects. This model enables teachers to use class time for more than delivering traditional lectures.

- **Flex** : The Flex model lets students move on fluid schedules among learning activities according to their needs. Online learning is the backbone of student learning in a Flex model. Teachers provide support and instruction on a flexible, as-needed basis while students work through course curriculum and content. This model can give students a high degree of control over their learning.



- **A La Carte** : The A La Carte model enables students to take an online course with an online teacher of record _in addition_ to other face-to-face courses, which often provides students with more flexibility over their schedules. A La Carte courses can be a great option when schools can't provide particular learning opportunities, such as an Advanced Placement or elective course, making it one of the more popular models in blended high schools.

• **Enriched Virtual**

The Enriched Virtual model is an alternative to full-time online school that allows students to complete the majority of coursework online at home or outside of school but attend school for required face-to-face learning sessions with a teacher. Unlike the Flipped Classroom, Enriched Virtual programs usually don't require daily school attendance; some programs may only require twice-weekly attendance, for example.



Blended Learning Example

Flipping a Math course: Students have access to all the course concepts through online modules that were developed for the fully online version of the course. They prepare for class by watching about 30 minutes of course content before the start of each week and then come to class to work through a set of problems that address the concepts in

the online videos. Students work at their own pace, conferring with their classmates and the course instructor as needed. The instructor notes that students ask more insightful questions when his course is taught this way and he ranks this as his most enjoyable teaching experiences to date.

Blended Learning Advantages and Disadvantages

Advantages of blended learning:

- **Larger groups :** With blended learning you are able to engage learning in large groups. First you will give them an instruction and after that, put the students to work.
- **Own pace :** Participants can partly work at their own pace and still have face-to-face education. If you're faster than the other participants, you don't have to wait for them. The other way around, if you're slower, you can take your time.
- **Reduction in costs :** Less room, less teachers, and with that said; a less amount of money.
- **Fun :** It's just fun! From elementary school to university students and advanced courses, blended learning has proven to be more engaging for various participants.

Disadvantages of blended learning:

- **Lack of motivation :** The type of blended learning can worsen the motivation and willingness of your participants. Not every blended learning model is applicable to every age category. Just like you don't give young children a book with long texts and few images. When children start reading, you give them books with many images and few words. After several years you can give them a book with more words and less images. If you expect young children to do all their homework and prepare lessons on their computer at home, you are wrong.
- **Basic technology knowledge :** You expect participants to have a basic knowledge of technology. If learner don't know what to do, because of the lack of technology knowledge, they will get annoyed. Because participants have to focus on a new system and new knowledge, it might cause a cognitive overload
- **Plagiarism and credibility problem :** It's hard to withstand the temptation of looking up things on the web. Participants have to think by themselves what the answer could be and search the answer on the internet.

Dr Sarika Chouhan
Asst. Prof.

Control Raspberry Pi Without Monitor



During the set up process of Raspberry Pi we require a lot of peripherals like monitor, HDMI cable, wireless keyboard and OTG adapter. Most of the time we don't need these peripherals after the first boot. To save some money we can use the Pi in Headless mode i.e accessing it without a monitor.

In Headless mode, we can access the Raspberry Pi over wireless network using SSH (Secured Shell Protocol). So without wasting anymore time, lets get right into it.

Step 1: Requirements:

Hardware Components:

1. Raspberry Pi
 - Raspberry Pi Zero W ([Amazon.com Link](#))
 - Or
 - Raspberry Pi 3 Model B+ ([Amazon.com Link](#))
2. Micro SD card
3. Micro SD card reader

Softwares Requirement:

1. Raspbian OS
2. PuTTY for Windows
3. Fing App

Step 2: Enabling SSH With Monitor:

After successfully installing the OS on the SD card, insert into the Pi and boot it up. After the Pi is booted, click on the the raspberry icon on top left corner. You will see a drop-down menu, from this menu select "Preferences". From the second drop-down menu, select "Raspberrypi configuration".

A pop up window will appear, Select "Interface" tab.

Next, enable Camera, I²C, GPIO and SSH. These are the features we will be using the most.

The Pi is now ready to be controlled without monitor and keyboard.

Step 3: Enabling SSH Without Monitor:

Now to enable SSH without a monitor, follow the steps below:

- Install the Raspbian image onto the SD card similar to the previous tutorial.
- After the image is burnt, do not plug out the card. Instead open the boot partition. Note that windows might ask you to format the drive, say no or cancel it. DO NOT

FORMAT THE PARTITION.

- In the boot partition, there are many files and folders. Do not edit or delete any files from here, or else it might cause system failure.
- Here we have to add two files, SSH and wpa_supplicant.conf
- First we need to create the SSH file, right click in the boot partition and click on "new", from the list select "New text document". Name the file ssh and remove the ".txt" extension. Next save the file. This file will enable SSH allowing us to connect to the Pi using PuTTY.
- Next create a new text document and name it "wpa_supplicant.conf" and save the file.
- Open the wpa_supplicant file in a text editor and add the following script:

```
country=IN
ctrl_interface=DIR=/var/run/wpa_supplicant
GROUP=netdev
update_config=1
network={
  ssid="Your WiFi network name"
  scan_ssid=1 psk="WiFi password"
  key_mgmt=WPA-PSK
}
```

- In the script you have to make some changes. In the first line country=IN , I wrote IN because I am from India, and the ISO code for India is IN. You can find the code of your country from Wikiwand. Next add your ssid which is nothing but your WiFi name. Also add psk which is your WiFi password. When you're finished, be sure to save the file.
- Now eject the SD card and insert it into the Pi. Power up the Pi and wait for a few minutes. It takes longer to boot for the first time.

Step 4: Finding the IP Address:

Before we can SSH into Raspberry Pi, we need to know the IP address of the Pi. To find the IP address I prefer using an app called Fing. It is available for both Android and iPhone. To find the IP address:

- First make sure your smartphone is connected to the same WiFi network as the Pi.
- Open the Fing app, on the home page you will notice a list of devices connected to the router.

- Note down the IP address of "raspberrypi". We will use this to establish connection with the Pi.
- Now we will connect to the board using SSH in the next step.

Step 5: SSH Into the Pi:

For Unix Users: (Linux and macOS)

- To create SSH connection in Linux, open terminal and enter the ssh command.

ssh [pi@192.168.xx.xx](#)

- Here you will add your IP address and hit enter.
- Next, you'll be asked if you want to connect to the device. Type y.
- Then you will be asked to enter the password, type in the default password "raspberry".

Step 6: Securing the Raspberry Pi:

To prevent any unauthorized access to our Pi, we will change the default password.

To change the password:

- Type passwd and hit enter.
- You will be asked to enter the current password for authentication. Enter the default password raspberrypi and hit enter.
- Now you will be asked to enter new password, here enter a unique password with a combination of alphabets, numbers and special characters. When you type the password, nothing will be displayed on terminal, so make sure you type slowly and correctly.
- After you enter new password, you will be asked to confirm the password. Here type the new password again and hit enter.
- A success message will be displayed on terminal:
password: password updated successfully

Step 7: Final Note

Now you are ready to use your Raspberry Pi with SSH

Sabir Moin.Moinuddin Shaikh

Asst. Prof.

Intelligent Apps (I — Apps)



I-Apps are pieces of software written for mobile devices based on artificial intelligence and machine learning technology, aimed at making everyday tasks easier. This involves tasks like organizing and prioritizing emails, scheduling meetings, logging interactions, content, etc. Some familiar examples of I-Apps are Chabot's and virtual assistants.

Intelligent apps are applications that use historical and real-time data from user interactions and other sources to make predictions and suggestions, delivering personalized and adaptive user experiences.

The next generation of mobile applications will be the result of multiple worlds colliding: when application development meets artificial intelligence, the Internet of Things and big data analytics, intelligent apps are the outcome. Put simply, these are apps that continually learn from user interactions and other data sources to become even more relevant and useful.

The typical features of smart apps:

Chatbots, virtual assistants and recommendation engines on e-commerce sites are just some examples of intelligent applications. While it's difficult to formulate a catch-all definition of smart apps, they have a number of typical features:

Data-driven:

Intelligent apps combine and process multiple data sources – such as IoT sensors, beacons or user interactions – and turn an enormous quantity of numbers into valuable insights.

Contextual and relevant:

Intelligent apps make much smarter use of a device's features to proactively deliver highly relevant information and suggestions. Users will no longer have to go to their apps. Instead, the apps will come to them.

Continuously adapting:

Thanks to machine learning, intelligent apps continuously adapt and improve their output.

Action-oriented:

By anticipating user behaviors with predictive analytics, smart applications deliver personalized and actionable suggestions.

Omni channel:

Progressive web applications (PWAs) are increasingly blurring the lines between native apps and mobile web applications.

Although the adoption of smart apps will move faster in B2C, their added value is equally high in B2B.

Applications in business:

In a production environment, a smart app could use beacon signals to alert people when they enter a zone where safety gear is required.

Based on Wi-Fi and smart phone data, an app could determine when to turn off the lights in an office building. Apps could also replace current systems for manual time registration.

For salespeople, an intelligent app could evaluate and prioritize leads by predicting which opportunities are most likely to close.

Aasha Chavan
Asst. Prof.

Machine Learning Algorithms



What is Machine Learning?

Machine Learning is a concept which allows the machine to learn from examples and experience, and that too without being explicitly programmed.

Let me give you an analogy to make it easier for you to understand.

Let's suppose one day you went shopping for apples. The vendor had a cart full of apples from where you could handpick the fruit, get it

weighed and pay according to the rate fixed (per Kg).

Task: How will you choose the best apples?

Given below is set of learning that a human gain from his experience of shopping for apples, you can drill it down to have a further look at it in detail.

Learning 1: Bright red apples are sweeter than pale ones

Learning 2: The smaller and bright red apples are sweet only half the time

Learning 3: Small, pale ones aren't sweet at all

Learning 4: Crispier apples are juicier

Learning 5: Green apples are tastier than red ones

Learning 6: You don't need apples anymore



What if you have to write a code for it?

Now, imagine you were asked to write a computer program to choose your apples. You might write the following rules/algorithm:

if (bright red) and if (size is big): Apple is sweet.

if (crispy): Apple is juicy

You would use these rules to choose the apples.

But every time you make a new observation (what if you had to choose oranges, instead) from your experiments, you have to modify the list of rules manually.

You have to understand the details of all the factors affecting the quality of the fruit. If the problem gets complicated enough, it might get difficult for you to make accurate rules by hand that covers all possible types of fruit. This will take a lot of research and effort and not everyone has this amount of time.

This is where Machine Learning Algorithms come into the picture.

So instead of you writing the code, what you do is you feed data to the generic algorithm, and the algorithm/machine builds the logic based on the given data.

What is a Machine Learning Algorithm?

Machine Learning algorithm is an evolution of the regular algorithm. It makes your programs “smarter”, by allowing them to automatically learn from the data you provide. The algorithm is mainly divided into:

- Training Phase
- Testing phase

Training Phase

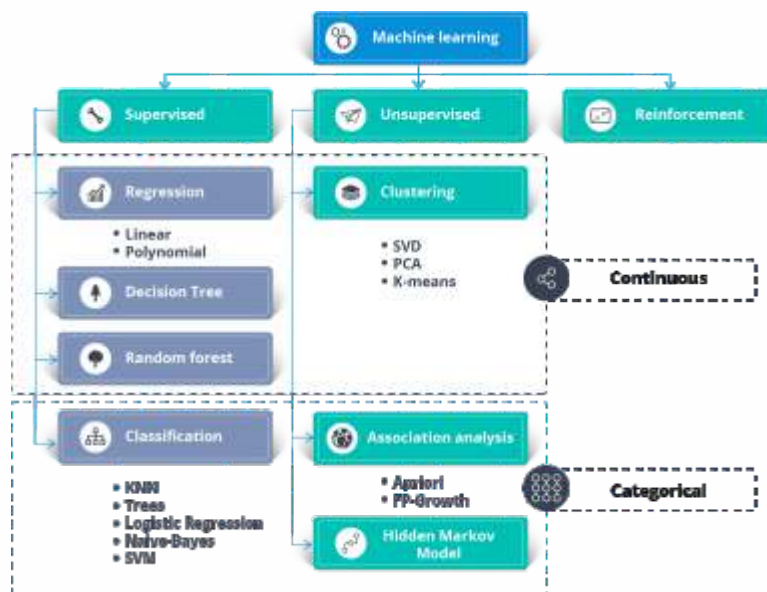
You take a randomly selected specimen of apples from the market (training data), make a table of all the physical characteristics of each apple, like color, size, shape, grown in which part of the country, sold by which vendor, etc (features), along with the sweetness, juiciness, ripeness of that apple (output variables). You feed this data to the machine learning algorithm (classification/regression), and it learns a model of the correlation between an average apple's physical characteristics, and its quality.

Testing Phase

Next time when you go shopping, you will measure the characteristics of the apples which you are purchasing (test data) and feed it to the Machine Learning algorithm. It will use the model which was computed earlier to predict if the apples are sweet, ripe and/or juicy. The algorithm may internally use the rules, similar to the one you manually wrote earlier (for eg, a decision tree). Finally, you can now shop for apples with great confidence, without worrying about the details of how to choose the best apples.

What are the types of Machine Learning Algorithms?

So, Machine Learning Algorithms can be categorized by the following three types.



1. Supervised Learning

This category is termed as supervised learning because the process of algorithm learning from the training dataset can be thought of as a teacher teaching his students. The algorithm continuously predicts the result on the basis of training data and is continuously corrected by the teacher. The learning continues until the algorithm achieves an acceptable level of performance.

Let me rephrase you this in simple terms:

In Supervised machine learning algorithm, every instance of the training dataset consists of input attributes and expected output. The training dataset can take any kind of data as input like values of a database row, the pixels of an image, or even an audio frequency histogram.

Example: In Biometric Attendance you can train the machine with inputs of your biometric identity – it can be your thumb, iris or ear-lobe, etc. Once the machine is trained it can validate your future input and can easily identify you.

2. Unsupervised Learning

Well, this category of machine learning is known as unsupervised because unlike supervised learning there is no teacher. Algorithms are left on their own to discover and return the interesting structure in the data.

The goal for unsupervised learning is to model the underlying structure or distribution in the data in order to learn more about the data.

Let me rephrase it for you in simple terms:

In the unsupervised learning approach, the sample of a training dataset does not have an expected output associated with them. Using the unsupervised learning algorithms you can detect patterns based on the typical characteristics of the input data. Clustering can be considered as an example of a machine learning task that uses the unsupervised learning approach. The machine then groups similar data samples and identify different clusters within the data.

Example: Fraud Detection is probably the most popular use-case of Unsupervised Learning. Utilizing past historical data on fraudulent claims, it is possible to isolate new claims based on its proximity to clusters that indicate fraudulent patterns.

3. Reinforcement Learning

Reinforcement learning can be thought of like a hit and trial method of learning. The

machine gets a Reward or Penalty point for each action it performs. If the option is correct, the machine gains the reward point or gets a penalty point in case of a wrong response.

The reinforcement learning algorithm is all about the interaction between the environment and the learning agent. The learning agent is based on exploration and exploitation.

Exploration is when the learning agent acts on trial and error and Exploitation is when it performs an action based on the knowledge gained from the environment. The environment rewards the agent for every correct action, which is the reinforcement signal. With the aim of collecting more rewards obtained, the agent improves its environment knowledge to choose or perform the next action.

Sanjeela Sagar
Assistant Professor

Microarray Technology



Molecular Biology research evolves through the development of the technologies used for carrying them out. It is not possible to research on a large number of genes using traditional methods. DNA Microarray is one such technology which enables the researchers to investigate and address issues which were once thought to be non traceable. One can analyze the expression of many genes in a single reaction quickly and in an efficient manner. DNA Microarray technology has empowered the scientific community to understand the fundamental aspects underlining the growth and development of life as well as to explore the genetic causes of anomalies occurring in the functioning of the human body. A typical microarray experiment involves the hybridization of an mRNA molecule to the DNA template from which it is originated. Many DNA samples are used to construct an array. The amount of mRNA bound to each site on the array indicates the expression level of the various genes. This number may run in thousands. All the data is collected and a profile is generated for gene expression in the cell.

Microarray Technique

An array is an orderly arrangement of samples where matching of known and unknown DNA samples is done based on base pairing rules. An array experiment makes use of common assay systems such as microplates or standard blotting membranes. The sample spot sizes are typically less than 200 microns in diameter usually contain thousands of spots. Thousands of spotted samples known as probes (with known identity) are immobilized on a solid support (a microscope glass slides or silicon chips or nylon membrane). The spots can be DNA, cDNA, or oligonucleotides. These are used to determine complementary binding of the unknown sequences thus allowing parallel analysis for gene expression and gene discovery. An experiment with a single DNA chip can provide information on thousands of genes simultaneously. An orderly arrangement of the probes on the support is important as the location of each spot on the array is used for the identification of a gene.

The DNA microarray is a tool used to determine whether the DNA from a particular individual contains a mutation in genes like BRCA1 and BRCA2. The chip consists of a small glass plate encased in plastic. Some companies manufacture microarrays using methods similar to those used to make computer microchips. On the surface, each chip contains thousands of short, synthetic, single-stranded DNA sequences, which together add up to the normal gene in question, and to variants (mutations) of that gene that have been found in the human population.

DNA microarray used for

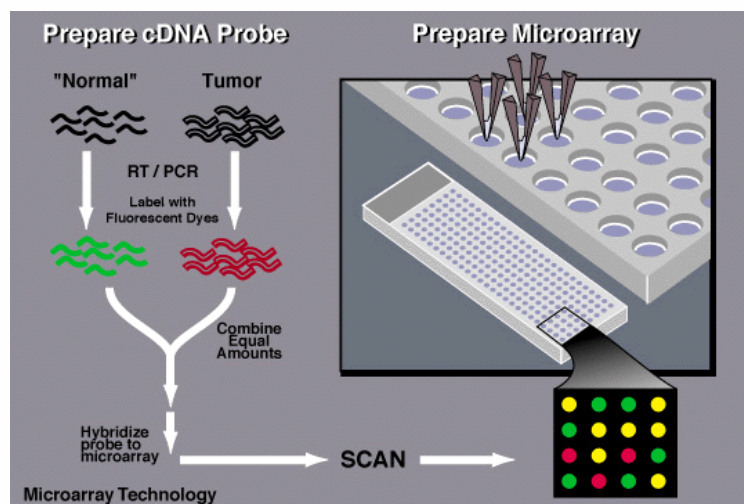
DNA microarrays were used only as a research tool. Scientists continue today to conduct large-scale population studies - for example, to determine how often individuals with a particular mutation actually develop breast cancer, or to identify the changes in gene sequences that are most often associated with particular diseases. Today, DNA microarrays are used in clinical diagnostic tests for some diseases. Sometimes they are also used to determine which drugs might be best prescribed for particular individuals, because genes determine how our bodies handle the chemistry related to those drugs.

How does a DNA microarray work?

To determine whether an individual possesses a mutation for a particular disease, a scientist first obtains a sample of DNA from the patient's blood as well as a control sample - one that does not contain a mutation in the gene of interest.

The researcher then denatures the DNA in the samples - a process that separates the two complementary strands of DNA into single-stranded molecules. The next step is to cut the long strands of DNA into smaller, more manageable fragments and then to label each fragment by attaching a fluorescent dye (there are other ways to do this, but this is one common method). The individual's DNA is labeled with green dye and the control - or normal - DNA is labeled with red dye. Both sets of labeled DNA are then inserted into the chip and allowed to hybridize - or bind - to the synthetic DNA on the chip.

If the individual does not have a mutation for the gene, both the red and green samples will bind to the sequences on the chip that represent the sequence without the mutation (the "normal" sequence).



If the individual does possess a mutation, the individual's DNA will not bind properly to the DNA sequences on the chip that represent the "normal" sequence but instead will bind to the sequence on the chip that represents the mutated DNA.

Types of Microarrays:

- 1. Microarray Expression Analysis:** In this experimental setup, the cDNA derived from the mRNA of known genes is immobilized. The sample has genes from both the normal as well as the diseased tissues. Spots with more intensity are obtained for diseased tissue gene if the gene is over expressed in the diseased condition. This expression pattern is then compared to the expression pattern of a gene responsible for a disease.
- 2. Microarray for Mutation Analysis:** For this analysis, the researchers use gDNA. The genes might differ from each other by as less as a single nucleotide base. A single base difference between two sequences is known as Single Nucleotide Polymorphism (SNP) and detecting them is known as SNP detection.
- 3. Comparative Genomic Hybridization:** It is used for the identification in the increase or decrease of the important chromosomal fragments harboring genes involved in a disease.

Applications of Microarrays

Gene Discovery: DNA Microarray technology helps in the identification of new genes, know about their functioning and expression levels under different conditions.

Disease Diagnosis: DNA Microarray technology helps researchers learn more about different diseases such as heart diseases, mental illness, infectious disease & especially the study of cancer. Until recently, different types of cancer have been classified on the basis of the organs in which the tumors develop. Now, with the evolution of microarray technology, it will be possible for the researchers to further classify the types of cancer on the basis of the patterns of gene activity in the tumor cells.

Drug Discovery: Microarray technology has extensive application in Pharmacogenomics. Pharmacogenomics is the study of correlations between therapeutic responses to drugs and the genetic profiles of the patients. Comparative analysis of the genes from a diseased and a normal cell will help the identification of the biochemical constitution of the proteins synthesized by the diseased genes. The researchers can use this information to synthesize drugs which combat with these proteins and reduce their effect.

Toxicological Research: Microarray technology provides a robust platform for the research of the impact of toxins on the cells and their passing on to the progeny. Toxicogenomics establishes correlation between responses to toxicants and the changes in the genetic profiles of the cells exposed to such toxicants.

Multi-Core Processor Technology



In consumer technologies, multi-core is usually the term used to describe two or more CPUs working together on the same chip. Also called multicore technology, it is a type of architecture where a single physical processor contains the core logic of two or more processors. These processors are packaged into a single integrated circuit (IC). These single integrated circuits are called a die. Multi-core can also refer to multiple dies packaged together. Multi-core enables the system to perform more tasks with a greater overall system performance. Multi-core technology can be used in desktops, mobile PCs, servers and workstations. Contrast with dual-core, a single chip containing two separate processors (execution cores) in the same IC.

Dual-processor (DP) systems are those that contains two separate physical computer processors in the same chassis. In dual-processor systems, the two processors can either be located on the same motherboard or on separate boards. In a dual-core configuration, an integrated circuit (IC) contains two complete computer processors. Usually, the two identical processors are manufactured so they reside side-by-side on the same die, each with its own path to the system front-side bus. Multi-core is somewhat of an expansion to dual-core technology and allows for more than two separate processors.

A dual-core processor has many advantages especially for those looking to boost their system's multitasking computing power. Dual-core processors provide two complete execution cores instead of one, each with an independent interface to the frontside bus. Since each core has its own cache, the operating system has enough resources to handle intensive tasks in parallel, which provides a noticeable improvement to multitasking.

Complete optimization for the dual-core processor requires both the operating system and applications running on the computer to support a technology called thread-level parallelism, or TLP. Thread-level parallelism is the part of the OS or application that runs multiple threads simultaneously, where threads refer to the part of a program that can execute independently of other parts.

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Mr. Laxmikant Avinash Manchekar
Asst. Prof.

Natural Language Processing (NLP)



Natural Language Processing (NLP) refers to AI method of communicating with an intelligent systems using a natural language such as English. Processing of Natural Language is required when you want an intelligent system like robot to perform as per your instructions, when you want to hear decision from a dialogue based clinical expert system, etc.

The field of NLP involves making computers to perform useful tasks with the natural languages humans use. The input and output of an NLP system can be -

- Speech
- Written Text

Components of NLP

There are two components of NLP as given –

Natural Language Understanding (NLU)

Understanding involves the following tasks –

- Mapping the given input in natural language into useful representations.
- Analyzing different aspects of the language.

Natural Language Generation (NLG)

It is the process of producing meaningful phrases and sentences in the form of natural language from some internal representation.

It involves –

- **Text planning** : It includes retrieving the relevant content from knowledge base.
- **Sentence planning** : It includes choosing required words, forming meaningful phrases, setting tone of the sentence.
- **Text Realization** : It is mapping sentence plan into sentence structure.

The NLU is harder than NLG.

Difficulties in NLU

NL has an extremely rich form and structure.

It is very ambiguous. There can be different levels of ambiguity –

- Lexical ambiguity – It is at very primitive level such as word-level.
- For example, treating the word “board” as noun or verb?
- Syntax Level ambiguity – A sentence can be parsed in different ways.
- For example, “He lifted the beetle with red cap.” – Did he use cap to lift the beetle or he lifted a beetle that had red cap?
- Referential ambiguity – Referring to something using pronouns. For example, Rima went to Gauri. She said, “I am tired.” – Exactly who is tired?

- One input can mean different meanings.
- Many inputs can mean the same thing.

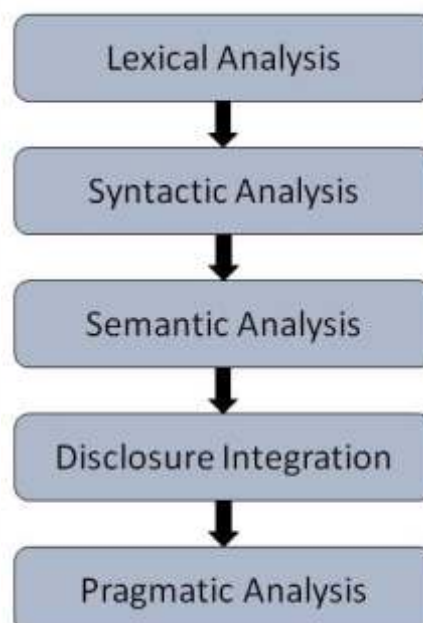
NLP Terminology

- **Phonology** – It is study of organizing sound systematically.
- **Morphology** – It is a study of construction of words from primitive meaningful units.
- **Morpheme** – It is primitive unit of meaning in a language.
- **Syntax** – It refers to arranging words to make a sentence. It also involves determining the structural role of words in the sentence and in phrases.
- **Semantics** – It is concerned with the meaning of words and how to combine words into meaningful phrases and sentences.
- **Pragmatics** – It deals with using and understanding sentences in different situations and how the interpretation of the sentence is affected.
- **Discourse** – It deals with how the immediately preceding sentence can affect the interpretation of the next sentence.
- **World Knowledge** – It includes the general knowledge about the world.

Steps in NLP

There are general five steps –

·Lexical Analysis – It involves identifying and analyzing the structure of words. Lexicon of a language means the collection of words and phrases in a language. Lexical analysis is dividing the whole chunk of txt into paragraphs, sentences, and words.



·Syntactic Analysis (Parsing) – It involves analysis of words in the sentence for grammar and arranging words in a manner that shows the relationship among the words. The sentence such as “The school goes to boy” is rejected by English syntactic analyzer.

- **Semantic Analysis** : It draws the exact meaning or the dictionary meaning from the text. The text is checked for meaningfulness. It is done by mapping syntactic structures and objects in the task domain. The semantic analyzer disregards sentence such as “hot ice-cream”.
- **Discourse Integration** : The meaning of any sentence depends upon the meaning of the sentence just before it. In addition, it also brings about the meaning of immediately succeeding sentence.
- **Pragmatic Analysis** : During this, what was said is re-interpreted on what it actually meant. It involves deriving those aspects of language which require real world knowledge.

Ashwini Koyande
Asst. Prof.



What is Financial Analysis

Financial analysis is the process of evaluating businesses, projects, budgets and other finance-related entities to determine their performance and suitability. Typically, financial analysis is used to analyse whether an entity is stable, solvent, liquid or profitable enough to warrant a monetary investment. When looking at a specific company, a financial analyst conducts analysis by focusing on the income statement, balance sheet, and cash flow statement.

Python – an optimal technology for finance

The financial services industry is a challenging one. Organizations that want to compete on the market need to develop products that are secure, functional, and fully compliant with state and international regulations. Attention to detail is critical as well because these solutions almost always include integrations with institutions, services, and bank API connections that need to run smoothly. Python's clear programming syntax and amazing ecosystem of tools make it one of the best technologies to handle the development process of any financial service.

Python and the financial community

A number of large financial organizations use Python and have adopted it in their core processes. On the sell side, JPMorgan's Quartz system uses Python extensively. Quartz is used for pricing trades, managing exposure and computing risk metrics across all asset classes. Athena, a similar system at BAML also extensively uses Python. Of course, this is not to say that the sell side has suddenly dumped technologies like the .NET Framework and Java, but it is a sign that Python has come of age. Many large quant hedge funds, such as AHL, have also adopted Python.

How finance companies use python today

Python comes in handy in a broad range of applications. Here are the most popular uses of the language in the financial services industry.

I. Analytics tools

Python is widely used in solutions that process and analyze large datasets. Library called Pandas turns this language into a powerful mean for working with data and analyzing it. Developers deal with the massive amount of data in order to analyze it.

This library helps simplify this process by visualizing all that data and allowing to conduct statistical calculations based on it. Python is a great language for machine learning(ML). With the help of libraries such as Scikit-Learn and PyBrain, the ML models can be trained to make predictions. Examples of such products: Iwoca, Holvi.

II. Banking software

This area covers both payment solutions and online banking solutions. Python is a good choice for these areas due to its math syntax opening more space for flexibility in terms of calculations and other math-related tasks. This language is often used to write software for ATMs and enhance payment processing.

Venmo is an excellent example of a mobile banking platform that has grown into a full-fledged social network. Python comes in handy for developing ATM software that enhances payment processing.

Examples of such products: Venmo, Stripe, Zopa, Affirm, Robinhood

III. Cryptocurrency

Every business that sells cryptocurrency needs tools for carrying out cryptocurrency market analysis to get insights and predictions. It's possible to build scripts with this language that will analyse the current situation on the market and make predictions. For example with the help of the tool called Anaconda, you can get information about cryptocurrency prices and analyze it. Examples of such products: Dash, enigma, ZeroNet, koinim, crypto-signal

IV. Trading

Stock markets generate massive amounts of data that require a lot of analysis. And that's where Python helps as well. Developers can use it to create solutions that identify the best trading strategies and offer actionable, predictive analytical insights into the condition of specific markets. With the help of this language, developers can define the winning trading strategies and get useful tips related to the future conditions of one or another market. To create the software with such capabilities can be used not only Python but Django framework based on Python. Examples of such products: Quantopian, Quantconnect, Zipline, Backtrader, IBPy

Shajil Kumar P A
Asst. Prof.

Smart Jewellery: Fashion for Tech-savvy



Smart Jewellery – What does that actually mean?

Smart Jewellery is the name given to pieces of ornament that have some kind of a “smart” functionality. You can use to stay in touch with the people and information you value the most. In general, smart Jewellery is an extension of your smart phone. It can provide you with a variety of information and notifications. It's a wearable device, yet stylish. Smart Jewellery is the answer for many a fashionable woman who wants the activity tracking of a fitness band without the bland silicon strap, or the woman who wants the notifications of a smart watch without any chunky design.

What can Smart Jewellery do?

Not all Smart Jewellery has the same capability. Some Smart Jewellery combines with technology to provide you with call, text and email notifications. Some has the ability to track fitness (in a similar way to a FitBit), track your sleep and issue silent alarms (through LED lights or vibrations) that you set. Some Smart Jewellery has a “wellness focus” where it prompts you with mindfulness or meditation reminders. It might track your activity and stress levels, active minutes, calories burned, distance travelled, sleep duration and quality and lots more. There are even some Smart Jewellery that connect with smart devices in your home. You can operate ACs, TV, heaters with smart Jewellery.

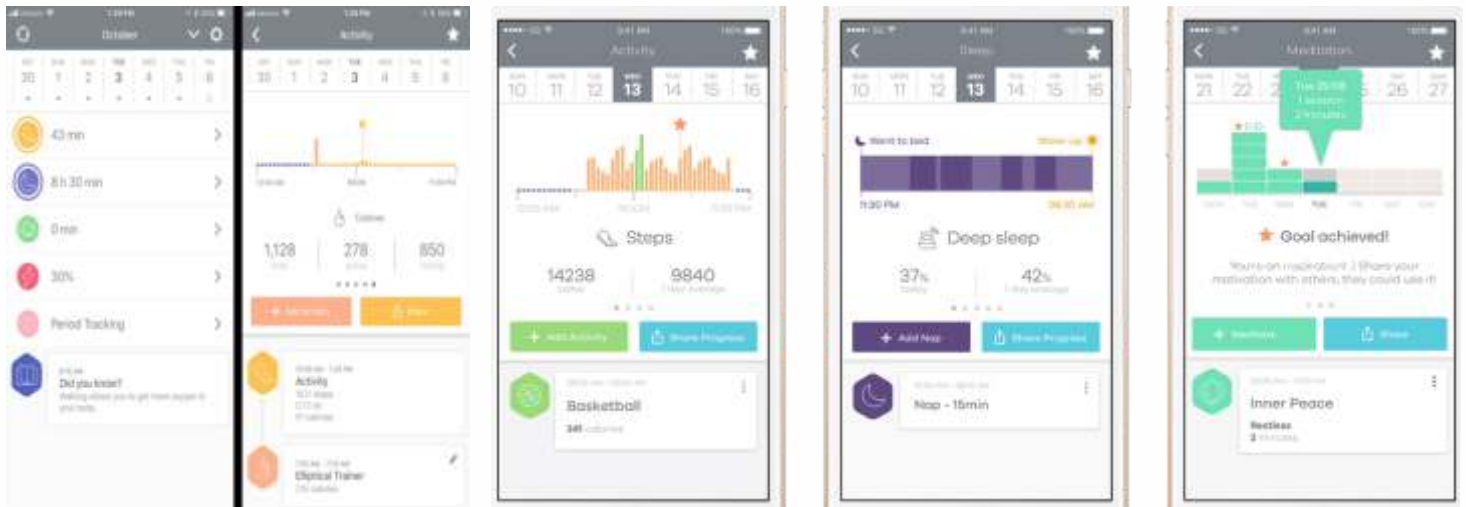
Smart Jewellery Options-



1. The Bellabeat Leaf Urban

The Leaf is a clip that you can wear as a necklace, as a bracelet, or as a brooch clipped onto your clothing. The Leaf Nature is made of wood and its metal clip is fashion in the shape of a leaf.

To see your data, you have to sync the Leaf to the companion app. In the app, you can set goals for your active minutes, calories burned, distance traveled, sleep, and mindfulness meditation sessions. You can also set up silent alarms to wake you up peacefully and track your period or fertility in the app, as shown below.



2. Ringly Aries Smart Ring and Bracelet :

The rings are available in 18k gold or gunmetal plated stainless steel varieties. The ring charges up in its Jewellery box. The Ringly app is very easy to use. You can view your activity metrics, set up how you want notifications handles for different apps. Once you've paired a piece of Ringly Jewellery, it'll prompt you to select only the notifications — messages, apps, people, or calls — that you want to come through. From there, you'll have the option of assigning the aforementioned vibration and light patterns to each individual notification, and setting fitness and activity goals.



If you're not into rings, Ringly also has a line of stunning smart bracelets called Aries. The bracelet offers all the same functionality of the smart ring, so you can customize notification vibrations and colors for more than 100 apps. It'll also track your fitness metrics.

If you're not into rings, Ringly also has a line of stunning smart bracelets called Aries. The bracelet offers all the same functionality of the smart ring, so you can customize notification vibrations and colors for more than 100 apps. It'll also track your fitness metrics.

3. Motiv :

This unisex smart ring that can be used for fitness tracking from the finger. It has optical heart rate sensor to monitor heart rate, 3-axis accelerometer for tracking steps, distance, calories as well as sleep. Battery life is five days, the ring is waterproof up to 50m and it now works with both iOS and Android.



ECG will be used as a form of biometric identification, meaning Motiv users will be able to enter secure websites and physical locations just by wearing it.

ECG will be used as a form of biometric identification, meaning Motiv users will be able to enter secure websites and physical locations just by wearing it.

The same technology will be used to authenticate the wearer's identity prior to processing attempted NFC payments.

4. Periferii Smart Earrings- Ear-O-smart :

The Ear-o-Smart is a pair of smart earrings that connect to your smartphone via Bluetooth to monitor your heart rate, calories, and activity levels. Ear-o-Smart's studs are remarkably small and actually look like a normal pair of earrings, in spite of all the sensors inside. Using the same PPG (photoplethysmogram) technology seen in many fitness bands, the earrings take your heart rate by measuring blood flow. Essentially, light from an LED is reflected by blood flowing through your veins, and absorbed by a photodiode to determine when the heart beats.



It is unlikely that Smart Jewellery will ever replace the full functionality of a Smart Phone. Bundling up technology is difficult and the size of most Jewellery pieces means that manufacturers simply cannot cram the functionality of a Smart Watch into a Smart Ring or other Smart Jewellery pieces. In spite of that, smart Jewellery is a really great way of combining fashion-forward designs with the latest and greatest innovations in tech. From smart rings to smart watches, and everything in between, there are tons of different Jewellery choices that are bound to work with your lifestyle

Maitreyi Joglekar
Asst. Prof.

Sms Based Public Distribution System



Definition:

Ration card is an official and important document issued by state governments in India to the people who are eligible and entitled to buy the ration/food grains and fuels at a very minimal cost from the Public Distribution Centre. The manual system consists of the information about the user and purchase history written manually about the entitlement of ration. This manual process of updating a ration book is time consuming more over many fraud entries are being done. The ration/grocery sellers are indulging in forgery by not distributing the entitled quantity of food grains to the beneficiaries. This talk about the future rationing system where the ration card (book) will be linked with Aadhar with the bank account details in confidential manner. The user's details along with the entitled details will be stored in the government database which would be linked via Aadhar Card. Every Month when government sanction the ration to the public distribution centre, immediately one message will reach the user via SMS mentioning the details - date, time and venue from where the ration will be availed. The user is supposed to avail that facility, if user does not reach on that slot then automatically government database will send a new date and time slot to the user again.

Objectives:

- Monitor the flow of food grains supply from government to supplier, from supplier to grocery/retail/ration shop and finally to the entitled people.
- To send purchase details to customers through SMS using SMS Gateway.
- To be able to successfully authenticate the user.
- To achieve transparency in public distribution system by ensuring that only genuine and eligible beneficiaries get the benefits of this entitlement, providing them timely and accurate information about the supply of their entitlements every month.
- Eliminate fake and duplicate ration cards.
- Avoiding malpractices in distribution of food grains.
- Reduce the waiting time standing queue.

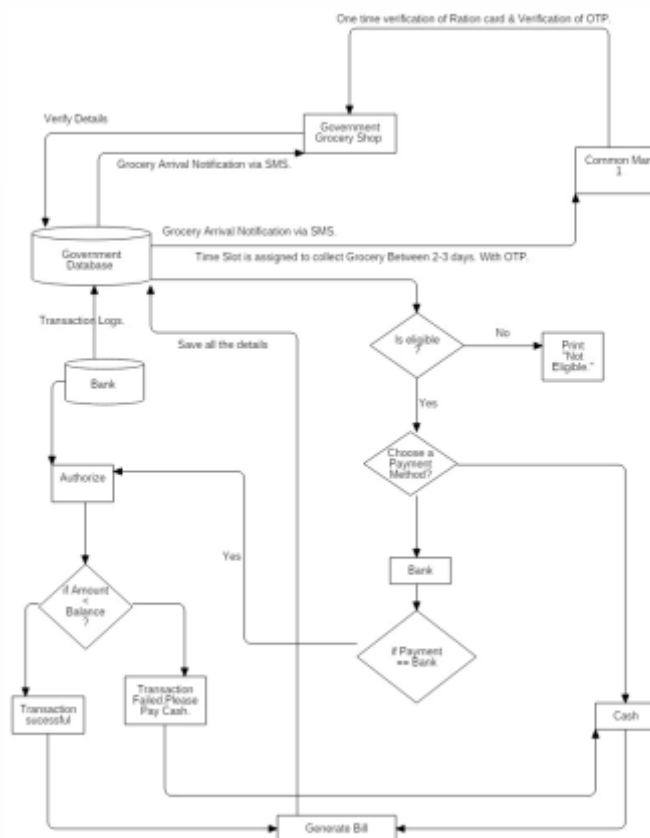
Working:

All beneficiaries should possess Aadhar Card before entitlement of the ration. Beneficiaries have to register into this system with the valid documents with unique password, ration card ID, personal details. Then the government database keeps all the details of all the beneficiaries. At the starting of every month government will send a

SMS automatically to all the ration card holders/beneficiaries of that particular area informing the arrival of the food grains and fuels with the date and time to collect the ration. Beneficiary has to approach the distribution centre with the ration card or Aadhar card to take the benefit. Once the beneficiary reaches the ration distribution centre the online authentication is done by sending Aadhar number and fingerprint to Unique Identification Authority of India (UIDAI) and to the government database server. Then the One Time Password (OTP) or Personal Identification Number (PIN) is generated which is send to beneficiary's mobile number and after the entering OTP/PIN by the distribution centre which will be valid only for 15 minutes and if the authentication is done then the quantity would be displayed and the beneficiary sees the details. It provides printed bill to the beneficiaries. After authentication the ration/grocery distributor enters the details of commodities. The bill is displayed and a Short Message Service will be sent to the beneficiary saying the quantity of ration taken for the particular month, and amount would either be deducted from Aadhar linked bank account or cash payment can also be done.

This device records all transactions along with time stamp and sends the data to the government database centralised server. This data can be used by the government servant and beneficiaries who will act as a backup by the consumer on this ration card account and shopkeeper cannot lie to the consumer. This system will ensure transparency in the system and helps in prevention of the corruptions and exploitation of beneficiaries.

FlowChart:



Challenges

Availability of devices and the presence of a good network in rural areas is a major concern for the smooth functioning of the project.

Conclusion

This system will help in avoiding corruption in rationing system to a large extent by providing transparency at each level from beneficiaries to government databases. The data or the record will not be stored manually either in books or register, all the data will be stored in government database. Hence it becomes easy for higher authority to cross check the data at any point of time. So implementing this will be really helpful to the poor and needy people. This system can support the beneficiaries by providing them the facility to register under this scheme where an Aadhar card will be linked during its registration process of Aadhar only. This would help in simplifying processes for existing card holders as well. This system also reduces the manual work and corruption by the shopkeeper.

Ms.Geeta Sahu
Assistant Professor

TaskJuggler Makes Balancing Project Tasks More Flexible



TaskJuggler is a modern and powerful, Free and Open Source Software project management tool. Its new approach to project planning and tracking is more flexible and superior to the commonly used Gantt chart editing tools.

TaskJuggler is project management software for serious project managers. It covers the complete spectrum of project management tasks from the first idea to the completion of the project. It assists you during project scoping, resource assignment, cost and revenue planning, risk and communication management.

TaskJuggler provides an optimizing scheduler that computes your project time lines and resource assignments based on the project outline and the constraints that you have provided. The built-in resource balancer and consistency checker offload you from having to worry about irrelevant details and ring the alarm if the project gets out of hand. The flexible as-many-details-as-necessary approach allows you to plan your project as you go, making it also ideal for new management strategies such as Extreme Programming and Agile Project Management.

Features and Highlights

Basic Properties

- Manages tasks, resources and accounts of your project
- Powerful to-do list management
- Detailed reference manual
- Simple installation
- Runs on all Linux, Unix, Windows, MacOS and several other operating systems

Advanced Scheduling

- Automatic resource levelling and tasks conflict resolution
- Unlimited number of scenarios (baselines) of the same project for what-if analysis
- Flexible working hours and leave management
- Support for shift working
- Multiple time zone support

Accounting

- Tasks may have initial costs, finishing costs
- Resources may have usage-based costs
- Task and/or resource base cost models
- Support for profit/loss analysis

Reporting

- Comprehensive and flexible reports so you can find the information you need when you need it
- Powerful filtering functions to provide the right amount of detail to the right audience
- Time and status sheet reporting infrastructure
- Project tracking and status reporting with dashboard support

Scaling and Enterprise Features

- Projects can be combined to larger projects
- Support for central resource allocation database
- Manages roles and complex reporting lines
- Powerful project description language with macro support
- Scales well on multi-core or multi-CPU systems
- Support for project management teams and revision control systems
- Data export to Microsoft Project and Computer Associates Clarity

Web Publishing and Groupware Functions

- HTML reports for web publishing
- CSV data export for exchange with popular office software
- iCalendar export for data exchange with calendar and productivity applications
- Built-in web server for dynamic and interactive reports
- Server based time sheet system for status and actual work reporting

Rohini Desai
Designation

The Use Of 3D Pen



A 3D pen is a tool that can draw in the air. You can think that it's a kind of magic, but it's just another technological breakthrough in the field of 3D modelling.

A gadget that will forever change the idea of what "drawing" is, because now you can draw not on only paper, but in space!

The device resembles an FDM printer, but the scope of its application is really immense. By means of it you can not only practice drawing and carrying out some experiments in the creation of artistic masterpieces, but you can definitely solve many problems of everyday chores.

To date, there are two types 3D pens: cold and hot. The first ones are printed rapidly polymerizing resins- photopolymers.

"Hot" pens use various polymer alloys in the form of bobbin tube with a plastic thread.

Unlike conventional devices for writing and drawing, instead of ink, a 3d pen is filled with a plastic thread. Most of the pens available in the retail market use a conventional polymer rods, which are bought for printers that use layer-by-layer technology. In the back of the case there is a special hole in which the filament is inserted. The built-in mechanism automatically lays on ink to the extruder, where it is melted and extruded into the molten form to the outside.

The metal tip of the print head heats up to a temperature of 240 ° C, so working with the device, basic safety rules should be adhered to. Even though 3D pens are equipped with a built-in fan to accelerate the process of solidification of plastic, neglectful attitude towards the device is directly connected with the risk of getting burns. The dimensions of the pen make it easy to hold it in one hand. Minor noise during the operation of the built-in mechanism does not distract from 3D modelling.

Of course, a 3D printer is capable of creating complex shapes, repeating exactly the elements of the programmed model. But 3D printer has a number of its own exclusive advantages:

1. First of all, it's weight. Modern gadgets weigh from 40 grams. They are easily held in the hand even by a child. Small size and ergonomic design allows you to take the device on business trips or on vacation.
2. Some devices are equipped with rechargeable batteries, which makes it possible to use them far from the access points to the power supply network.
3. Furthermore, the small size of the pen allows you to draw even in hard-to-reach places.



4. The device significantly expands the scope of fine art. If you do not care about art, then your children will definitely like this device. The pen will be an excellent toy for children. It will not only help to brighten up leisure time and take a fresh look at modern entertainment, it also contributes to broaden the child's outlook, the development of spatial thinking and the fine motor skills.
5. Another argument in favour of 3D pens is an affordable price. With similar capabilities with a desktop printer, the cost of a pen is a fraction of the number. You can buy several copies for your family at once in order to evaluate the charms of 3D printing yourself.

We need to remember that the 3d pen is an electric appliance. It operates from an outlet with 220v, so it has the the same safety arrangements as when working with other kind of power tools. It should be noted that during drawing, the pen point heats up to a temperature of 270 degrees, which can easily cause a burn on the exposed skin. Therefore, it is prohibited to grasp fingers with a metal or ceramic nozzle while working with the device. Apart from that, the pen is absolutely safe.

Payal Shah
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