Wissen

vidya
Progress through Education

" *Excellence*
is a **continuous** process
and **not an accident** "

A. P. J. ABDUL KALAM

PRINCIPAL 'S MESSAGE

We live in a time where technology is an unavoidable part of our everyday life. Advances in technology have made life more convenient, enjoyable, and productive.

Vidya's education system has been focused on supporting students in exploring latest developments in technology and moulding them as professionals . We believe that technical magazines like this will act as catalysts to faster learning for those who follow technology as a passion.

I congratulate the HoD, staff and students of ECE department who put their efforts to sharetheir technical ideas and taking initiative to release the first version of the Technical Magazine from the department, WISSEN 1.0.

"Do more than belong: participate
Do more than care: help
Do more than believe: practice
Do more than be fair: be kind
Do more than forgive: forget
Do more than dream: work"

- William Arthur Ward

I appreciate every student who shared the joy of participation in co-curricular & extracurricularactivities, including the efforts to release this magazine, along with their commitment to curriculum. Such extra efforts will definitely add more feathers to their cap.

Happy reading. Stay Safe.
Regards,
Principal

HOD 'S MESSAGE

The department of ECE has been showing considerable developments with exemplary speculative achievements since its inception in 2003 on B.Tech Degree and 2013 on M.Tech Degree Courses. The primary focus of the department is to empower students with broader curriculum outcomes and moral values. This is possible with our highly motivated and erudite faculty to shape students to professional demands. Moreover, the department is having a constructive platform to explore and contribute to the institutions.

It gives me immense pleasure that the department published the first volume "WISSEN" technical magazine for the period 2020-21. The technical magazine aims to constitute a spectrum of technical diversity, advancements, and awareness of electronics fields. It's wide-spectrum articles will definitely benefit the readers with useful information. I applaud all the article contributors of the magazine and congratulate the editorial team members for their efforts in timely launching this magazine.

We believe the vibrant practices of the department will continue further in building a competitive ambiance to ECE members. I take up this opportunity to thank our Management and Principal for their necessary support and encouragement.

EDITOR 'S MESSAGE

Dear readers,

We are delighted to introduce the first publication of the Technical magazine of ECE department, WISSEN. The objective of this magazine is to give an opportunity to teachers and students of ECE to transform their technical thoughts into words.

We would like to thank HoD-ECE and college authorities for offering full support in design and publication of this magazine . We extend our special thanks to all those who have contributed articles to make this effort a success.

Happy Reading!

Regards,

Suraj Rajappan
Sruthi M.

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ARTIFICIAL INTELLIGENCE : AN INNOVATIVE TREND

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Artificial Intelligence, which is a leading, trending, advanced and an efficient technology is considered as a powerful tool to deal with things intelligently. This is done by using software programs . AI refers to ability of a computer program or a machine to think and learn. It is also a field of study which tries to make computers "smart". If we look at the origin or emergence of AI, it will be John McCarthy, who coined the term in 1955, defined it as "the science and engineering of making intelligent machines". Basically it's a branch in Computer Science which deals mainly with computer programs. It was known after "Turing Test ". It's a test which simply explained the power of AI which is a method to check whether a computer is capable of thinking like human or not. Now we are facing a bigger challenge which is Covid (corona virus disease) and so we need better technology so that we can overcome current situation in a better way. Technology develops human and so getting updated with new knowledge is a necessary thing. we have to be more advanced since India is a developing country and so we need a good technical support to strengthen our foundation on technicality. Theoretical approach is the basis but in the case of technology we have to concentrate on practical approach . And so while entering to the field of technology it's a compulsory thing to have practical knowledge . The top most companies like Amazon, Google, Face book, Microsoft etc are using AI for customer's better experience. The countries like USA, UK, Canada etc are using AI widely.

Looking in to deeper level we have to analyze why we have to choose AI as a key factor. The reason is because we need better accuracy and also a good speed while dealing with things. so we have to analyze various fields in which we can apply AI . For better effectiveness we have to overcome certain strategies. Error reduction should be one among them.

History of AI

The beginners of advanced AI described AI as a thing which can perform human thinking as a symbolic system. And thus in 1940s "programmable digital computer "was invented which was machine based on the abstract essence of mathematical reasoning. Thus a thought arose which was to build an electronic brain. Investment and interest in AI boomed in the first decades of 21st century.

When we discuss about AI, we have to know about various types of AI namely ;

- Limited memory
- Self-awareness
- Theory of mind
- Reactive machines

Emerging trends will be always interesting. The reason is simple... we are looking to be more advanced and thus we will always try to improve ourselves. The fact is that each time technology will have advantages as well as disadvantages.... "Go Digital" is an interesting motto... thus the things will be more relieve. AI is such a trend and it can act as human intelligence. It deals with "Machine Learning" nowadays simply represented as ML to mimic human intelligence. The matter looks like simple but dealing with that will be complicated . AI mainly focuses to improve human efficiency while dealing with data.

Limited memory

By going through an example, in the case of a self driving car; the things like car's speed, direction etc are observed.

Self-awareness

It concentrate to build systems that can represent themselves. Self-awareness is a state of being conscious.

Theory of mind

It clearly differentiate between the machines we have and machines which will be developed in future. So we have to be aware about machines which will be developed in future by understanding that why they are needed and what will they perform. So we need more advanced machines and in Psychology it's called Theory of mind.

Reactive machines

The basic types of AI systems are merely reactive. The perfect example for this will be the "Deep Blue", IBM's chess-playing supercomputer. It can identify pieces on the chess board and know how they moves. It can also have the capability to predict the next move of it and also of its opponent. But the fact is that it doesn't have any idea of past and nor any memory of what happened before.

Advantages of AI

- AI would have a low error rate compared to humans, if coded properly. They would have incredible precision, accuracy, and speed.
- Replace humans in repetitive, tedious tasks and in many laborious places of work
- Predict what a user will type, ask, search, and do. They can easily act as assistants and can recommend or direct various actions.
- Can detect fraud in card-based systems, and possibly other systems in the future.
- Organized and manages records
- Since we are focusing on AI, we have to answer certain questions like....
- Why AI is needed?
- Which are the fields in which AI is applicable?
- How AI will be effective in future?
- How we can merge AI with Robotics?
- These questions are answered by explaining with its application.
- AI in healthcare
- Gaming sector
- Finance sector
- Data security
- It will be highlighted because we all need a safer path for data transaction and some of them are AEG bot, A12 platform where we can determine software bug and also prevents from cyber attacks.
- Automotive industry
- It's also an important applications since we are using virtual assistants like "Tesla Bot"
- Robotics
- It will be most effective application of AI because the topic "AI in Robotics" is a most researched topic nowadays and also it is considered as the most powerful tool to explore coming decades. And also this combination is considered as "most disruptive force in technology in the coming decade". This technology can generate intelligent robots. And the outcome is simply called "Humanoid Robot". The familiar example will be "Sophia".

AI Development services

- Machine Learning
- It's a better way to develop knowledge on AI. It can gather unstructured data to actionable insights to expand business growth
- Business intelligence
- By this AI engineers develop and carry out strategies to execute optimization, customer analysis, forecasting and performance analysis.
- Natural Language Processing (NLP)By using NLP and NLU, AI developers can assist organizations or institutions to analyze feedback from customer in order to improve their services and thereby increase their business.
- Computer Vision
- AI experts can develop solutions for recognition of objects and classification of images by using "Amazon Rekognition" and Deep Learning based visual search.

FUTURE OF AI

Researches on AI are still developing and so there are plenty of scopes for AI in future not only in networking but also in various aspects of life such as ;

- Transportation : Autonomous cars will be one among the advanced technology in future and it will be used worldwide.
- Manufacturing : It involves the manufacture of Humanoid robots
- Healthcare : AI-nascent field of healthcare, diseases are more quickly and accurately diagnosed, drug discovery is sped up and streamlined, virtual nursing assistants monitor patients and big data analysis helps to create a more personalized patient experience.
- Education : Text books will be digitized and virtual tutors will be assisting teachers.
- Media
- Customer Service

AI For Better Governance

- Detect grant fraud : Grant monies from the government are often issued with specific criteria for how the money is supposed to be spent. Detecting whether funds are being used as intended can be a challenge, due to the number of grants requiring review.
- Reducing fraud and error in tax and benefits systems : Governments today can benefit from the application of anomaly detection to benefits claims and tax rebates.
- Find error in public finance data : Government accounting systems generate large volumes of data, something driven by the size of the institution and its remit. This means that detecting issues in financial reporting can prove challenging. The use of time-series modeling to understand changes in regular expenditure profiles and debtors, combined with identification of rare transactions and analysis of fraud indicators, are only the starting point of the analytics that can help both finance departments and auditors.
- Examine service delivery processes : Many public services are becoming digital, creating electronic footprints of the business processes in operation. The use of process mining, a technology which uses timestamps to identify workflows, can be used to understand the flows of citizens through public services.
- Automate public services : Public services have traditionally used resource-intensive call centers to manage access to help and support. This does not have to be the first line; the use of chat bots in the private centre to triage support requests has proven successful.
- Predict Public health crisis
- Efficiently allocate resources : Resource allocation is paramount in delivering effective public services, whether it is the management of intensive-care beds or the maintenance of the road and rail network. The ability to predict need before it occurs allows managers to make better decisions; giving them this capability will become increasingly important in the public sector.

Conclusion

As an overview those who are interested in AI can easily handle the things by learning experience. For a student, in coming days AI will be best option to secure their future and also nowadays it's the most required skill for a student who is dealing with computer science, electronics or an electrical related subjects. In other words we can say that AI will be a thing which will be one among the top most technology in coming decades. Also it will play a significant role in the life of young generation. In future we can have improved speech, voice, image, video recognition , Personal assistants will become more personal and context aware and also more and more systems will run autonomously to a point

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COVID-19 DETECTION FROM CHEST X-RAY IMAGES USING DEEP LEARNING

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COVID-19 Pandemic condition is devastating day by day and is severely affecting the health of many people globally. During this study, a replacement model for automatic COVID-19 detection using raw chest X-ray images is presented.PCR testing is the most widely used screening method currently, which is a highly sensitive and accurate method, so needs more manpower, time, money and also a complicated manual process. So an alternative screening method proposed in this project is the detection of COVID-19 from chest radiography examinations. Although it's a computer-aided diagnostic process, it can assure more protection than PCR testing. For this, designed an AI-based deep learning convolution neural network architecture. The platform chosen for this project is Google colab the library is Tensor Flow with Keras.

COVID-19 PANDEMIC AND CHEST RADIOGRAPHIC EXAMINATIONS

The novel corona virus 2019 (COVID-2019), was first appeared in Wuhan city of China in December 2019, spread rapidly round the world and have become an epidemic. It's caused a devastating effect on daily lives, public health, and therefore the global economy. It's critical to detect the positive cases as early as possible so on prevent the further spread of this epidemic and to quickly treat affected patients. The necessity for auxiliary diagnostic tools has increased as there are not any accurate automated toolkits available. Recent findings obtained using radiology imaging techniques suggest that such images contain salient information about the COVID-19 virus. Application of advanced AI (AI) techniques including radiological imaging is often helpful for the accurate detection of this disease, and may even be assistive to beat the matter of a scarcity of specialized physicians in remote villages.
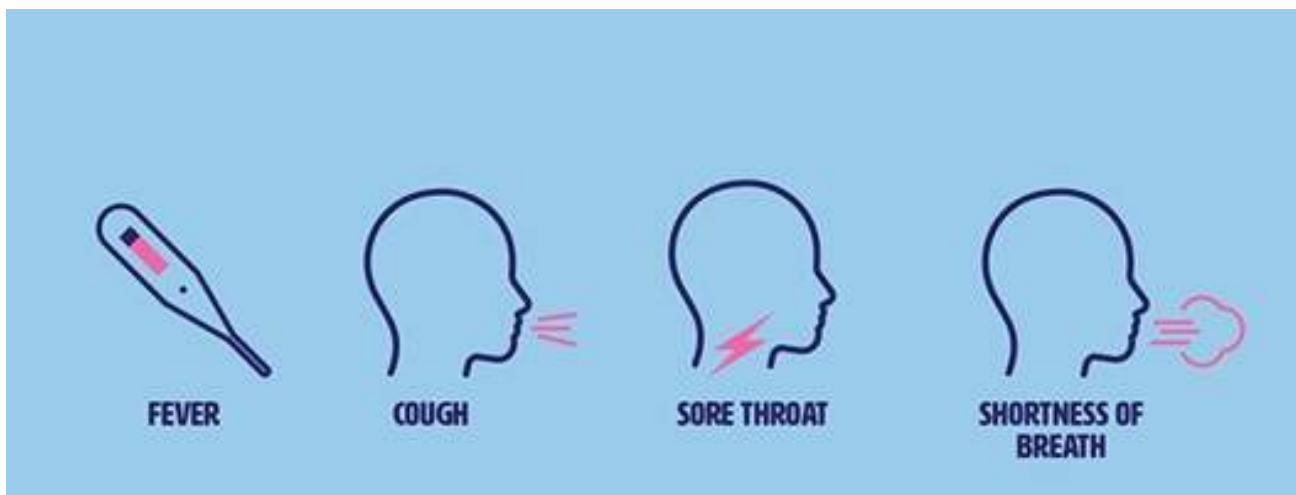

Fig. 1: Common symptoms of covid-19 infection (Department Of Health)

An alternative screening method that has also been utilized for COVID-19 screening has been radiography examination, where chest radiography imaging (e.g., chest X-ray (CXR) or computerized tomography (CT) imaging) is conducted and analyzed by radi- ologists to seem for visual indicators related to SARS-CoV-2 virus infection. The most screening method used for detecting COVID-19 cases is reverse transcriptase-polymerase chain reaction (RT-PCR) testing, which may detect SARS-CoV-2 RNA from respiratory specimens (collected through a spread of means like nasopharyngeal or oropharyngeal swabs). While RT-PCR testing is that the gold standard because it is very specific, it's a really time-consuming, laborious, and sophisticated manual process that's briefly sup- plies. Furthermore, the sensitivity of RT-PCR testing is very variable and hasn't been reported during a clear and consistent manner to date and initial findings in China show- ing relatively poor sensitivity.

Fig. 2: CXR of covid-19 infection and normal images (Kaggle dataset)

COVIDx Dataset

The dataset used to train and evaluate the proposed architecture, named as COVIDx, is comprised of a complete 4200 chest x-ray images. To generate the COVIDx dataset, we combined chest x-ray images from Kaggle and GitHub which is openly accessible. Example CXR images from the COVIDx dataset are shown in Fig 2.Selection of those datasets from which to make COVIDx is guided by the very fact that each datasets are open source and fully accessible to the research community and therefore generally public, and as datasets will still grow COVIDx by adding new chest x-rays available timely.Dataset generation scripts for constructing the COVIDx dataset is out there publicly for open access at:

- https://www.kaggle.com/praveengovi/coronahack-chest-xraydataset
- https://github.com/ieee8023/covid-chestxray-dataset

Proposed model

Designed Artificial intelligence based deep learning convolution neural network architecture shown in figure 3, a computer-aided diagnostic process to detect covid19 from chest radiographic examinations .The

platform chosen for this project is Google colab & the library is Tensor Flow with Keras programmed in python.

In this architecture used VGG16 as base model, a convolution neural network model. This model makes improvement over Alex-Net (another convolution network model) by replacing large kernel sized filters & it achieves more accuracy about 92.7 %.Adam optimizer is used to optimize maximum performance in input layers. It is optimization algorithm to train deep learning models. It offers best values like learning rate while training model. It have longer training time ,works reliably in noisy problems and combines best properties of Adagrad and RMS prop algorithms. So I'm selecting Adam optimizers than SGD optimizer. Model works best with loss function 1e-3 with batch size 8.From Sklearn ,importing classification report to classify results to 0 & 1,also imports confusion matrix to generate all possible results from output & stores all possible outputs.
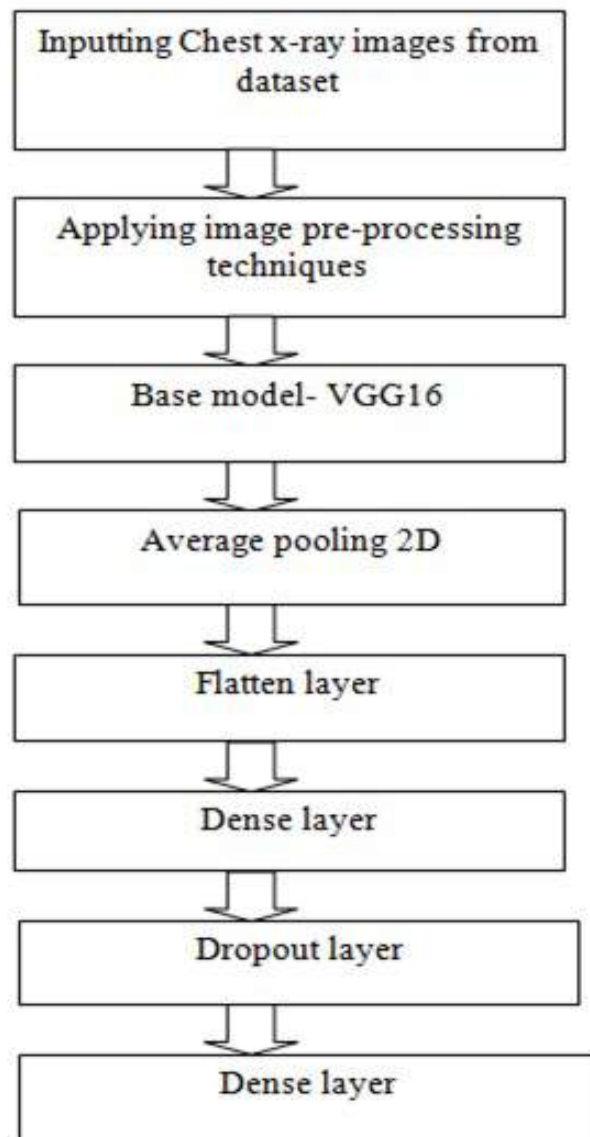

Fig. 3: Block diagram of proposed model

Going to layers in block diagram, reprocessed chest x-ray images are fed in to VGG16 base model (mentioned earlier) after there out is taken & input to Average pooling layer. Here pool size taken is

4, 4 (vertical, horizontal) .Pooling layers will reduce computational complexities and variance in neural networks. While performing average pooling average value of all pixels in batch is selected. Flatten layer will converts data to 1-dimensional array for inputting to next layer. It is important layer to create single long feature vector. It is connected to final classification model called Dense layer or fully connected layer. Drop out layer ensures that no value are dropped out while training datasets and it also prevents neural network from overfitting.A dense 64 is used in first dense layer and activation function is Relu (rectified linear activation function).Is an non linear one ,doesn't show any back propagation errors and shows faster results than other activation function. Dense layer (2) in output stage is provided by activation function Softmax.It maps output to a [0,1] range. The output of Softmax is therefore a probability distribution.

Advantages

- Fast testing
- Low cost
- Less laborious
- Radiography examinations are faster
- Ensures more protection than PCR testing

Conclusion

In this study, introduced a deep convolution neural network design for the detection of COVID-19 cases from CXR images that's open source and available to the overall public. Also, introduced COVIDx dataset that's comprised of 4200 images including both covid positive cases and normal chest x-ray images. The platform chosen for this project is Google colab the library is Tensor Flow with Keras. Trained our covid 19 model with 80% of dataset and rest 20% of dataset are used to test model. Model is trained to predict class 0 for covid positive cases and class 1 for normal cases. We tested covid 19 model by inputting images outside from datasets and it predicted accurately results for covid cases and normal cases.

Acknowledgement

COMMUNICATION

TELEVISION

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Television is a telecommunication system for receiving and broadcasting moving images and sound over a distance. The word Television is obtained from the Latin word tele which means far and Latin word visio means sight. The programmes and news telecasted through this audio-visual medium of communication attract almost all age groups and cause a huge impact on the mind of people. Along with that it acts as a source of information, entertainment and relaxation which made the television the most popular medium. The major contributions which led to the development of the television technology are shown in table 1:

TABLE I: Contribution towards electronic Television system

YEAR	CONTRIBUTOR	CONTRIBUTION
1880s	Paul Nipkow	invented scanning disk device
1923	Valdimir Zworykin	practical television era tube(ionoscope tube)
1925	Charles Jenkins	transmitted first long distance TV image
1926	John Baird	made the first mechanical television system
1927	Philo Fransworth	created the first electronic television system

Fig 1. shows how the evolution of the television towards TV broadcast has occurred.
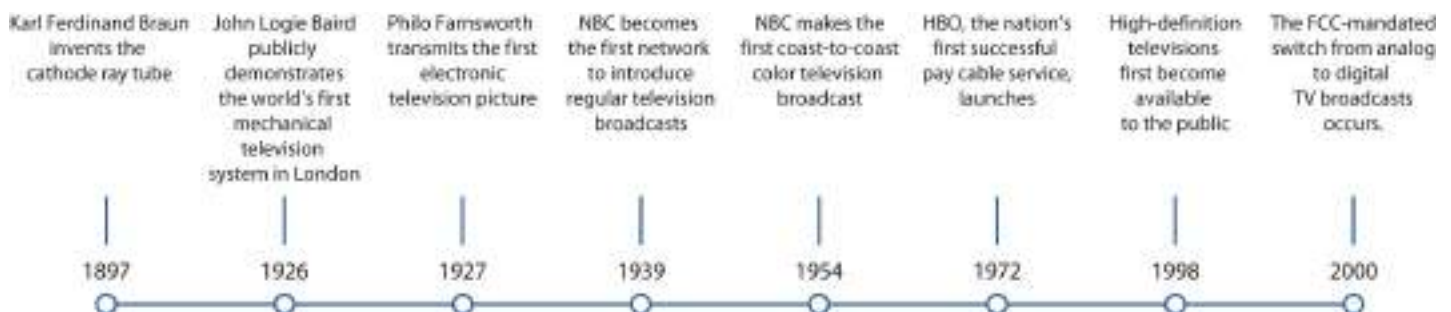

Fig. 1: Evolution of television[Source:Libraries]

Television has played an integral role in replacing radio, which was the most popular mass medium in the 1950s, at the time when some people find it difficult to imagine being without it. Both shaping and reflecting cultural values, television has at times been criticized for its alleged negative effect on young people and children and at other times lauded for its ability to create a common wisdom for all its viewers. In the modern world, as satellite broadcasting and Internet technology change the way people watch television, the medium continues to evolve, solidifying its position as one of the most important inventions of the 20th century.

Types of Televisions

Now, televisions have become a part of our family life and most households will own at least one. The development taking place in the television industry attracts people to buy the trending model. Earlier times there were no many options, but now purchasing a new TV can be frustrating if youre not quite sure what you are looking at. Modern TVs have a baffling array of formats, acronyms and tech jargon all planned to promote and explain their features. But if you are unaware what to look out for researching your TV can be minefield. Fig 2. shows different types of televisions based on technology, screen type, features and resolution.
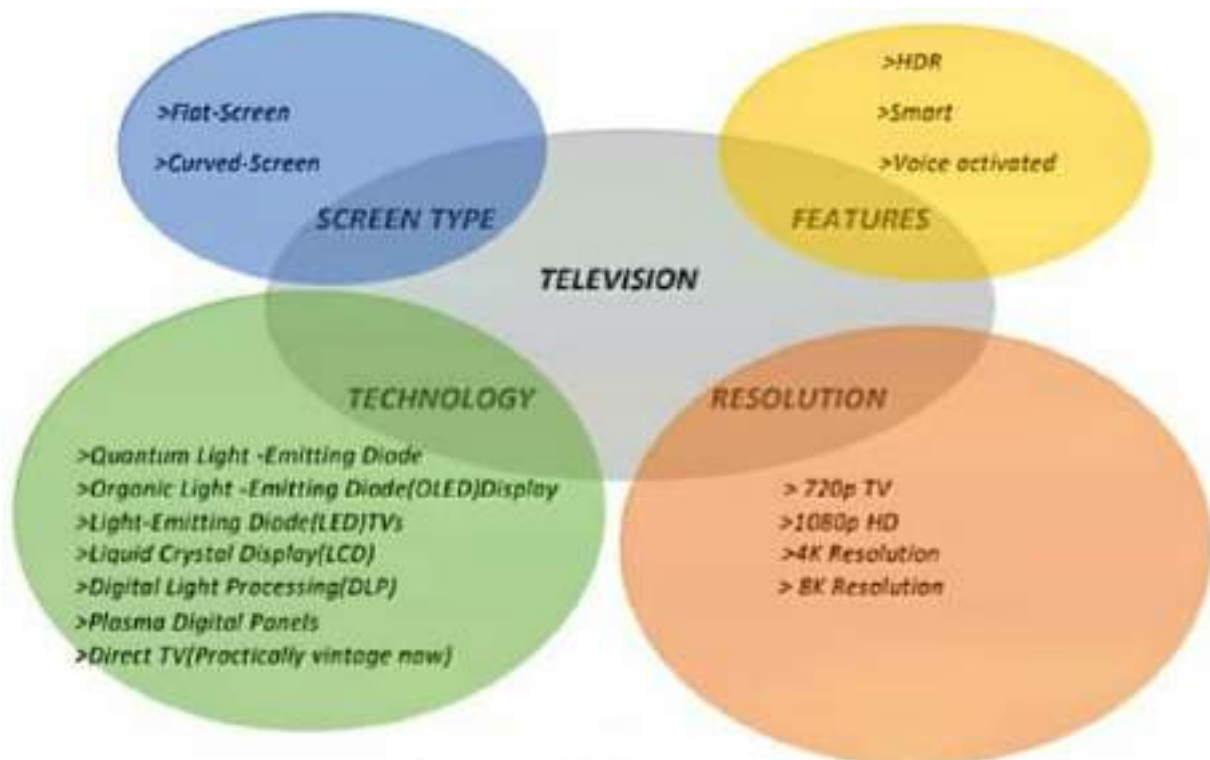
>Flat-Screen
>Curved-Screen

SCREEN TYPE

>HDR
>Smart
>Voice activated

FEATURES

TELEVISION

TECHNOLOGY

>Quantum Light -Emitting Diode
>Organic Light -Emitting Diode(OLED)Display
>Light-Emitting Diode(LED)TVs
>Liquid Crystal Display(LCD)
>Digital Light Processing(DLP)
>Plasma Digital Panels
>Direct TV(Practically vintage now)

RESOLUTION

> 720p TV
>1080p HD
>4K Resolution
> 8K Resolution

Fig. 2: Types of television[Source:Libraries]

Television transmission and reception

Fig.3 shows how the television system generates transmit and utilize the television signal during its transmission and reception. Firstly, the camera on the left hand side of the figure captures the images to be televised and then send it to the image sensor. The lens inside the image sensor focus the required

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image/scene and produces the picture signal that represent the amounts of the three primary colors (blue, green, and red) present at each point in the image pattern. This primary-color signals are converted to chrominance and luminance signal using the color coder placed over the color camera.
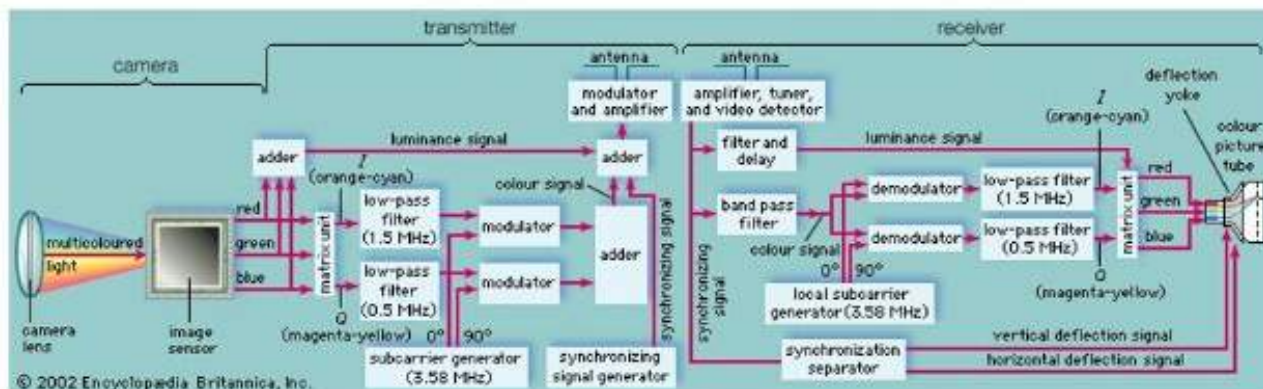

Fig. 3: Colour television[Source:Britannica]

After that the Individually deducted luminance signal from the original primary-color signals, and the color-difference signals are further mixed in a matrix unit to get the I (orange-cyan) and Q (magenta-yellow) signals. At the same time these are applied to a modulator, where the chrominance subcarrier signal mixes with it. The chrominance and luminance components are then combined in another addition circuit to form the overall color picture signal. Later, synchronization and blanking pulses are added to convert the signal to composite video waveform. The sound program accompanying a television picture signal is shown in fig 4.
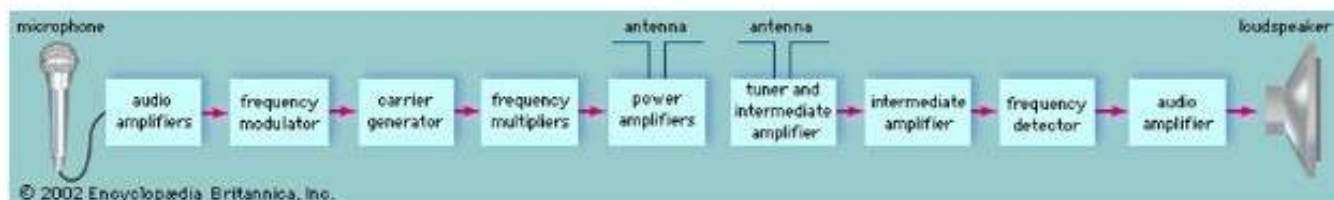

Fig. 4: Television sound components[Source:Britannica]

Here the carrier frequency of the sound channel is spaced 4.5 MHz above the picture carrier frequency and is isolated from the picture carrier in the TV receiver appropriate circuitry. The stereo information which is encoded as the difference between right and left audio channel, amplitude modulates the stereo sub-carrier, which is suppressed in the absence of stereo difference information. The base sound signal is transmitted as the sum of the right and left audio channels and hence is compatible with monster receivers. This sound signal along with the composite video signal is then imposed on a carrier wave transmitting with an allocated frequency and passed through the television receiver. After that they are shifted back to their original frequencies and applied to the receivers display and loudspeaker.

Advantages of Television

- **Entertainment and laughter**-Entertainment and laughter is one of the best ways by which we can get rid of stress and get relaxed. Various musical, dance and comical reality shows on TV can help us for this purpose.
- **Improve Memory and Easy Learning**- We tend to store and recall the things that recently happened in our favorite show before the next episode will be shown on TV. This improves our memory power. For children, it is easier to learn subjects if someone can show them how to do it. Therefore, educational channels provide the children an easy way of learning.
- **Bonding with Family and Friends**-During weekends when all family members are at home, watching TV and discuss things that you see on it and spending time with family members is one of the best ways by which we can maintain the bonding with family and friends.
- **Awareness and Alertness**-By watching TV, you can update your knowledge on what is happening outside your country. And also get alerted if there is a possibility for a disaster to occur. Weather reports, news channels etc. Are meant for this purpose.

Disadvantages of Television

- **Decline in creativity and imagination**-TV shows impart their creative stuff readily available to us and decline our ability to be innovative. Therefore, imparting their ideas and opinion, which is not favorable to us is one of the drawbacks of watching television
- **Health problems**-Usually, we try to occupy a comfortable place before the TV while watching our favorite movies or shows and limit yourself from moving a lot from that place until that program is over. At the same time we take a lot of junk foods in the excitement of watching our favorite programs. This can lead to serious aliments caused by eating a lot and moving less.
- **Make people lazy**-Most of us get hooked when watching programs of our favorite TV channel. I.e., when people get fully immersed or addicted with their favorite TV shows they forget to do their work. Therefore, the major drawback of watching television is that it makes people lazy.

Application of Television

- Public entertainment, Newscasts and Weather reports
- Political campaigns and organization
- CCTV is a special application
- Guidance and announcements in public places like airport terminals, sales promotion and many others

Conclusion

Starting with an introduction on television, its types, overall idea of transmission and reception, advantages, disadvantages and applications that we identified are discussed.

Acknowledgement

TRANSITION FROM 4G TO 5G

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Mobile communications are unique in their overall technology, speed, frequency and system. It is represented in numeric generations such as 1G, 2G, 3G, 4G or 5G. Each generation has a unique technology that defines them. Cellular systems have experienced an enormous growth over the last two decades. Figure 1 shows the evolution of mobile communication over the years.

Looking in to deeper level we have to analyze why we have to choose AI as a key factor. The reason is because we need better accuracy and also a good speed while dealing with things. so we have to analyze various fields in which we can apply AI . For better effectiveness we have to overcome certain strategies. Error reduction should be one among them.

Fig. 1: Evolution of mobile communication over the years [Source: Researchgate]

Evolution of Mobile Technology:

1G: First generation of commercial cellular networks was introduced in the late 1970s with total establishment in 1982. The radio signals used by 1G are analogue, which means that the voice of a call is modulated to a higher frequency rather than being encoded to digital signals. The voice channel typically used frequency modulation, with FDMA techniques. Examples: NMT (Nordic Mobile Telephone) and AMPS (Advanced Mobile Phone System) which was frequency modulated. It is based on an analog system, and has a poor battery life with limited capacity.

2G: 2G refers to the second generation and is based on GSM. The 1980s witnessed 2G which mainly focused on digital signals. It enabled delivery of text and picture messages. It used digital signals.

2.5G: Between 2000 and 2003, there was an upgrade in technologies which introduced the packet network that provided high speed data transfer over the internet. This was the era of 2.5G. The standard was GPRS (General Packet Radio Service) which supported flexible data transmission rates and provided

continuous connection with the network allowing the service provider to charge for the amount of data that is sent rather than their connection time.

3G: 3G is based on Wideband Code Division Multiple Access and provides various services like data services access to television/video. It supported high speed wide band internet access as well as fixed wireless internet access and allowed for video calls, chatting and conferencing, mobile TV, video on demand services, navigational maps. It also provided facilities like email, mobile gaming, music and digital services such as movies. Significantly greater security features were introduced like Network Access and Domain Security and Application Security

4G: 4G, initiated in 2010, is an all IP based network system. It provides high speed, high quality services to users while improving security and lowers the cost of voice and data services, multimedia and internet over IP. 4G introduced the LTE standard which only supported packet switching and an all IP Network. Significant amounts of infrastructure changes were brought by service providers in order to supply voice calls in GSM. Table: 1 shows the summary of 1G to 4G.

Generation	Features	Applications
First Generation	Uses Analog technology	Voice communication
Second Generation	Primary Technology Used	Slow rate data
Third Generation	144kb/s for mobile	Advanced applications
Fourth Generation	Requires ability of 40Mhz	Fast rate data

TABLE I: Summary of 1G to 4G

5G: Various types of advanced features are included in fifth generation. 5G is used across three main types of connected services, which are enhanced mobile broadband, mission critical communications, and the gigantic IoT. 5G is designed for forward compatibility which enables flexible support for future services that aren't known today. Some of the features of 5G technology are as follow:

- Faster response time
- Very high capacity
- More software option to upgrade
- Ubiquitous connections
- Wide range of applications
- Speed up to 10 Gbits/s
- Virtually '0' latency
- 100 times more devices

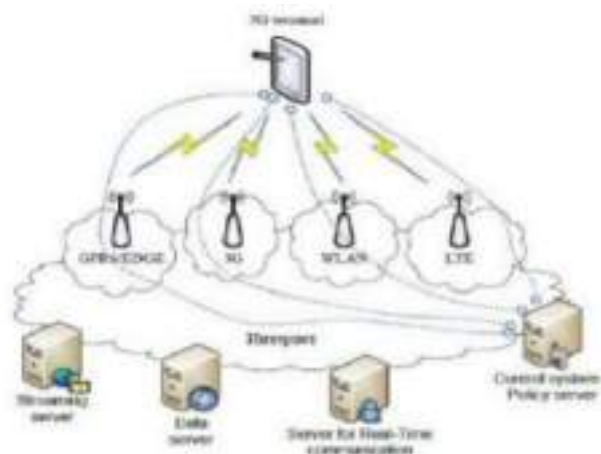**Architecture of 5G:** Figure 3 shows the architecture of 5G.

Fig. 2: Architecture of 5G [Source: Tutorialspoint]

Characteristics of 5G:

- High capacity allowing more devices to connect concurrently and quickly
- Lower battery consumption
- Better connectivity regardless of the geographic region
- Larger number of supporting devices
- High increased peak bit rate

Figure 3 shows the theoretical differences between 4G and 5G.

Fig. 3: Theoretical differences between 4G and 5G [Source: Thales]

Advanced Features

- Worldwide coverage
- About 90% reductions in network energy usage.
- Battery life will be much longer.
- Whole world will be in a Wi-Fi zone.

Advantages

- 5G technology acts as a backbone for multimedia, voice and internet
- 5G provides global access and service portability.
- High resolution and large bandwidth is offered by 5G.
- It possesses very high capacity and speed.

Applications of 5G

5G creates a unified global standard for all providing network availability that enables people to use their mobile devices anywhere anytime. Due to IPv6 technology, as per the connected network and geographical position, visiting care of mobile IP addresses will be assigned. 5G has a cognitive radio technology that facilitates different versions of radio technologies to share the same spectrum efficiently.

Conclusion

A 5G-powered future fundamentally reshapes supply chains. 5G can be thought of as the "secret sauce" which has a high speed and instantaneous response times, making connected cars, cloud-connected traffic control and other applications. From the healthcare sector, emergency response and smart energy solutions to gaming, the possibilities are virtually limitless.

Acknowledgement

EMBEDDED SYSTEMS

IoT BASED VOTING MACHINE WITH FINGERPRINT VERIFICATION

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In a democratic country, like India voting is an important way where the citizen can cast their vote. Usually voting is done by casting their vote in polling booth. As the technology increases, nowadays electronic voting machine is used for casting vote.This paper is about an IoT based voting machine with fingerprint verification. The main aim of this project is to make voting secure using fingerprint verification and also to reduce malpractices. The details of the voter along with their fingerprint in stored as a database. The finger is first placed for verification. After matching with the stored fingerprint,verifies aadhar number matches of the user and checks for multiple voting. If the fingerprint matching is not correct "Matching failed" message is displayed. If aadhar number is not correct then" Aadhar not match" message will be displayed. Voter can enter their native place and vote for the corresponding candidate using thingspeak and the result can be obtained it also done using thingsspeak. The Arduino Uno is the controller used in this project. Fingerprint is used to identify the user. The fingerprint minutiae features will be different for each person. Fingerprint is used as an authentication of the user. When a malpractice occurs already voted message will be displayed on a display. The arduino IDE is used for programming the board and cloud is used to display ballot card and to store the result. System provides an alert on malpractice and authorized voter can only vote. This project safeguards the citizen right to vote and guarantee fair election.

I. INTRODUCTION

VOTING is the right of each citizen to cast the vote and select there leader. India is a democratic country and each citizen has the right to vote and show their option. People also has the right to change the ruling party in upcoming election by voting for the candidate. Voting is not done to elect the government leaders, but also conducted to elect the leaders in schools, colleges, banks, society, etc.

Biometrics is way used to recognize a person based on his physical nature. The fingerprint, iris, face, voice, etc are the mainly used biometrics to recognize a person. There are two key functions for a biometrics, first is one to one matching and other is one to many matching. In one to many matching the biometric sample is compared with the already stored samples. In one to one matching,it compares with the previously stored sample. Biometric method results in a more faster security, and more convenient method for user verification. Biometric method is better than password security. Fingerprint is unique for each individual so it can be used as a mark of signature, verification and authentication.

Almost all the sectors are storing all data digitally. To create digital India, most of the tasks are made through on-line.When the voting is made on-line it helps the voters to vote from anywhere in the world. Thingspeak is one of the way which helps in making voting on-line. Obtaining online result makes the system faster.

A. Existing Systems

Electronic voting machine are used nowadays for polling vote. Electronic voting machine consist of two part: one is control unit and other is balloting unit. The control unit is controlled by the presiding

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officer and after the verification, voter will be allowed to poll his vote. The balloting unit is inside the voting compartment. When the verification is completed by the presiding officer, he presses the ballot button then the voter can cast his vote. Voter use the button against name of candidate which he wants to vote. In the existing system voter needs to carry his ID card for verification. The presiding officer will check with the list and ID card for verifying of the voter. This is time consuming. At the end of voting all the EVM will collected and submitted to counting center and the selected government employees will count the vote and finally publish the result.

B. Proposed System

In this system we are using fingerprint as the biometric method of verification and its on-line version. The voters fingerprint and aadhar number is enrolled and stored in a database. During the process for voting the first system ask for the aadhar number if the aadhar number matches with the stored aadhar number, it checks whether the fingerprint matches. If the fingerprint matches then the system checks whether that person has voted before for the same election. If he has not voted then "fingerprint and aadhar number match cast vote" message display. After voting the register will be incremented. If that person has voted before then " already voted" message is displayed along with a buzzer sound.

Voting is done using keypad through thingspeak. When a message displayed to cast vote then that person is allowed to cast vote. For voting first the system ask for entering the native place, it is done using keypad. Then the voter is allowed to

vote for the corresponding candidate. Voters vote and time of voting is saved in thingspeak. The result also will be obtained. Since this system uses thingspeak, it can be used for postal voting also. There should be a polling officer in-order to control voting. The voter can vote from candidate of their native place since the system is on-line.

1) BLOCK DIAGRAM:

The functional block diagram of the IoT based voting machine with fingerprint verification consist of controller, fingerprint module, Wi-Fi module, key- pad, power supply and a cloud. The controller used in this system is arduino Uno. Power is given to the system from the laptop. Keypad is used to poll the vote. Message regarding the system instructions and any malpractice will be displayed on the serial monitor. Fingerprint module is used to place the finger, it is used to store the database of the voters fingerprint. Fingerprint module identify the fingerprint of each users with the fingerprint in the database and displays a message if it belongs to an authenticated person. It will give the result of matching on the serial monitor. The ballot paper of the voting is stored on the cloud. The final count of each candidate is store in different field in the cloud.Here,thingspeak is used to store the final count obtained by the candidate . ESP8266 is used to provide Wi-Fi to the controller. Buzzer is used as a alert when a person vote for the second time.Here they are divided into two units finger-print unit and voting unit. The figure1 shows the block diagram of verification unit.

Fig. 1: . Block diagram of verification unit

Its mainly deals with the enrolling and matching. It consist of the fingerprint module which is used for store the fingerprint of the voter and checks with the database for matching. Here the aadhar number of the voter is also stored. The system also verifies the aadhar number of user stored in the database. System checks whether that person tries to cast his vote more than once. Buzzer is used to alert when second voting occurs.
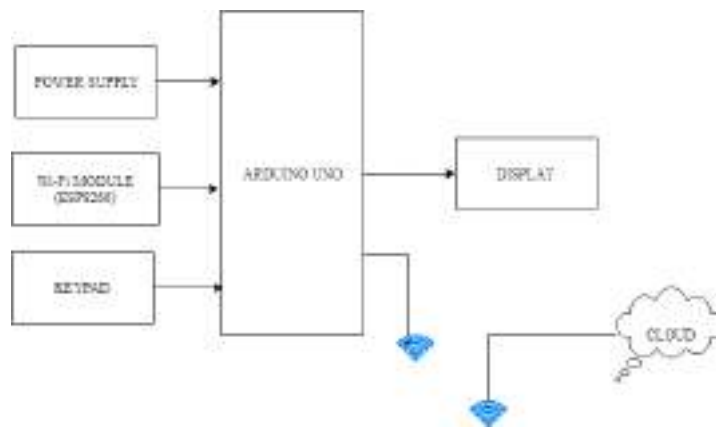

Fig. 2: Block diagram of voting unit

Figure 2 shows the deals with the voting procedure. When a message occurs in the fingerprint unit that person is eligible to cast vote,then he can cast vote through this unit. After voting a register will be incremented. The voter can select the place where he wants to vote.Voting is done through the thingspeak using keypad. Finally result can be obtained in the serial monitor of the arduino.

2) SYSTEM WORKING

First the voter needed to enroll his aadhar number and fingerprint. During the process of voting it checks with enrolled data if it matches, then check if there exists any previous entry against that user. If that voter has voted before, "already voted" message will appear along with a buzzer alarm. If not voted before, he can cast his vote through thingspeak where he select his native place and cast vote and a register will be incremented. Then at the end of the voting the result can be obtained.
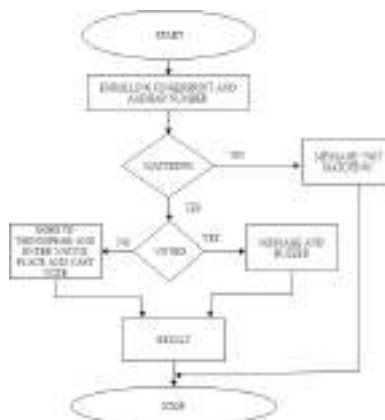
Fig. 3: The architecture of ART1

II. RESULTS OF IMPLEMENTATION

The proposed system is implemented.There are mainly two units in this system, one for verification and other for voting. Arduino UNO was programmed using Arduino IDE. In the verification unit there are three scenarios- voting for first time, voting more than once, mismatch in fingerprint and aadhar number. If user attempts to vote for the first time, his fingerprint and aadhar number is compared with data in the database, if a match occurs, he can cast vote and message "Authenticated Proceed" displays on the serial monitor of the arduino. If an authenticated user tries to cast vote more than once then a buzzer sound will be produced and "already voted " message displays on serial monitor. If the fingerprint and aadhar number of a person is not available in the database, he can't cast his vote. In the voting unit, the voter can cast vote by using keypad through thingspeak and finally the authorized officer gets the summary of voting.

Fig. 4: Verification unit

Fig. 5: Voting unit

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III. CONCLUSION

The concept of a Iot based voting has been proposed here, as India is a democratic country all the citizens has right to express their vote and select the person whom to lead them. World is becoming completely digitized as a part of digiti- zation here we are making voting also digitized. In-order to reduce the lack of time in getting result here we can get result more faster. The system is made more secured by introducing biometric verification and aadhar number verification. This system allows one person to vote only once, multiple voting are not allowed. This system can be used for postal voting also.

IV. FURTHER SCOPE

This method of voting helps to make voting more secured. Postal voting can also be made secured by using Iot based voting. This system allows voting from anywhere in the world. This system requires less time for getting result then the current methods used. Revolving around this topic, when the controller with more memory helps in storing more data. Adding more biometric method helps to improve security, biometric such as face, iris, etc can be added. Introducing more security for the on-line can help in making the system fully automatic.

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SMART TOKEN BOOKING AND QUEUE MANAGEMENT SYSTEM

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Now a days, queue management is high in demand because of the kind of services offered by every organization. These issues are regularly happening in banks, hospitals, schools, shopping centers and big organizations where heavy flow of customers happens. The inappropriate administration of such lines will cause pressure and stress among clients furthermore, representatives. Numerous organizations give queue management framework for controlling lines of individuals in different circumstances and areas in a line zone. The vast majority of the strategies utilized are physically for a little space and straight forward stream. Here the works are done manually by the secretary and other operational staffs. Medical clinics and banks are the two spots where it is important to have a good queue management system.

Fig. 1: Current appointment method in hospitals

Booking appointments and reservations in the traditional way requires labor or staffs, regardless of whether its the assistant picking up the telephone, a head dealing with a paper arrangement plan, or a staff member settling on update telephone decisions. The major problems with a conventional appointment booking system are

- Time consuming: manual token generation takes more time.
- Hard to make updations: Various changes to data like patient details or vaccination details etc are hard to make changes in paper work.
- Blunder due to manual count: Manual figurines are mistake inclined and take a ton of time this may bring about inaccurate data. For model computation of patients bill dependent on different medicines.
- Arrangement of exact and brief reports: This turns into a troublesome assignment as data is hard to gather from different registers.

The scheduling of appointments and bookings is an important task in hospital for queue management. Smart token booking and queue management system is an automated token registration system for hospital. This system provides ease and comfort to patients while taking appointments from doctors. Here the token generation system is designed in two methods ie, by an android app and a kiosk system. Patient's in the remote area from the hospital can book or cancel the appointment through an android app and also patients in the hospital can book the appointment by a kiosk device.

The android application and a kiosk system will act as a client, whereas the database containing all the details is maintained by a website that acts as a server. It empowers health care providers to improve operational effectiveness, reduce costs, decrease clinical blunders, reduce time consumption and upgrade the quality of care. This framework also helps to reduce the issues happen when utilizing the manual framework and helps patients to skip endless queues. Also, it will make simpler for the information record and retrieval.
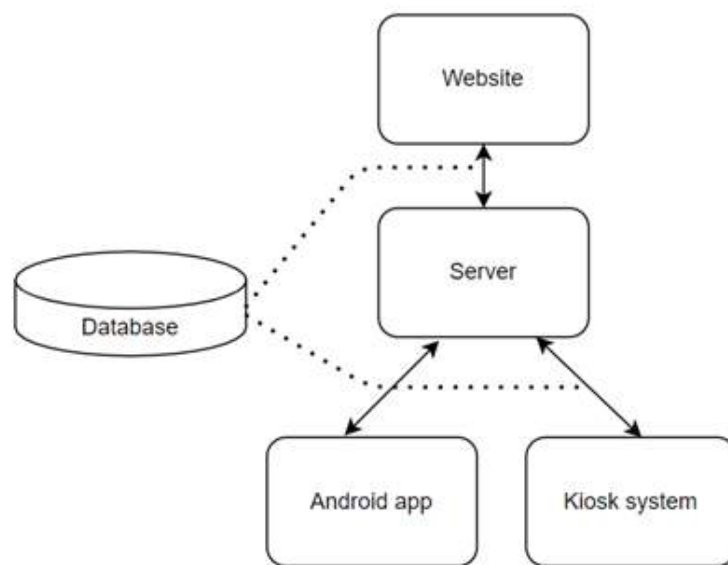
Fig. 2: Block diagram of the system

Android Application

The android system is designed for patients in the remote location. Initially the client wants to download the application from playstore and introduce it in their mobile phones. Once this application is installed it will remain permanently in the phone until the client erases or uninstalls it. By the android platform user can make the appointment from the doctor in an easy manner. Patients can select the doctors and book the appointment by entering their CR number(Patient registration number). Also patients can cancel their tokens by the cancel option in the screen. Doctors can also login to the android application for viewing the appointment details by entering their employment number. The android application consist two modules.

User Module

- User login: User can login to their profile by entering their particular Op number as username and their registered phone number as password.
- Doctor List: User can browse the entire doctors list and book appointment by selecting their profile.

- Upcoming appointments: User can view the upcoming appointments. Past appointment list will be deleted automatically.
- Make appointment: User can search entire doctor list with available days and book appointments. Then token numbers will be provided.
- Cancel appointment: User can also cancel the booked appointments by clicking the cancel button.

Doctor Module

- Doctor Login: Doctor can login to their profile by entering their Employment number as username and password.
- Appointment List: Also doctor can view his/her upcoming appointment list here.

Kiosk system

The kiosk system is designed for patients who doesnt have an android phone. They can book their appointments from the hospital without standing in the line. By entering the CR number in the display, screen they can book their appointments.

Patient details and doctors details are placed in the database in server. So, if the user request for the token or cancel the token, that data will be updated to the server automatically. Also a website is designed for overall management of the appointment. From the website, hospital staffs can enroll new doctors or patients and manage the data.

Admin Module

Admin module is designed on the website. He will login to the site and manage the overall data. Admin can view entire doctor lists and appointment lists of the hospital. He can add or delete doctor details and user details. Also he can set the op timings and manage the booking. All the doctors and patients are registered by the admin; they cannot register themselves. Admin will provide Op number to patients and Emp number for the doctors. By using these numbers they can login to their profile. Also admin will store all the appointment details.

Advantages

The utilization of proposed framework will solve the issues of the current issues in Clinical Appointment System. The proposed framework offers:
- Manual work which is tedious can be decreased.
- Easy storing of information in the data set.
- Administrator can add/eliminate new specialists and patients.
- Increase handling speed.
- Automatic expulsion of past arrangements.
- Responsive format that fits all the devices.
- Reduces patients long waiting and time waste.
- Keeping slots full
- Efficient, convenient and easy token registration
- Optimum utilization of staff and workflow
- Paperless token

Conclusion

Queue Management System is a system that manages the queuing number of the given customer in obtaining services. One of the problems arise normally is the long wait in the queue, due to system inefficiency. Making facility arrangements shouldnt be hard, however frequently because of the manual method of making arrangements, patients think that its difficult to make meetings with their ideal specialist. Regularly patients need to stand by in long lines but then here and there they wont have the option to book their arrangements.

So, this new facility Appointment System is a simple answer for such patients. They dont need to stand by in unlimited lines or request that somebody help them out, on token booking. This system is attempting to design an automated token registration system in order to reduce the long waiting in hospitals. From the medical clinic/center perspective, they regularly neglect to fulfill the requirements of their patients/clients. Starting with an introduction in conventional token booking system and its issues, Smart token booking and queue management system its modules, advantages are discussed.

Acknowledgement

EMBEDDED SYSTEMS

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A system is an arrangement in which all its units assemble works together according to a set of rules. It can be also defined as a way of working, organizing or doing one or many tasks according to a fixed plan. All its subcomponents depend on each other in a system. Embedded means something is that attached to another thing. An embedded system is thought of as a computer hardware system having software embedded in it. An embedded system can be a part of a large system or it can be an independent system. An embedded system is designed to perform specific task. It is microcontroller based system or microprocessor based system. An embedded system has three major units as shown in Fig 1.
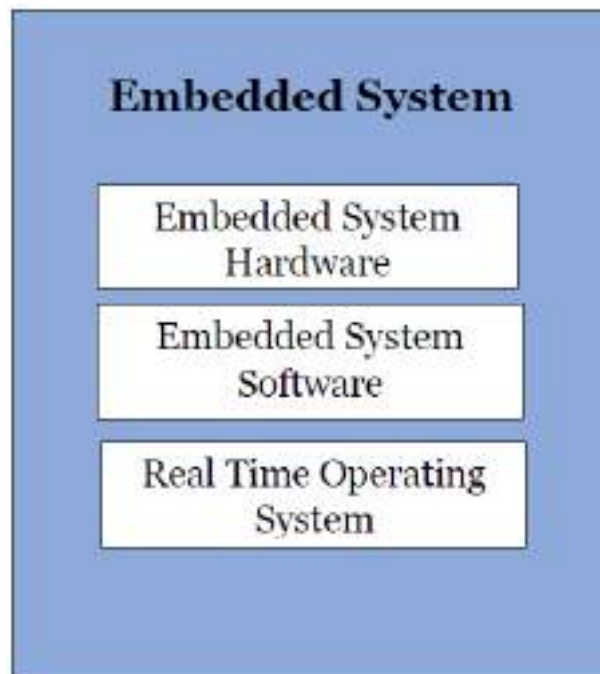
Fig. 1: Major Units of Embedded System

Embedded system hardware is built with a microprocessor or a microcontroller. Embedded system hardware has elements like input output (I/O) interfaces, user interface, display and the memory. Usually, an embedded system consists of: Power Supply, Memory, Processor, Timers, Output/Output circuits, Serial communication ports, System application specific circuits. The embedded system software is written to perform specific functions. Embedded system software is written in a high-level language, and it is then compiled to achieve a specific function within a non-volatile memory in the hardware. Real time operating system manages the application software and allow a mechanism to let the processor run. The Real Time operating system is responsible for handling the hardware resources of a computer and the host applications which runs on the computer. An RTOS is specially designed to run applications with a high amount of reliability and very precise timing.

Types of Embedded Systems

Embedded systems are classified into two as shown in Table 1. The first classification is based on their performance and functional requirements, and the second classification is based on the performance of the microcontroller.

TABLE I: Types of Embedded Systems

TYPES OF EMBEDDED SYSTEMS	
Based on their performance and functional requirements	**Based on the performance of the microcontroller**
• Standalone Embedded Systems • Real Time Embedded Systems • Networked Embedded Systems • Mobile Embedded Systems	• Small Scale Embedded Systems • Medium Scale Embedded Systems • Sophisticated Embedded Systems

Standalone Embedded Systems

Standalone embedded systems work by themselves. They are independent embedded systems, which do not depend on a host computer. It takes input either analog form or digital form and do some processing then provides the output. Examples: Microwave oven, Calculator, Digital cameras etc.

Real Time Embedded Systems

Real Time Embedded Systems is a system which gives output in a particular time, that is, this system is strictly time specific. These systems follow a time limit for the completion of a task. It provides quick response for critical situations. It is used in the medical sector, defense sector, etc.

Real Time Embedded Systems are further classified into two. They are, Soft Real Time Embedded Systems and Hard Real Time Embedded Systems. In Soft Real Time Embedded Systems, the deadline to complete the task may vary and the task performed after the given time interval is still acceptable and useful. In Hard Real Time Embedded Systems, the task must be completed by a given deadline and the task performed after the given time interval is not acceptable.

Networked Embedded Systems

Networked Embedded Systems are connected to a network by wired or wireless. The system communicates with the server and the node using the network. Examples: ATM Machine, IOT Devices, Card Swipe Machine, etc.

Mobile Embedded Systems

Mobile Embedded Systems are the most preferred embedded systems. They are small and easy to use. Mobile Embedded Systems require less resources. They are better at the portability point of view. Examples: Digital camera, MP3 Player, Mobile Phones, etc.

Small Scale Embedded Systems

Small Scale Embedded Systems are designed using the 8-bit or 16-bit processor. The processor has only limited resources of memory and processing speed. They do not act as an independent system they act as any component of a system. Examples: Washing Machine, Oven, CD Drive, Printer, etc.

Medium Scale Embedded Systems

Medium Scale Embedded Systems are designed using the 16-bit or 32-bit processor. Compared to Small Scale Embedded Systems, Medium Scale Embedded Systems are faster due to the number of bits of the processor. The integration of hardware and software in these types of system is complex. The programming languages used to develop Medium Scale Embedded Systems are Java, C++ and C. Then the software tools used are Compiler, Debugger, Simulator, etc.

Sophisticated Embedded Systems

Sophisticated Embedded Systems are designed using the multiple 32-bit or 64-bit processor. These systems are designed to perform complex functions. They have high hardware and software complexity.

Embedded System Applications

Today, large scale and complex organizations are using of embedded systems for enhancing their quality and productivity. Embedded systems are used in different sectors due to its best characteristics.

- **Medical Sector**- Embedded system is used in medical sector for various medical equipments such as sensors and environment control mechanisms. For example; MRI, CT, and PET scanners, Sonography, Defibrillator, Digital Flow sensors, Blood pressure device etc.

- **Manufacturing Industry**- In manufacturing industries, Embedded system is used in different types of machines for performing various tasks. For example; Industrial Robot, Assembly lines, Systems for feedback, Systems for data collection etc.

- **Home Appliances**- Embedded systems are also used in the different types of home appliances which we are used in our daily life. For example; Refrigerators, Washing machines, Microwave ovens, Air conditioners etc.

- **Automobiles Sector**- Now a day, modern cars contain different types of embedded system, which are performed various tasks based on their applications in your car. For example; Cruise control, Backup sensors, Navigation systems, Airbag systems, Motor Control System, Car entertainment and multimedia, Fuel injection system of vehicle etc.

- **Telecommunication Sector**- Embedded system plays an important role in the telecom industry because they help to increase ultra-speed networking capabilities. For example; Data routers, MODEM, Network switches, Satellite phones, Networking, Wireless Communications etc.

- **Banking sector**- In Banking sectors embedded systems is used in different areas for security purpose. For example; Smart Cards, ATM, Anti-lock banking system etc.

Conclusion:

Embedded system has become an important component of almost every larger system. The modern days embedded systems have marked a revolutionary change in every aspect of the manufacturing processes and automobile designing because of their adaptability and flexibility. In future, embedded systems will contribute to many smart gadgets.

Acknowledgement

DRIVERLESS CAR

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In the modern era, fully automated vehicles have been a great technological development. Autonomous vehicle technology is mainly based on Artificial Intelligence (AI), Global Positioning System (GPS) and advanced sensing systems which detects signs and signals, lane boundaries and obstacles. A driverless car will be capable of sensing its surroundings and operates without human involvement. It can go anywhere as like a normal car and do everything like an experienced human driver.

Driverless vehicles utilize a wide scope of advancements like radar, cameras, ultrasound, and radio antennas to explore securely on our roads. For instance, Tesla's driverless car, known as "Autopilot", utilizes eight cameras to give 360-degree visibility, and twelve ultrasonic sensors and a radar work to investigate the vehicle's environmental factors for expected risks. Figure 1 shows the working model of a self- driving car.
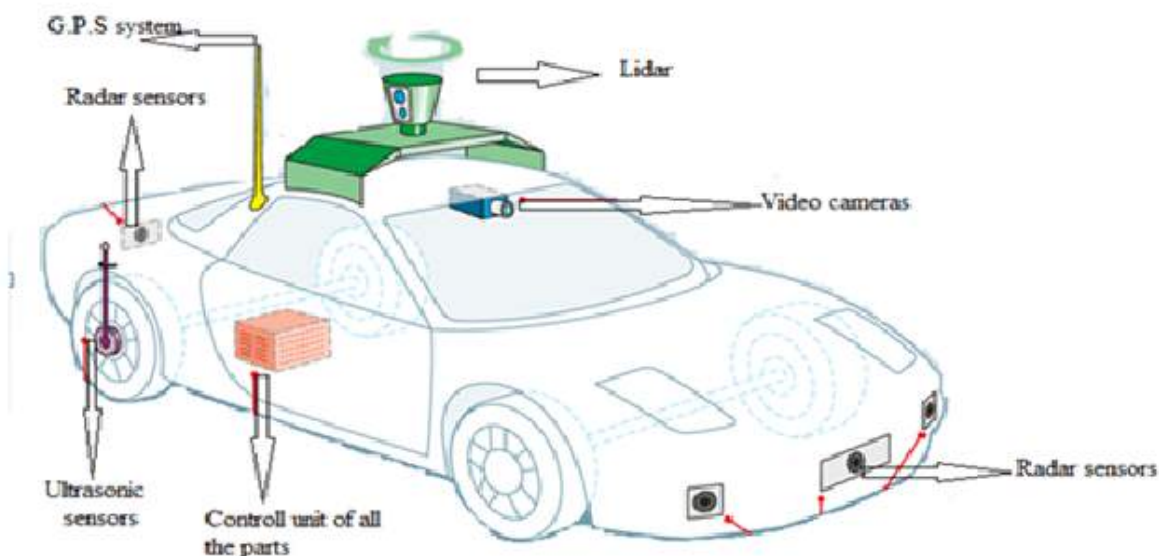
Fig. 1: Working model of a self- driving car [Source: Google]

- Ultrasonic sensors are used to measure the position of obstacles or other vehicles that are nearby while parking.
- Cameras are used to detect traffic lights, sign boards, and to keep track of the position of other vehicles and looks for pedestrians obstacles on the road.
- Radar sensors monitor the position of other vehicles nearby.

- LIDAR (light detecting and ranging) sensors bounces off the light from the surroundings and are analyzed to detect the lane boundaries and the edges of roads.
- The information from all of these sensors are analyzed by a central computer that controls the steering, accelerator and brakes.

Figure 2 shows the different applications in a driverless car. It consist of sections like Lane-change assistance for path turn movements, Blind-spot detection to identify the of the vehicle serve as electronic eyes and monitor the space in the adjacent lane, allowing the system to cover the dangerous blind spot, Cross-traffic alert indications, Lane-departure warning, brake assistance for collision avoidance, adaptive cruise control, and side impact etc.
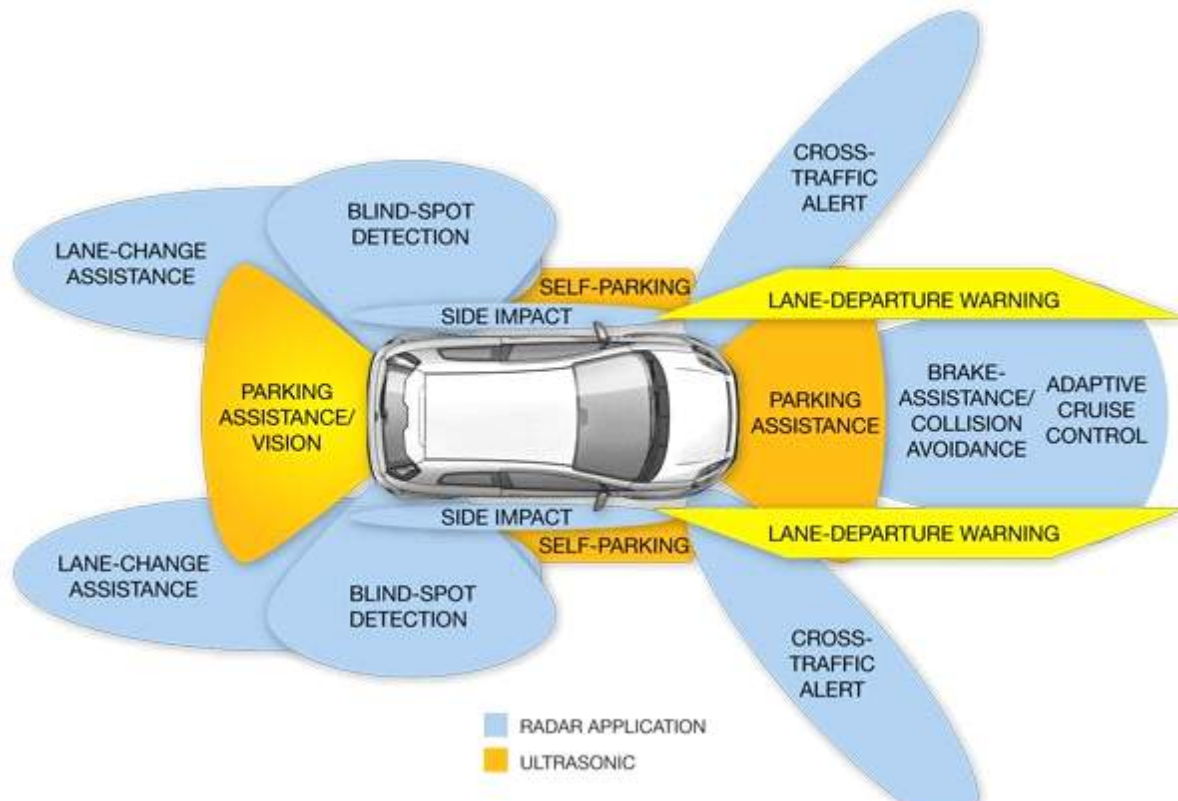
Fig. 2: Functions in a driverless car [Source: Google]

Artificial Intelligence

AI uses image recognition systems, along with machine learning and neural networks in a driverless car. The neural network recognizes the data patterns and is fed to the machine learning algorithms. The data from the cameras includes the vehicles surroundings like pedestrians, traffic lights, sign boards, trees, curbs, etc. Thus AI stimulates the decision making process using neural networks and controls all the sensing systems.

Mapping and localization

Before making any navigation decisions, the vehicle first builds a map of its environment and precisely localizes itself within that map. Laser rangefinders and cameras are used for this purpose. A laser

rangefinder uses laser beams to scans the surroundings and calculates the distance to the nearby objects by measuring the time it takes for each laser beam to travel to the object and back. Thus as the vehicle moves, new positional information and sensor datas are updated in the vehicles internal map.

Obstacle avoidance

The internal map contains the present and predicted locations of all the static (e.g.: buildings, sign boards, traffic lights) and mobile (e.g. pedestrians and other vehicles) obstacles in its surroundings. The vehicle utilizes a probabilistic model to predict the track of moving objects based on the predetermined shapes and trajectory.

Path planning

Path planning uses the data caught in the vehicles map to securely direct the vehicle to its destination by neglecting the obstacles and following the rules of the road. The vehicle uses a general path planning algorithm.

Figure 3 shows the driverless car detecting the obstacles, sign board and speed of the nearby vehicle.

Fig. 3: Identifying the obstacles and sign board [Source: Google]

Advantages

- Reduces the number of accidents
- Lessens traffic jams
- Easy accessibility of transportation
- Saves time by identifying the best route
- Stress free parking

Limitations

- Expensive
- Bad weather makes everything trickier
- Non functional sensors

Acknowledgement

NETWORK AND SECURITY

Vehicular Ad Hoc Network

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Vehicular ad hoc networks (VANETs) are created by applying to the vehicle domain the concepts of mobile ad hoc networks (MANETs)-the spontaneous development of a mobile wireless network.In 2001, under "car-to-car ad-hoc mobile communication and networking" applications, VANETs were first described and introduced, where networks can be formed and information can be transmitted.It has been shown that communication architectures for vehicle-to-vehicle and vehicle-to-roadside will coexist in VANETs to provide road protection, navigation, and other roadside services. A central part of the Intelligent Transport Systems (ITS) architecture is VANETs. Intelligent Transportation Networks are often referred to as VANETs. They are considered to have developed into a wider "Internet of vehicles" which is supposed to gradually develop into "Internet of autonomous vehicles".
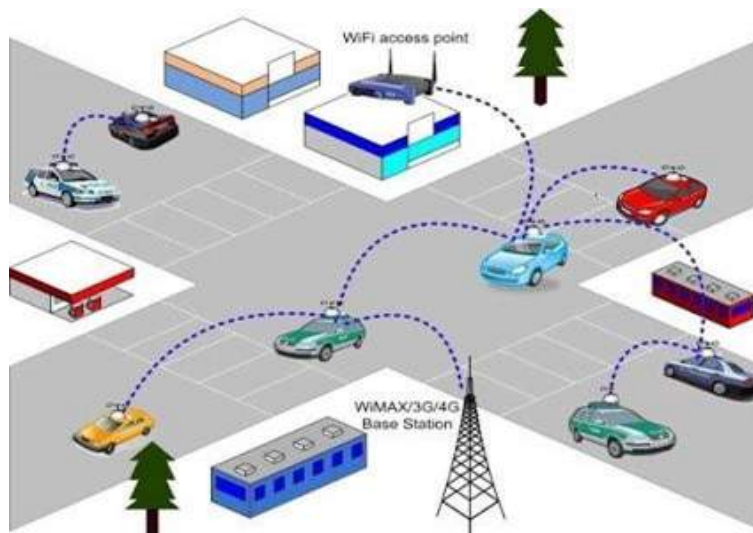
ARCHITECTURE

Main components

According to the standard guidelines of the IEEE 1471-2000 and ISO/IEC 42010 architecture, the VANET method can be accomplished through entities that can be split into three domains: the mobile domain, the infrastructure domain, and the generic domain.

The mobile domain consists, as shown in Figure 1, of two parts: the domain of the vehicle and the domain of the mobile device. Both types of vehicles, such as cars and buses, fall in the vehicle domain. All kinds of handheld devices, such as personal navigation devices and smartphones, are part of the mobile device domain.

There are two domains within the infrastructure domain: the domain for roadside infrastructure and the domain for central infrastructure. Roadside unit organizations such as traffic lights are part of the roadside infrastructure domain. Infrastructure management centre such as traffic management centre (TMCs) and vehicle management centre are included in the central infrastructure domain.
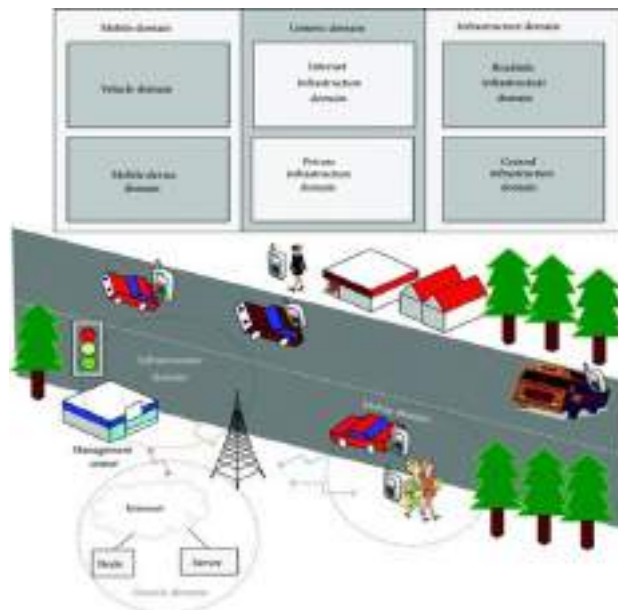

Fig. 1: VANETs system domains-Hindawi Publishing Corporation International Journal of Distributed Sensor Networks Volume 2015

Fig. 2: C2C-CC reference architecture -Hindawi Publishing Corporation International Journal of Distributed Sensor Networks Volume 2015

The development of the architecture of VANETs differs from region to region, however. The reference architecture is a little different within the CAR-2-X communication system pursued by the CAR-2-CAR

communication consortium. The Communication Consortium CAR-2-CAR (C2C-CC) is Europe's key driving force for vehicular communication and released its Manifesto in 2007. There are three domains in this system architecture: in-vehicle, ad hoc and infrastructure domain domains.

As shown in Figure 2, an on-board unit (OBU) and one or more device units make up the in-vehicle domain (AUs). Typically, the links between them are wired and often wireless. However, vehicles fitted with OBUs and roadside units are part of the ad hoc domain (RSUs).An OBU can be used as an ad hoc network mobile node and an RSU is also a static node. An RSU can be connected via a gateway to the Internet.

RSUs can also communicate directly or via multi-hop with each other. There are two forms of domain access to infrastructure, RSUs and hot spots (HSs).OBUs can use RSUs or HSs to communicate through the Internet. OBUs can also communicate with each other by using cellular radio networks (GSM, GPRS, UMTS, WiMAX, and 4G) in the absence of RSUs and HSs.

Communication Architecture

In VANETs, contact styles can be divided into four types. As mentioned above, the category is closely related to VANET components. The main functions of each contact type are listed in Figure 3.
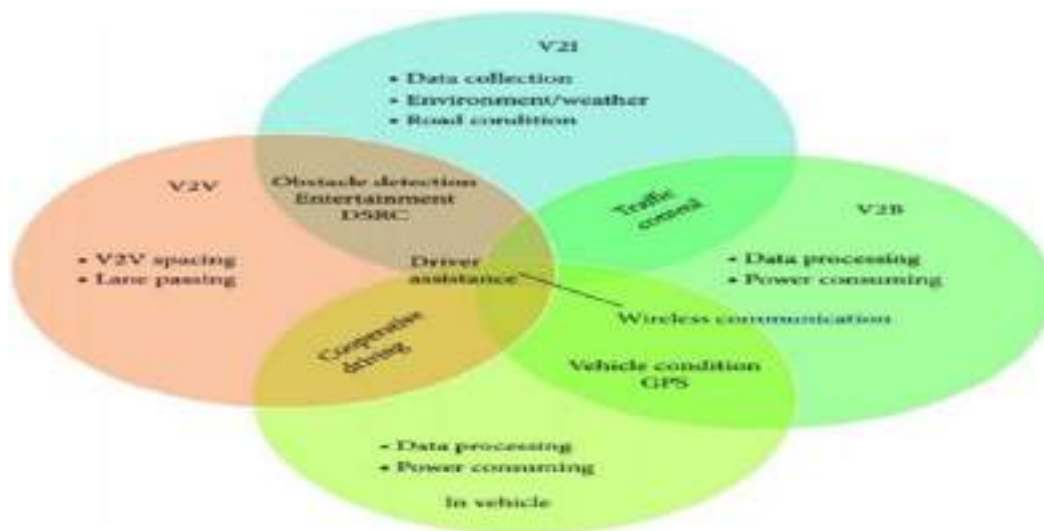
Fig. 3: Key functions of each communication type -Hindawi Publishing Corporation International Journal of Distributed Sensor Networks Volume 2015

The in-vehicle domain refers to in-vehicle communication, which is increasingly required and relevant in VANET's research. The in-vehicle communication system can detect the performance of a vehicle, and in particular the fatigue and drowsiness of the driver, which is important for driver and public safety.

Vehicle-to-vehicle (V2V) contact may provide drivers with a data exchange network to share information and alarm messages in order to expand driver support. Another useful area of research for VANETs is vehicle-to-road infrastructure (V2I) connectivity. V2I connectivity helps drivers to receive real-time traffic/weather alerts and offers environmental sensing and tracking.

Connection between the vehicle and the broadband cloud (V2B) means that vehicles can communicate through wireless broadband mechanisms such as 3G/4G. As more traffic information and monitoring data as well as infotainment will be included in the broadband cloud, this type of communication would be useful for active driver assistance and vehicle tracking.

APPLICATIONS

- **Electronic brake lights** that allow a driver (or an autonomous car or truck) to react to breaking vehicles, even if they may be obscured (e.g., by other vehicles).
- **Platooning**, which enables vehicles to follow a leading vehicle closely (down to a few inches) by obtaining acceleration and steering information wirelessly, thereby forming electronically coupled 'road trains.
- **Traffic information systems** that use VANET communication to provide a vehicle's satellite navigation system with up-to-the-minute obstacle reports.
- **Border Transportation Emergency Services**-to minimize delays and speed up emergency rescue operations to save the lives of those wounded, using VANET communications, VANET networks, and road safety alert and status information dissemination.
- **On-The-Road Services**-It is also envisaged that "information-driven" or "wirelessly enabled" will be the future transport highway. VANETs will assist the driver with promotional services (shops, gas stations, restaurants, etc.) and also submit reminders to any sales at that time.

ADVANTAGES

- VANET technology offers high-speed access to the Internet in a truck
- Safety facilities are provided as productive instruments.
- VANET defines the time management necessary for the use of the block traffic from efficient working time.
- Traffic management can be tracked via GPS system.
- It also offers VoIP services such as Google talk or Skype among consumers, reducing telecommunication costs

DISADVANTAGES

- The inappropriate use of the internet in VANET could be concerns of distracting and time wasting.
- Applications such as the internet, video watching while driving can lead to accidents.
- During watching access, there are chances of more accidents.
- The protection of the network is the principal concern of many VANET researchers.

CONCLUSION

In this paper, we first introduce the architecture of VANETs, Comprising network elements and modes of contact. Then we discuss Applications, Advantages and Disadvantages of VANETs.

ACKNOWLEDGEMENT

REFERENCE

Dr. S. Swapna Kumar, Professor and Head of the Electronics and Communication Engineering department, "Vehicular Ad Hoc Network", World Academy of Science, Engineering and Technology International Journal of Computer, Information Science and Engineering Vol:8 No:4, 2014.

NETWORK SECURITY

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Network security is an expansive term that covers a large number of advances, gadgets and cycles. In its most straightforward term, it is a bunch of rules and setups intended to secure the uprightness, privacy and availability of PC organizations and information utilizing both programming and equipment innovations. Each association, paying little mind to estimate, industry or framework, requires a level of organization security arrangements set up to shield it from the always developing scene of digital dangers in the wild today. The present organization engineering is perplexing and is confronted with a danger climate that is continually changing and aggressors that are continually attempting to discover and abuse weaknesses. These weaknesses can exist in a wide number of regions, including gadgets, information, applications, clients and areas. Therefore, there are many network security executives devices and applications being used today that address singular dangers and misuses and furthermore administrative rebelliousness.

Fig. 1: Network Security

WORKING OF NETWORK SECURITY

There are numerous layers to consider when tending to arrange security across an association. Assaults can occur at any layer in the organization security layers model, so your organization security equipment, programming and arrangements should be intended to address every zone. Organization security commonly comprises of three distinct controls: Physical, Technical and Administrative. Here is a short depiction of the various sorts of organization security and how each control functions.

- Physical Control : This security controls are intended to keep unapproved work force from acquiring actual admittance to organize segments like switches, cabling pantries, etc. Controlled admittance, like locks, biometric validation and different gadgets, is fundamental in any association.

- Technical Control : Specialized security controls ensure information that is put away on the organization or which is on the way across, into or out of the organization. Assurance is twofold; it needs

to shield information and frameworks from unapproved faculty, and it additionally needs to shield against noxious exercises from workers.

- Administrative Control: This security controls comprise of security approaches and cycles that control client conduct, including how clients are verified, their degree of access and furthermore how IT staff individuals execute changes to the foundation.

TYPES OF NETWORK SECURITY

There are different types of network security and these are very important as number of cybercrimes are increasing rapidly everywhere everytime.

Fig. 2: Types Of Network Security

- Network Access Control : The Network Access Control or NAC controls which individuals can get to your organization and which ones can't. It permits you to distinguish various clients and gadgets, and see whether unapproved staff are attempting to access the organization. You can thusly, authorize distinctive security strategies to obstruct gadgets and control what can occur in your organization.

- Application Security : You can likewise exploit application security, which is intended to offer total insurance to your applications. It is significant, since it guarantees that applications with blemishes in them aren't focused on and exploited by programmers. It fundamentally gets your organization from the danger of your applications getting hacked, which is the reason it is unquestionably a fundamental organization security instrument you should have.

- Antivirus and Antimalware software : Malware resembles a sickness for your organization, and won't just remain inside your organization, however will spring assaults, and cause your frameworks to breakdown. Antivirus and antimalware programming permit you to effortlessly recognize malware and other infection dangers, since they will be ceaselessly examining the organization looking for malware that is stowing away.

- Wireless Security : Organizations are leading more business on the cloud, and this implies remote organizations and passages. The enormous issue here is that remote organizations aren't exceptionally secure, and can be effortlessly assaulted by programmers, which is your wirelesssecurity should be first class.

- Email Security : It is important that you give importance to email security as well, especially if you have a business that is primarily dealing with a lot of emails. If hackers are able to get their hands on personal or financial information, they can resort to blackmail, and will also start deceiving your
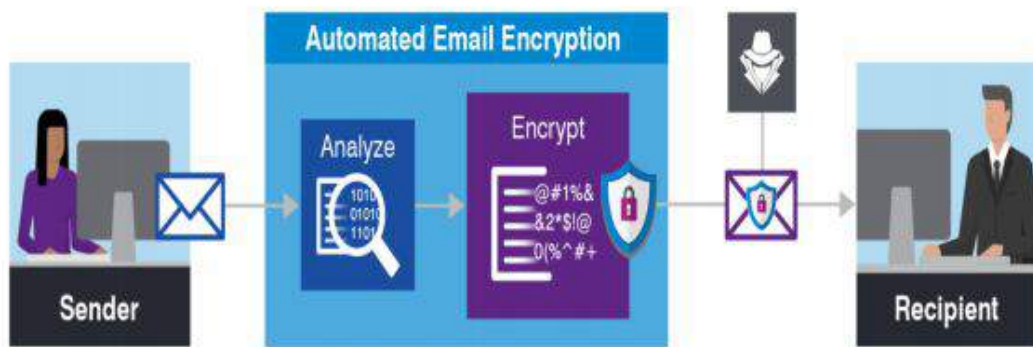
Fig. 3: Email Security

clients, by stealing their personal information and sending them malware. This is why email security has to be a priority for every business running today.


Fig. 4: Antivirus and Antimalware software

Conclusion

Internet was not created with security in mind. So there is a growing need to protect private information crossing the public network.An organization security strategy, an examining technique, and an infringement reaction plan should all be set up to manage any penetrate or breakdown of organization security before it happens.

Acknowledgement

ROBOTICS
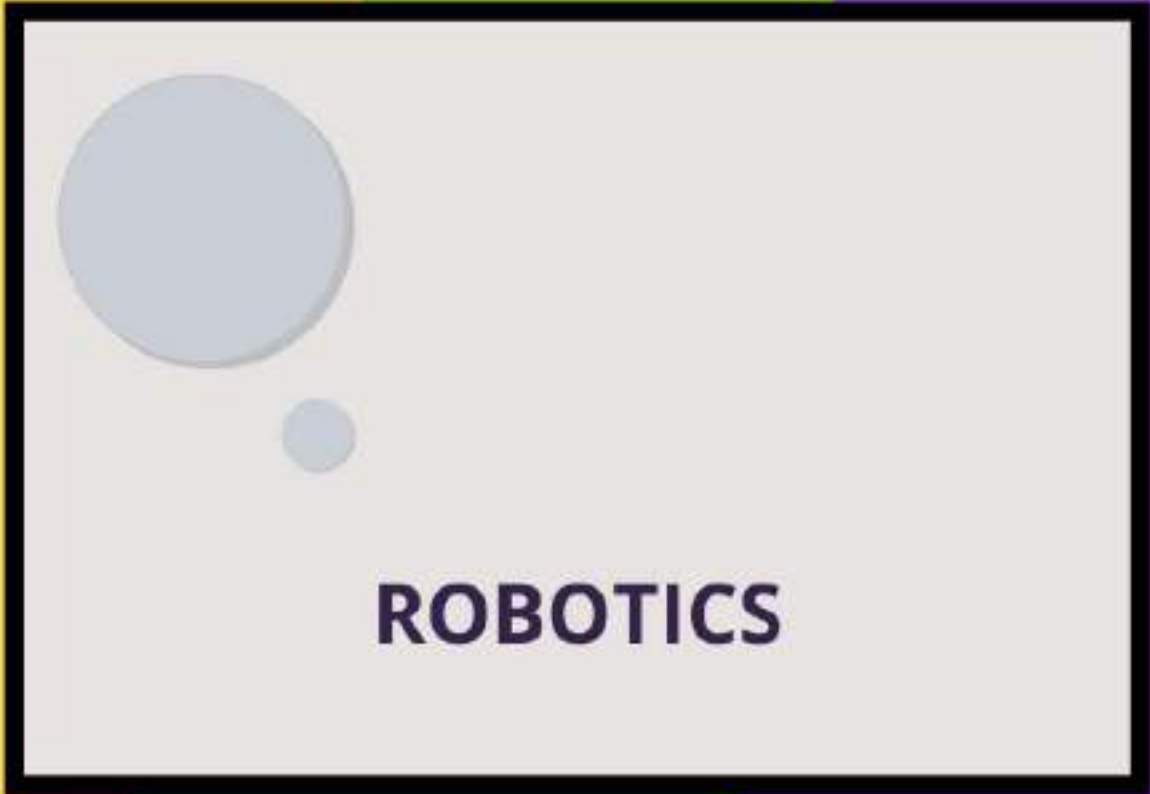
AUTONOMOUS HUMAN FOLLOWER ROBOT

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Nowadays, there have been many robotic devices developed for automation and navigation. Robotics is an emerging field, which reduces the human work. Many types of robotic navigation techniques are available in the world. The proposed system is an autonomous robotic device, which aims to follow specific human. It can follow human movement automatically. It doesn't need to be encouraged or withdrawn. It is a user friendly system, as interference between the user and device is minimal. Secured delivery of the materials can be achieved by the proposed system. Manual effort of driving device and carrying materials can be minimized using this system. Microcontroller, sen sors and motors are incorporated in this system. Wireless communication and sensor technology are used to trace specific human(owner). Obstacle detection is also enabled in the proposed device. Microcontroller was used for interfacing between hardware and software.
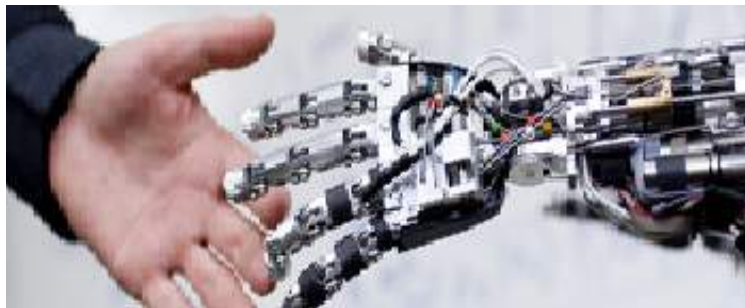
Fig. 1: Source: Tutorialspoint

AUTONOMOUS ROBOT

A mobile robot is a robot that has the ability of locomotion. Mobile robotics is coming under robotics and information engineering. A mobile robot is a machine or mechanical structure controlled by software that uses sensors and other technologies to figure out its surroundings and move around its environment. Mobile robot functions includes artificial intelligence (AI) and physical robotic elements, such as tracks, wheels or 5 legs. Mobile robots are growing popular across different business sectors. They are used to help with work processes and even fulfill tasks that are impossible or dangerous for human workers. Mobile robots are also renowned as "autonomous mobile robot" (AMR) which means they are having the ability of moving in an uncontrolled environment without a physical or electro-mechanical guidance device

AUTONOMOUS HUMAN FOLLOWER SYSTEM

Different methods to follow humans are as follows:

Ultrasonic sensor

In this method ultrasonic sensor will be incorporated to the mobile device.Ultrasonic sensors work by conveying a sound wave at a recurrence over the scope of human hearing. The transducer of the sensor goes about as an amplifier to get and send the ultrasonic sound. The sensor decides the separation to an objective by estimating time slips between the sending and accepting of the ultrasonic pulse. This method detect human or object in a specific range and follows accordingly. The major drawback is that, it will follow anything which comes under that region.

Fig. 2: Source: Researchgate

Bluetooth

Bluetooth controlled robotic device resembles like a remote controlled system as directions of robots need to be controlled by the device. Bluetooth is a wireless technology standard, which is used for exchanging data between fixed and mobile devices over short distances using UHF radio waves. An Android app need to be installed on user's mobile phone and in which wireless communication can be enabled between user and the device giving the direction the device can be be moved accordingly.

Fig. 3: Source:Tutorialspoint

Image processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Cameras can be incorporated to the device. Specific human can be followed by this method according to the detection of gesture or some other predefined features. But this method is complex as several analysis are required.

Fig. 4: Source: Researchgate

Motion detection sensor (Accelerometer):

The human follower robotic device is an autonomous system with separate transmitter and receiver section. The communication between transmitter and receiver section is enabled with the aid of wireless technology. Transmitter section is attached in trolley and receiver section is present in user's hand. Upon detection of the tilting of the transmitter device in specific direction, corresponding movement of robotic part is possible accordingly. Obstacle detection is also enabled in the robotic section. Hence, the proposed system can be used for following a specific human.

ADVANTAGE

- Human interference is minimal.
- Manual effort of driving a device can be minimized.
- On-board intelligence system and AI.
- Ease of Implementation.
- Flexibility and Accuracy.

CONCLUSION

Autonomous robot for human following purpose is established here. Manual effort of driving the device can be replaced by the proposed systems. Different methods can be implemented to follow specific human being. Ultrasonic sensor, bluetooth, image processing and motion detection sensor can be used for this purpose. Each methods have its own advantage and applications.

ACKNOWLEDGEMENT

HUMANOID ROBOTS

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A humanoid robot is a robot in which its body shape resembles the human body. Like all service robots, they provide value by automating tasks in a way that leads to cost- savings as well as productivity. Humanoid robots are being used in the analysis, disaster response at power plants to relieve human workers from dangerous tasks they're prepared to take over routine tasks for astronauts in space travel and mainly used as research tools in several scientific areas. Humanoid robots have the greatest potential to become the industrial tool of the future. Making eye contact with a robot may have the same effect on people as eye contact with another person, this results forecast that interaction between humans and humanoid robots will be surprisingly smooth.

Features of Humanoid Robots:

- Self- maintenance
- Autonomous learning
- Avoiding dangerous situations to people, property, and itself.
- secure interacting with human beings and the environment.

AI in Humanoid Robots:

Artificial Intelligence (AI) based interaction robot is analogy to human intelligence. The level in which humanoid robots can interact with humans is quite limited. Thus artificial intelligence is critical. It can help decipher commands, statements and might even be able to give witty, sarcastic replies and understand random, ambiguous human ravings.

Humanoid architecture and Control Mechanism

Humanoid robots are complex systems that must be carefully designed. Development of a hardware architecture is the important step to the integrated control system of a Humanoid Robot.To interact with a human and to operate like a human mode, sensorimotor skills of the robot are required. The humanoid robot must be equipped with actuators and different sensors to manage its movements and check its state and to avoid collisions with humans or objects in the environment.The architecture is provided with a large level of expandability and modularity by dividing the hardware system into three basic layers. Each layer is represented as a controller centred on its own task such as external communications, motion controllers, network supervision, and general control.
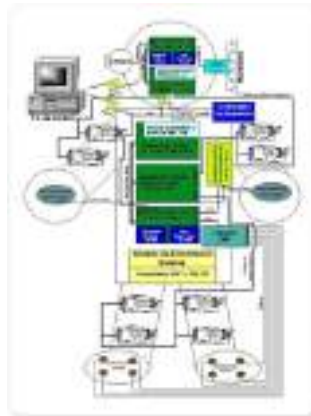
Bottom level software architecture

Figure shows the bottom level software architecture. The bottom level software is for the advanced movement of the control system. It configures intelligent motion controllers, provides CAN communication, controls trajectory execution and assemble motion data which is used in humanoid robot control processes
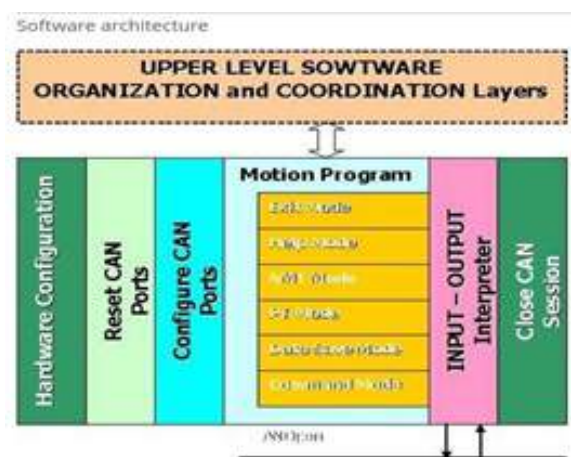
Requirements of humanoid robot

The main goal of the humanoid robot control system is to provide it with stable walking and avoid fallings down. The robot should have following characteristics:

- Scalability
- Small outline
- Energy efficiency
- Modularity
- Standardized interface

To do this, generate motion design for each articulation as per the Zero Moment Point (ZMP) theory. The humanoid robot does not fall down when the target ZMP is inside of the support polygon made by the supporting leg(s).

Concept of zero moment point:

This concept clarifies the dynamic balance of humanoids during walking which requires information about the contact forces and the desired direction of movement. According to the ZMP Theory, the pressure under the supporting foot can be changed by the relevant reaction force acting at a certain point of the mechanism's foot. Since the sum of all moments of active forces with respect to this point is equal to zero, it is known as the zero moment point(ZMP).

Applications of Humanoid Robot

Application of humanoid robot is widely used now a day. Some of the applications are listed below:

- Health care humanoid robot: On top of surgical robots, healthcare humanoid robots have been successfully helping people in disease management, pain relief and physical therapy.
- Clinical application: In Clinical settings, humanoid robots have been used to assist patients in reducing anger, anxiety, and depression among cancer patients. The patients treated using humanoid robots are mostly elderly persons and adolescents
- Non-clinical application: Non-Clinical healthcare has essentially contributed to autism management followed by diabetes management by performing activities such as playing games, singing, dancing, hand movement, blinking, interacting with the patients. Humanoid robots can be used to promote social and behavioural skills within autistic children, thus, can improve a patient's autistic behaviour.
- Socially assistive robots: Social robots or socially assistive robots are known as assistive robots, for elderly people and the hospitality industries. The social robot assists human beings in their daily life and replaces human activities in the hospitality industry. These assistive robots act as a companion, for both children and elderly individuals.

Conclusion

Though the technology has advanced much in the field of humanoid Robotics; there are still several areas which need attention. The technological excellence of the humanoids is required to be sharpened more and the shortcomings in the results must be handled properly. They serve as assistants for humans in daily life and as overall helpers in man-made and natural disasters. Immense progress has been made in the area of humanoid research that resulted in a number of humanoid robots that can move and perform well-designed tasks. An encouraging era of science and technology has emerged in the field of humanoid

research that has resulted in the development of highly advanced humanoid mechatronic systems endowed with rich and complex sensorimotor capabilities.

Acknowledgement

ADAPTIVE RESONANCE THEORY (ART)

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Adaptive resonance theory (ART) is a theory developed by Dr. Stephen Grossberg and Dr. Gail Carpenter in 1987 on the study of how the brain processes information. It describes several neural network models that use supervised and unsupervised learning methods to address the pattern recognition and prediction. Its build for new learning architecture while keeping in place old models exist. The ART is a new learning pattern of adaptation and resonance without sacrificing knowledge of existing. ART is a cognitive and neural theory analogy to the human brain to predict objects having wide range of descriptive and predictive cognitive and neural theories.

The Stability-Plasticity Dilemma

The ART networks are known to solve the stability-plasticity dilemma i.e., stability refers to their nature of memorizing the learning, and plasticity refers to the fact that they are flexible to gain new information. This means once trained on a given network it prevents the network from being able to continuously learn while it interacts with its surroundings. This dilemma is based on the system's ability to remain static through irrelevant events. The stability-plasticity dilemma is a key way to understand ART and its use in neural network designs.

Rapid Learning Methods

Figure 1 shows regarding the Forward and Backward Learning method.
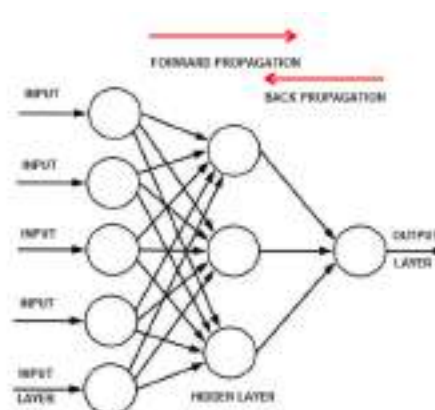
Fig. 1: Forward and Backward Learning

Human beings have the tendency to learn on their own throughout life. To a remarkable degree, humans can rapidly learn new facts without being forced and also rapidly forget what is already known. This property is called catastrophic forgetting. This is essential to integrate the past information into unified conscious to store into their sense. In the neural network the back-propagation algorithm suffers from a stability problem. Once a backpropagation is trained, the number of hidden neurons and the weights are fixed. The network cannot learn from new patterns unless the network is retrained from scratch. Thus we consider the backpropagation networks dont have plasticity. Therefore ART networks tackle the stability-plasticity dilemma preventing for learning.

Fig 1. shows how the evolution of the television towards TV broadcast has occurred.

Fig. 2: Evolution of television[Source:Libraries]

Television has played an integral role in replacing radio, which was the most popular mass medium in the 1950s, at the time when some people find it difficult to imagine being without it. Both shaping and reflecting cultural values, television has at times been criticized for its alleged negative effect on young people and children and at other times lauded for its ability to create a common wisdom for all its viewers. In the modern world, as satellite broadcasting and Internet technology change the way people watch television, the medium continues to evolve, solidifying its position as one of the most important inventions of the 20th century.

Types of Televisions

Now, televisions have become a part of our family life and most households will own at least one. The development taking place in the television industry attracts people to buy the trending model. Earlier times there were no many options, but now purchasing a new TV can be frustrating if youre not quite sure what you are looking at. Modern TVs have a baffling array of formats, acronyms and tech jargon all planned to promote and explain their features. But if you are unaware what to look out for researching your TV can be minefield. Fig 2. shows different types of televisions based on technology, screen type, features and resolution.

Television transmission and reception

Fig.3 shows how the television system generates transmit and utilize the television signal during its transmission and reception. Firstly, the camera on the left hand side of the figure captures the images to be televised and then send it to the image sensor. The lens inside the image sensor focus the required image/scene and produces the picture signal that represent the amounts of the three primary colors (blue, green, and red) present at each point in the image pattern. This primary-color signals are converted to chrominance and luminance signal using the color coder placed over the color camera.
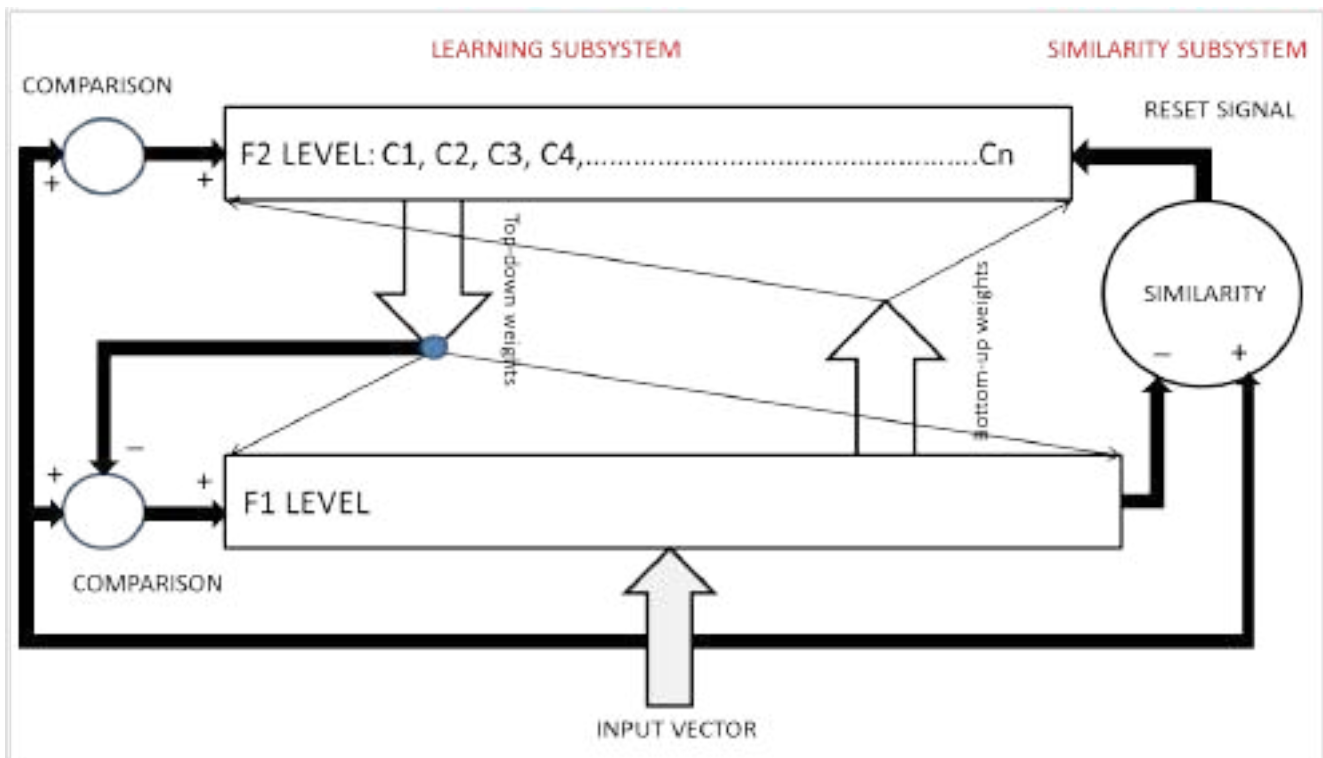
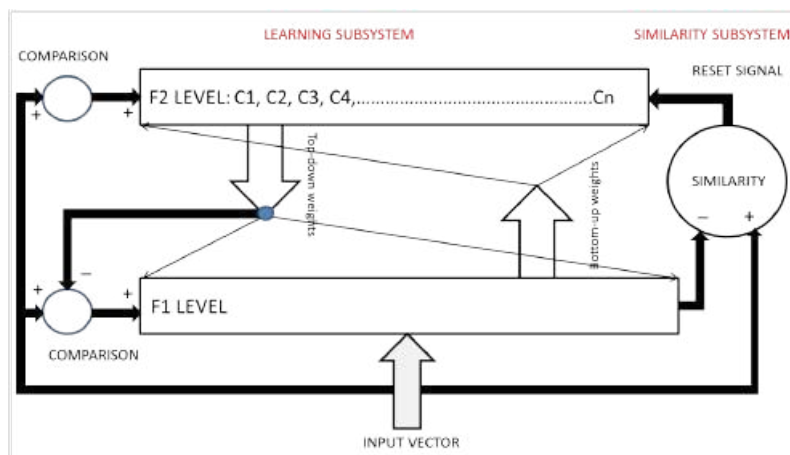Fig. 3: Types of television[Source:Libraries]

Fig. 4: Colour television[Source:Britannica]

After that the Individually deducted luminance signal from the original primary-color signals, and the color-difference signals are further mixed in a matrix unit to get the I (orange-cyan) and Q (magenta-yellow) signals. At the same time these are applied to a modulator, where the chrominance subcarrier signal mixes with it. The chrominance and luminance components are then combined in another addition circuit to form the overall color picture signal. Later, synchronization and blanking pulses are added to convert the signal to composite video waveform. The sound program accompanying a television picture signal is shown in fig 4.

Here the carrier frequency of the sound channel is spaced 4.5 MHz above the picture carrier frequency and is isolated from the picture carrier in the TV receiver appropriate circuitry. The stereo information which is encoded as the difference between right and left audio channel, amplitude modulates the stereo
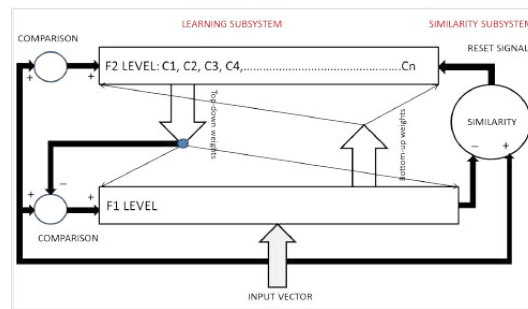
Fig. 5: Television sound components[Source:Britannica]

sub-carrier, which is suppressed in the absence of stereo difference information. The base sound signal is transmitted as the sum of the right and left audio channels and hence is compatible with monster receivers. This sound signal along with the composite video signal is then imposed on a carrier wave transmitting with an allocated frequency and passed through the television receiver. After that they are shifted back to their original frequencies and applied to the receivers display and loudspeaker.

Advantages of Television

- **Entertainment and laughter**-Entertainment and laughter is one of the best ways by which we can get rid of stress and get relaxed. Various musical, dance and comical reality shows on TV can help us for this purpose.
- **Improve Memory and Easy Learning**- We tend to store and recall the things that recently happened in our favorite show before the next episode will be shown on TV. This improves our memory power. For children, it is easier to learn subjects if someone can show them how to do it. Therefore, educational channels provide the children an easy way of learning.
- **Bonding with Family and Friends**-During weekends when all family members are at home, watching TV and discuss things that you see on it and spending time with family members is one of the best ways by which we can maintain the bonding with family and friends.
- **Awareness and Alertness**-By watching TV, you can update your knowledge on what is happening outside your country. And also get alerted if there is a possibility for a disaster to occur. Weather reports, news channels etc. Are meant for this purpose.

Disadvantages of Television

- **Decline in creativity and imagination**-TV shows impart their creative stuff readily available to us and decline our ability to be innovative. Therefore, imparting their ideas and opinion, which is not favorable to us is one of the drawbacks of watching television
- **Health problems**-Usually, we try to occupy a comfortable place before the TV while watching our favorite movies or shows and limit yourself from moving a lot from that place until that program is over. At the same time we take a lot of junk foods in the excitement of watching our favorite programs. This can lead to serious aliments caused by eating a lot and moving less.
- **Make people lazy**-Most of us get hooked when watching programs of our favorite TV channel. I.e., when people get fully immersed or addicted with their favorite TV shows they forget to do their work. Therefore, the major drawback of watching television is that it makes people lazy.

Application of Television

- Public entertainment, Newscasts and Weather reports
- Political campaigns and organization
- CCTV is a special application
- Guidance and announcements in public places like airport terminals, sales promotion and many others

Conclusion

Starting with an introduction on television, its types, overall idea of transmission and reception, advantages, disadvantages and applications that we identified are discussed.

Acknowledgement

FUZZY LOGIC – TYPE 2

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Fuzzy set and crisp set are both a part of distinct set theory i.e. set theory is a mathematical theory of well-defined collections of objects called sets. The idea of fuzzy logic was proposed by Dr. Lotfi Zadeh of the University of California at Berkeley in 1960s.
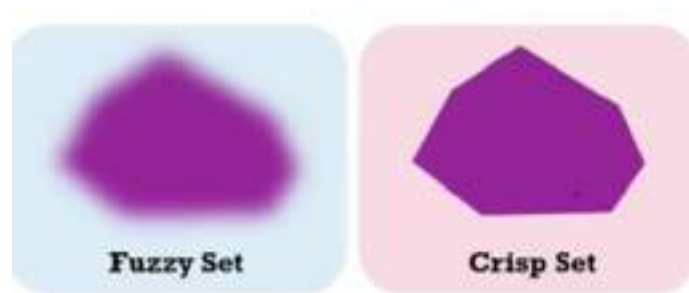
Fuzzy set implements infinite valued logic while crisp set employs bi- valued logic. Crisp set describes wether the object is in a set or not ie it describes the function to be either true or false (0 or 1) . Whereas for a fuzzy set 1 or 0 represents extreme cases of truth or false respectively. It also includes values in between 0 and 1 for representing degree of truth. Fuzzy set allows one to work in uncertain situation and solve problems with incomplete solution. Fuzzy sets are classified to N types. The easiest and common types of fuzzy sets are type 1 and type 2 fuzzy sets.

Type 1 fuzzy sets describes vagueness not uncertainty i.e. vagueness are statements which involves concepts for which there is no exact definition which are true to some degree.
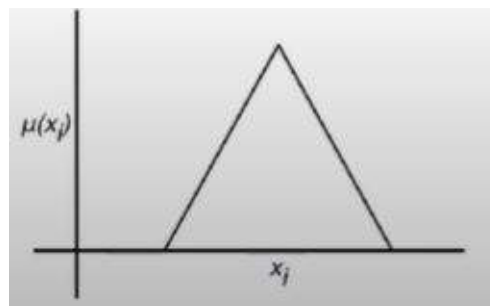
Fig. 1: Type1 Fuzzy set

A type 1 fuzzy set is characterized by its true membership function T(x) and its false membership function F(x) with
$0 < (T(x)+F(x)) < 1$

TYPE 2 FUZZY SET

In 1975 Dr. Lotfi Zadeh realised the problem in type 1 fuzzy sets as it cannot incorporate uncertainties. So he introduced type N fuzzy sets as an advancement of type 1 fuzzy sets. The definition of type2 fuzzy set was introduced by Mizumoto in 1976 and new definitions for the same was given by Mendel and others. It integrates all the uncertainties to a large extend and reduces vagueness.
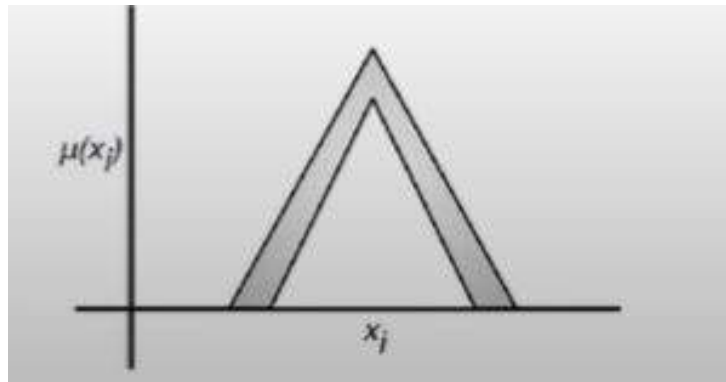
Type 2 fuzzy set is a fuzzy set which has the membership function as type 1 fuzzy set on [0,1]. It is known that all fuzzy sets are characterized by membership function (it is user oriented). A type 2 fuzzy set is denoted by a three dimensional membership function.
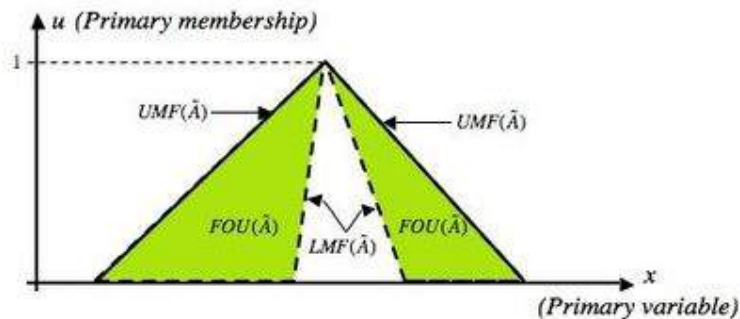
In order to understand the concept of type 2 fuzzy sets further it is very much important to consider the term Footprint Of Uncertainty (FOU). It represents bounded regions that constitute uncertainty in primary membership function grades of type two fuzzy sets. Mendel described FOU as "the union of primary membership" where primary membership is a subset of unit interval. In fig, the outer sharp line of the triangle represents the Upper Membership Function (UMF) and the dotted line represents the Lower Membership Function (LMF). An upper membership function and lower membership function are two type1 membership functions. The upper MF is a subset that has the maximum membership grade of the footprint of uncertainty. The lower MF is a subset that has the minimum membership grade of the footprint of uncertainty.
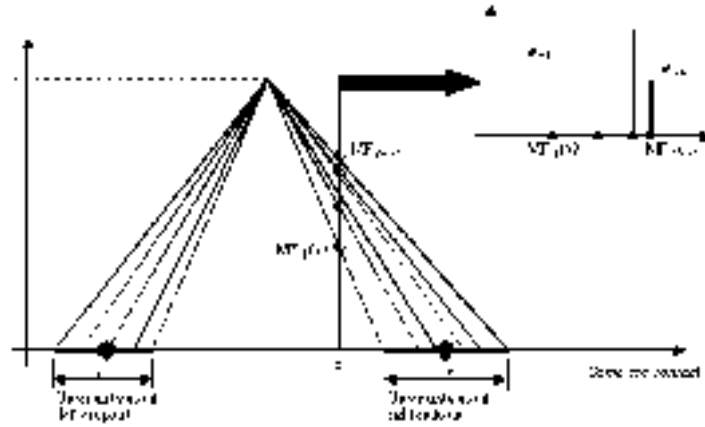
The above fig depicts triangular membership functions when base end points (l and r) have uncertainty interval associated with them. For some value of x there can be N number of membership functions associated with it

$$MF1(x), MF2(x), MF3(x).\ldots\ldots\ldots.MFN(x)$$

Each membership function is associated by weights say Wx1, Wx2 ....WXn. The weight represents the possibilities associated with each triangle at the point x. At each x, the MF itself a function – the secondary membership function

$$MF\text{-}(MFi(x),Wxi)$$

$$\text{Where } i=1,2,3,\ldots\ldots\ldots N$$

Thus the type 2 Mf is three dimensional.

Application of TYPE 2 FUZZY SETS

Type 2 fuzzy sets and fuzzy logic systems are used in decision making, image processing, video processing and computer visions, function approximation and estimation as well as in control systems. In power systems, for its better operations it is very much necessary to be accurate about the system parameter. Due to non-linear nature of the system any deviation in the system parameter causes destruction. So in such a large network there is a huge possibility of uncertainty in the parameter data, therefore type 2 fuzzy sets are applied. There are many other advanced applications of type 2 fuzzy logic as it has the capability to predict the next result on the basis of the previous knowledge.

Conclusion

In this article the concept of fuzzy and crisp set are presented. The fundamental and significance of type 2 fuzzy sets are discussed as it has an important role in handling many complex problems in many fields.

Acknowledgement

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About K-map

The Karnaugh map is also called as K-map. This is developed by scientist Karnaugh. Here this is developed in 1953.They are also called as Marquand–Veitch diagrams, and K-map is a Karnaugh–Veitch maps (KV maps). It is used to simplify the Boolean algebraic expressions,so they can be used to implement a minimum number of logic gates. A sum-of-products expression (SOP) can implemented using AND gates feeding an OR gate, and a product-of-sums expression (POS) can implemented using OR gates feeding an AND gate. The POS expression gives a complement function (if F is the function so its complement will be F').Generally for a two variable and up to from two variable to four variable expressions we can easily solve by using K map methods. It is a pictorial method to solve Boolean expressions without using Boolean laws & theorem.

The number of cells in the K-map is determined by the number of input variables and it is expressed as, 2n, where n is the number of input variables.

Theory Of K-map

Karnaugh Map Simplification Rules-

To minimize the boolean expression,

- We draw a K Map according to the number of variables it contains.
- We fill the K Map with 0's and 1's according to its function.
- Then, we minimize the function in accordance with the following rules.

Rule-01:

- We can either group 0's with 0's or 1's with 1's but we can not group 0's and 1's together.
- X representing don't care can be grouped with 0's as well as 1's.

Rule-02:

- Groups may overlap each other.

Rule-03:

- We can only create a group whose number of cells can be represented in the power of 2.
- In other words, a group can only contain 2n i.e. 1, 2, 4, 8, 16 and so on number of cells

Rule-04:

- Groups can be only either horizontal or vertical.
- We can not create groups of diagonal or any other shape

Rule-05:

- Each group should be as large as possible.

Rule-06:

- Opposite grouping and corner grouping are allowed.
- The example of opposite grouping is shown illustrated in Rule-05.

- The example of corner grouping is shown below.

Rule-07:
- There should be as few groups as possible.

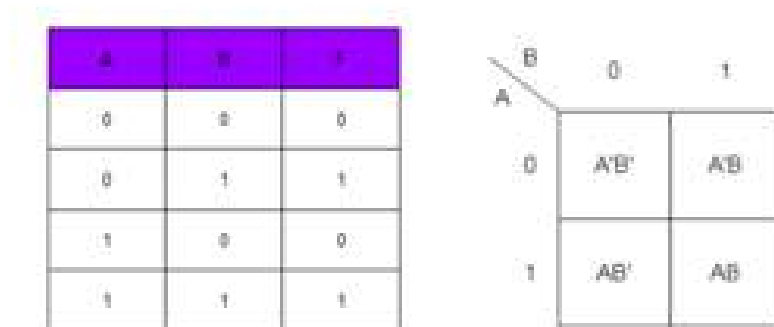**Construction of K-map:**

2 Variable K-Map

Fig. 1: Two-variable Karnaugh map.

This is a two variable K-map, so here this always contains a box with the separation and the separation is for variables. For example one variable is A and another variable is B. For example our expression is containing A and B. We can design two variable Kmap. In two variable Kmap you may have 1's and 0's in the cells. Here you can inter change the position no problem. This is about two variable K-map.Number of cells= 2n = 22 = 4

In further classes we are going to solve problems on 2 variable kmap, 3 variable kmap, and 4 variable kmap. So now for more than four variables also by using kmap we can solve, but that is little difficult. Up to 4 variable it is very easy compared to Boolean expression laws.

3 Variable K-Map
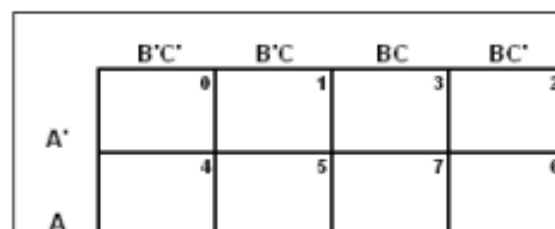
Fig. 2: Three-variable Karnaugh map.

In 3 variable Kmap we can how to structures in 3 variable Kmap. We can take vertically or we can take horizontally. Here I am taking horizontal representation of 3 variable Kmap. So here as usual we

are having partition. For example if you are taking horizontal means we can taking maximum variables at top side. Number of cells= 2n = 23 = 8

4 Variable K-Map

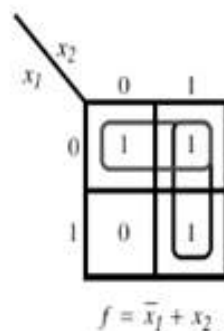In 4 variable Kmap Number of cells= 2n = 24= 16 cells. Here 16 cells structure may be like this. Four variable means WXYZ.

Fig. 3: Four-variable Karnaugh map.

Examples of K-Map

2 variable K-map

Example: Simplify the truth table using k-map.

$f = \bar{x}_1 + x_2$

Example:

After labeling and transferring the truth table data into the K-Map, write the simplified sum-of-products (SOP) logic expression for the logic function F_1.

Solution:

$F_1 = J'$

3 variable K-map

Example: Simplify the truth table using k-map.
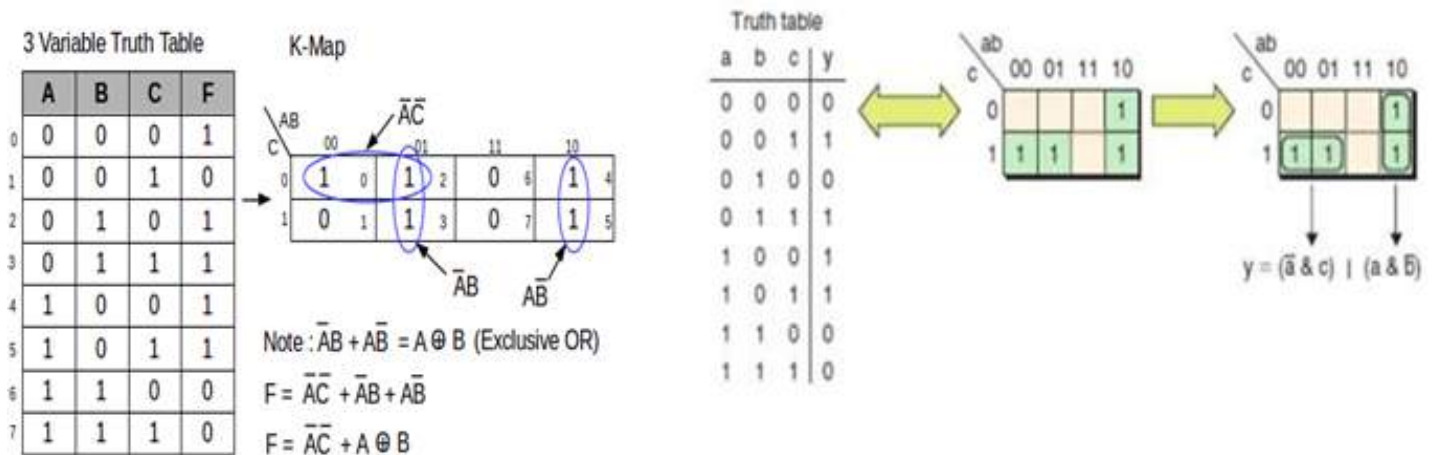
Example: Z= A,B,C(1,3,6,7)

Solution:

$$Z=A'C+AB$$
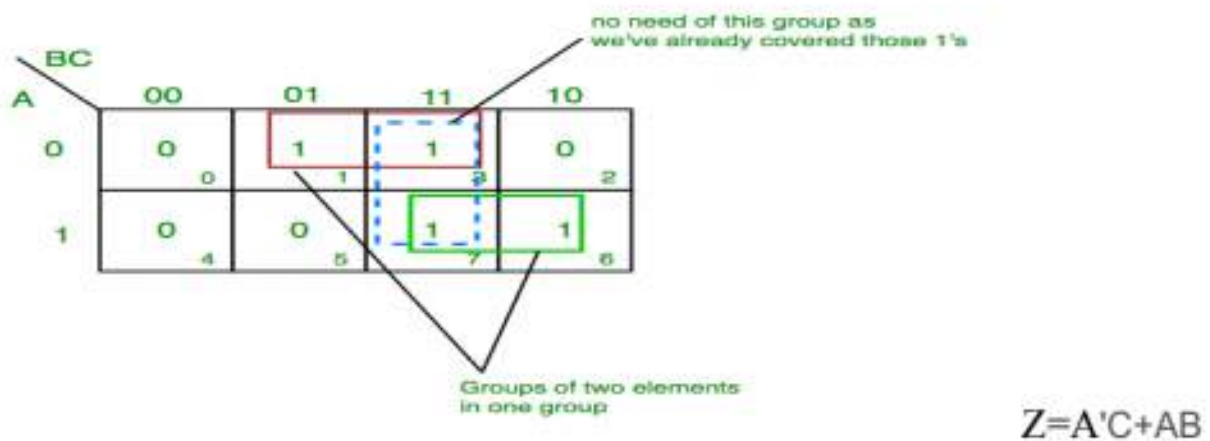
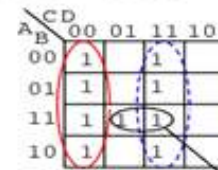## 4 variable K-map

Example: F(P,Q,R,S)=(0,2,5,7,8,10,13,15)
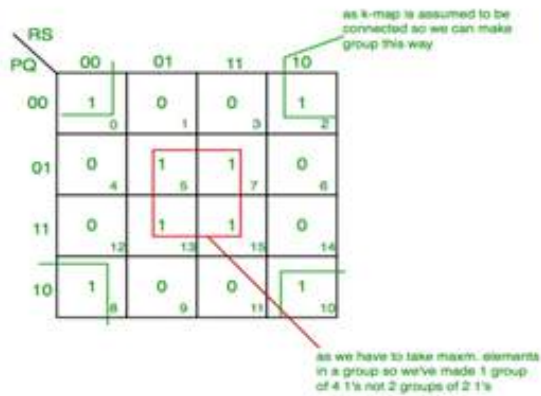
$$F = QS + Q'S'$$
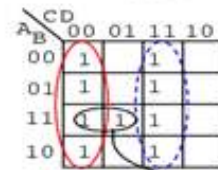
Advantages of K-Maps

- Simplify Boolean expressions without using Boolean laws.
- Very easy method for few variables.
- Minimize number of logic gates.
- Always lead to single minimal solution.

Disadvantages of K-Maps

- Complex for more than 4 variables.
- Some examples are solved more easily with Boolean laws

Conclusion

We have analyzed the structure of K-maps,we may arrive at conclusion that the K-map simplification process is an effective reduction technique when dealing with contain around three to six input variables.

TECHNICAL
ACHIEVEMENTS

Department Technical Achievements - Funded Projects

The main technical achievements of ECE department include the funding received from reputed agencies for high quality, socially relevant project/research works conducted internally.

Faculty Projects

Sl. No.	Name of Project	Investigators	Funding Agency
1	Robotic Exoskeleton for Rehabilitation of TMD via Assisted Motion of the Jaw	Dr. S. Swapna Kumar / Sruthi M	CERD - Research Seed Money
2	Real Time based Intelligent energy saving system	Ramesh C R / Aswathy Surendran P	CERD - Research Seed Money
3	To develop a system based on Image Processing tools for real time monitoring of wear and tear of metal cutting blades.	Dr. S. Swapna Kumar / Suraj Rajappan	CERD - Research Seed Money

Student Projects

Sl. No.	Name of Project	Investigators	Funding Agency
1	Water contamination detection and theft prevention system	Dr. S. Swapna kumar / Sruthi M / Anjana Hari	IE(I)
2	Wireless body sensing in a smart hospital system	Sojan Francis/Dr. S. Swapna Kumar /Muhsina Latheef V	IE(I)
3	Non-conventional sources of sustainable energy generation for rural areas	Dr. S. Swapna kumar / Surya S	KSCSTE
4	Early Detection of Glaucoma from fundus images	Sandhya V G / Dr. S. Swapna Kumar/ Swathy C K	KSCSTE
5	A novel approach towards driver assist based on biological parameters	Sojan Francis/Ramesh C R/Baby K A	KSCSTE
6	RFID Based Blind Assist System	Anil M/ Reshma V.C./Amritha V,Anupama M.S,Archana M,Ashina Ajith,Samson C.V	KSCSTE
7	Design and validation of low cost non-invasive haemoglobin test	Ramesh C R/Rakesh V S/ Aftab Ashraf, Aiswarya Pradeep, Aiswarya Rajeev, Akash Sathyan, Anjali P	CERD - Student Project / Indian Innovation Challenge Design Contest 2017 at IIM, Bengaluru
8	A novel wireless smart shoe system for gait analysis in older adults	Ashitha P R/Aathira N A	IE(I)

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