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IOT (INTERNET OF THING) AND AI (ARTIFICIAL INTELLIGENCE) ASSISTED ALERT SYSTEM FOR HOME, DAM WATER MANAGEMENT AND PREDICTIONS OF CLOUDBURST AND FLASH FLOOD

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Abstract
Smart Home Automation System (SHAS) works on the basis of Internet of Things (IoT) and Artificial Intelligence (AI) is found to be very helpful for Disaster Management in global climate change scenario and Indian monsoon pattern change. Our observation and data analysis of last 15 years reveals that drought prone Marathwada region of Maharashtra is now became clear-cut Cloudburst and Flashflood region. It is essential for human civilization to develop lifesaving; property damage controlling. One third of the 7.97 billion global populations are hunger-starving and this alert system is also provide direct agriculture crop protection and not only vital for food grain security but also for sustainable economic growth. People get a helper to handle their needs and home on the basis of their commands to them. Feature of wireless technology in home automation provide remote access from Smartphones or tablets users to operate or control the life saving devices and systems. This three block design of practical implementable system not only uses just technology of IoT but also uses AI and cloud feature for water bodies' management such as dam water management with accurate prediction of Cloudburst and Flashflood. Predictions can also be done regarding Cloudburst and Flashflood with the help of predictive engine that can help by giving alerts in prevention of humans such as pregnant women, children, old age senior citizens, ill and people with disability and as well as cattle life. IoT and AI when works hand to hand then it is many fold beneficial and reliable due to its features and nowadays adopted by more and more people for comfortable and secured life. Expansion of such technology network to generate local and as well as global need based customized alert depending upon the severity level of the impending calamities in the interest of human civilization is practically possible.

Keywords: Internet of Thing, Artificial Intelligence, Home Automation, Disaster Management, Cloudburst, Flashflood, Smart City, Dam water management.

Introduction:

The Internet of Things (IoT) is a very broad term, but we can define it as a network of physical intelligent devices that are equipped with networks, sensors and processing systems, that are linked to the internet for exchange of information and data which communicate with each other without human interventions and sometimes or in some case with human interventions. Artificial

Intelligence (AI) is nothing but replication of human intelligence with help of machines or computer with self-learning ability to improve efficiency, services and productivity.

Cloudburst is nothing but abrupt and heavy rainfall at the rate of more than or equal to 100 mm per hour along with lightning and thunderstorm usually occurred due to with above normal Total Liquid Water Content (TLWC) of local formed Cumulonimbus (CB) cloud. Whereas Flashflood is nothing but most dangerous flooding which creates disaster due to Cloudburst in short span of time.

India experienced massive Cloudburst and Flashflood on July 26, 2005 in Mumbai, Maharashtra with rain above 940 mm and more than 1000 casualties on the same day. On September 29, 2010, a Cloudburst in NDA (National Defence Academy), Khadakwasla, Pune, in Maharashtra left many injured and hundreds of vehicles and buildings damaged due to the consequent flash flood. Again on October 4, 2010, a Cloudburst in Pashan, Pune, in Maharashtra left four dead, many injured and hundreds of vehicles and buildings damaged; the record books registered the highest rainfall in intensity and quantity in Pune city, then about 118 years old (record of 149.1 mm in 24 hours) of October 24, 1892. In the history of IT hub Pune, for the first time this flash flood forced locals to remain in their vehicles, offices and whatever available shelter in the accompanying traffic jam. On October 4, 2010, a Cloudburst in Pashan, Pune may have been the world's first predicted Cloudburst. Corresponding author predicted Cloudburst and Flashflood event on 4th October 2010 in Pune, Maharashtra in the city frantically sent out SMSs to the higher authorities warning of an impending Cloudburst over the Pashan area. Even after taking the necessary precautions, on 4th October 2010 during 7.30 pm to 9.00 pm IST Cloudburst occurred with 182 mm rain in just 90 minutes and four people died including one young scientist.

More than 101 Cloudburst events occurred in Maharashtra state of India in just 24 hours of 7th and 8th September 2021 and more than 1200 casualties.

Global climate change scenario and Indian monsoon pattern change increases the Cloudburst and Flashflood events not only in India but across the globe. Cloudburst and Flashflood events are not only occurring in mountain or hilly area but in plain land region such as Maharashtra, India. Our observation and data analysis of last 15 years reveals that drought prone Marathwada region of Maharashtra is now became clear-cut Cloudburst and Flashflood region and corresponding author given several alerts regarding it to higher authorities regarding the same. Dam water management is challenging with massive alert in homes in smart cities and smart villages with Cloudburst and Flashflood.

Technology of IoT can be seen in various places like industry, smart homes have become reality and even its influence can be observed on a whole smart city. IoT is possible due to development and innovation of various technologies, sensors, real time analytics, automation, embedded systems, control systems, wireless systems and machine learning (Ali, Nazim, Azeem, Javed, Tariq, Haroon, and Hussain, 2020).

Artificial Intelligence (AI) is a thorough and powerful technique with programming that studies the level of intelligence with the help of computer systems and utilization of these conceptions in resolving problems of actual world. AI consists of four major applications with home automation system i.e. remote control, comfort ability, optimal utilization of resources and security (Kumar and Qadeer, 2012). Natural Language Processing (NLP) plays an important part in AI as it act as interface between machines and humans. Home controls like home appliances monitoring, door monitoring, bed movement monitoring, security, environment control, etc can be assisted with the

help of IoT, which is controlled by AI and all related information is stored in cloud (Mouha, 2021). AI manages all technology driven devices at home. Predictions can also be done like flash flood and Cloudburst with the help of predictive engines and life of many people can be saved timely. These home automation technologies can be helpful to physically impaired people and old people who are not able to perform their work easily or independently. IoT and AI main purpose is to reduce the human involvement in work to minimum and provide them with relaxing and comfort life (Tripathi, Dabre, Dsouza, and Fernandes, 2017).

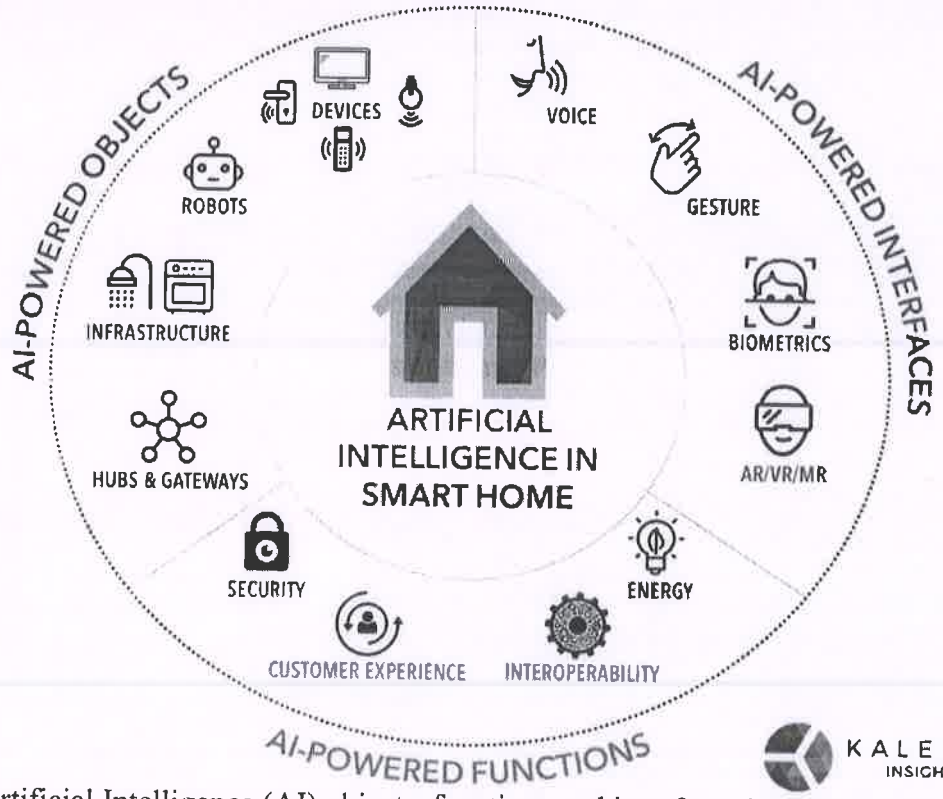

Figure 1. Artificial Intelligence (AI) objects, functions and interfaces in Smart home automation. *Source- www.kaleidoinsights.com*

AI applications are becoming popular day by day and its adoption and demand is also increased in everyday work of home such as follows:

Smart Washing Machines: With AI technique, washers regulate separately the strength of washing and detergent to be utilized on the basis of load weight and fabric type. Similarly dam water control and discharge management in river is practically possible with predictive catchment area water calculations in Cloudburst and Flashflood event.

Smart Refrigerators: User can monitor and identify items of food inside the fridge. Information is stored automatically in inventory list and user can monitor fridge from anywhere. Similar terminology can be used for atmosphere and space events.

Smart Speakers: Speakers can be controlled with commands of voice to do activity like playlist creation, turn on reminders, making list for groceries, search on web and can be used for giving customized alerts in home, village, city, town and so on based on need.

Smart TVs: Powered by AI and with updated features like voice command that can understand National Language Processing (NLP) are getting huge popularity nowadays.
Door Lock System: with the help of smartphone connectivity and remote assistance, users can check if doors are locked or not and update their friends or families accordingly. This type of door locking system enhance overall house safety.
Smart Camera: This is also very important for home security and user can supervise even tiny home or surroundings activities.
Energy Saving: Remote connectivity and smart meters access possibility helps users to track down the consumption of electricity.
Baby Monitoring: is a 2 piece device with receiver at parents room, that monitor the baby with video or sound and other device i.e. transmitter stays in room of baby.
Robotic Cleaners: clean tight automatically and reached spaces that were overlooked or were hard to access in usual ways. This decrease the possibilities of diseases or falling ill, hence it helps in money saving that would otherwise is spent on medical bills or additional help.

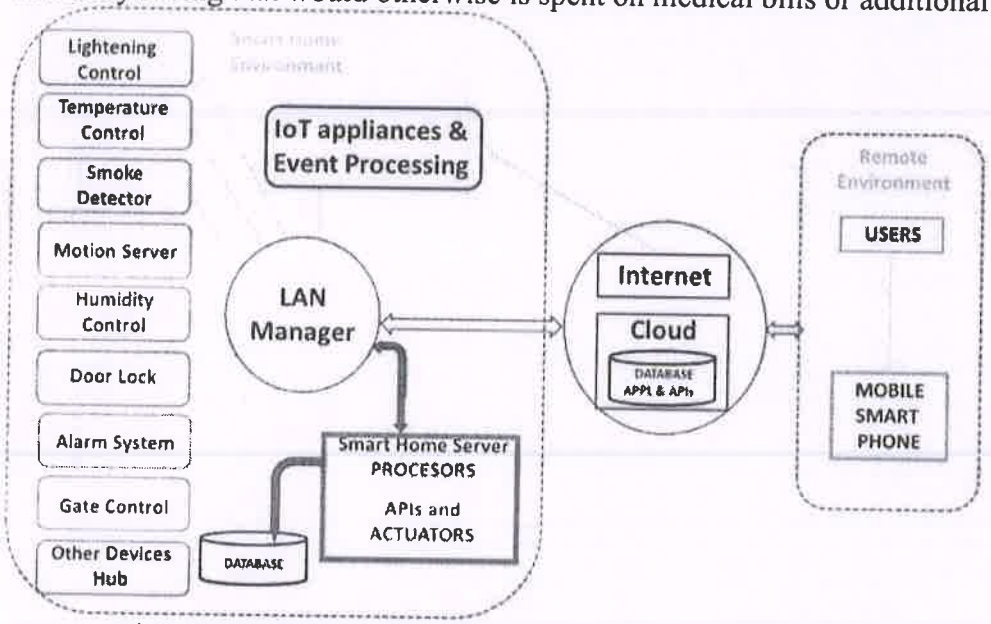

Figure 2. Advanced smart home, IoT (Internet of Thing) and Cloud computing.
Source www.intechopen.com

Home automation is a control on devices at home with IoT and AI. All these devices are linked to internet and allow them to control remotely. In this devices triggers one another hence, there is no need to control devices manually or voice assistant or any app. Smart home automation makes users life more comfortable and even they can save money spend on bills of "cooling, heating and electricity" (Gunge and Yalagi, 2014). Home automation also provides more safety with IoT's devices like security cameras. All devices of home automation are IoT devices; hence they automated to trigger each other. Home automation actually works with the help of network of devices that are associated to internet through different protocols of different communication such as Bluetooth, Wi-Fi, ZigBee and so on. These devices include sensors that observe light, temperature, various atmospheric parameters, TLWC and motion changes and provide information to the user regarding surroundings. Home automation consists of three phases i.e. monitoring,

control and Automation. Home automation does not include high end computer or IP address; this system is based on cloud and is more easy to use and affordable (Yang, Di Martino, Zhang, 2017).

Review of Literature:

Gladence, Maria, Rathna and Brumancia (2020) explored that in today's market, smart home automation is present upcoming technology that is easy to control and makes life simple. IoT based home automation system also used Artificial Intelligence (AI) feature as well as cloud and is made to provide help to disabled and old people. People get assistance in managing in home and their need on the basis of their commands. Wireless communication technology provides remote access from smart phone or tablets. Home controls like home appliances monitoring, door monitoring and bed movement monitoring is assisted by IoT and controlled by Artificial Intelligence and all the information stores on cloud.

Ghosh, Chakraborty and Law (2018) found that internet functioning is transferring into Internet of Things (IoT) from Internet of Computers (IoC). Technology is heading towards internet of everything in a Smart Cyber Physical Earth. This technology is not just to save money, decrease human efforts, smart things; it also make human life easy. IoT refers as every virtual, living or non-living object is connected with each other through some medium of communication. AI is the science of making machine intelligent so that they can perform tasks that needed human mind earlier.

Qinxia, Nazir, Li,M.; Khan, Lianlian and Ahmad (2021) examined that devices with AI enabled are more intelligent and are able to perform particular task that saves lots of time and resources. IoT has been developed in all areas of life with the appearance of AI and makes the life easy for consumers. The main function of IoT is to provide accessible resources with smart, reliable and effective services.

Domb (2019) revealed that Smart Home Automation System (SHAS) has achieved huge popularity since last decades as it provides comfort and quality life. Microcontrollers and smart phones control usually most of the SHAS. With technique of wireless communication, smartphones applications controls and monitors home functions. Cloud services managed home appliances and allow the user to control smart actuators connected with home appliances like fans and lamps. Scanned ID is sending to cloud system through internet. Cloud computing shared pool of computing resources and provide various computing services at different levels i.e. from basic to most critical application services.

Prasad (2017) explored that popularity of automation system for houses or offices is growing every day. Automation is not just efficient but also provides use of water and electricity economically and decrease lots of wastages. IoT provide people the facility to connect from anywhere, anytime and with anyone with the help of network. AI monitors the consumption of energy and controls the environment in offices, schools, buildings or museums with the help of various types of actuators and sensors that controls humidity, temperature and lights.

Maskeliunas, Cius and Segal (2019) explored that IoT objective is to extend the internet to real world objects and connecting sensing and smart devices to global networks by virtual and physical objects. IoT increase the quality life of people by providing comfort and easy technology. IoT focused on the technologies that bridges social behavior, digital technologies and physical things on the basis of language, speech, computer version etc. Ambient Assisted Living (AAL) environment provide positive influence on people's health and quality of life, particularly old people.

Syed, Sosa, Kumar and Elmaghraby (2021) revealed that IoT is a system that put together different technologies and devices and remove the necessity of intervention of human. IoT makes the city smart around our world. It has organized development of smart city system to increase comfort, sustainable living and productivity for people. Smart phones include usage of sensing objects installed in person's home that gives information regarding home and occupants. These sensors may include activity monitors like motion trackers, ambient sensors and energy/ power consumption.

Nizetic, Solic, Artaza and Patrono (2020) found that IoT technologies are nowadays considered as important pillar of fourth industrial revolution because of noteworthy potential in innovations and useful benefits for people. Funds and energy saving can be attained with more effective time management under IoT system. Different types of control options are possible with the help of concept of smart phones and enable in effective amalgamation of renewable energy technologies at home.

Garg and Gupta (2020) revealed that IoT is the extension of present internet to provide connection and communication between different devices. Home appliances based on IoT can be managed from a distance easily and this can also lead to decrease in time wastage. These appliances are connected to internet and sensors. Various IoT devices are made to make the consumer's life easy.

Skouby, Lynggaard, Windekilde and Henten (2014) explored that smart homes helps in supervising and assisting in areas like Ambient Assisted Living (AAL) i.e., support elder people to stay more time at home, energy and pollution savings and telemedicine. IoT and AI offers timer and remote control systems and fixed devices like heating, light, entertainment systems, ventilation, appliances etc. to make better comfort, energy efficient, convenience and security. Smart homes become more than the home automation level by including extended behavior in form of awareness and AI.

Sagar and Kusuma (2015) found that Wireless Home Automation System (WHAS) use IoT that includes control basic functions of home by mobile devices or computers with the help of internet from anywhere from the whole world. Due to IoT and AI, homes have become smart homes and more self-controlled, comfort and automated. With the inventions of wireless technologies like WiFi and cloud networks, wireless systems with AI are used everywhere and every day.

Majeed, Abdullah, Ashraf, Zikria, Mushtaq and Umer (2020) revealed that the main challenges in smart phones are secure identifications, decision making intelligently and IoT devices authentications, connectivity, privacy and data security issues. IoT provides low cost and more flexible solutions to improve daily life of users. Finding of the study shows that IoT devices still does not provide secure communication and further improvements are necessary.

Kumar, Tiwari and Zymbler (2019) explored that IoT is a new standard that modified into high tech life style from traditional way of living. Smart homes, cities, transportations, energy savings, pollution control are some of the transformation happens due to IoT. Whereas there are still lots of issues and challenges that must be sort out to accomplish full potential of IoT. It is an innovation that brings together various smart systems, intelligent devices, frameworks and sensors.

Jabbar, Ramli, Kian, Zubir, Zamrizaman, Balfaqih, Shepelev and Alharbi (2019) found that due to advancement in communication technology, home automation system gained considerable attention. Smart home is and IoT application that use internet to control and monitor appliances with the help of home automation system. Lack of awareness on IoT technology usage, non-

friendly user interface, limited range of wireless transmission and high costs are some of the limitations face by current home automation systems.

Kumar, Maurya and Dwivedi (2019) explored that now a day's homes includes more automated systems to make sure comfort and safety of user's. These smart automation devices are designed to protect the privacy and decrease costs with the help of IoT and AI. Home automation can be controlled through mobile phones irrespective of distance from all over the world.

Guo, Shen, Zhang and Wu (2019) found that smart phones and AI technologies has improved the quality of life of people. Technology of smart home collects data from environment and analyze. Smart home technologies include wireless or wired networks, sensors, intelligent systems and actuators. Data processing, activity recognition, image recognition, voice recognition, prediction making and decision making are some of the AI functions in smart homes.

Chandra, Nikhil, Raju, Sanjay and Chandrappa (2018) revealed that artificial intelligence is an increasing trend in IoT applications to make cities smart. Internets of things are expanding into different areas. This study used MQTT (MQ Telemetry Transport) as a platform to give services of IoT that will supervise the applications and creates alerts or make intelligent decisions with the help of IoT.

Arora, Pant and Banita *(2019) found that IoT is a universal global neural network that connects various objects. It is an intelligent connecting device that includes smart machines communicating and interacting with other objects, machine environment and infrastructure. With automation technology advancement, life has become simple and easy and comfort for people in all aspects.*

Gabhane, Thakare and Craig (2017) revealed that IoT applications are increasing and use of these technologies are also enhancing. In IoT based smart homes, household devices are connected with the internet with standard protocols and network architecture. User can control and monitor home devices with the help of internet.

Objective:

In terms of Global Climate Change and Indian Monsoon Pattern Change scenario with increase of Cloudburst and Flashflood, the objective is design the life and property saving full proof system solution which will work from local to global level.

Methodology:

The main role of AI-enabled IoT creates intelligent machines that can implement innovative behaviour and supports decision making with little or no human intervene. IoT and AI when works hand to hand then it is many fold beneficial and reliable due to its features. Access to low-cost, low-power sensor technology, Connectivity, Cloud computing platform, Machine Learning (ML) ability, Analytics are the strong points of the IoT with AI systems.

The overall design of IoT and AI assisted alert system for home, dam water management and predictions of Cloudburst and Flashflood is three blocks that is Input Block, Central Processing Block and the output block.

Input block senses the information especially related to Total Liquid Water Content (TLWC) which is obtained from Cumulonimbus Cloud with the help of X band (8 GHz to 12.5 GHz) and Ka band (26.5 GHz to 40 GHz) Doppler radar frequencies and Image processing of real time Cloud pictures along with various local, Ionospheric, Atmospheric, Space and Solar parameters depending upon need.

Central processing block is nothing but IoT and AI based Data Processing Algorithm having self-learning ability. Predictions can also be done regarding Cloudburst and Flashflood with the help of predictive engine in this block. This is important for life and property protections.

Output block is for giving alerts in text, Sound, light and Visuals form on smartphones, PCs, Big screens and enriched type of the real physical world such as Virtual Reality (VR) and Augmented Reality (AR). Alerts are given to homes, City, village, town, dams and river water management local and global administrations. The system provides the options for setting different threshold levels based on calamity severity for Executive Decision Support System (EDSS). Feature of wireless technology in home automation provide remote access from Smartphones or tablets users to operate or control the life saving devices and systems.

Results and Discussion:

Smart Home Automation System (SHAS) includes major applications like remote control, comfort, optimum utilization of resources, alarms, alerts and security. This provides the facility to user to monitor and control IoT and AI based devices anywhere, anytime and with anyone with the help of network from any corner of the world.

IoT and AI assisted home automation with essential need based, **customized** alerts in prevention of human civilizations, cattle and useful for environment protection. It makes life of user not just easy and comfortable but also saves lots of energy, time and money. Door lock, security, smart home appliances, cameras and so on many devices that user can operate even away from home. In IoT, devices are associated to internet and swap information and data to enhance productivity, efficiency and services. AI is a thorough and powerful programming technique that facilitates users with its features and makes their life comfortable.

Applications of this three block smart system helps in prevention of humans such as pregnant women, children, old age senior citizens, ill and people with disability and as well as cattle life. One third of the 7.97 billion global populations are hunger-starving and this alert system is also provide direct agriculture crop protection and not only vital for food grain security but also for sustainable economic growth. This design of system not only uses just technology of IoT but also uses AI and cloud feature for water bodies' management such as dam water management with accurate prediction of Cloudburst and Flashflood. Expansion of such technology network to generate local and as well as global need based customized alert depending upon the severity level of the impending calamities in the interest of human civilization is practically possible.

When IoT and AI works together then it gives effective and efficient result such as energy and money saving, decrease human efforts, increase comfort, sustainable living, productivity enhancement, wastages reduction, smart, reliable, services quality.

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