iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VIII **Month of publication:** August 2021

DOI: https://doi.org/10.22214/ijraset.2021.37863

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VIII Aug 2021- Available at www.ijraset.com

A Comprehensive Review on IoT and Its Applications

Dr. S V Viraktamath[1], Shankaranand B Banti[2]
[1, 2]Electronics and Communication Engineering, SDM College of Engineering and Technology, Dhavalagiri, Dharwad

Abstract: The IoT (Internet of Things) is one of the leading and advantageous technologies in the 21st century, which can give the high level implementation feasibility in the field of wireless telecommunications. The IoT can also be defined as a smart and interconnected network in a highly dynamic infrastructure. It also provides the feature of from anywhere at any time. The main aim of internet of things is to create a huge and complex information system by combining various trending technologies like sensor data, Artificial Intelligence, Machine Learning, Data science, Networking, big data and Clouds. The biggest deal in IoT is to collect the huge data and data security in maintaining the data confidentiality and providing the privacy for every entity. As a result of all these aspects, new difficulties are entering in improving and implementing the current technologies. There are many such technologies by which many more difficulties are entering. They all must be investigated further. This is a special issue which examines the most recent contributions of IoT platform as well as in the progress of the trending technologies. A statement from IoT is that, monitor and control any technology from anywhere, anytime, wireless, fastest.
Keyword: Wireless, IoT, Machine learning, Cloud.

I. INTRODUCTION

For the past decade, the Internet of Things (IoT) has been in the focus. It is considered as one of the disruptive technologies of century, and it has piqued the interest of society, industry, and academia as a means of technologically enhancing day-to-day activities, the development of new business models, products, and services, and as a rich source of research topics and ideas. Several unions, organisations, businesses, and even governments have recognised its significance and acknowledged the IoT potential benefits [1]. The Internet is a communication platform that connects individuals to information, whereas the Internet of Things is a network of uniquely addressable physical items with varying degrees of processing, sensing, and actuation capabilities that share the potential to interoperate and communication using the Internet as their common platform [2]. As a result, the Internet of Things primary goal is to enable items to communicate with other objects, as well as persons, at any time and from any location, utilising any network, method, or service [2].

II. IOT AND ITS CHARACTERISTICS

The Internet of Things is still in its early stages of development, and there is no universal definition of Internet of Things. There are three ways to look at Internet of Things. 1) Internet-oriented 2) things oriented and 3) semantic oriented Also, The Internet of Things (IoT) can be used to enable consumer (human) or industrial (industrial) applications, and it can even be referred to as human or industrial Internet of Things. Despite the fact that these differing perspectives have emerged as a result of the subject's interdisciplinary nature, they are likely to collide in application area in order to achieve the IoT's objectives. The IoT was first defined from a "things oriented" approach, with RFID tags being considered things [3].

III. CHARACTERISTICS OF IOT INFRASTRUCTURE

1) *Heterogeneous devices:* Since many IoT devices rely on embedded and sensor computing, a low price computing platforms are likely to be adopted. Low-power radios are expected to be used for Internet connection in order to lessen environmental effect and energy consumption of such devices. Wi-Fi or well-established cellular network technologies are not used by such low-power radios. The Internet of Things, on the other hand, will not be made up solely of embedded devices and sensors; it will also require higher order computing systems to accomplish more demanding tasks. Device heterogeneity arises from a variety of factors, including multivendor goods and application needs, in addition to variances in capacity and features [3].
2) *Resource-constrained:* Small device form factors are required for embedded computing and sensors, which limits their processor, memory, and communication capabilities. RFID tags or devices may lack processing power or even a battery to power them [3].

3) *Spontaneous interaction:* In IoT applications, sudden interactions can take place as objects move around, and come into other objects' communication range, leading to the spontaneous generation of events. For example, a smart phone user may come into close proximity to a television, refrigerator, or washing machine at home, which can trigger actions without the user's knowledge. In the Internet of Things, interacting with an object usually results in the development of an event that is broadcast to the system without the need for significant human participation [3].
4) *Ultra-large-scale network and large number of events:* In an IoT context, thousands of devices or things may interact with one another, a scale significantly bigger than most traditional networking systems. Globally, the Internet of Things will be an ultra-large-scale network with billions, if not trillions, of nodes. A massive number of events will be generated as regular behaviour in IoT as result of spontaneous interactions among an enormously large number of items or devices. This uncontrollable amount of events could lead to issues like event congestion and a reduction in event processing capacity [3].
5) *Dynamic network and no infrastructure:* The Internet of Things will connect devices, many of which will be mobile, wirelessly networked, and resource constrained. The network's mobile nodes can leave or join at any time. Nodes can also be disconnected owing bad wireless connectivity or a lack of batteries. Because of these features, IoT network will be extremely dynamic. It will be challenging to maintain a reliable network in such an ad hoc setting, when a fixed infrastructure link is low or non-existent, to support various IoT-based application scenarios. To keep network connected and operational, nodes will have to work together [3].
6) *Context-aware:* Context is critical in IoT and applications. A large number of sensors will provide large amount of data, which will be meaningless unless it is processed, assessed, and understood. Context-aware computing saves information about sensor data's context, making it easier to understand. In Internet of Things, context awareness is crucial for devices' adaptive and autonomous behaviour. Such behaviour will aid in elimination of human-centric mediation in Internet of Things, making M2M communication, a key component of IoT's vision, easier [3].
7) *Intelligence:* According to Intel's vision, the two main components of IoT are intelligent devices and intelligent systems of systems. These intelligent things, along with other entities like Web services (WSs), SOA components, and virtual objects, will interoperable and able to act autonomously depending on context, conditions, surroundings in IoT's dynamic and open network [3].
8) *Location-aware:* Position or geographical information about things (items) sensors is vital in Internet of Things, as location is crucial in deep computing. Positions, surrounds, and the presence of other entities all have a significant impact on interactions in a large-scale network of objects [3].
9) *Distributed:* The traditional Internet, like the Internet of Things, is a worldwide spread network. Because of the IoT's significant spatial dimension, the network is deployed at various scales.

IV. COMPONENTS AND WORKING OF IoT

The Internet of Things architecture is made up of five levels that define all of the functions of IoT systems. Perception layer, network layer, middleware layer, application layer, and business layer are the layers involved. The perception layer, which consists of physical devices, is present at the bottom of the IoT architecture i.e. sensors, RFID chips, barcodes etc. And other physical devices connected to an Internet of Things (IoT) network. These devices collect information before sending it to the network layer. The network layer, which serves as a transmission medium, transports data from the perception layer to the information processing system. This data can be transmitted by any wired or wireless means, such as 3G/4G, Wi-Fi, Bluetooth, and so on. The next level layer is the middleware layer. The primary responsibility of this layer is to process data from the network layer and make judgments based on ubiquitous computing discoveries. The application layer then uses the processed data to manage all of the devices in the system. A business layer sits on top of the architecture, overseeing the entire IoT system, including its apps and services. The information and data obtained from the application layer are visualised by the business layer, which then uses this knowledge to develop future aims and plans. Furthermore, IoT architectures can be customised to meet specific needs and application domains. Along from the layered architecture, an IoT system consists of a number of functional blocks that support various IoT functions such as sensing, authentication, and identification, as well as control and management [4].

Several functional blocks handle I/O activities, network challenges, processing, audio video monitoring, and storage management. All of these functional blocks, when combined, make an effective IoT system, which is critical for optimal performance. Although numerous reference designs with technical criteria have been offered, they are far from being standard design suited for global IoT. As a result, an appropriate architecture must still be built to meet global IoT requirements [4]. Fig.1. illustrates such functional blocks of IoT architecture.

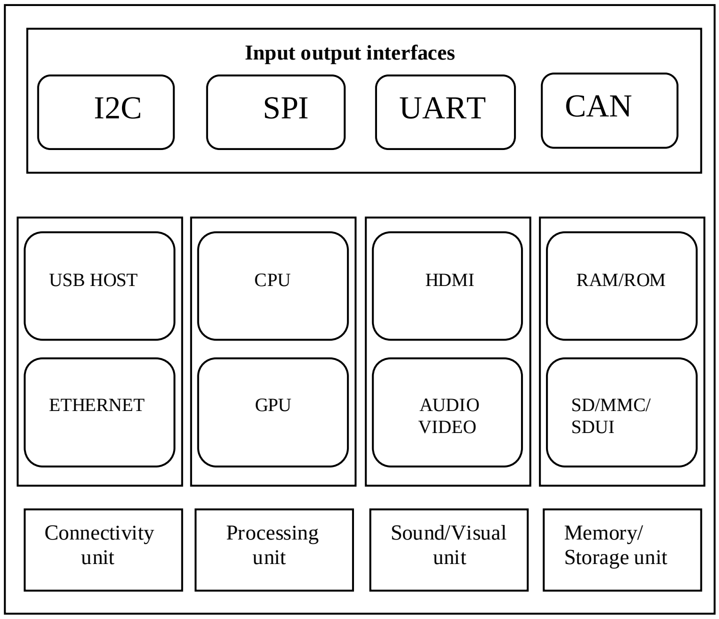

Fig.1. A generic function module of IOT system [4]

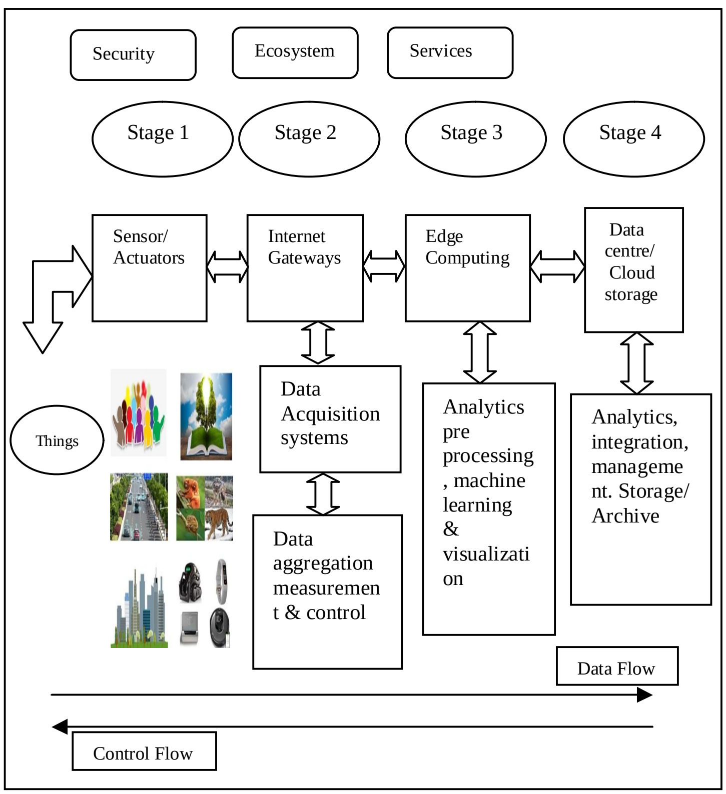

Fig.2. Four stage IOT architecture to deal with massive data [4]

Furthermore, ever-increasing number of massive data created by IoT sensors and devices presents new difficulty. As a result, in order to deal with huge amounts of streaming data in an IoT system, an efficient architecture is necessary. Cloud and fog/edge are two IoT system topologies that allow IoT systems handles, monitor, and analyses huge amounts of data. As a result, current IoT architecture can be thought of as a four-step process shown in Fig .2.

Sensors and actuators play a crucial role in architecture's stage 1. The actual world is made up of environment, animals, humans, smart cars, and structures, among other things. Sensors detect signals and data flows from real world items and convert them to data that can be analysed. Furthermore, actuators have the ability to intervene in reality, such as controlling the room's temperature, slowing the vehicle's speed, switching off the music and lights, and so on [4].

As a result, stage 1 facilitates in collection of data from real world that may be relevant for subsequent research. Sensors and actuators, as well as gateways and data collecting systems, are all part of Stage 2. This stage collects and optimises large amount of data collected in stage 1 in structured fashion appropriate for processing. Once huge amount of data has been gathered and categorised, it's time to move on to stage 3, edge computing. Edge computing can be defined as a distributed open architecture that allows IoT technologies and huge processing capacity to be used from many locations throughout the world. It's a very powerful way for processing streaming data, so it can be used for IoT devices. Edge computing technologies in stage 3 deal with large amounts of information and provide different functions such as visualisation, data integration from other sources, machine learning analysis, and so on. The final stage includes various critical actions such as in-deep processing and analysis, as well as transmitting feedback to increase system's precision and accuracy. At this time, everything will be done in a data centre or on cloud server. Machine learning techniques can be used to improve predictions, resulting in a much more precise and efficient IoT system capable of meeting current demand. ML techniques can be applied to improve prediction models, resulting in more accurate and reliable IoT system that can fulfill customer demands. Machine learning uses better approach to develop prediction models, which could help for more accurate and reliable IoT system to meet current demand. Big data frameworks such as Hadoop and Spark used to handle this large streaming data, machine learning approaches can be used to build better prediction models [4].

1) *Radio Frequency Identification (RFID):* Radio waves send's the object identify wirelessly in the form of series number. In the Internet of Things, RFID technology plays a critical role in resolving object identification challenges. It's categorized into three groups based on how it's processed: active, passive, and semi active. Tags, readers, antennas, access controllers, software, and servers are the major components of RFID. It is useful to take automatic definition that allots a distinctive digital identity to everything. It's used in a variety of wireless applications, including discoverability, health monitoring, and defence uses [5].
2) *Electronic product code (EPC):* It is made up of four parts object naming service, EPC discovery service, EPC information service, EPC security service. Electronic product code is 64-bit or 94-bit code that electronically registers on RFID tag and to develop better design of Electronic product code bar code and hold data about the EPC type, product serial number, product information, manufacture specification. [5].
3) *Barcode:* This is a unique method of encrypting numbers and messages that use series of spaces and bars of varying sizes. A barcode is a machine-readable optical label that is placed on goods to record information about the object. Alpha Numeric, Numeric 2, and Dimensional are the 3 types of barcodes. It is developed to be readable machine, but by using a camera and laser scanner it can be read [5].
4) *Internet Protocol (IP):* It's the most used internet protocol for transferring information across circumference and network borders. IPV4 and IPV6 are the two versions of IP currently in use. On the Internet, IPV4 is now in use [5].
5) *Addressing scheme:* The Internet of Things establishes connections between objects with the goal of creating a smart environment. As a result, all items must be uniquely identifiable, location and function. This is necessary for the purposes of digitising all IoT entities, and everything assigned a special number that identifies it from other objects for the purposes of remote control over the Internet. This is critical for the success of the Internet of Things. Individuality, as well as reliability and scalability, are critical factors to consider while creating a unique addressing system. IPV4 designates a geographically defined range of sensors. IPV6 is another effective solution for gaining unique remote access to sources [5].
6) *Wireless sensor network:* It is a made up of dispense devices that work together to monitor physical or environmental factors such as temperature, sound, and so on, using smart sensors. The data is collected and forwarded to central system for analysis [5].
7) *Wireless Fidelity (Wi-Fi):* This is a networking technique which uses a wireless signal to connecting computers and other devices [5].
8) *Bluetooth:* This is a low-cost wireless technology that uses short-range radio waves to communicate [5].
9) *Zig Bee:* Zigbee is a low-cost, low-power wireless IoT network technology that was designed as an open worldwide standard.The IEEE 802.15. 4 physical radio specifications under pins the Zigbee standard, which runs in unlicensed bands such as 2.4 GHz, 900 MHz, and 868 MHz. A protocol that was created to enhance the benefits of wireless sensor networks [5].
10) *Near Filed Communication (NFC):* It is wireless technology it is only here for a short period [5].

11) *Middleware:* Because there are differences and multiplication of items utilised in the Internet of Things, The middle layer plays an important part in the links and connections between things and the application layer, in addition to restricted storing and a diverse set of applications. This layer makes it easier for connected devices to communicate and integrate functionality. Furthermore, it enables data storage, analysis, and the employment of exact software for intelligently use data and makes appropriate automatic judgments [5].
12) *Actuators:* These are located in the physical layer and are responsible for converting energy into motion. Actuators are classified as hydraulic, electric, or compressed air. Hydraulic actuators utilise hydraulic fluid, electric actuators use electric current, and compressed air actuators utilise compressed air. The movement is linear, circular, or pulsed, and it covers only a few feet [5].

V. APPLICATIONS

A. A study of IoT approach for Monitoring water quality using MQTT Algorithm

Data is transferred one after the other during transmission, causing a buzz and a delay in transmission. Data transfer, on the other hand, should be simultaneous, faster, and more secure. Other technologies, such as MQTT (Message queuing telemetry transport), can be utilised to fulfil all of these requirements. Instead of employing a GSM network or another technology, the MQTT method will be used to make the system viable, flexible, scalable, and cost effective, as well as allowing data to flow simultaneously between sensors and servers. Without encountering any difficulties, a significant amount of data can be transferred. To figure out which water parameter will give you a good idea of how polluted the water is pH, dissolved oxygen, and temperature were chosen as the parameters after thorough investigation. A list of locations that will provide important information, the search was limited to industrial locations, sewage waste openings, and city boundaries where human activity has a significant impact. For testing, several sensors were deployed at such sites to transfer the sensor's data to the Arduino kit for further processing. The next step is to transmit the data obtained, which is where MQTT comes into play. The information received is transferred into the server and end user via MQTT and the Raspberry Pi. Finally, the gathered data set is subjected to data analysis using the Nave Bayes algorithm, which yields the required results [6].

B. IoT Based vehicle Emission Monitoring & Alerting System

It is widely acknowledged that transportation is one of the biggest causes of climate change and its numerous negative consequences for all living things. Existing approaches use additional protocol techniques to filter out noise and unwanted signals, resulting in a more complex nature. It was suggested that a low-cost monitoring system be used to decrease the complexity of obtaining the data. This is concerned with identifying and monitoring each vehicle's emission level, as well as notifying the RTO if vehicle exceeds standard limit. This process includes installing a gas sensor to the vehicle's exhaust system that can detect both CO and COx. The GALV Thermal Isolation Clip shields the sensor from heat dissipation and protects it from vehicle exhaust, which might cause sensor to fail. The system is GPS-enabled, which allows officials to track the polluting vehicle's locations. The prototype is connected to two 6V batteries that supply power to entire setup, including the GSM, LCD Display, GPS module, and indication, with exception of the gas sensor, which is driven by a single 9V battery due to high power consumption. The acquired data is saved in real-time in a PIC microcontroller and assessed using embedded C coding. Any difference in comparison is shown on driver's LCD screen and transmitted to nearest control station through GSM and GPS modules [7].

C. Survey on Multi Sensor based air and water quality Monitoring Using IoT

The use of IoT to monitor air and water quality utilising many sensors is proposed. Manual data processing using laboratory procedures takes time, and current technologies are inadequate in terms of producing correct results and do not support long-range communication. However, because this project uses the GPRS module, data may be sent over a great distance, and it is also cost effective. The first stage is to determine which water variables can be utilised to forecast pollution. The parameters pH, turbidity, temperature, CO, and air quality were chosen after thorough investigation. The data from the sensors is then sent to the microcontroller kit for examination. The controller's ADC will convert the analogue output to digital and send the measured data through UART protocol to a GPRS module connected to the microcontroller. The data is collected and sent to the server through GPRS by the end user. The Micro Controller Unit is connected to sensors that detect air and water quality, such as pH, temperature, turbidity, CO_2 sensors, and MQ sensors, for processing. The Serial Communication Unit connects the MCU to the GPRS module, which transfers data to the workstation and saves it in the cloud for later use. The implementation and testing of a less price, efficient, real-time water quality monitoring system has been completed. This may aid in the prevention of diseases caused by contaminated water and the presence of metals [8].

D. Heart Attack Detection by Heartbeat Sensing Using IoT

Heart attacks are becoming more common these days. This technology uses heart beat sensing to identify a person's heart rate even if they are at home. This technology is especially useful for hospital monitoring, as it allows a single person in the server room to keep track of all of the patients. This system aids in the measurement of a person's body temperature, heartbeat, and pulses. This system will be created for the purpose of saving animals. If this technology advances, we will be able to use it to detect heart blockages. The system uses a heart rate sensor to determine the current rate of heartbeat and display it on the LCD screen. The transmitting circuit consists of an AVR family microcontroller connected to an LCD screen and powered by a 12V transformer. AVR family microcontroller and RF receiver are also included in the receiving circuit, as well as a 12V transformer. An LED light and a buzzer are also included in the receiver circuit, which are used to alert the person monitoring the patient's heartbeat rate, and which turn on the LED light and buzzer when the patient's heartbeat level does not fall within the prescribed normal heartbeat level. Now this system using into all of the hospital wards. The operator can watch all of the patients from a single place. The sensor fires a light lobe into the ear and counts how much light reaches the LED. In the Circuit, the amplified signal is inverted and filtered. The LM358 OP-AMP is used to build a heart-rate sensor that monitors heartbeat pulses in order to calculate heart rate based on blood flow to the fingertip. When the system is turned on, the IR emits 100% intensity light towards blood cells. With 100% from it, light reflects back to Rx. Our heart rate is represented by the ‘x' number. All data will be sent immediately to the server room, allowing for quick response in the event of an emergency. The operator can sit in a single location and monitor all of the patients [9].

E. Waste Management System Based on IoT

This waste management system uses IoT to implement waste management in real time, employing a smart dustbin to check the dustbin's fill level to see if it is full or not. In smart cities, a revolutionary cloud-based waste collection system has been developed. Providing assistance to the various stakeholder groups involved in this sector. This information is sent, and prompt action is made based on the aspect. The sensor is used to determine the amount of dust in the trash can. A sound transmitter and receiver are used. A pulse is produced by an ultrasonic sensor. Listen for the pulse reflection when you call ping. A sonar projector with a signal generator, power amplifier, and electro-acoustic transducer array generates the sound pulse electrically. To concentrate the acoustic power into the beam, a beam former is commonly used [10].

F. IoT Based Smart Parking SYSTEM

The most significant advantages are time and fuel savings. It can also provide environmentally beneficial, long-term parking management. This technology has a lower maintenance cost, which helps the property developer save money. It ensures that the parking lot is secure. It eliminates the trouble of finding a parking spot and traffic congestion. It will also boost Automation Engineering in our country, allowing us to develop in terms of technology usage. The system's brain is Arduino. All of the components are controlled and monitored by it. The ultrasonic sensors will be installed in the parking spots and will detect the presence of cars. One sensor will be installed near the parking lot's main entrance. When the sensors detect the presence of a car in front of the entry, they send a signal to the Arduino chip, which checks to see if there is an empty parking spot inside. When the Arduino chip detects that one or more slots are vacant, it sends a signal to the dc servo motor, which opens the main door. If, on the other hand, the Arduino chip encounters no free slots when a car tries to enter, the gate will simply not open. There will also be a webpage linked to the Arduino board that will display the amount of parking spaces that are still available. On the Arduino circuit board, the Ethernet shield can be mounted. The circuit will be powered by a 9v dc battery. The ultrasonic sensor and Arduino board will be connected via three wires, and the dc servo motor will be controlled via two wires. The Arduino circuit board's pin configuration will be done using a simple programming language that will be designed and implemented using the Arduino IDE [11].

G. Smart Security Solution for Women Based on Internet of Things

As the first of its kind, this concept plays a critical role in assuring Women's Safety as quickly as feasible. The purposed design will address significant challenges that women have experienced in the recent past and will aid in their resolution through technological advanced devices. The technology is capable of performing real time monitoring of the desired area and accurately detecting violence. A specifically created programme functions as an interface between the gadget and the phone, allowing it to connect with it. The application that is preinstalled on the mobile continuously monitors the data directed by smart band, such as the pulse rate, body temperature, and movements of the body. The app directs the smart phone to carry out the actions in times of misuse. Sends a message to family members with GPS coordinates.

The coordinates are submitted to the nearest police station, along with a request for quick action. Also sends out information requesting public attention to persons in the area. The app is set up in such a manner that it uses the smart phone's GPS to detect co-ordinates and monitor movement for easy tracking. The GSM function built into the phone is used to send the help message to family members and the nearest police station. The software also functions as a social network, allowing users who have the app installed to receive messages immediately, allowing them to participate to the timely delivery of justice. This functionality is implemented by utilising the user's phone's internet capabilities. The control unit gathers data from smart wrist unit and GPS receiver. The GSM module will then transmit all of this data from the control unit to the base station. Wrist device uses temperature sensor, sensor of pulse rate, and then switches to collect data from humans. The wrist unit sends data to the control unit via an RF module [12].

H. IoT based smart irrigation system

The proposed system can be used to automate the process of irrigation, which is one of the most time consuming processes in farming, by turning on and off the water sprinkler based on soil moisture levels. Agriculture is one of the water-intensive occupations. The system irrigates the soil using data from soil moisture sensors, which helps to minimise over- or under-watering of the soil and thereby crop damage. A website allows the farm owner to keep track of the process. By this application of IOT and automation in farming can lead to significant advancement. The control of water sprinkler is done by setting threshold value which the irrigation system starts. The sprinklers are turned on when the sensors detect moisture content below the threshold. Moisture sensors, an Arduino Uno, and a GSMGPRS SIM900A modem make up the hardware. The GSM modem is in need as transferring the data from the Arduino to the internet. The data from the sensors is sent to an online database, from which it is displayed on a website. The website shows the moisture content of soil, which is separated into two groups. There are two levels: low and high. When the moisture content is low, the pump should be turned on. The threshold levels vary depending on the soil type [13].

I. IoT based web controlled home automation using Raspberry PI

This research will be continued by adding relays into the Raspberry Pi board to operate house appliances from far in a real-world setting. As an extension, they propose a general IoT framework that connects and manages IoT devices using cloud computing infrastructure. The usage of smart home technologies to increase family safety, specifically linked to fire protection and carbon monoxide monitoring, is expected to rise in popularity in the near future. The programme is first loaded onto the Raspberry Pi board, and power is supplied through an adaptor. A wifi connection is established between the Raspberry Pi board and the mobile device, with the URL being used to open the board page in the mobile device. A light and fan are utilised in the system instead of connecting house appliances, and a camera is mounted to the entrance for security purposes. Wi-Fi is utilised in this system to control devices in a small coverage area. Raspberry Pi has a dashboard controller that allows you to connect your appliances via input and output ports. The Raspberry Pi and the phone are linked over Wi-Fi. Raspberry PI is used to connect a light, a fan, and a camera. Home appliances operate at 230V; however the Raspberry Pi operates at 5V. So, in this system, a relay circuit is used to cover the high voltage to low voltage, low voltage to high voltage, and low voltage to high voltage transitions, as well as acting as a switch. In this case, a four-way relay is utilised to connect a zero-watt bulb to 230V. The DC motor is the next device. Two 5V supplies are required for the DC motor. However, the Raspberry Pi board only has three 5V pins. To connect the motor, male header pins are utilised [14].

J. IoT based ration card system using Bluetooth technology

Instead of using traditional ration cards, the smart ration card system uses NFC. This will make it easier to replace manual data processing with automated processing. The internet-of-things-based ration card technology will make it easier to monitor and administer the ration distribution system. This will also go a long way towards reducing corruption. A unique identifying number on the NFC card is connected to the Aadhaar card number. With the use of a hand-held NFC scanner, the consumer scans the card, which is then identified and decoded. The proposed system shows how food (wheat/rice) and kerosene are distributed. This approach also lowers the shopkeeper's manual labour and corruption. The NFC reader is utilised as an input to the system, and the Arduino output is sent to the PC through Bluetooth. We get information about the customer from the database using the web application. The amount of grains assigned to each customer is displayed on a computer. The data on the web server will be updated after the grains have been received. This data may be used by both government employees and consumers, and it will serve as a backup for the customer on this ration card account, and the shopkeeper will not be able to fool the consumer [15].

VI. CONCLUSION

The Internet of Things is a concept that connects the virtual world of information technology to the physical world of things. The Internet of things technology used in many applications domain such as transportation and logistics, Health care, automotive, smart environment, industrial, personal and social domain, and security etc. It makes our lives easier and comfort.

REFERENCES

[1] Jorge E. Ibarra Esquer, Felix F.Gonzalez-Navarro, Brenda L.Flores-Rios,Laryas Bursteva and Maria A.Astorga-vargas "Tracking the evolution of the internet of things concept across different application domains".
[2] AbdelRahman.H.Hussein "Internet of things (IOT) Research challenges and Future applications" vol 10, issue No.6, 2019, International journal of Advanced computer science and applications.
[3] Mohammad Abdur Razzaquae, Milojevic-Jevric, Andrei Palade, and Siobhán Clarke "Middleware for Intertnet of Things: A Survey" IEEE Internet of Things Journal Vol 3, Issue No.1, February, 2016.
[4] Kumar et al. J big data (2019) "Internet of things is a revolutionary approach for the future technology enhancement".
[5] Safa A. Ahmed, Nahla Fadil Alwan, Ammar Mohamed Ali "Overview of internet things Basics,components and applications" J. of Univercity of Anbar for pure science vol 1, issue No.3, 2018.
[6] Alfiya Abubkar, Kavya C R, Tilju Thomas, Nikhil Joseph,Shifana Begam "A study on IOT approach for monitoring water quality using MQTT algorithm" Srinivas school of engineering, Mangalore, vol 5, issue No.3, march,2018.
[7] P.Arun Mozhi Devan et al. "IoT based vehicle emission monitoring and alerting system" 2019 IEEE student conference on research and development October 15-17, 2019.
[8] Ashwini Doni Et la. "Survey on multi sensor based air and water quality monitoring using IOT" SSIT Tumakuru Indian J.sci.res.17 (2) 147-153, 2018.
[9] DR.A.A.Gurjar,Neha.A.Sarnaik "Heart attack detection by heartbeat sensing using internet of things IOT", Sipna COET, Amravati IRJET vol.5 issue No.3 march 2018.
[10] Sapna suryawanshi, Rohini bhuse et la "Waste management system based on IOT", Matoshri College of engineering and Research center Eklahare, Nasik, India IRJET.
[11] Saidur Rahman,Poly Bhoumik "IOT based smart parking system", Daffodil institute if IT, Dhaka, Bangladesh.
[12] Suhas Shirol et la. "Smart security solution for woman based on internet of things (IOT)", BVBCET, Hubballi, March 2016.
[13] Srishti Rawal "IoT based smart irrigation system", VIT University, vol 159, issueNo.8, February International journal of computer applications.
[14] G,Joga Rao, A.vinod, N. Priyanka, Ch.siva Hari Kumar.k, "IoT based web controlled home automation using Raspberry PI" Raghu institute of technology, Visakhapatnam, Andra Pradesh, India, vol 2, issueNo.2, March,2019.
[15] Neha Sharma, Ayushi Gupta, Vinod Ghadge, Mayank Harwani "IoT based ration card system using Bluetooth Technology", Vivekanand Education society's Institute of Technology, vol 7, issueNo.3.