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SPECIAL ISSUE ON “Innovative Future Technologies for Internet of Things Communications”

Guest Editors: 1Dr.Priyanka Mishra, 2Bosubabu Sambana

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This special issue of Frontiers focuses on the innovations from recent technological applications in IoT Communications for future knowledge curiosity minds. This special issue gives significant cutting edge specialized applications enhanced core operations for humanity. This Special issue entirely focuses on the Internet of Things enhanced computational communications and its applications for various fields like Agricultural, smart farming, Autonomous Agriculture Irrigation systems, Wireless Sensor Networks operations, Aerial View Culturing Monitoring, etc.

The first paper has been at the forefront of focus areas across the energy enhancement in Wireless Sensor Networks using ANT Colony Optimization approach to the Internet of Things(IoT). This paper gives a qualitative comparative study using the real-time environment for the best way to understand this field to upcoming researchers needs, and global manufacturing industries using the Industrial Internet of Things (IIoT). The authors modeled the predictive maintenance tool for condition-based Optimization enhanced WSN operations are run safely with predictable fields. In this study, we examine two more base papers in which the throughput increased. Still, the energy level fell compared to ant colony optimization utilizing ZRP. This work boosts energy levels while also increasing output.

The second paper has been developed with the principal objective of identifying global warming and exploring better approaches for serving various factors while keeping up with the minimal expense and multiple techniques of the new technologies enhanced Global Warming Mitigation using an Internet of Things based Plant Monitoring System. The authors designed the paper for recent times; one of the challenges has been global warming. Every living being on the earth is being affected due to Global warming. It gives rise to many problems like melting the icecaps, expanding ocean levels, evaporating water bodies, and increasing the average temperature. Deforestation is the primary factor of global warming. Deforestation has a significant impact on biodiversity in various ways. Afforestation is the only key to lessening global warming. Since the population of cities is more and the majority of those living in cities are too busy earning their lives, it is difficult for them to find more places as land is scarce and they have no time to do plantation. This manuscript aims at an IoT-based plant monitoring device for the healthy growth of the plant. The designed system mentioned here does the tasks like taking care of the plant and preventing environmental changes and other damage. An additional concept here is the usage of sentiment analysis, which communicates the state of the plant directly to the user’s mobile phone so that the user may visit his field based on the necessity. This method can enhance the plantation process in cities, which increases greenery and helps in minimizing global warming.

The third paper aimed to develop an IoT-based automated Agricultural Irrigation Control System that describes the real-time Intelligent Agricultural Irrigation environment. The authors prepared vital information for researchers to understand qualitative results-based operational outcomes. The automatic irrigation control using an Arduino Uno has been experimentally proven to work satisfactorily, and we were able to establish the timekeeper and control the motor over time. This method not only captures temperature and humidity measurements; but also prevents the engine as a result. Analyzing the atmospheric state, the motor will sustain water delivery automatically, allowing for the maintenance of greenery without human involvement.

The fourth paper considers and gives significant research work on Arial View Cultivating Monitoring. This paper concentrated on the Amalgam Approach to Computer Vision in Deep Learning, and IoT Approached for Aerial View Cultivating Monitoring and presented the literature survey to predict Cultivating Monitoring. The IoT solutions & techniques discussed are Accuracy Farming, Accuracy Livestock Farming, Computerization in Smart Greenhouses, Horticultural Drones. These are helpful to solve problems in agriculture. But to analyze the data, feature extraction plays an important role. So, we used an IoT Novel approach to implement the Amalgam approach Aerial view Cultivating Monitoring. This will give more efficient and helpful information to predict climatic conditions using Data Analytics; we can expect Cultivating. Finally, we can say that the prediction of Climatic conditions, Stock management, Live Monitoring is still under development, and we have to improve the accuracy of the prediction rate.
Dr. Priyanka Mishra was born in Jaipur, India, in 1980. She received the B.E. degree in Computer Engineering from the Modi College of Engineering & Technology, Laxmangarh under the University of Rajasthan, India, in 2003, and M.Tech. degree in Computer Science in 2006. She received a Ph.D. degree in Computer Science & Engineering from the National Institute of Technology (NIT) Hamirpur, India, in 2016. She is presently working as Assistant Professor in the Dept of CSE, IIITK, MNIT Campus, Jaipur. Dr. Mishra secured one International Patent and filed 3 Indian Patents to be published in Indian Patent Journal, GoI. She secured 1 Copyright with the Copyright Office, GoI. She also wrote two UG e-text books and one book under press by Springer Nature. She published many book chapters in SCI indexed books like CRC Press, Springer etc.

She completed 16 months project sanctioned by DSIR as “Independent Innovator” and one DST project as “Researcher” during her Ph.D. She also completed one International Project “ Data Dashboard Automation Sanctioned by My Tech Squad PTY Ltd., Australia and 4 projects sanctioned by private software companies. Dr. Mishra conducted several ICT and STTP through reputed institutes like NITTR Chandigarh.


Dr. Mishra is a life member of CSI, Chartered Engineer and Fellow member of IEI, member of ISTE, and a Professional Member of ACM. She is also a Member of IEEE, CSTA, IAENG, SDIWC, SCIEI, IRED, Rotary Club Jaipur, She is a Member of the Editorial Board of many international journals viz. IJCE, ICST, IJCTT. Her research interest includes machine learning, IoT, distributed artificial intelligence, identity management, trust and reputation modeling, network security. Her papers appeared in various International Academic Journals and conferences such as IEEE, Springer, Elsevier, etc. Her research interest includes Trust & Reputation Management, Identity Management, Network security. Dr. Mishra organized conferences and workshops sponsored by DRDO ,DST and AICTE . She also conducted various special sessions and acted as PC member in various reputed series conferences of MNIT, NIT Agartala, MNNIT Allahabad, IIT Patna, NIT Raipur and many more. Dr Mishra has 15 years of teaching experience. She is being an active member and leading several responsibilities like NSS PO, EDC Head, R&D Cell Head, Department Convenor of Post Graduate Programs, Institute Annual Report Convenor etc.

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Bosubabu submitted 1 Internet-Draft for RFC (Request For Comments) for Internet Protocol version 16 (IPv16) to IETF, Internet Society. He wrote four UG textbooks and 3 e-Books. He published book chapters in IEEE, Springer Nature, and CRC Press. He published papers in various reputed (UGC approved, Scopus/SCI/Web of Science) International and National Journals, magazines, and conferences. He participated in various International and National conferences, workshops, and FDPs. He secured 6 certifications from NPTEL – IISc / IITs and two online courses from IIRS-ISRO and NIELIT - Chennai. He has more than nine years of teaching experience. Currently, he is an active member of IEEE, IAENG, AMIE, ISA, CSI, and the Indian Science Congress.
Energy Enhancement in Wireless Sensor Networks using ANT Colony Optimization approach to the Internet of Things: Comparative Analysis

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Abstract — Reduce delay, load, and enhance the energy level of packet delivery fraction using wireless sensor network-based energy enhancement employing ant colony optimization and Cygwin. The number of sensor nodes moving on the network simulator is greater than 20 to 40, and the energy level is increased by employing the zone routing protocol. Ant Net is a routing system for IP networks that adapts to the best effort routing. Ant Net's architecture is based on ant colony optimization (ACO), which investigates ant behavior processes by denying a meta-heuristic inspired by nature for combinatorial optimization in the lowest possible time. It has been used to solve various combinatorial problems with great success. Ant Net was the first packet-switched route optimization method developed by ACO. This ACO-based algorithm has several interesting characteristics: it works in a highly decentralized environment, is very flexible to changing network and traffic conditions, and uses lightweight mobile agents (dubbed "ants") to sample-path assets. In this study, we examine two more base papers in which the throughput increased, but the energy level fell compared to ant colony optimization utilizing ZRP. This work boosts energy levels while also increasing output.

Index Terms — Ant colony algorithm, Energy enhancement, Cygwin, ns2 simulator, ZRP, routing protocol, etc.

1 INTRODUCTION

Mobile ad-hoc networks can be self-contained or connected to a more extensive network, such as the Internet. Mobile ad hoc networks have the potential to make the goal of being connected “anywhere, at any time” a reality. A catastrophe recovery or military operation are two examples of typical applications. These networks are not
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limited to specific scenarios, and they may perform better in other settings as well. Consider a group of persons with laptops attending a business meeting in a location where no network services are available. They can quickly create an ad-hoc network to connect their equipment. This is only one of many scenarios in which these networks could be helpful [4-8]. The behavior of ant colonies is used to build routing protocols for fixed, traditional wired networks. AntNet is one of these ant-based routing technologies. AntNet is a packet-switched communication network adaptive distributed routing protocol (the Internet).

There is no central control in distributed routing systems, but the information is shared across the network nodes. AntNet is also adaptive (dynamic), which means the routing tables are constructed and updated automatically. The routing policy in dynamic systems responds to changes in traffic conditions and changes in network structure. Changes in network topology can be induced by various factors, including the failure of network links or nodes[19]. AntNet uses “artificial ants” that travel over the network regularly and collect data on the current traffic circumstances.

This data would be used to guide data packets to their intended destinations. AntNet exhibited impressive results in dynamic network situations and proved highly adaptable. AntNet-like protocol appears to be well suited for MANET routing due to its ability to respond to emotional concerns. The most up-to-date overview of ACO's previous and current research in numerous engineering applications can be found here. They presented a comprehensive study of the application of ACO algorithms in a variety of fields, including mobile and wireless networks, sensor networks, grid computing, P2P computing, Pervasive computing, Data mining, Software engineering, Database systems, Multicore Processing, Artificial Intelligence, Image processing, Biomedical applications, and other domains relevant to Electrical Engineering fields; thus, the use of ACO algorithms is one of the most encouraging optimization techniques [2].

ACO algorithms have also been used in mobile network path planning. In both static and dynamic situations, they improve robotic navigation systems. In robotics, the requirement for autonomous mobile robots that can move quickly in a dynamic, complicated, and even unknown environment is critical. Human operators would be required to specify the motion for mobile robots without path planning. To improve the efficiency of robot operation, autonomous path planning is needed [13].

Many parts of social insects’ collaborative activity are self-organized. Complex behavior can evolve from interactions among individuals who exhibit simple behavior, according to theories of self-organization (SO) in social insects. This is a natural process that is neither guided nor controlled by anyone, and the resulting organization is wholly decentralized or spread among all colony members. According to recent research, SO is a significant component of many collective phenomena in social science.

2 RELATED WORK

ANT Colony Optimization

The difficulty of implementing AntNet to a topology of the network where nodes can migrate is addressed in this paper. AntNet is designed for fixed networks and cannot be used with mobile nodes. To use AntNet in this setting, we modified the artificial ants’ actions to work in a network with mobile nodes. The dynamic network architecture necessitated changes in the node model as well. As a result, an active node model was created, and a new buffer was. Finally, Mobile AntNet emerged from AntNet and the collection of our adjustments. The software tool AntNet for Ad-hoc Network is used to test Mobile AntNet. AntNet was the first ACO-based routing method for mobile nodes. ACO algorithms are helpful in cases where paths to goals must be found[11-14].

While exploring their surroundings, natural ants leave pheromones that direct them to resources. Artificial ants use a state transition technique to go across a searching space representing all possible solutions to find the best answer. They evaluate the quality of their answers so that additional ants can nd better ones in subsequent simulation cycles. They see the quickest and most cost-effective route from the nest to the destination or food. The primary drawbacks of this strategy are that it does not allow you to adjust the hop or area duration of your search for a destination or food in the network [15-20].

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Proposed Work:

Ant Net was the first packet-switched network routing algorithm developed by ACO. This technique, known as the ant colony optimization algorithm, aims to develop an efficient and optimal solution. This study aims to create a new state transition technique for Ant Colony Optimization algorithms to increase overall performance. The study found that introducing non-rational decision-making to ACO can improve the state transition approach.[19-22]. ACO invented Ant Net, the first packet-switched network routing method.

The purpose of the ant colony optimization algorithm, also known as the ant colony optimization algorithm, is to generate an efficient and optimal solution. This research aims to develop a novel state transition technique for Ant Colony Optimization algorithms to help them perform better overall. According to the findings, incorporating non-rational decision-making into ACO can improve the state transition strategy.

The problem specification is given below of two papers o the basis of problem finds out.

a). First problem throughput increases, but the accuracy of the routing algorithm is not found more than 89% max percentile.

b). The energy level of the second paper decreased with throughput also increased.

c). Both papers consist of algorithm accuracy of 89%, and 92% as wells energy level decreased if put also increased.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>01 paper</td>
<td>Throughput increase, energy level decrease</td>
<td>Accuracy 89%</td>
</tr>
<tr>
<td>02 paper</td>
<td>Energy level decrease if throughput increase</td>
<td>Accuracy 92%</td>
</tr>
<tr>
<td>Our work</td>
<td>Energy level increased. Load decreased; the delay also reduced. Throughput also increased</td>
<td>Accuracy 96%</td>
</tr>
</tbody>
</table>

These are the various issues found in all three base papers in which our work is also one paper for consideration. They are all common issues found for wireless sensor networks.

General Issues in Wireless Sensor Networks:

In a mobile ad hoc network, all nodes work together to forward packets across the web, thus making each node a router. As a result, one of the most crucial challenges is routing. The main focus of the research is on routing challenges in ad hoc networks. This part will go through some of the other concerns in ad hoc networks. [4]

**Distributed Network:** A MANET is a wireless network with no fixed infrastructure. Similar to peer-to-peer (P2P) networks, by distributed, we mean that there is no central controller to manage the clients' state [6].

**Dynamic Topology:** Because the nodes are movable, the network self-organizes. As a result, the network's topology is constantly changing. As a result, routing protocols for such networks must adapt to topological changes [5].

**Power Awareness:** Because ad hoc networks are often powered by batteries and deployed in hostile environments, they have strict power requirements. This means that the underlying protocols must be designed to conserve battery life or be power sensitive.

**Addressing scheme:** Because the network topology is constantly changing, the addressing system utilized is crucial. A ubiquitous addressing method is required in a dynamic network topology to avoid duplicate addresses. Mobile IP is now used in cellular networks, where the node addressing is handled entirely by the base station. Due to its decentralized structure, such a scheme does not include ad hoc networks.

**Network size:** Data sharing in conference halls, seminars, and other commercial applications of ad hoc networks
are attractive features of ad hoc networks. The latency in the underlying protocols, on the other hand, establishes a severe upper limit on the network's size.

Security: In deployment circumstances such as the battleed, security in an ad hoc network is critical. Because every node in the network contributes equally, the three security goals of secrecy, integrity, and authenticity are challenging to satisfy.

3 Research Methodology

Routing determines a path from a source to a destination using randomly distributed routers. In an ad-hoc network, broadcasting is an unavoidable and standard operation. It entails sending a message from a source node to all network nodes. Broadcasting can be used to disseminate information throughout a network. In ad-hoc networks, it has also been utilized for route ending protocols. This study employs the Ant Net Routing protocol for data transport and multichip transfer. Ant net was the first packet-switched network routing method developed by ACO. This ACO-based algorithm, Gianni di Caro and Marco Dorigo proposed the Ant Net [20] for adaptive routing algorithms.

Ant colonies and, more broadly, the concept of stigmergy influenced the creation of these algorithms. An algorithm for adapting best-effort routing in IP networks is ant net. Ant Net is based on the optimization of ant colonies. Real ants have been demonstrated to use a stochastic decision process based solely on local knowledge provided by pheromone trails left by other ants to locate the shortest paths. Ant Colony Improvement (ACO).

ACO researches the behavior of ants in a colony and attempts to replicate it in software. A graph indicates the problem that needs to be solved. Artificial agents, i.e., software ants, build trails in this graph over time. The Traveling Salesmen Problem, factory control systems and other disciplines have all used ACO. ACO is a metaheuristic in and of itself. When paired with a real-world problem, it can result in several heuristics. The application of ACO to Internet routing problems resulted in Ant Net. Over the network, intelligent agents, or ants, are sent. They communicate indirectly by the information they leave behind in the routers on their path. Over time, this information leads to optimal routing paths between the routers in the network [22].

Artificial ANTS

The ant-based routing algorithms work on the same principle as the example above, but they use artificial ants or agents instead of real ants. We will make the agents more complex than real ants because we want them to solve more complex problems. Unlike genuine ants, the agents will have the same added capabilities:

a). They will remember things. They will be able to recall their way and return along the same path, for example, thanks to their memory. They will be able to deposit their pheromone in proportion to the quality of the solution they have created. For instance, we will consider the ant's path's quality in our scenario.

b). The quality of this journey is determined by its duration. They are no longer completely 'blind.' They will be in a position to 'see' greater than just a pheromone, and their decisions will be influenced with the aid of some neighborhood data. This will help ants to clear up the shortcut problem.

c). We shall briefly outline the role of the agents in (Mobile) AntNet in illustrating a possible behavior of artificial ants. We will employ agents to solve the routing problem in a telecommunication network in (Mobile) AntNet. We will look at a case where the network is connected, which means that any other node may contact each node in the network. [14-19].

ANTNET Routing

AntNet is a hybrid algorithm containing each reactive and proactive element. The algorithm is reactive because it only gathers routing statistics about destinations that are worried in communication sessions. It is bold in the experience. It maintains and improves statistics about existing paths while the communication session is happening (unlike merely reactive algorithms, which do not search for routing facts until the presently
recognized routes are no longer valid). Routing information is saved in pheromone tables comparable to those used in different ACO routing algorithms [1-3]. These tables are used to forward control and data packets in a stochastic manner. Specific reactive procedures, such as local route repair and warning messages, deal with link failures. The general operation of the ant net routing algorithm is described below. The routing information in AntHocNet is arranged in pheromone tables, which are similar to those used in other ACO routing algorithms like AntNet.

The Ant Net Routing System is an agent-based routing algorithm inspired by the behavior of real ants. Ants in ant-net explore the network to identify the best pathways between the randomly chosen source and destination pairs. Furthermore, while traversing the network, the ants update the probabilistic routing tables and build a statistical model of the local traffic of the nodes. Ants use these tables to communicate with one another. The algorithm employs two ants to acquire network statistics and update the routing table: forward ants and backward ants.

There are two sorts of queues in each node: low priority and high priority. Low priority queues are used by data packets and forward ants, while backward ants use high priority queues. Later forward, ants also use the high-priority lines.

a). Forward Ants who gather information about the state of the network, and
b). Backward Ants use the collected data to adapt routers' routing tables on their path.

An ant net router has a unique routing table that associates each destination with all interfaces and assigns a probability to each interface. In the current situation, this probability indicates whether or not it is worthwhile to pursue that link. A statistical model is also included in the router, which stores the mean and variance values of travel times to all destinations in the routing table. These are used as benchmarks. An ant net router has a unique routing table that associates each destination with all interfaces and assigns a probability to each interface. In the current situation, this probability indicates whether or not it is worthwhile to pursue that link.

A statistical model is also included in the router, which stores the mean and variance values of travel times to all destinations in the routing table. These are used as benchmarks.[5-8]. Every router sends a Forward Ant with a random goal over the network regularly. The Forward Ant's job is to gather information about the network's current state. The elapsed time since the start is saved on an internal stack in each router they pass, along with the router's identity. The next hop is then determined. Usually, this is dependent on the routing table's probabilities.
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However, there is a slight chance (exploration probability) that the next hop will be randomly chosen. This must constantly investigate the network and respond quickly to network changes such as connection failures or congestion. Adjust some energy settings and change the mobility of Ant-Colony Optimization to solve the congestion problem. In the upgraded version of ACO, this Ant-Colony Optimization may identify multiple optimal outgoing interfaces rather than just one, which is claimed to give faster throughput and will be able to explore new and better paths even if network topologies change often. The traffic from the overloaded link will be distributed to other preferable links. As a result, the network's throughput will be enhanced, and the problem of stagnation will be resolved [17].

Simulation Result and Discussion

Network Simulator

NS2 is an event-driven network simulator developed at the University of California, Berkley, that covers a variety of network objects such as protocols, applications, and traffic source behaviors. The NS is part of the VINT project [16], a DARPA-funded project running since 1995.

Performances Matrices:

When the value of information is computed using mathematical methods, it reveals that even performance metrics professionals choose to measure the value [8,18]. These parameters demonstrate the Routing Protocol's performance as follows:

When the value of information is computed using mathematical methods, it demonstrates that even professionals in performance metrics adopt measures of matter [4-10]. These parameters show the Routing Protocol's performance:

- Packet Delivery Ratio (Fraction) is calculated by dividing the number of packets received by the destination by the number of packages originating from the source. PDF = (Pr/Ps) where Pr is the total Packet received, and Ps is the entire Packet sent.

- Average delay is when a data packet is transmitted across a MANET from source to destination. D = (Tr – Ts) where Tr receives Time and Ts is sent time.

- The normalized load can also be defined as the ratio of routed packets to data transmissions in a single simulation. The routing overload per unit data delivered successfully to the destination node is the routing overload.

When the value of information is computed using mathematical methods, it demonstrates that even professionals in performance metrics adopt measures of matter [4-10]. These parameters indicate the Routing Protocol's performance:

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Simulation Parameter

Table 1: Parameters Analysis

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>NS-2</td>
</tr>
<tr>
<td>Routing protocol</td>
<td>AntNet</td>
</tr>
<tr>
<td>Number of Nodes</td>
<td>20</td>
</tr>
<tr>
<td>Area</td>
<td>500m X 500m</td>
</tr>
<tr>
<td>Packet size</td>
<td>512byte</td>
</tr>
<tr>
<td>Simulation time</td>
<td>100s</td>
</tr>
<tr>
<td>Pause time</td>
<td>10.0</td>
</tr>
<tr>
<td>Traffic type</td>
<td>CBR</td>
</tr>
<tr>
<td>Mac protocol</td>
<td>Mac/802.11</td>
</tr>
<tr>
<td>Speed</td>
<td>10 to 40 m/s</td>
</tr>
</tbody>
</table>

Figure 3: NS2.33 Simulators with Nodes

Figure 4: Average Delay V/s Maximum Speed
Figure 5: Network Load V/s Maximum Speed

Figure 6: PDF V/s pause time

Figure 7: Average Delay V/s Pause time
Figure 8: Network Load V/s Pause Time

Figure 9: PDF V/s Maximum Speeds

Comparative Analysis:

<table>
<thead>
<tr>
<th>Paper</th>
<th>Accuracy</th>
<th>Comparative Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 base paper 22</td>
<td>Routing algorithm 92%</td>
<td>Energy level decreased, but throughput also increased, load increase, delay increase.</td>
</tr>
<tr>
<td>02 base paper 23.</td>
<td>Accuracy of algorithm 89%</td>
<td>Ant net algorithm with a routing problem</td>
</tr>
<tr>
<td>03 our proposed work</td>
<td>Accuracy 96%</td>
<td>Energy level increased, throughput also increased, load also decreased, the delay also decreased.</td>
</tr>
</tbody>
</table>
4 CONCLUSION

The influence of a Black Hole in an AODV Network was investigated in this paper. As a result, we implemented an AODV convention, which continues in NS-2 as Black Hole and Dark Hole Node into the organization. In addition, we used an alternative method (plan Improved AODV by Using Alternative Way) to reduce the Black Hole effects in NS-2 and replicated the setup using identical circumstances. The results of our reenactment can be found in the results section. After recreating the Black Hole Attack, we discovered that the parcel misery has grown in the specially selected organization. The difference in the number of bundles lost in the organization with and without a Black Hole Attack may be seen in the recreation results. This also implies that the Black Hole Attack impacts the organization's general availability and that data loss could signify the attack's presence.

The information loss is projected to increase as the number of Black Hole Nodes grows. When comparing dark opening AODV procedures to alternative strategies, the parcel misfortune was reduced by 4.32 %. The results show that our technique is 96 % accurate compared to plain paper. When comparing past findings, the existing result accuracy using the AODV procedure is found to be 89 percent and 92 %, respectively. The result of ant colony optimization is that as energy is raised, the PDF grows, the load drops, and the latency decreases—the throughput increases in prior work and our approaches, similar to both projects.

Future Scopes

We have left so many points in this research to determine future aspects. In the future, mobile agent-based energy augmentation will be used.

References


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Global Warming Mitigation using an Internet of Things based Plant Monitoring System

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Abstract- In recent times, one of the challenges has been global warming. Every living being on the earth is being affected due to Global warming. It gives rise to many problems like melting the icecaps, expanding ocean levels, evaporating water bodies, and increasing the average temperature. Deforestation is the primary factor of global warming. Deforestation has a significant impact on biodiversity in various ways. Afforestation is the only key to lessening global warming. Since the population of cities is more and the majority of those living in cities are too busy earning their lives, it is difficult for them to find more places as land is scarce and they have no time to do plantation. This manuscript aims at an IoT-based plant monitoring device for the healthy growth of the plant. The designed system mentioned here does the tasks like taking care of the plant and preventing environmental changes and other damage. An additional concept here is the usage of sentiment analysis, which communicates the state of the plant directly to the user's mobile phone so that the user may visit his field based on the necessity. This method can enhance the plantation process in cities, which increases greenery and helps in minimizing global warming.

Keywords- Internet of Things, Sensors, global warming, plant monitoring, deforestation.

1. INTRODUCTION

Global warming is a major challenge in recent times and can impact the human sector, animals, and agriculture. The rapid increase in the earth's average surface temperature is global warming. Temperatures have risen during the last century, owing mostly to the production of greenhouse gases [32]. Global warming causes depletion of the ozone layer [37], which impacts sudden changes in temperature and climate sensitivity. Loss of snow spread, expanding water pollution, and dissolving permafrost are only a few examples. Extreme weather events such as heatwaves, droughts, cyclones, blizzards, and rainstorms are becoming more common due to global warming, [33-35]. There are various factors behind global warming; Fig (1) summarized those discussions [32-36].
A. Challenges in Urban Greening

The forecasted figures indicate that the total population is relied upon to contact 8.6 billion in 2030, 9.8 billion out of 2050, and 11.2 billion of every 2100, an expansion of roughly 25% from the current figure by 2050 [38]. On the contrary side, the inclination of urbanization is determined to continue at a revived pace, with about 70% of the whole population. Kun Mean Houston anticipated that about 49% of the growing population may be increased in urban areas by 2050 [39]; as the population rises proportionally, land usage for residential industrial purposes increases. That most often causes deforestation, increase in pollution and greenhouse gases, particularly more quantity of Carbon dioxide (CO2) releases. The primary factor of global warming is the rising concentration of Atmospheric CO2 [40-42].

The current causes of global warming are the lack of evaporation surfaces and anthropogenic combustion processes. So far, there have been no solutions, and now we need to find out the solution for this issue. In urban areas, the vast majority of the land is secured by structures of different sorts. A solution arises from this rapid growth of buildings, and roofs can increase greening in urban areas. Green roofs would be a perfect substitution for complex roofs with titles or gravel to reduce heat islands [45]. The alternatives to mitigate the concentration of CO2 are the go green and plantation [5, 6]. Also, the air temperature can be reduced by increasing the green coverage ratio by vegetation [29-31].

B. Technological Solutions

The fast development of innovations in the twentieth century has permitted countless advances in horticulture, which is appropriate for rural and urban regions to lessen the Earth-wide temperature boost. The following are the solutions to reduce global warming by urban greening:

a) Productivity in farming
b) Reduce pollution
c) Efficient use of water, fertilizers
d) Remote monitoring
e) Good impact on the environment.
C. IoT in Agriculture Area

Internet of things (IoT) is a developing innovation used to interlink and communicate various devices [4]. The general mechanism of IoT is connected devices are associated with sensors, and sensors sense and acquire data as per the requirements and communicate the same over the Internet. IoT is essential and can apply to all areas. There are many IoT-based agriculture applications developed and available such that those are useful for intelligent farming in the direction of Urban Greening [3, 7]. The leading IoT applications in agribusiness are listed in Fig(2).

![Figure.2 Applications of IoT in agriculture](image)

Intelligent decision-making and automation are vital in agriculture [3]. The utilization of Information Communication (ICT) and Internet of things (IoT) philosophies in savvy agribusiness for checking farming items will bring about guaranteeing wellbeing and quality yields [43]. Urban greenery is very important because most of the population is available in cities, but they are busy livelihood. Now it is the moment to create an IoT-based plantation monitoring system.

D. Sentiment Analysis

Sentiment analysis is information mining that uses natural language processing (NLP), computational linguistics, and text analysis to remove and break down abstract data. This results in extracting the inner outlook, either positive or negative or neutral, and expressing emotions as emojis [46,47]. Sentiment analysis is used in Business applications, Predictions, Trend analysis, and support in decision-making [26]. The most frequently used sentiment analysis techniques are supervised learning-based, unsupervised learning-based, Semi-Supervised learning (SSL) based, and Lexicon-based approaches [28].

2. RELATED WORK

In agriculture, a lot of work has been done and is still being done using IoT. Various researchers concluded about smart agriculture and greenhouse development through the proper plantation.
Xiaojie Shi et al. summarized about board plants, counterfeit strategies to change climatic boundaries like temperature, to make natural conditions suitable for the development of creatures and plants [1].

Olakunle Elijah et al. concluded that the job of IoT and Data Analytics in agriculture is to improve operational proficiency and efficiency of plants and their difficulties [2].

Dušan Marković et al. assured how the physical objects such as different sensors and actuators are connected through the Internet for acquiring and analyzing the data [4].

Uferah Shafi et al. explained a dynamic IoT-based elegant solution for harvest health monitoring using precision agriculture also said about how to place sensors in the field to get accurate data [8].

Tran Anh Khoa et al. developed IoT based water monitoring system using cheap and exceptionally proficient segments, such as water level, soil moisture, temperature, humidity, and rain sensors. Further extended the system using mobile apps [9].

AAAA et al. built a structure for precision agriculture utilizing IoT Gateway to improve agriculture productivity – by connecting various sensors devices to make an intelligent system at their level best [10].

Dr. N. ANANTHI et al. implemented a system for the farmers to improve crop productivity by sensing field parameters and suggesting suitable crops through field manager via mobile communication [11].

Muhammad Shoaib Farooq et al. reviewed around 70 research papers. They stated various developments made by different researchers in agriculture based on IoT technologies to monitor the growth of the fields, quality, and quantity of crops by acquiring and controlling general parameters of areas [12].

Khalid Haseeb et al. constructed An IoT-based WSN skeleton for Smart Agriculture to gather the field data securely [13].

Carlos Cambra Baseca et al. Stated the cycle of smart forming data management and detailed the implementation of a smart decision support system [14].

Kodali et al. proposed a minimal effort framework to screen the agriculture farm developed using the Losant platform, which senses the moisture levels of the plants and informs the former when the groups are low[15].

R. Nageswara Rao et al. developed a Programmed water system using an IoT framework to adjust and refine the efficiency of the yield. Streamlining the usage of water for plant development is its primary goal. Humidity sensors and temperature sensors are used in the system [16].

Vaishali S et al. built IoT based automatic irrigation system to monitor the plantation in such a way to atomize water pumping [17].

Vimal P. V et al. developed IoT based control system for the farming fields. This uses GSM to send the present status of the earth boundaries to the client to control them by actuating the control activities [18].
Wei-Chieh Tai et al. proposed a wireless framework for observing and controlling the development of greenhouse. They additionally structured a website page as a human-machine interface for the clients and ranchers to watch and gain insight into the status of plant development [19].

Gudla Sateesh et al. built an IoT-based system for forest farming; the system senses environment parameters and detects the entry/presence of detrimental bodies from the fields such that automatic control actions are taken for the growth of the crop either by preventing or avoiding the damage[20].

Rahul Dagar et al. stated poly house cultivation based on IoT and concluded farmers' general problems [21]. G.Sushanth et al. proposed a GPS-based remote-controlled IoT vehicle for savvy cultivating that monitors the articles, for example, the flying creatures and creatures likewise from natural boundaries [22].

Manishkumar Dholu et al. suggested an IoT-based system for agriculture monitoring. It can gain and control the boundaries locally and communicate the same data to a thing-speak cloud further; the user can access that in the mobile phone [23]. Pallavi S et al. developed a system to sense and organize agriculture parameters to the greenhouse agriculture to expand the yield and offer organic farming [24].

Edwin Collado et al. Stated the review report on competent forming in Panama, about intelligence irrigation, monitoring system for nutrient levels, drone system, precision agriculture system, pollution control system and their advancements for further development of smart farming throughout the globe[25].

Sani Abba et al. designed IoT based smart irrigation system for pumping sufficient water from the reservoir to household farming. Also, the system communicates the acquired parameters via wifi[26].

Yixiong Wang et al. developed a plantation monitoring system to acquire data, transfer data, analyze the data such that users can get the data whenever and where required [27].

Motivation

Deforestation is the major problem leading to global warming. Though many systems were proposed and actions were taken, this problem isn't decreasing. Deforestation is mainly done for infrastructural development, timber extraction, mining, and other industrial purposes. Cutting trees and other vegetation can lead to environmental change, desertification, soil erosion, decreased agricultural productivity, unseasonal rainfalls, and more release of greenhouse gases. These all impact the health of humans. As the plantation is one of the sources to mitigate global warming, we considered how to improve overall plantation based on population. The majority of the population lives in cities and is too busy earning their living. So, it's difficult for them to find more places and time for plantation. This motivated us to build a system that makes plantations easy in urban areas.

3. PROPOSED SYSTEM & ITS METHODOLOGY

The proposed system we have designed is an IoT-based system to observe a plant's growth. This system functions by gathering the parameters such as soil moisture, temperature, presence of insects, pests, smoke, and detection of objects such as animals (rats, pigs, cattle, herd) or any non-living things. These data can be compared with the threshold values based on the nature of the agricultural estate. Further, we have included sentiment analysis based on supervised learning to express the emotions of the plant
by considering certain emojis. After analyzing the sensed data from the fields, a decision is taken, and a unique emoji is assigned for each kind of opinion. The obtained emoji notification is received on our mobile phones using this phenomenon. Further, appropriate action can be taken for plant growth.

Water is automatically pumped to the plant if the soil moisture measurement is below the threshold value. If any object is recognized, a control action is taken based on the kind of object. The temperature sensor senses the temperature, based on which we can decide what precautions are to be taken to protect the plant's growth. If an explosion is identified, water is sprinkled over the affected area.

Figure 3: System Architecture

The algorithm states the working of the system.

Step-1: Read environment parameters using sensors from the fields
Step-2: Compare each sensor reading with the respective threshold
   a) If soil moisture levels of the area are less than the threshold, then initiate water pumping
   b) If smoke sensor reading exceeds the threshold, then begin sprinkling of water
   c) If the ultrasonic sensor detects an object, it may either sound buzzer or starts sprinkling pesticide based on the object
Step-3: Use GSM to communicate emoji to the user Mobile
Step-4: Repeat the Steps 1 to 3.

Algorithm to map and communicate emoji

Step-1: Start sensing the environment parameters
Step-2: Comparing each sensor reading with a respective threshold to map the emoji
   a) If the soil moisture level is below the threshold, communicate emoji-1
   b) If there is a detection of an object, then communicate emoji-2
   c) If an explosion takes place, then share emoji-3
   d) If everything is OK, communicate emoji-4
Step-3: Repeat steps 2 and 3.

Emoji Mapping Table

<table>
<thead>
<tr>
<th>S.N o</th>
<th>Emoji</th>
<th>Action/ Emotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>: - #</td>
<td>Lack of humidity/moisture levels</td>
</tr>
<tr>
<td>2</td>
<td>: - O</td>
<td>Detection of an object – inserts, pets, rat, cat, cattle, etc.</td>
</tr>
<tr>
<td>3</td>
<td>: -!</td>
<td>Explosion takes place</td>
</tr>
<tr>
<td>4</td>
<td>: &gt; )</td>
<td>Everything is fine</td>
</tr>
</tbody>
</table>

Table-1. Emoji Mapping
Authenticated users will get notifications about the plant growth, based on which the person can take necessary steps towards the healthy development of the plant. It is rarely possible for anyone to take care of the plants every day in this busy life. So using this smart plantation in urban areas will increase the plantation and reduce global warming efficiently at a low cost.

Component Connection

Figure 6 Connecting Ultrasonic sensor

Figure 7 Connecting GSM module

Figure 8 Connecting Humidity Sensor
## Sensor Details Table

<table>
<thead>
<tr>
<th>Sensor</th>
<th>IC No.</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature sensor/ Humidity sensor</td>
<td>DHT 11</td>
<td>Temperature/Humidity sensor work by distinguishing changes that adjust electrical flows or temperature.</td>
<td>Senses measures and reports both moisture and temperature in the air.</td>
</tr>
<tr>
<td>Smoke sensor</td>
<td>MQ2</td>
<td>When smoke enters the chamber, it disturbs the progression of particles, diminishing the advancement of current and activating the alarm.</td>
<td>Senses smoke, typically as an indicator of fire.</td>
</tr>
<tr>
<td>Soil sensor</td>
<td>FC 28</td>
<td>They are used to measure the water substance inside the soil.</td>
<td>Senses moisture level in the ground.</td>
</tr>
<tr>
<td>GSM Module</td>
<td>SIM 800A</td>
<td>A GSM digitizes and reduces the data and sends it down through a channel with two distinct streams of client data.</td>
<td>Either a mobile phone or modem device can establish communication between devices.</td>
</tr>
<tr>
<td>Touch Sensor</td>
<td>TTP223</td>
<td>A touch sensor works when an object or individual comes closer to it.</td>
<td>A touch sensor is an electronic sensor utilized in recognizing and recording physical touch.</td>
</tr>
</tbody>
</table>

Table 2: Sensor Details Table

### 4. RESULTS

![Fig.9 The working of the system](image1)

![Fig.10 Emoji displayed on board.](image2)
Figure .11: Emoji communicated to user mobile

Comparative Study of Traditional Method & IOT Based Method

<table>
<thead>
<tr>
<th></th>
<th>Traditional Method</th>
<th>IoT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Old</td>
<td>Emerging Technology</td>
</tr>
<tr>
<td>Workforce</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Cost</td>
<td>Expensive</td>
<td>Low cost</td>
</tr>
<tr>
<td>Time</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Precision</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Ease of Use</td>
<td>--</td>
<td>Easy to Use</td>
</tr>
<tr>
<td>Scalability</td>
<td>--</td>
<td>Scalable</td>
</tr>
</tbody>
</table>

5. CONCLUSION

A plant monitoring system using IoT is designed to sense soil moisture level, temperature, fire and detect the presence of objects such as insects, pests, rats, herds, and cattle from the environment. The analysis carries out to control the plantation by pumping or sprinkling water, spraying pesticides, and taking precautions to stop the entry of insects and animals into the agricultural fields. Further, from the inspection of the acquired information, using sentiment analysis, the system communicates the plant's feelings through emoji through the mobiles. So that the user can visit the field based on the necessity. This intensifies the advancement in plantation development, particularly in urban areas, to improve the greenery despite the busy schedules of the city population and scarcity of lands. Hence, this system contributes to afforestation in the urban areas wherever and whenever possible to reduce overall global warming.

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Internet of Things based Automated Agricultural Irrigation Control System

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Abstract: With the progression of automation, life is getting smooth and facile in all facets. In the moment's world, Automatic setup is chosen over manual labor setup. The mechanical design is a booming system of the ordinary thing from industrial machines to consumer goods that can carry through the tasks while engaged with other works. Indian country population is compassed beyond 1.2 billion. The population rate is adding day by day also the next 30-40 years, and there will be a severe scarcity of food, so the development of cultivation is needed. Moment, the cultivators are suffering from the deficit of rain and water. The initial idea of this paper is to give IOT Based Automated Agricultural Irrigation Control System, thereby saving time, power & money for the agronomist. Conventional cropland irrigation requires manual intervention with automation. It can be diminished whenever there is an alteration in the temperature and moisture of the surroundings. These sensors sense the modifications in temperature and humidity and give an interrupt signal to the microcontroller.

Keywords: Soil Moisture, Temperature Sensor, Wireless Sensor networks, ESP 32 module, Arduino Uno.

1 INTRODUCTION

India is a village-based country, and agriculture plays a significant part in the country's development. Agriculture in our country is reliant on showers with insufficient water supplies. As a result, irrigation is used in agricultural areas. The irrigation system delivers water to the plants based on the soil type. In agriculture, two impacts are significant: the first is obtaining information on soil fertility, and the second is measuring the moisture content of the air. Numerous irrigation systems are currently being used to reduce the need for rain, and the trend is being driven by electrical power and an on-off schedule. This method places temperature and moisture sensors near the plant and the module. The gateway unit interprets the sensor data and transmits it to the controller, which controls the water intake via the pump. Temperature and moisture sensors are put near the plant and the module in this manner, and the gateway unit processes the sensor data and feeds it to the controller, which controls the water flow through the pump.
1.1 Motivation

It is critical to rapidly improve food technology products to meet the growing demand for food and the resulting decrease in supply. Agriculture is the only means of obtaining this. This is a critical component of rising and dynamic food demand for human societies. Agriculture plays a significant part in developing countries like India. Planters employ irrigation because of a lack of water and a land-water deficit that affects the declining volume of water on the planet [10]. Irrigation can be defined as the science of artificially applying water to land or soil, which means plants must be fed with water based on the soil type.

1.2 IOT In Smart Farming

Smart farming is a modern farming management concept that uses IoT technologies to boost agricultural efficiency. Planters can effectively use fertilizers and other resources to increase the quality and amount of their crops by using smart farming [6]. Agronomists are unable to work in the field 24 hours a day. Also, an agronomist may not be familiar with the various instruments available for measuring the appropriate environmental conditions for their crops [12]. IoT offers them an automated system that may work without human supervision and can alert them to take appropriate action in response to various types of challenges they may encounter while farming [5]. Even if the farmer is not on the farm, it can contact and notify him, allowing agronomists to manage more cropland, thus improving their production [13].

2. Literature Survey

2.1. WSN and ESP 32 Module-based Automated Irrigation System

If the moisture and temperature of the landfall are below a certain point, Irrigation is automatically turned on. Along with watering, light intensity management in glasshouses can be automated. The announcements are sent to agriculturalists' mobile phones regularly. Agronomists can effectively monitor field conditions from any location [15]. This approach will be more useful in areas where water is scarce [9]. This system outperforms the traditional method by 92 percent. They devised a sensor-based plan for crop monitoring [8]. The utilization of wireless sensor data transfer from the field and storage in a database and control via mobile operation provided proof of concept for automated irrigation.

2.2. Crop Monitoring System based on WSN

Balaji Banu [1] devised a wireless sensor network for monitoring farming conditions and calculating crop production and quality. Sensors detect diverse terrain conditions, including water locations, humidity, temperature, etc. The system is designed with analog to digital conversion and wireless sensor nodes with wireless transceiver modules based on the Zig-bee protocol [4]. Data is retrieved and stored using databases and mobile applications.

3. Irrigation Control System Function

User Interface: The user interface helps the user interact with the system by conveying information to the regulator and providing the user with system information. Usually, it is a computer or a smartphone.

Controlled Devices: Controlled devices comprise a wide range of equipment that this Arduino Uno and sensor is capable of. Computer Programming: Some system controllers have a user interface that allows the user to program the system. Another approach necessitates the use of a computer to program. Then we use a computer to access the Arduino IDE.

Controllers: In automatic irrigation control, relay controllers provide intelligent control operations.

Sensing Devices: Sensing devices can report values or states, such as temperature and humidity.
I/O Interface Devices: These devices give the logical communication link between the controllers and the controlled device systems.

4. Benefits of Automatic Irrigation Control

Prevents Disease and Weeds: Specialized drip irrigation systems distribute water exactly to each plant's root ball rather than spraying the entire garden like a regular rainfall. As a result, surrounding weed seeds cannot develop, reducing the weeding required. Standing droplets on the foliage produce leaf diseases prevented by water at the roots. Blight diseases cannot spread because the water does not strike the leaves or blossoms. Conserve Water and Time: Watering by hand or with a hose takes time, and early morning and evening watering routines take time away from family and work. Both drip and sprinkler irrigation systems feature timers that can be set for daily and weekly watering, so you do not have to keep track of how much water is being used because the timer shuts off the water when it has done. Your water cost should be lower if the irrigation system is successful. Preserves Soil Structure and Nutrient: Watering with a wide-open garden hose may allow too much water to infiltrate into the soil, compromising soil structure and nutrients. As a result, nutrients leak off with the water runoff, leaving fewer nutrients accessible to the plants. When you rinse with a hose, the soil may also become compacted. With suffocating compacted soil, plants may show withering or root disease. Smaller droplets are produced by drip or sprinkler watering, which helps maintain nutrients and reduce soil compaction.

Gardening Flexibility: Working in the garden while the plants are being watered will come in handy if you have a busy schedule. You can plant and prune in one garden patch while another is flooded.

5. Proposed System

Sensors, microcontrollers, Bluetooth, and Android applications can all be used to automate irrigation [1]. We employed a low-cost soil moisture sensor and a temperature and humidity sensor. They keep a constant eye on the field. An Arduino board [7] is used to connect the sensors. The sensor data obtained is delivered via wireless transmission to the user, allowing him to control irrigation. The data obtained by the mobile operators can be dissected and compared to the moisture, humidity, and temperature threshold values. The choice can be made automatically or manually with user intervention. The motor is turned on if the soil moisture is less than the threshold value, and it is turned off if the soil moisture is greater than the threshold value. The Arduino Uno board is attached to the sensors. This gadget connects via Bluetooth wireless transmission, allowing the user to obtain the data via his Android phone, receiving sensor data from the Arduino via Bluetooth [2]. In terms of gadget cost, Bluetooth technology is employed, which can be replaced by a Wi-Fi motor.

5.1 Flow Chart of The System

Data Transferring:
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6. Working of the System

An Arduino-Uno board's analogous pins link the soil moisture sensor and temperature sensor [5]. A USB cable connected to a computer or an Arduino board's adaptor provides 5 volts of electricity. A solar panel is used to continuously charge the battery during the day to provide electricity to the 12v battery, which will be charged until nightfall. When the user can operate the engine after sunset, the delegated power should be drained continually. We can save money on electricity by employing this solar panel. The Wi-Fi module is initialized and then waits for the network to connect. Adaptor [3] is used to provide 12v power to the Wi-Fi module. An Arduino Uno board's analogous pins are linked to the soil moisture and temperature sensors [5]. A 5v power supply is generated through a USB connection connected to a computer or an Arduino board's adaptor. During the day, a solar panel is utilized to charge the battery and deliver electricity to the 12v battery; it will be set constantly until sunset.

The delegated power should be discharged continually when operating the motor after sunset. We may optimize electricity utilization by employing this solar panel. The Wi-Fi module is initialized and then waits to connect to the network. The Wi-Fi module receives 12v power via adaptor [3].

Fig-2: Working of the System

PROPOSED SYSTEM HARDWARE AND ARCHITECTURE

Components used in the proposed product

<table>
<thead>
<tr>
<th>S No.</th>
<th>Name Of Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arduino_UNO</td>
</tr>
<tr>
<td>2</td>
<td>DHT11 Temperature and Humidity Sensor</td>
</tr>
<tr>
<td>3</td>
<td>Electric DC_Motor</td>
</tr>
<tr>
<td>4</td>
<td>Relay_Module</td>
</tr>
<tr>
<td>5</td>
<td>One_k_Resistor</td>
</tr>
<tr>
<td>6</td>
<td>Power Supply cord for Arduino</td>
</tr>
<tr>
<td>7</td>
<td>Female_Headers</td>
</tr>
<tr>
<td>8</td>
<td>Male_Headers</td>
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<td>11</td>
<td>ESP32_sensor</td>
</tr>
<tr>
<td>12</td>
<td>FC 28_SENSOR</td>
</tr>
</tbody>
</table>

Table-1: Components used in the proposed product
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Work to work on the association between humans and machines. For the most part, face appearances are regular and direct means for individuals to convey their feelings and expectations. Face looks are the critical attributes of non-verbal correspondence. Feeling Recognition is a significant area of work to work on the association between humans and machines. The intricacy of feeling makes the obtaining task more troublesome. Quondam works are proposed to catch feeling through unimodal systems like looks or vocal info. All the more, as of late, the origin of the possibility of multimodal feeling acknowledgment has expanded the exact pace of the discovery of the machine[8]. Besides, profound learning procedures with neural organizations broadened the achievement proportion of devices regarding feeling acknowledgment[9]. Late works with deep learning strategies have been performed with various types of the contribution of human conduct, for example, general media inputs, looks, body motions, EEG flags, and related brainwaves[10]. Still, numerous viewpoints around here to improve and make a robust framework will recognize and order feelings all the more precisely.

Detection And Characterization of Emotions Using Facial Features

7. RESULTS:

- Print Settings of the Valve:

Fig-3: Circuit of the Prototype

Fig-4: Print Settings of the Valve
When the humidity is less than 80%, and the timer is set, the valve opens:

![Image](image1.png)

Fig-5: The valve opens when the humidity is less than 80%, and the timer is set,

When humidity is more than 80%

![Image](image2.png)

Fig-6: When humidity is more than 80%

8. Conclusion

The automatic irrigation control using an Arduino Uno has been experimentally proven to work satisfactorily, and we were able to establish the timekeeper and control the motor over time. This method not only captures temperature and humidity measurements; but also prevents the engine as a result. Analyzing the atmospheric state, the motor will sustain water delivery automatically, allowing for the maintenance of greenery without human involvement.

9. Future Work

Using this system as a framework, the system may be modified to include various other features, such as motor control through a mobile application and WiFi-controlled monitoring. These will improve the prototype's functioning capabilities and effectiveness. Using the sprinkler concept; may be implemented not just in agriculture but also in lawns and gardens in any location. When combined with robotics, it has the considerable potential [11]. This will give automation a new level.

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Amalgam enhanced to Computer Vision - Deep Learning and Internet of Things for Aerial View Cultivating Monitoring

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Abstract: In the two or multi-decade, the prospect of associating existing processing gadgets has delivered another idea called "Interfacing Things." In light of the advances in data assortment innovation in sensors, like installed gadgets, universal and RFID innovation has driven an enormous number of devices associated in the network which are reliably sending their information throughout the time. This information acquired is precious to numerous undertakings, so there is a need for a secure mass stockpiling framework for this information. The developing utilization of Interfacing Things IoT gadgets associations has expanded the number of assault vectors accessible to attackers because of the less secure nature of the gadgets. The broadly embraced bring your gadget (BYOG) strategy permits a representative to get any Interfacing Things device into the work station and connect it to a private network, chances of increasing the high level of attacks. In this paper, We have made an itemized concentrate on the new advancements in customized medical care and cultivating systems with the concentration towards DL and IoT, Cloud computing, and FC-based applications. Features different boosting and well-being industry issues can be settled utilizing the synergistic application of DL and IoT. Past work finished with these innovations is examined. Also, we have introduced a plan to converge with DL and the IoT, an explicit spotlight on the total cycle of applying Deep Learning in areas like farming and so forth information to make expectations for applications. Here we reflect the quickly developing requirements of the better-cultivating frameworks and give conceivable future work guidelines.

Keywords: Computer Vision, Deep learning, IOT

1 INTRODUCTION

The Interfacing Things (IoT) is administering different areas these days. It has ventured into houses and businesses with other applications. It's anything but an exemption that IoT has likewise gone into the cultivating room. IoT has offered an enormous degree of advantages in brilliant agribusiness by presenting associated gadgets. Cultivating includes different tasks among plowing and yielding harvests. It includes watering the fields at good stretches, estimating the climate boundaries, checking the dirt dampness, and so on. These activities are mechanized with sensors to quantify the various limitations unequivocally.
ranchers can notice the field conditions from wherever. It is exceptionally proficient contrasted with the conventional methodology. IoT in savvy cultivating empowers decrease of waste and increment usefulness.

Food security is a huge issue that will become more essential in the following a long time because of the expected addition of the complete total populace and the developing government assistance in arising economies. Meanwhile, it is generally contended that we have surpassed the conveying limit of planet earth with the current method of agricultural creation. Globalization, environmental change, a shift from a fuel-based towards a bio-based economy, and contending claims ashore, new water, and work will convolute the test to take care of the world minus any additional contamination or asset consumption. It is expected that the Internet of Things (IoT), where everything' is particularly recognizable, furnished with sensors and associated constant to the web, could contribute altogether to address these difficulties through:

a). Better detecting and observing of creation, including ranch asset use, crop advancement, animal conduct, and food handling;

b). A better comprehension of the particular cultivating conditions, like climate and ecological conditions, the rise of nuisances, weeds, and sicknesses;

2 Ingenious Cultivation

The IoT design proposed in [29], and displayed in Fig, endows four layers, thinking about fundamental parts of an Interfacing Things arrangement: gadgets, organization, administrations, and application. The insight layer connects with the actual devices in the collection and how they cooperate with the vehicle layer. These gadgets are answerable for gathering information, empowering the supposed "things" correspondence. This should be possible by utilizing business arrangements—such as UAV gadgets [30], sensor hubs —or new gadgets, created with parts like sensing element also SBC—like Arduino is microcontroller while Raspberry Pi is a microprocessor-based minicomputer—to assemble perceiving element hubs and correspondence passages. Sensor hubs, for instance, are utilized to screen plant infections [31] supremacy ecological factors in the nurseries, and outer harvests [32-35], among others. The connection between the gadgets that have a place with the discernment layer and the administrations that has a place to handling layer is middleware by the vehicle layer and may happen in more ways than one, for example, through the immediate correspondence between sensor hubs and an information handling stage (for example, FIWARE [36], Smart Farm Net [36]) or a passage that, other than intermediating the correspondence between sensor hubs and the web, goes about as an information center and empowers the correspondence between network conventions that are initially contrary, like ZigBee what's more the Internet. Correspondence between network conventions that are initially incongruent, like ZigBee, what's more, the Internet.

Fig. 1. Interfacing Things solution architecture that includes four layers: perception, transport, processing, and application
3 IoT in Agriculture

In different genuine applications, IoT is reaching out. IoT enormously influences smoothing out the creation in the horticultural area. In shrewd horticulture, we develop a system using sensors like soil dampness sensor, water level sensor, gum-based paint ture sensor for observing the farming movement like harvest and plant checking, water system checking notwithstanding others. In like manner, the horticultural field can be monitored by ranchers from wherever consistently. IoT-based savvy cultivating is very productive when it appeared differently concerning the customary developing methods like Planting.

Fig. 2. IoT Agriculture Architecture

manual plowing, and harvesting (Verma and Usman 2016). various utilizations of IoT-based agribusiness are displayed in Fig. Brilliant farming is one of IoT's arising regions. The volume of information created by the sensor persistently produces enormous amounts of organized, unstructured, or semi-organized information. This gigantic information brings out vast data, which is an immense amount gathered from different sources like business, sensors, and person-to-person communication-related colossal transmission. The preeminent difficulties experienced in IoT are recording, storing, dissecting, and searching the data. The information investigation process in IoT is displayed in Fig.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Irrigation problems</td>
<td>Proper water administration is vital as cultivating polishes off 70% of new water worldwide (Projectguru n.d.)</td>
</tr>
<tr>
<td></td>
<td>Astute water the executive’s framework ought to be utilized (Muangprathub et al. 2019)</td>
</tr>
<tr>
<td>Lack of soil knowledge</td>
<td>Because of fluctuating atmospheric conditions, the dirt construction changes consistently, and ranchers generally face issues in recognizing the dirt for their harvest (Mohanraj et al. 2016)</td>
</tr>
</tbody>
</table>
Disease Detection problems in Plant

Opportune Detection of sickness in leaves of the plant (Thorat et al. 2017) is vital, yet there might be a delay in the discovery of plant illness on the perfect opportunity, so programmed recognition is required (International Atomic Energy Agency 1998).

Logistics Management Problem

The productivity of the inventory network can be improved with the help of area-based sensors, showing upgrades in straightforwardness and client understanding (Razzak et al., 2018).

Nutrient’s deficiency detection

Assessment of supplement requests in soil and plant with the help of IoT gadgets ought to be done productively (Sundmaeker et al. 2016).

Fig. 3. Future of IOT Farming

4 The IoT-Based Smart Farming Cycle

The focal point of IoT is the data you can draw from things and send over the web. To upgrade the developing framework, IoT devices presented on a farm should assemble and deal with data in a tedious cycle that enables farmers to answer emerging issues and changes in encompassing circumstances quickly. Adroit development follows a process like this one:

- **Observation**: Sensing element records observational data from the harvests, domesticated varmint, soil, or environment.
- **Diagnostics**: The sensing element esteems are taken care of to a cloud-facilitated Interfacing Things stage with predefined optional standards and models-additionally called "commercial rationale"- that discover the state of the analytical item and recognize any lacks or needs.
- **Decisions**: After the point at issues are uncovered, the client and additionally AI-driven parts of the Interfacing Things stage decide if explicit area treatment is essential & assuming this is the case, which.
- **Action**: After end-user assessment and activity, the cycle re-hashes all along.
5 IoT Solutions to Agricultural Problems

Many accept that Interfacing Things can increase the value of all cultivating areas, from developing harvests to ranger service. While there are multiple ways that IoT can work on growing, two of the significant ways IoT can upset agribusiness are accuracy growing and cultivating robotization.

- **Accuracy Farming**

  Exactness developing, or exactness agribusiness, is an umbrella thought for IoT-based procedures that make developing more controlled and exact. In short words, plants and dairy steers look unequivocally for the treatment, not permanently set up by machines with divine precision. The best differentiation from the conventional methodology is exactness developing licenses decisions per square meter or even per plant/animal rather than the field.

  By unequivocally assessing assortments inside a field, farmers can help the suitability of pesticides and composts or use them explicitly.

- **Accuracy Livestock Farming**

  Like the occurrence of precision agriculture, canny developing systems engage farmers better to screen the necessities of individual animals and change their food similarly, hindering disease and updating swarm prosperity. Gigantic residence owners can use far-off Interfacing Things applications to filter their cows' region, flourishing, and adequacy. With this information, they can perceive cleared out animals, so they can be disengaged from the gathering to thwart the spread of disorder.

**Computerization in Smart Greenhouses**

Conventional nurseries control the natural boundaries through manual intercession or a corresponding control component, which regularly brings about creation misfortune, energy misfortune, and expanded work cost.

IoT-driven shrewd nurseries can insightfully screen just as controlling the environment, taking out manual mediation requirements. Different sensors are sent to quantify the natural boundaries as per the particular necessities of the harvest. With insignificant manual mediation, that information is put away in a cloud-based stage for additional handling and control.

- **Horticultural Drones**

  Horticulture is one of the significant verticals joining ground-based & elevated robots to evaluate crop well-being, water supply, crop observing, crop showering, Planting, soil & field investigation, and different circles.

Since drones bring together multispectral, warm and visual symbolism while flying, the information they accumulate furnish ranchers with experiences into an entire exhibit of measurements: plant well-being records, plant counting and yield expectation, plant tallness estimation, shelter cover planning, field water lake planning, exploring reports, reserve estimating, chlorophyll estimation, nitrogen content in wheat, waste planning, weed pressure planning, etc.

Critically, IoT-based brilliant cultivating doesn't just enormous objective scope cultivating tasks; it can increase the value of arising patterns in agribusiness like natural growing, family growing, including rearing specific steers and additionally developing explicit societies, safeguarding of distinctive or great assortments, and improving profoundly straightforward growing to shoppers, community and market cognizance.
6 Recent Developments

- In March 2021, Deere & Company launched an updated version of Exact Rate. This on-planter system fertilizes new crops twice the previous speed and reduces the number of refills needed for fertilizer tanks during planting.
- In February 2021, DeLaval introduced RC550 & RC700 to its portfolio of robots. These robots were designed for solid floors to improve cow comfort and hoof condition. With their unique rotary manure intake system, the collector can handle any manure, and additional water need not be added.
- In February 2021, DeLaval acquainted RC550 and RC700 with its arrangement of robots. These robots were intended for strong floors to further develop cow solace and foot condition. With their exceptional revolving fertilizer consumption framework, the authority can take care of any compost, and extra water need not be added.
- In January 2021, Raven Industries presented its first driverless horticulture technology for collecting activities. It assists ranchers with observing driverless vehicles by setting field plans, changing velocities, and checking area exercises.
- In December 2020, Trimble Inc. had gained Midstates VRS, an organization that Butler Machinery and Frontier Precision recently claimed. This obtaining in-wrinkles the impression of Trimble’s VRS Now® GNSS associations. Trimble VRS covers more than 1 million square miles in North America with this AIR CONDITIONER QUESTION. This securing is ideal for giving an elite exhibition GNSS answer for precision horticulture.
- In November 2020, Innovasea Systems presented the littlest V3 acoustic telemetry transmitters in its industry-driving setup of fish following labels. It empowers analysts to concentrate on both more modest types of fish and more giant species that are at prior phases of their lifecycle.
- In November 2020, the AKVA bunch went into a concurrence with Nordic Aqua Ningbo to convey a total RAS office outside Shanghai. The task has an arranged creation volume of 8,000 tons in 2026.
- In September 2020, Deere and Company obtained Unimil (Brazil), a Brazilian supportive video of reseller’s exchange parts to sugarcane gatherers. Through this procurement, the organization made interests in the Brazilian market, which will help clients in Brazil to decrease their sugarcane creation costs. This obtaining would likewise allow Deere to offer clients an extended arrangement of parts with savvy answers.
- In July 2020, DeLaval obtained milkrite|InterPuls (UK), a draining point solution supplier to dairy ranchers, to improve its portfolio. Milkrite|InterPuls would continue working as an independent organization after the procurement.
- In June 2020, Merck Animal Health, the parent organization of Allflex, gained Quantified Ag (US). Evaluated Ag is the leading information and examination organization in checking creature well-being. This procurement will offer both organizations’ corresponding results to ranchers, giving ongoing data to ranchers.
- In January 2020, AKVA bunch gained Newfoundland Aqua Service Ltd (NAS), the leading provider of fish cultivating administrations in Newfoundland and Labrador. NAS fabricates fish confines, moors, boats and barges, and nets and offers a full scope of administrations remembering for land net washing and sterilization, net assembling, test-ing, patching/fix, and antifoulant treatment. The company intends to fortify its geographic presence around here through this obtaining.
- In August 2019, AKVA bunch finished its model of a completely electric Polarcir-keelboat, outfitted with a battery pack of 100 kWh with the limit of 1-hour activity, and can be charged shortly. The item is appropriate for the hydroponics business. The organization will market the Polarcirkel boat in 2020.
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- In August 2019, Topcon Agriculture banded together with IBM to foster programming for horticulture that incorporates the utilization of computerized reasoning and carries advancement to every one of the periods of the cultivating cycle.
- In March 2019, Steinsvik was picked as a reconciliation supplier for FishGLOBE and a drifting shut confines framework created by Norwegian business visionary Arne Berge for a shut enclosure hydroponics framework. FishGLOBE will convey the primary enclosure to a client in Norway. It will be outfitted with taking care of the system, information securing, and distant activities abilities from Steinsvik.

7 Conclusion

This paper concentrated on the Amalgam Approach to Computer Vision in Deep Learning, and IoT Approached for Aerial View Cultivating Monitoring and presented the literature survey to predict Cultivating Monitoring. The IoT solutions & techniques discussed are Accuracy Farming, Accuracy Livestock Farming, Computerization in Smart Greenhouses, Horticultural Drones. These are helpful to solve problems in agriculture. But to analyze the data, feature extraction plays an important role. So, we used an IoT Novel approach to implement the Amalgam approach Aerial View Cultivating Monitoring. This will give more efficient and helpful information to predict climatic conditions using Data Analytics; we can expect Cultivating. Finally, we can say that the prediction of Climatic conditions, Stock management, Live Monitoring is still under development, and we have to improve the accuracy of the prediction rate.

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