RESEARCH ARTICLE   **OPEN ACCESS**

Research Review in IOT Based Smart Tractor for Field Monitoring and Ploughing.

S. Tharik Ahamed*, T. Vishnu, M. Arun Avinash, M. Gopi,
A. Ranjith Raj, S. Paramaguru, P. Jothi Palavesam, R. Rekha, N. Baskar
Department of Mechanical Engineering, Saranathan College of Engineering,
Tiruchirappalli, Tamil Nadu, India.

ABSTRACT:
Internet of Things (IOT) is a terminology that describes the interconnections of daily life routine through internet. In IOT concept, device and object is connected to each other. The rapid growth of this technology which moved the industry from statistical to quantitative approaches. IOT is also used for smart agriculture. We integrate IOT with smart tractor. It makes the entire system smart. Smart tractor is an autonomous vehicle which is the integration of electronic components. It performs the work efficiently, smartly control, ensures the safe agriculture and suitable for human being. Now, due to increase in population, demands are also increasing. It is essential to implement the smart tractor in the field of agriculture to obtain a maximum output for farmers. We use smart tractor for sensing the soil colour and perform the ploughing process. Here, plough tool will be used for ploughing. It is a fully autonomous vehicle thereby several actions are executed automatically by voice commands. Activities are controlled by Personal Computer (PC) or mobile phone associated with internet facility and the operation will be performed by electronic components such as colour sensor, nodemcu, servomotors. These adjustments in farming are shaking the current agrarian strategies and making new chances along a scope of difficulties.
Keywords: Smart Agriculture, Autonomous Vehicle, Internet of Things.

I. INTRODUCTION

Recent times, IOT influences most of the industrial fields in India. All human being are depart towards a smart world. In 20th century, Internet of Things (IOT) is widely used technology which are very useful in our daily life. We create our own idea and implement it by using IOT. It is present and future of impacting our life by intelligence. It allows an agriculture in arable farming to create an impact in our environment. It gives detailed description of the current situation in agriculture. The role of IOT in agriculture is the outline of different technique, capabilities and applications. It focus on the usage of communication technology and official procedure. It carry out the main challenges by IOT in agriculture.

Smart agriculture refers to introduce the artificial intelligence, robots, automatic monitoring, sensing and control in farmland. It is the main consideration and emerging subject for every nation. It is necessary to implement of automation in agriculture because industry 4.0 is fully based on automation. Digital agriculture is an another term which is using computer system to calculate the value of prediction, detection, quality and more

parameters. This paper aims to apply the knowledge of Internet of Things (IOT) in agriculture field. We describe the details of IOT technology, protocols used in agriculture; challenges, opportunities and benefits of automation in agricultural field.

II. LITERATURE REVIEW:

The implementation of autonomous smart tractor in terrain have many unique features based on IOT Technology. There is a greater demand for Automatic tractor with IOT. Most of the researchers have concentrated on the development of smart tractor in order to reduce the manual work and enhancing the tractor performance is listed below.

A. SMART TRACTOR:

Ali Roshanianfard (2020) illustrated that Smart tractor robot will play a significant role in future sustainable agriculture. The four types of transporter system in tractors are wheel-type, half-crawler type, crawler-type and robotic leg. Wheel typed vehicle is commonly used in agriculture. It is easy to design and implement, lightweight and it provides good vehicle speed. Operation functions of tractor are forward and backward movement, rotary speed of wheel. Punam K. Jadhav (2019) addressed

an implementation of smart tractor is the emerging technology in agriculture. This autonomous vehicle in the farming process is saving the energy and time required for performing farming tasks and increase the quality and production of yield by smart farming concept.

Ashish Malik (2020) studied electric tractors is the alternative solution to polluting engine based tractors. Smart tractor is purely an electric tractor. It does not depend on engines and fuel based material like lignite, coal, uranium, etc. It does not pollute the air. He is studied about the challenges and benefits of electric tractor in current scenario. Shivani S. Deshmukh (2019) conducted a survey about Autonomous Vehicle in agricultural sector. Here, nodemcu is an open source IoT platform which runs on ESP8266 WiFi system on a chip. It plays a vital role in the smart tractor. It is used to control the gesture of vehicle will be coded by using a Arduino software. Blynk app is installed in mobile and it is used for all operations like forward, backward, left and right movements through this app. The mobile and nodemcu is connected with the help of Wi-Fi network. electromagnetic relay switch is connected into nodemcu when the user give a action like on (or) off mode, depends on work will held on smart tractor. The rotary speed of wheel is achieved by DC motor. It is used to convert direct current electrical into mechanical energy.

G. Vijayakumar (2020) demonstrated the development on automation and intelligence of agricultural machinery is increasing. Smart tractor performs basic operations like ploughing, seeding, harvesting, planting, etc. The purpose of this vehicle is to do the all functions automatically. Nidhi Agarwal (2016) studied the smart tractors are multi-functional system elements. This autonomous system in agriculture helps the people to initiate efficient agricultural system. Various aspects of this vehicle performs better than manual system. Darshan. M (2020) developed a smart vehicle using microcontroller which reduces the effort of farmers. Solar energy is required to drive this vehicle. It can be successfully implemented in a real time system with modifications. This design is made for multipurpose use for the farmers in a single machine.

Luis Emmi (2014) studied about fully autonomous vehicle. Initially, the each individual subsystems of components are merged into single autonomous vehicle like robot unit. This vehicle is easier and more efficient. The efficiency and safety is also considered while designing the entire autonomous vehicle. Redmond Ramin Shamshiri (2018) illustrated the concepts of smart tractor in digital farming. Sensors are integrated with tractor to obtain a desired performance. Prerana.N.Khairnar

(2019) explained a smart tractor is a vehicle that can be programmed and reprogrammed to do certain tasks which is assigned to it and described about the goal of creating an automatic vehicle in agriculture where all the works will be done by it. Noboru Noguchi (2020) demonstrated a review on autonomous agricultural vehicle and convey the characteristics, developments and performance qualification of vehicle.

B. SENSORS:

Sanika Ratnaparki (2020) addressed the main goal of the sensors is to determine the physical properties of the soil and surroundings. It is a subsystem to detect events or changes in its environment and send the information to control unit. There are different types of sensors used in agricultural field. Achilles D. Boursianis (2020) performed a survey of the research on IoT sensor types and intelligent sensors applied in agriculture. He provided a brief overview of sensors types and network used in farming. Types of sensors are soil water content sensor, soil moisture content sensor, soil electrical conductivity sensor, pH sensor, colour sensor, temperature sensor, optical sensor, mechanical sensors used in agricultural fields. These sensors are equipped with wireless chip so that they can be remotely control. They are cheaper, simple and easy to install. They are used in agricultural weather stations and provide information such as soil temperature at various depths, air temperature, rainfall, leaf witness, chlorophyll, wind direction, solar radiation, relative humidity, atmospheric pressure, etc.

Rithula Thakur (2016) illustrated a study of dispensing out the solid and liquid at a particular rate and interval with the help of ultrasonic, orientation and soil moisture sensor. Ritika Srivastava (2020) explained about the implementation of soil moisture and water level sensor in agriculture. Soil moisture sensor is used to test the moisture content in the soil and water level sensor monitors the water level in the water tank or bore well, etc., plays a vital role in agriculture. Abdul Rasheeque (2017) addressed an use of wireless sensor in smart agriculture. He considered a certain features while choose a sensor. They are accuracy, range, cost, resolution, repeatability and environmental conditions. Abdellah Chehri (2020) stated that sensor data are collected, aggregated, filtered and classified, can be applied in algorithm to predict, detect and analysis of view.

Kazunobu Ishii (2020) illustrated a variation in sensors such as positioning sensors, attitude sensors and safety sensors. There are many classification of sensors is based on sensor

parameters which can be internal and external parameters.

Chen Jin (2020) studied about the characteristics of soil in agriculture. He found soil bulk density, soil aggregate, root length density, grain density as a results. Sensor sense the soil depends upon its characteristics. K.Vijayalakshmi (2020) used ultrasonic sensors to detect an obstacle. It works with the help of waveforms. The movement of vehicle stops due to obstacle detection. Suvaid Khan (2020) demonstrated a different applications of sensors in area like livestock maintenance, greenhouse farming, transportation, storage, etc. It provides more accurate data with low percentage of error. Smart agriculture sensors in IoT will create employment opportunities.

C. PLOUGHING:

In the field of agriculture, ploughing is the process of loosening and turning the soil. Ploughing were customarily drawn by bulls or ponies, however in present day ranches are drawn by farm vehicles. Use of the traditional plough has decreased in many areas threatened by soil damage and erosion. Dastgir Ganagapur (2020) studied about ploughing mechanism in farming. Plough arm made of screws drops down and plows the dirt and it is lifted up after the execution of ploughing. Plough tool is design in order to accomplish this cycle. The plan and construction of plough tool relies upon different limitations such as sort of soil to be ploughed and the profundity required dependent on the kind of harvest. We have design the plough tool using Creo Parametric software. The plan and measurements of the furrow instrument are as per the size of the bots. The point of tendency and length of the instrument are aligned by considering the profundity needed for furrowing the dirt and it fluctuates with the kind of harvests and soil. The tool is operated by using servomotor. The underlying and last places of the plough tool are constrained by coding it in a necessary way.

I.P.Troyanovskaya (2017) stated that ploughing is the most power and cost based operation. Smart Ploughing system produces homogenous work output over the whole plot. It meets the growing demands in precision agriculture. The main advantages are greater working comfort, time savings and more profit. C.H.Pujitha (2020) identified the essential objective of ploughing. When the smart tractor follows the path simultaneously it has to do ploughing the soil with the plougher. The servomotor is integrate with tractor and its shaft is attached with the plougher.

III. PROBLEM IDENTIFICATION:

In this survey, we identified the problems in manual tractor and found the solution to overcome this problem. A tractor used in agriculture is the semi automated vehicle. It means the vehicle operated manually by human. Manual farm vehicle mostly relies upon fuel. The fuel control level on the motor can likewise be tricky. On the off chance that it gets stuck, it will be more diligently for fuel to make to the motor. Motor related issue is the spark plugs, which can turn sour or get harmed as work around the homestead. Hard beginnings, low fuel utilization and low execution are altogether indications of a flawed spark plug. Another issue that regularly springs up is the carburetor. It assists mix with broadcasting and fuel for the motor. In the event that it gets stopped up, it will meddle the vehicle's presentation. To overcome this problem, we replace the manual tractor with smart tractor.

IV. RESEARCH SCOPE:

The main focus of this research is the implement of smart tractors in agriculture. We understand the present manual work, texture and contour of the terrain and detect the colour sample from the terrain. We design and gesture of vehicle using IoT and insert the colour sensor in vehicle. Then the vehicle is testing and determines the performance. In future, this technology may be implemented in real tractor.

V. CONCLUSION:

Based on literature survey, the authors concluded the points listed below. In the modern era, implementation of IoT based smart tractor is essential in agriculture. It reduces the manual work and working time and lowering the prospect of human error. It provides a review of current and emerging technology applications used in agriculture. It proposes a technology which can generate message on different platforms to notify farmers. IoT based farming can solve many agricultural issues. The aim of this survey is to introduce a working product which will allow the farmers to use in real time. Finally our work is implemented in IoT based smart tractor is very much useful for environment as well as human being.

REFERENCES:
[1]. Sjaak Wolfert , Lan Ge a, Cor Verdouw , Marc-Jeroen Bogaardt [2017], "Big Data in Smart Farming – A review", Agricultural Systems, Elsevier publication.
[2]. Cor Verdouwa, Harald Sundmaekerc, Bedir Tekinerdogana, Davide Conzond, Teodoro Montanaro [2019], "Architecture framework

of IoT-based food and farm systems: A multiple case", Computers and Electronics in Agriculture, Elsevier publication.

[3]. Andres Villa-Henriksen, Gareth T.C. Edwards , Liisa A. Pesonen , Ole Green , Claus Aage Grøn Sørensen [2020], "Internet of Things in arable farming: Implementation, applications, challenges and potential", Biosystems Engineering, Elsevier publication.

[4]. Laurens Klerkxa, Emma Jakkub, Pierre Labarthec [2019], "A review of social science on digital agriculture, smart farming andagriculture 4.0: New contributions and a future research agenda", NJAS - Wageningen Journal of Life Sciences, Elsevier publication.

[5]. Jash Doshi, Tirthkumar Patel, Santosh kumar Bharti, [2019], "Smart Farming using IoT, a solution for optimally monitoring farming conditions", Procedia Computer Science, Elsevier publication.

[6]. Murugaiyan Pachayappana, C Ganeshkumar, Narayanasamy Sugundan, [2020], "Technological implication and its impact in agricultural sector: An IoT Based Collaboration framework", Procedia Computer Science, Elsevier publication.

[7]. Dinesh Manikandan, Arjun Manoj Skl, T. Sethukarasi, [2020], "Agro-gain- an absolute agriculture by sensing and data-driven through iot platform", Procedia Computer Science, Elsevier publication.

[8]. Abdellah Chehria, Hasna Chaibib, Rachid Saadaneb, Nadir Hakemc, Mohamed Wahbi, [2020], "A Framework of Optimizing the Deployment of IoT for Precision Agriculture Industry", Procedia Computer Science, Elsevier publication.

[9]. Dieisson Pivoto , Paulo Dabdab Waquil, Edson Talamini, Caroline Pauletto Spanhol Finocchio , Vitor Francisco Dalla Corte, Giana de Vargas Mores, [2018], "Scientific development of smart farming technologies and their application in Brazil", Information Processing in Agriculture, Elsevier publication.

[10]. Dimitris S. Paraforos, Vangelis Vassiliadis, Dietrich Kortenbruck, Kostas Stamkopoulos, Vasileios Ziogas, Athanasios A. Sapounas, Hans W. Griepentrog, [2016], "A Farm Management Information System Using Future Internet Technologies", IFAC-PapersOnLine, Elsevier publication.

[11]. Kirtan Jha, Aalap Doshi, Poojan Patel, Manan Shah, [2019], "A comprehensive review on automation in agriculture using artificial intelligence", Artificial Intelligence in Agriculture, KeAi publication.

[12]. Misbah Pathan, Nivedita Patel, Hiteshri Yagnik, Manan Shah, [2020], "Artificial cognition for applications in smart agriculture: A comprehensive review", Artificial Intelligence in Agriculture, KeAi publication.

[13]. Manlio Bacco, Paolo Barsocchi, Erina Ferro, Alberto Gotta, Massimiliano Ruggeri, [2019], "The Digitisation of Agriculture: a Survey of Research Activities on Smart Farming", Array, Elsevier publication.

[14]. Badreddine Miles, El-Bay Bourennane, Samia Boucherkha, and Salim Chikhi, [2020], "A study of LoRaWAN protocol performance for IoT applications in smart agriculture", Computer Communications, Elsevier publication.

[15]. Imran Charania, Xinrong Li, [2019], "Smart Farming: Agriculture's Shift from a Labor Intensive to Technology Native Industry", Internet of Things, , Elsevier publication.

[16]. Ali Roshanianfard, Noboru Noguchi, Hiroshi Okamoto, Kazunobu Ishii, [2020], "A review of autonomous agricultural vehicles (The experience of Hokkaido University)", Journal of Terramechanics, Elsevier publication.

[17]. Ashish Malik, Shivam Kohli, [2020], "Electric tractors: Survey of challenges and opportunities in India", Materials Today: Proceedings, Elsevier publication.

[18]. Sanika Ratnaparkhi, Suvaid Khan, Chandrakala Arya, Shailesh Khapre, Prabhishek Singh, Manoj Diwakar, Achyut Shankar, [2020], "Smart agriculture sensors in IOT: A review", Materials Today: Proceedings, Elsevier publication.

[19]. Huang Xing, Li Xiaofeng, [2020], "Agricultural Labour Market Equilibrium Based on FPGA Platform and IoT Communication", Microprocessors and Microsystems, Elsevier publication.

[20]. Jirapond Muangprathuba, Nathaphon Boonnama, Siriwan Kajornkasirata, Narongsak Lekbangponga, Apirat Wanichsombata, Pichetwut Nillaorb, [2019], "IoT and agriculture data analysis for smart farm", Computers and Electronics in Agriculture, Elsevier publication.

[21]. Achilles D. Boursianis, Maria S. Papadopouloua, Panagiotis Diamantoulakis, Aglaia Liopa-Tsakalidi, Pantelis Barouchas, George Salahas, George Karagiannidis, Shaohua Wand, Sotirios K. Goudos, [2020], "Internet of Things (IoT) and Agricultural Unmanned Aerial Vehicles (UAVs) in smart

farming: A comprehensive review", Internet of Things, Elsevier publication.

[22]. Fanyu Bu, Xin Wang, [2019], "A smart agriculture IoT system based on deep reinforcement learning", Future Generation Computer Systems, Elsevier publication.

[23]. Alexandros Kaloxylos, Robert Eigenmann, Frederick Teye, Zoi Politopoulou, Sjaak Wolfert,Claudia Shrank, Markus Dillinger, Ioanna Lampropoulou, Eleni Antoniou, Liisa Pesonen,Huether Nicole, Floerchinger Thomas, Nancy Alonistioti, George Kormentzas, [2012], "Farm management systems and the Future Internet era", Computers and Electronics in Agriculture, Elsevier publication.

[24]. Abhishek Khanna, Sanmeet Kaur, [2019], "Evolution of Internet of Things (IoT) and its significant impact in the field of Precision Agriculture", Computers and Electronics in Agriculture, Elsevier publication.

[25]. I.P. Troyanovskayaa, B.M. Pozinb, N. Noskov, [2017], "Ploughing Tractor Lateral Withdrawal Model", Procedia Engineering, Elsevier publication.

[26]. J.Raja, W.Stanley Karunakaran, [2017], "Automatic Ploughing And Seeding Robot", IOSR Journal of Electronics and Communication Engineering.

[27]. Nidhi Agarwal, Ritula Thakur, [2016], "Agricultural Robot: Intelligent Robot for Farming", International Advanced Research Journal in Science, Engineering and Technology.

[28]. V.V.Blednykha, P.G.Svechnikova, I.P.Troyanovskayaa, [2017], "Tractor Plough with Repeated Cutting Angle on Working Elements", Procedia Engineering, Elsevier publication.

[29]. Mohamed Torky, Aboul Ella Hassanein, [2020], "Integrating blockchain and the internet of things in precision agriculture: Analysis, opportunities, and challenges", Computers and Electronics in Agriculture, Elsevier publication.

[30]. G Vijaykumar, K Vijayalakshmi ,CH Pujitha, DN Sandhya Rani, [2020], "Automatic Arduino Controlled Agribot For Multi-Purpose Cultivation", International Conference of Advance Research and Innovation.

[31]. Chen Jin, Pang Dang-wei1, Jin Min, LUO Yong-li1, LI Hao-yu, 3, LI Yong, WANG Zhen-lin, [2020], "Improved soil characteristics in the deeper plough layer can increase grain yield of winter wheat", Journal of Integrative Agriculture, Elsevier publication.

[32]. Darshan M, Dastgir Ganagapur, RakeshChand H, Rakshith R, Venkatesha B K, [2020], "Fabrication of Agricultural Robot for Ploughing, Seeding and Grass Cutting", International Journal of Scientific & Engineering Research.

[33]. Mebrhit. A, Elias. B, Bezawit. D, Henok. B, Samual. N, Zenawi.T, [2017], "Design and Prototype Development of Hybrid Ploughing, Seeding and Fertilizing Machine", International Journal of Computational Engineering Research.

[34]. Luis Emmi, Mariano Gonzalez-de-Soto, Gonzalo Pajares, Pablo Gonzalez-de-Santos, [2014], "New Trends in Robotics for Agriculture: Integration and Assessment of a Real Fleet of Robots", The Scientific World Journal, Hindawi Publishing Corporation.

[35]. A.Anusha, A.Guptha, G.Sivanageswar Rao, Ravi Kumar Tenali, [2019], "A Model for Smart Agriculture Using IOT", International Journal of Innovative Technology and Exploring Engineering.

[36]. Kavita Zole, Sanghasevak Gedam, Aditya Dawale, Kiran Nikose, Jayant Hande, [2018], "Agricultural Robot", International Research Journal of Engineering and Technology.

[37]. Ritika Srivastava, Vandana Sharma, Vishal Jaiswal, Sumit Raj, [2020], "A Research Paper on Smart Agriculture Using IOT", International Research Journal of Engineering and Technology.

[38]. Abdul Rasheeque KA, Savitha, [2017], "E-farming Using Internet

[39]. of Things(IOT)", International Journal of Latest Trends in Engineering and Technology.

[40]. Punam K. Jadhav, Shivani S. Deshmukh, Prerana N. Khairnar, [2019], "Survey Paper Agro-bot Autonomous Robot", International Research Journal of Engineering and Technology.

[41]. Redmond Ramin Shamshiri, Cornelia Weltzien, Ibrahim A. Hameed, Ian J. Yule, Tony E. Grift, Siva K. Balasundram, Lenka Pitonakova, Desa Ahmad, Girish Chowdhary, [2018], "Research and development in agricultural robotics: A perspective of digital farming", Int J Agric & Biol Eng.

AUTHORS PROFILE:

Tharik Ahamed. S

Address: 11/1, Old post office road, Beemanagar, Trichy - 620001.

Phone No : 9894789386

tharikahamed1103@gmail.com

A.Ranjith Raj

Assistant Professor

Saranathan College of Engineering, Trichy – 620012.

ranjith-mech@saranathan.ac.in

Vishnu. T

Address: 3/2, South street, Palinganatham, Ariyalur - 621651.

Phone No : 9361578366

vishnu20000111@gmail.com

Arun Avinash. M

Address: 15, New street, Lalgudi, Trichy -621601.

Phone No :8825434619

arunavinash99@gmail.com
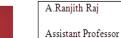
Gopi. M

Address: 2/3A, North street, Kolarpatti, Nagamangalam, Trichy -620012.

Phone No : 8940484906, 8838197473

mvgopi97@gmail.com