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The Factors Affecting Smart Rice Farming - A Systematic Literature Survey

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Abstract: *The Application Of Modern Data Analytics Techniques, Risk Assessment And Prediction, Internet Of Things Etc Are Making Farming More Productive And Profitable. Internet Of Things In Conjunction With Traditional Methods Of Rice Farming Can Put An End To The Major Farm Problems. Smart Rice Farming Is Critical For Sustainable Agro Production As It Focuses On Resource Efficient Methods And Techniques. Management Information Systems, Precision Farming, Agribots And Automation Are Addressing The Pressing Needs Of Rice Farming. The Primary Objective Of This Paper Is To Conduct Systematic Literature Survey On Smart Rice Farming, Farm Related Problems And Key Processes And Methods Used For Problem Elevation. Survey Has Been Conducted Among 5 Major Journal Databases And Extended Manual Survey Including Whitepapers. We Found 1963 Papers Connected To This Topic And 76 Papers Were Found Most Relevant .We Presented Analysis Of This Survey.*

Keywords: *Cloud, Iot (Internet Of Things), Mobile Application, Pest Control, Rice Farming, Water Management.*

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I. Introduction

Rice Is An Important Staple Crop Across The World And Especially In Southeast Asia Which Can Be Inferred From The Production And Demand Of Rice That It Is Socially Significant. It Provides From 35 Percent Up To 75 Percent Of The Daily Calorie Intake For 3 Billion Asians [9]. Rice Is A Sustenance Crop For Rice Farmers But In Broader Scope There Are Many Problems While Cultivation Which Includes Irrigation Problems, Pesticide Control, Mice Control And Lack Of Awareness Of Climatic Conditions, Minerals And Vehicles [2]. The Evolution Of Technology Can Espouse To Solve The Problems Faced By Rice Cultivators. Traditional Methods When Integrated With New Trends Such As Automation And Precise Farming Produce A Greater Yield And Helps In Resolving The Drawbacks. Inculcation Of Iot (Internet Of Things) Along With Management Information System Can Eradicate The Irrigational Difficulties Faced And Provide A Before-Hand Solution [4]. The Collaboration Of All The Above Mentioned Technologies Is To Automate The Farming Processes From Beginning To End (From Initial Stages Of Cultivation Till Marketing) By Efficient Use Of Resources [13]. This Paper Discusses The Methods For Monitoring Adequate Levels Of Water And Minerals, Security From Mice And Pests, Notifying Climatic Variations And Lowering The Expenses By Effective Utilization Of Rented Vehicles.

This Paper Addresses The Methods In A Coherent Manner. The Structure Of The Article Is Started With Section 2, Our Research Approach, Continued With Section 3, Our Findings, Followed By Section 4, Our Main Discussion, And Ends Up In Section 5, Our Conclusion Along With References.

Headings

II. Findings And Discussion

Findings

After Reviewing All The Relevant Articles We Now Provide Solutions To The Problems Faced By Farmers.

Irrigation Problems

The First And Fore Most Important Essential Element Is Water For The Purpose Of Irrigation. There Is No Effective And Efficient Usage Of Water Even Though There Is A Supply Of 34-43% Of The Total Irrigational Water. Water Enters The Fields Through The Means Of Small Canals After Releasing The Water From Respective Dams. Now, The Technology Plays A Key Role To Send The Information Correctly To The Farmer. A Water Detector Sensor Is Placed Next To The Dam Gates [15]. Its Function Is To Sense The Outlet Of Water, Calculate The Time Taken To Reach The Field And Then Transmits A Signal. The Sensor Measures The Distance Using Sonar. An Ultrasonic Pulse Is Transmitted From The Unit And The Distance To Target Is Determined By Measuring The Time Required For The Echo Return. Output From The Sensor Is A Variable-Width Pulse Which Is Given To The Microcontroller And Is Displayed Out In Levels. Hence When The Dam Gates Are Opened, A Message Will Be Delivered To The Farmers.

Sometimes Amount Of Entry Of Water Into Crop Might Cause Damage To The Crop To Eradicate This Problem We Use A Water Level Indicator Sensor [15] Whose Function Is To Indicate The Level Of Water In The Field Also Soil Moisture Is Monitored Using A Sensor[18]. The Sensor Values Are Programmed Before Hand To Maintain Proper Level Of Water In The Field. If It Is Low Then A Message Will Be Sent To The Farmer Reporting To Provide More Water. If Excess Then The Water Is Automatically Drained Out Through Pipes And Is Stored In Pits For Future Use.

Manpower

Going Hand On Hand With The Technology New Invention Should Be Used To Reduce The Effort And Energy Spent By The Man Power. Instead Of Manpower Sprinklers Can Be Used For Sprinkling Of Minerals And Pesticides. These Sprinklers Are Programmed Such A Way That They Sprinkle Only Required Amount Of Pesticides Into The Crop. Based On A Survey Conducted Sprinklers Prove To Be 85% More Efficient Than Man Power. Sprinkler Irrigation Is A Method Of Applying Irrigation Water Which Is Similar To Natural Rainfall. Minerals, Pesticides And Weedicides Are Distributed Through A System Of Pipes Usually By Pumping. These Sprinklers Are Controlled Or Operated Using IOT APP [6]. Whenever Required The Farmer Can On And Off By Just A Touch.

Problems Faced By Pests

Very Often Farmers Face Trouble With The Mice In The Farms [3]. To Avoid This Problem We Use Mice Chaser. The Complex Sound Waves (Ultrasonic Sound Waves) Emitted By Mice Chaser Circuit Do Not Allow Mice Or Rodents To Habituate To The Sound. These Ultrasonic Devices Have The Ability To Provide Long-Term Reductions In Rodent Populations By Creating An Environment That Discourages Rodent Infestations. This Mice Chaser Will Not Harm Or Injure Any Of The Pests That Cause Trouble But It Does Not Allow Any Of Them To Come In.

Online Solutions

In Order To Enable Interface Between A Farmer And IOT There Must Be A Software Solution [10]. An Online App Is Available For The Farmers To Reduce The Wastage Of Time Spent For Searching Of The Required Equipment [1]. The Online Application Provides The Following [11]:

- VEHICLE RENTING*:* Vehicles Can Be Rented By Checking Vacancy. To Order The Vehicles Farmers Just Need To Enter Their Required Particulars And Check For Availability In The App [10].
- PEST DETECTION: The Part That Is Effected Can Be Taken A Photograph Through The App And Sent So That The Information About The Pest Can Be Identified With All Such Related Results In The Recorded Database And The Pest Control Details Will Be Displayed [14].
- PESTICIDES ONLINE MARKETING**:** Pesticides Can Be Ordered Online. The Farmer Is Supposed To Select The Desired Pesticide And Its Quantity. It Can Also Predict How Much Amount Of Pesticide Is Actually Required [5]
- CLIMATIC INFORMATION: This Is To Provide The Climatic Information To The Farmers In The App [16]. It Takes The Information Directly From The Satellite And Gives Information Accurately To The Farmer.

III. Discussions

This Section Elaborates The Systematic Review Of All The Related 76 Articles About The Factors Effecting Smart Rice Farming. The Key Focus Of These Articles Is Coalescing Emerging Technology With Traditional Farming To Trim The Manpower [17]. The Focal Point Of All The Reviewed Articles Using Qualitative Methodology Is To Develop Smart Farming Procedures [12]. Similarly Quantitative Pathway Had Also Fetched Useful Techniques For The Given Farm. All The Articles Related Had Completely Made Use Of Both The Strategies To Build An Efficient Architecture. This Paper Follows An Optimistic Archetype That Studies The Evident Facts. We Had Clearly Focused On The Crucial Elements, By Employing Case Study Analysis, While Relating Technology To The Farming Such As Automation And Management Information System To Address The Needs Of Rice Farming.

Considering The Article Distribution, We Could See That Almost All The Articles Had Been Published Since The Past Five Years (From The Present Year 2017). This Shows That Smart Rice Farming Has Been Increasingly Alarming At A Constant Rate. However This Could Be Possible Only Because Of The Emergence Of Effective Technology. Automation, Robotics, Management Information Systems Not Only Helped Us In Data Analysis And Segregation But Can Also Help Us For Precise Farming. Need For Farming Has Increased In The Recent Times Due To The Increase In Population And Decrease In Land For Farming. Perhaps This Could Be The Beginning Of The Involvement Of Technology In Farming.

However The Research Process Involved Few Constraints Such As, Using The Same Keyword At Different Dates Which Produced Different Findings, And, Choosing Only Particular Keywords To Avoid Unnecessary Findings.

IV. Figures And Tables

Research Approach

Research Overview

The Systematic Literature Survey Is Done By A Non-Experimental Approach Which Inscribes The Methods For Solving The Problems Faced During Cultivation With The Integration Of New Technologies. The Problem Statement And The Solution Are Distinctly Stated In A Structural And Sequential Manner. The Key Components Are Represented Via Spreadsheet Through Which Classification Is Explained Easily Using Categories And Subcategories That Serve As Suitable Evidences. In This Paper, Section 3 And 4 Evidently Explains Observations And Discussions Of Our Findings.

Classification Framework

The Systematic Literature Review In This Paper Is Done By Implementing The Suggested Methods From Higgins And Green [8], And Kitchenham Et Al., [7]. The Codebook Holds Descriptors Data Such As Year, Journal Or Conference, Title, Volume No, Date Of Issue And Author Keywords

Data Collection

The Process Of Data Collection Has Been Done By Fetching Keywords In The Databases Of ACM Digital Library, IEEE Xplore Springer, Science Direct And Willey Interscience. The Search Keywords Are RICE FARMING, Iot, PEST CONTROL And CLOUD. The Search String Applied To Full Text & Metadata. This Search Process Took Place In The Month Of October And November, The Year 2017. Standards, Editorials, Courses, Tutorials, Prefaces, Workshops, Poster Sessions And Other English Language Articles Have Been Discarded In The Search Process.

A Total Of 1963 Related Text Files Or Articles Were Endowed While Keywords Search Process. Additional Study On These Articles Reduced The Number To 76 By Relevance Towards The Keywords RICE FARMING, Iot And PEST CONTROL.

Table

Database	No Of Articles	No Of Related Articles
IEEE	44	25
ACM	1909	46
Science Direct	1	1
Springer Link	8	3
Wiley Interscience	1	1
Total	1963	76

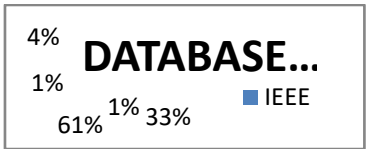

Fig 1

V. Conclusion

Iot Smart Rice Farming Is To Use Technology In Farming, For Getting A Higher Yield With Minimal Hard Work, Man-Power And Less Wastage Thereby Reducing The Expenses. Agriculture Being The Backbone Of Indian Economy Still Faces Many Problems. Despite All The Difficulties Faced IOT SMART RICE FARMING Provides A Facile Way For The Agriculture In The Future To The Farmers.

The Overall Burden On A Farmer Can Be Reduced By Using Of Simple Hardware Instruments Including, Raspberry Pi-Used As A Mini Computer Which Is Embedded With A Controller That Manages The Entire Farm, Motors- Which Facilitate To Convert Electrical Energy Into Mechanical Energy, Solenoid Valves, Water Level Indicators, Sprinklers- Used To Irrigate Agriculture Crops, Rodent Repellents, Water Detectors. These Core Materials Can Be Effortlessly Available Within A Limited Earmark.

The Firmware Used To Program The Hardware Can Be A High Level Language Such As Python, Mysql, Java And Many More. The Concept Of 'Smart Farming' Uses IOT, Internet Of Things, With A Cloud Support. The Software Can Be Developed Such That It Can Be Operated Manually Or The Process Is Automated.

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