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Integrated Farm Management System for Smart Agriculture in Oman

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Abstract: Innovation became an utmost word to deal with in this hi-tech modern world. From a kitchen to parliament, agriculture to semiconductor industry, barbershop to superstore everywhere innovation taken place. Implementation of innovative idea in the relevant area or business field became a magnificent fashion. Therefore, the purpose of this paper shall be to build a solid on this issue. visionary technology advancement for Oman agriculture sector that will also benefit and when implemented, as an innovative solution to support agriculture as an icon for global development. The suggested Farm Management System utilize IoT to gather live information. related information of the soil, temperature and humidity conditions, crop yield, and stock so as to make a better. informed decision-making. Its user-friendly interface provides foolproof recommendations that assist farmers to enhance on production and sustainability. courses it comprises a transportation management, demand forecasting, production forecasting, inventory control, and inventory purchasing. module that help in tracking of the resources and also help in organizing the farm operations. This overall approach does not only enhance productivity but it also revamps the agriculture so much that it empowers the farmers. with the capabilities that will enable them to succeed in a dynamic environment within the sector.

Keywords: automation, agriculture, magnificent, futuristic, decision making.

I. Introduction

The Farm Management System as we know, is windows desktop. application intended to bring change in the ways farmers cultivate crops today to a completely different level. are uniquely suited to working cohesively with IoT insert. This revolutionary Program is meant to give farmers a real-time information on back to their farms hence enabling them to be in a better position to make the right decisions. and How can they increase the yield of their harvests as well as increase the efficiency of their growths? By connecting to many IoT sensors duly installed at different locations the farm, the program records important things such as the soil humidity, temperature and the state of crops that will enable farmers immeasurable value to help one understand the conditions of their agricultural operations. In addition, the author also pointed out the integrated Farm Management System It also goes farther than mere surveillance, besides having a complete list. as a management tool to keep records of the farms, and also for farmers to be able to monitor the status of their farms with ease. manage their resources. However this formulated and packaged comprehensive strategy is not only increases efficiency while at the same time fosters increased extraction and exploitation of the environment. amiable and non-hazardous techniques for agriculture..

II. Literature Review

Farm Management Systems (FMS) are fixed on Windows platform. applications that helps farms manage their businesses. more productively and successfully. Farm Management Such systems may monitor a variety of data such as crop. PPEs include; inventory, equipment, and environmental. Farm Management Systems can also provide farmers with information as well as ideas that will enable the mass make better decisions with regards to their operations. It must be noted that our approach can be used to identify places which may contain possibilities to save money, increase efficiency of yields, environmental impact reduced.

Here a few highlighted points that the study has brought out. This based research this paper has found several others that have highlighted others that have stressed Some of the findings concerned the effect of FMS in enhancing the productivity of agriculture. productivity. FMS enables based on data decision making. use of resources, decision making, coordination of work, and other tasks which lead to the enhancement of productivity. improving agricultural yields and minimizing costs [4].. Precision agriculture is a key application area for FMS [5]. Highlights how the system helps with precise planting, irrigation, and nutrient control, lowering input waste and environmental effects. FMS have an important role in encouraging sustainable agricultural practices [6]. They contribute to soil health monitoring, conservation agriculture, and precise pest management, which decreases agriculture's environmental imprint [7]. Compatibility and smooth integration of FMS with other technologies, such as IoT sensors, drones, and weather forecasting systems, are critical for realizing their full potential [8, 9]. Also Understanding what elements influence FMS adoption is critical [10]. Investigate the impact of farmers' socioeconomic status, perceived benefits, and obstacles to FMS use. Data privacy problems and an initial investment cost are among the challenges [11]. Furthermore, there is an opportunity to improve the user interface. Future research directions include the application of artificial intelligence and machine learning to advanced decision assistance and predictive analytics [12,13]. Integrated farm management system aimed at improving sustainable agriculture practices. It addresses how precision agriculture, IoT, and data analytics might help with decision-making, resource efficiency, and overall farm productivity [14]. It studies the uptake of cloud-based agricultural systems and evaluates their impact on efficiency and resource use. It emphasizes the benefits of cloud technologies in terms of real-time data access, collaboration, and

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scalability for modern farming operations [15]. This paper aims at exploring the place of artificial intelligence (AI) and especially in the predictive modelling of the crop. managing, controlling, and informing activities, in particular decision-making, and Decision Support Systems with reference to its. integration into farm management. The present concept is aimed at the possibility. the application of artificial intelligence in enhancing profitability and success of. sustainability of agriculture [16]. To this end, this paper examines the significance of There are some positive ways of farm management that can assist agriculture to change in to. resilient to climate change. It explores how meteorological information, computation, and flexibility could help address Analyzing this, it is possible to suggest that data, computer modelling, and adaptive methods might assist farmers on how they can minimize impacts of climatic change on their operations [17]. The subject of this research is The Internet of Things Although the Internet of Things is a relatively young phenomenon, it has enjoys ever-growing popularity. The Extension of Physical items (IoT) utilization in agriculture, provide complete Brief summary about sensors, devices and multi-device communication technologies. It analyses the potential of Internet of Things in connected the apparatus to an agricultural management software to track crops. For example, they can be used to rationalize work processes, and enhance efficiency [18]. This research employs the economic evaluation approach to arrive at the conclusion on the financial. consequences of the application of precision agricultural technologies into farm management systems and, at the same time, adopted criteria for using the new technologies and allied resources. It looks at the efficiency on the aspects of cost such as GPS-guided equipment, variable rate technology and automated. machinery [19]. Identifying difficulties and opportunities, this study looks at factors that define the as a precondition for efficient use of FMIS. They address issues of Technology adoption, Data privacy, and farmer education; the relative importance given to impact, adoption rates and cost are also highlighted. advantages [20]. The investigations that are being done are a study of the impact of mobile technology more specifically, how the mobile-based apps and communication applications integrated into It could be noted that the identified farm management systems have advantages for the small-scale farmers. It speaking about the improved method of getting to market information and monetary. services, extension services [21]. This paper examines the impact of blockchain technique for agricultural business. stressing on its ability to enhance the traceability aspect of a product. the increase of transparency in operations of farm management systems. It examines the use of the distributed ledger technology in supply chain and aggregation of the best supply chain management solutions. food safety, to create confidence amongst the stakeholders [22]. This study concerns itself with impacts of the technologies in farm management. farmers in developing countries. It examines the adoption barriers, opportunities, and a possible function of IT in This evaluation shows that the fund utilizes more of poverty reduction and rural development goal [23].

Thus, the research founds out that limitations in Farming management solutions and emphasizes the need to use of technology in synergy with other systems like forecast on weather conditions and Internet of Things sensors to be precisely positioned and interconnected to one another. The research identifies limitations in Farming management solutions and underlines the importance of technology integration with systems such as weather forecasts and Internet of Things sensors. Socioeconomic factors and perceived benefits are important factors that affect the adoption of FMS; obstacles include investment costs and data privacy. Future studies should concentrate on combining machine learning and artificial intelligence for advanced decision assistance, as well as investigating cloud-based options and the function of FMS in economic analysis and climate resilience. Comprehensive measures are needed to close the gaps in training, data privacy, and technology uptake, particularly in developing nations. To maximize FMS's impact in agriculture, priorities include promoting cloud-based solutions, addressing socioeconomic aspects, providing training programs, improving AI applications, and supporting collaborative efforts across academics, industry, and politicians.

III. Methodology

Methodology is essential in project and software development because it provides a structured and systematic approach to planning, executing, and managing complex tasks. It helps ensure that the project progresses efficiently, meets its objectives, and minimizes risks. By following a methodology, such as Agile, Waterfall, or DevOps, teams can establish clear processes, define roles and responsibilities, and set realistic timelines and milestones, which collectively enhance project transparency and accountability. Moreover, methodologies often incorporate best practices and lessons learned from previous projects, contributing to improved project quality and successful outcomes [24]. By considering all possible causes and effects we are planning to go with agile methodology.

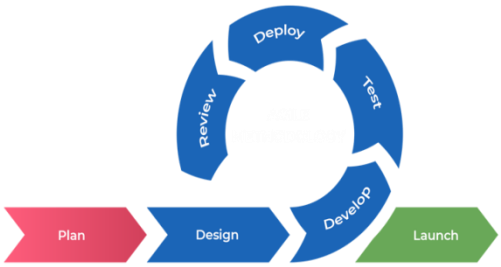

Figure 1 Agile methodology

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Agile methodology is an iterative and collaborative approach to software development that focuses on delivering incremental value to customers. It operates in short development cycles called "sprints," typically lasting 2-4 weeks, during which a cross-functional team plans, designs, develops, and tests a subset of project features. Users and stakeholders provide feedback throughout the process, allowing for flexibility, adaptation, and continuous improvement. This iterative cycle repeats until the project is complete, ensuring that the final product aligns with evolving requirements and user needs [25].

For Farm management system we used the System Development Life Cycle (SDLC). Because it provides a structured framework that guides the entire process from initiation to deployment and maintenance, ensuring a systematic approach to development. It helps identify and define project goals, requirements, and scope, facilitating better project management and resource allocation. By breaking down the development process into phases such as planning, analysis, design, implementation, testing, and maintenance, SDLC ensures thorough documentation, quality assurance, and efficient communication among stakeholders. This systematic methodology enhances the predictability of project outcomes, reduces risks, and promotes collaboration, ultimately leading to the delivery of high-quality software solutions on time and within budget [26].

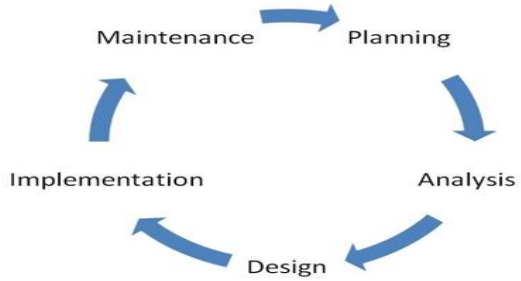

Figure 2 System Development Life Cycle (SDLC).

IV. Experiments and Results

A set of result going to display in a row from the experiments. Figures created from the experiments are as follows.

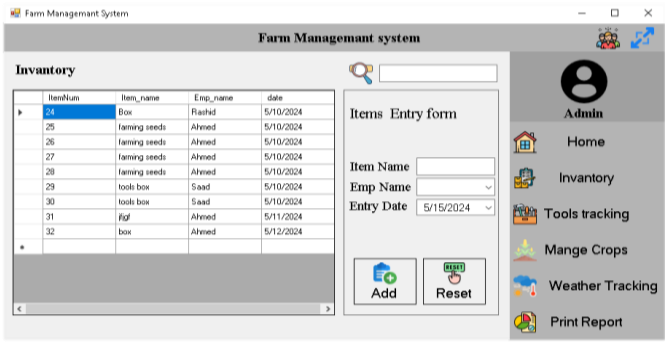

Figure 3. Inventory search result

Figure 3 showing add items form which is done by the ADD button. It is basically to add the data into MySQL data base. Followed by the data saving into the database. It also contains a reset button where user can clean the text boxes after that data entry.

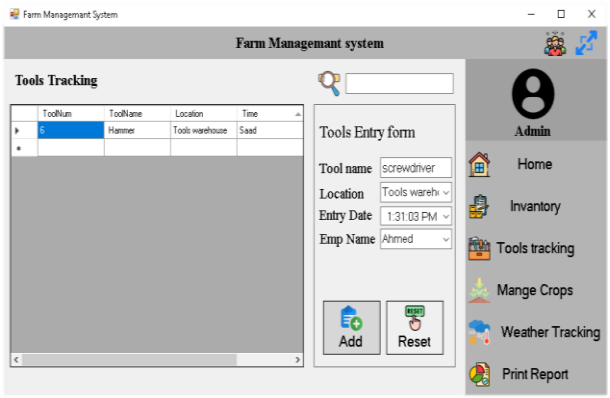

Figure 4. Tools tracking

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This function (figure 4) done by the ADD button and it works to add the data into MySQL data base. Finally, it will display the data has been saved inside the database. A reset button-like figure 3, also applied here in this page to clean the text boxes after that data entry. And it will clean the data as expected.

Figure 5 below shows the crops management output. This function done by the ADD button to add the data into MySQL data base. Some of sample data saved in the figure too. At the same time, we have search function in the form. This function works by enter any letter from the "Crop Name" attribute.

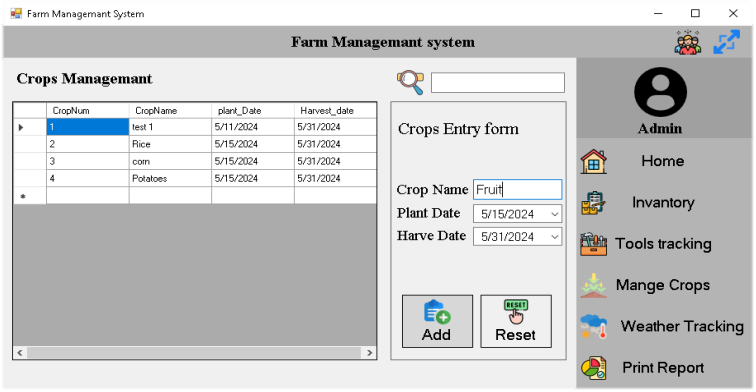

Figure 5. Crop management

Report Printing: This page contains 3 buttons. All of the buttons print report but they print different report. The first one is for the inventory report. Second, Tools report. And last thing is the crops report as showed in Figure 6. After we pressed the Inventory report a new window showed up as we can see in Figure 7. This window prepares the document for print and when we press the printer button a third window pops-up. This window is basically to let the user choose the place that he wants to save the PDF document.

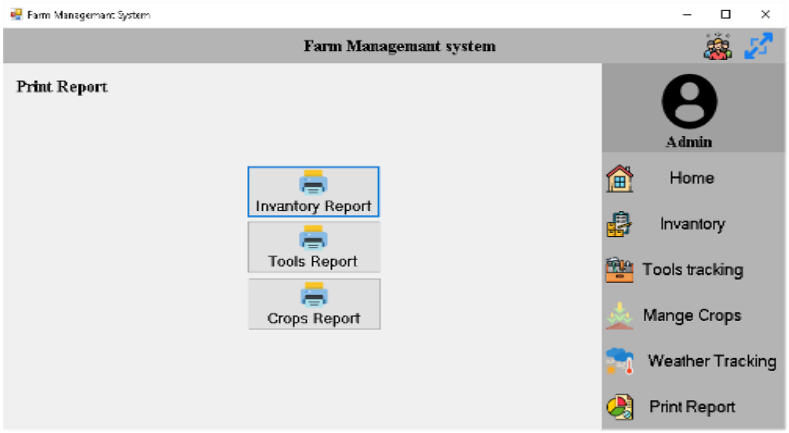

Figure 6. Print report

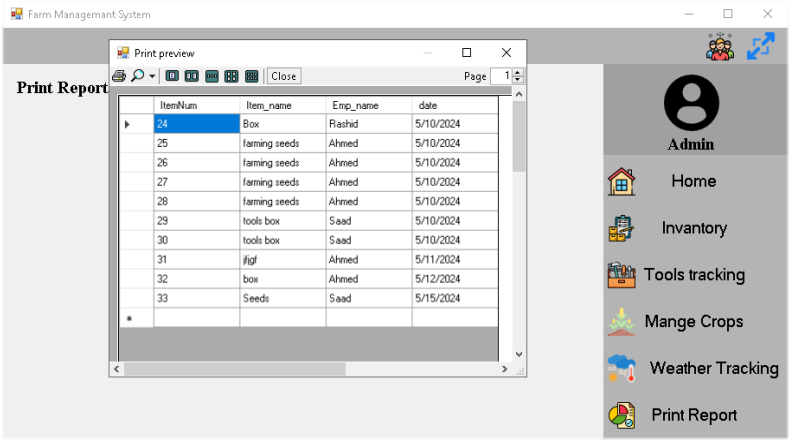

Figure 7. Documents for print

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Weather tracking App: As an additional feature; this system has an weather tracking app to extract real time weather information for the farmer. This page is linked with Open weather platform. To open the weather app, we need to click the (weather tracking) button in System side bar as shown in Figure 8. After clicking the button, the weather app will run automatically in the default browser shown in Figure 9. User need to enter the city that they want to get info about and all the necessary information will appear like in (Figure 4.3.5.3).

Figure 8. Weather tracking system

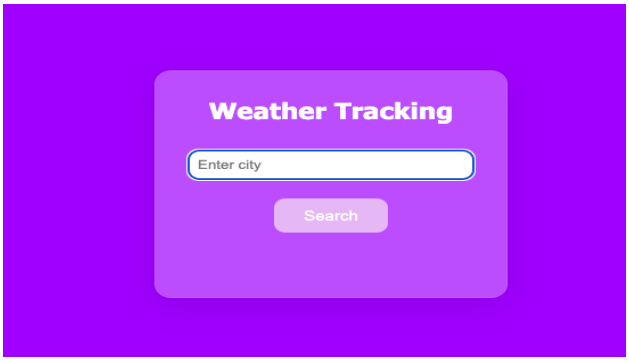

Figure 9. Weather App GUI

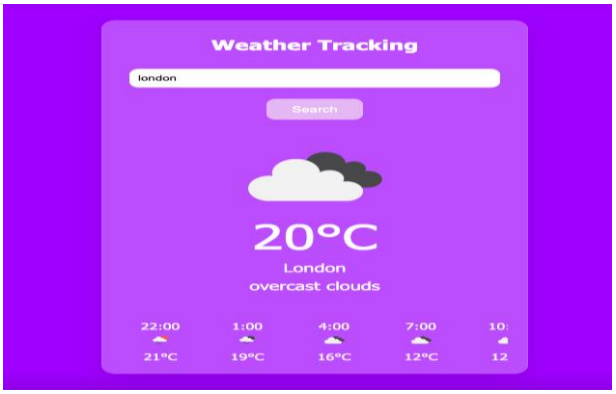

Figure 10. Weather result based on location entered

Through the results announced above, the farm management system has proven to be efficient in data entry and data retention processes for management operations. It is also proven stable and problem-free and works smoothly. All buttons work properly and the system response is excellent. The research is also focused on simplifying the user interface and making it smooth. As shown, all the buttons were on the same page and they contain colored icons that attract the user's attention and provided with an excellent user experience.

V. Conclusions

In conclusion, the Farm Management System is going to be a tool to transform conventional agricultural strategy to a modern agriculture. It enables farmers to make informed decisions, improve efficiency, and maximize yields by leveraging technology and data. This technology not only simplifies administrative work, but it also promotes sustainable practices, protecting our agricultural ecosystem. Its ability to eliminate waste, increase resource utilization, and improve overall farm profitability cannot be overstated.

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As the world's food demand and environmental issues develop, the output of this research “the farm management system” emerges as a critical solution which will act on bridging the gap between tradition and innovation followed by ensuring agriculture's future productivity and sustainability.

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