Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/8083
DOI URL: http://dx.doi.org/10.21474/IJAR01/8083

RESEARCH ARTICLE

IOT BASED SOIL TESTING.

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Manuscript Info

Manuscript History
Received: 12 September 2018
Final Accepted: 14 October 2018
Published: November 2018

Abstract

Soil Analysis has become an essential factor for effective cultivation. There are many existing methodologies for soil testing. Earlier soil testing was done in laboratories and research centers which took a lot of time and effort to achieve results. In today's world, with advancements in technology and digitization, it has become possible to do soil testing using various portable sensors. With the help of IoT is has become possible to connect the sensors to the internet. We intend to use these sensors with IoT for performing soil testing anywhere and anytime. The existing methodologies test various parameters like moisture, respiration, bulk density, color texture, pH, temperature, etc. Testing various parameters will be costly. Thus, the aim of this project is to provide soil testing and analysis at the lowest possible cost. Analyzing a few parameters also provide the same result of analysis. Thus, we use affordable yet efficient sensors for testing soil parameters like pH, moisture, humidity and temperature. Performing analysis is the main challenge that will be addressed in this project. The existing systems used platform dependent system or hardware dependent system. Some testing methods used platforms like Losant, etc. to display result in form of graphical representation and then transferred readings via SMS. Some systems used hardware like Bluetooth or Zigbee to transfer results to the users mobile which when connected to internet uploaded the readings to the server and then gave analysis on the readings. This project intends to proceed by using Raspberry Pi which will enable sensor readings to be uploaded on the cloud. The system will the send the suitable crop list to the user's mobile via SMS. On comparing results of the research papers and our expected output, we concluded that in our project, we need to collect the feedback from the users after certain period of time so that we can validate our predictions.

Introduction:-

India is an agricultural country and agriculture constitutes almost 75% of India's GDP. Although this figure has dropped to almost 15% due to lack of knowledge and inadequate facilities .Being an agricultural country it becomes vital to know everything about cultivation. Agricultural land takes around 60% of land available and it is increasing at an average rate of 0.03%. Thus, it becomes extremely vital for any agricultural country to make use of the land resources effectively. This can be done by time to time soil testing and analysis. Soil testing is an essential factor for effective cultivation. The importance for soil testing and analysis is lacking in many parts of the country. Where it is

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known, it is expensive and a tedious job to get it done. Thus, it is vital to make soil testing cost-effective and available for all.

To achieve this goal, we take the help of Internet of Things (IoT). Internet of Things as the name suggests is a network of devices that are interconnected and share data with each other over the internet, wireless connection, etc. In our case the devices we use will be sensors for Moisture, Humidity, Temperature and pH. Internet of Things makes any device portable and available to any user across the globe. With increasing internet connectivity around the globe and the help of IoT devices, data can be shared around thee globe in a matter of seconds which will give us enormous opportunities to develop and advance our agricultural methods.

Analysis of the soil is the most crucial part as soil testing will make sense if the analysis of the soil yields good results. In our country soil testing is a rarely known and available which makes analysis rarer. There is no data available that defines the soil condition and requirement for growing a desired crop. Thus, due to lack of available data analysis of soil is not done as per defined standards. Our project aims to solve this problem by gathering such data about soil condition and crop from around the globe. Our idea is to gather this data from around the globe and perform big data analysis to generate a function which when given input with the constraints about soil condition can give us results about suitable crops or vegetables to grow on that soil. Thus, to make this project work we need data from around the globe which is possible with the help of internet.

Problem Definition:

Phase I

Planning:

Planning provides basic process and analytic frameworks to support corporate/division/business unit managers in both their day to day management tasks and their quarterly/annual financial management responsibilities. Decision is made of how best to manage the process. This concentration was particularly relevant for us to plan on working within the finance and accounting function for project. We have worked with strategic Planning, budget and forecast processes, preparing for monthly/quarterly/annual Strategic and operational review processes and create day-to day decision analysis support, pricing, cost control, outsourcing, and capital spending.

Analysis:

This phase deals with analyzing the user requirements and accordingly planning and designing the process of project development. This phase requires up to date and precise knowledge about target users, their requirements and existing systems. After careful analysis of these factors, we can proceed with the designing phase of the project.

Design:

After careful analysis, the requirements and resources for the project are decided. Based on these requirements, we can begin the designing phase of the project. Designing deals with creating a basic layout of the project. Based on this layout, we can identify risks, errors and gaps that require to be filled.

Coding:

After designing the layout, we can proceed with Coding. Based on the layout we can decide the best possible platform and language for coding. As our project requires hardware tools, we have to code for connecting the hardware to the software. For connecting the hardware to the software we will be using Python language and Raspberry Pi. Our project requires cloud storage and analysis, for which we will use AWS cloud services and require basic SQL and R programming skills.

Phase II

Testing:

Testing gives us feedback about the working of our project, errors and faults in the system as well as deviation from expected output of the system. Testing quantifies the success of our project using test cases in a controlled environment. Perform various tests on soil samples system like unit testing, integration testing, and system testing etc. to check whether the integrated system works as desired.

Deployment:

After successful testing and resolving errors, the system becomes ready for the final phase that is deployment. Deployment consists of various activities like release, adaption, activation and updates. Our project requires user

system for feedback on the working of our project for updating our algorithm for crop suggestion. Hence, updates and maintenance play a vital role after launching or releasing the project.

Methodology Used

For developing a project or software it is important to know the flow or which type of software development lifecycle model we are going to use. Out of various SDLC model we need to choose the model which will be perfect for our project and therefore we are using Waterfall model.

The Waterfall model is basically a linear sequential process where each phase must be completed before the next phase can begin and there is no overlapping in the phases.

The model consists of six phases namely:

1. System Engineering.
2. Analysis.
3. Design.
4. Code.
5. Testing.
6. Maintenance.

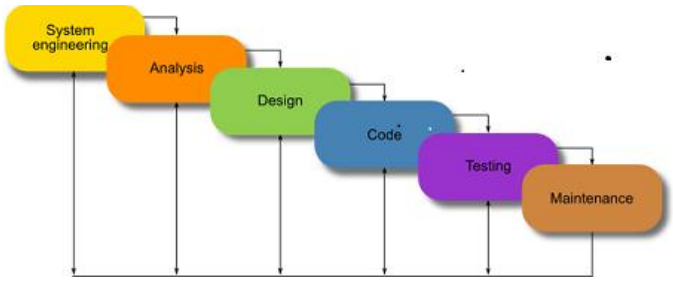

Fig 2.1:-Methodology

System Engineering:

Software Engineering plays a vital role in the development of any project, as without system engineering a project won't reach its maximum level. During this phase we try to identify various problems that are faced as well as problems that will be faced in the future. After identifying these problems we look for solutions to these problems in an amicable way.

Analysis:

After conducting the literature survey, we found gaps and limitations in the existing system. Just analyzing the existing systems is not enough for a successful project. The communication between user or customer and developer is also important. Thus, after a proper communication between customers and developers, we can decide the user requirements and system requirements. Analyzing the requirements and existing systems, we define a list of requirements.

Design:

After careful analysis, we create the list requirements. Based on the analysis we design an architecture for our proposed system. Our architecture lets us represents our proposed system with the help of Data Flow Diagram and Flowchart.

Code:

Our System requires working with hardware tools like sensors and Raspberry Pi. We connect the sensors to the system with the help of Raspberry Pi. We collect data from the sensors and send it to the cloud using Raspberry Pi with requires coding in Python language. After the data is uploaded on the cloud, analysis has to be done on the data which requires cloud computing in languages like R and SQL queries.

Testing:

After development of our project, testing is the next and one of the most important phase. We test our system on various soil samples. We test each hardware component individually as well as working as a system. After

successful testing and deployment our system requires user feedback for updates and modifications in our algorithm.

Maintenance:
As our system needs constant updates regarding soil quality and efficiency of our system, the maintenance of our system is very crucial. The user feedback enables us to know if our system is working as per user expectation. Changes help us modify our analysis algorithm for improving our analysis on suitable crop lists.

Feasibility Study
The preliminary and one of the most important phase during development of any project is initial investigation and analysis. The feasibility study is a major part of this phase. The feasibility study is the measure of how beneficial or practical the project is. For a successful feasibility study knowledge about target audience is essential.
The feasibility of the development software can be studied in terms of the following aspects:
1. Operational Feasibility.
2. Technical Feasibility.
3. Economic feasibility.
4. Legal Feasibility.
5. Motivational Feasibility
6. Operational Feasibility:

This project requires initial data set of various crops with their parameters and tools for initial phase. Though the setup requires integration phase activities but once the setup is done, it is easily operational and is feasible.

Technical Feasibility:
This project uses AWS cloud services, text message gateway API and Raspberry Pi. Raspberry Pi is used for collecting data and connecting to the cloud. Text message gateway API is used to send the result to the user in the form of text message.

Economic Feasibility:
This project requires various sensors and Raspberry Pi kit. Along with these equipment, this project requires cloud services for storing and communication. There are no miscellaneous and software cost and thus it is economically feasible.

Legal Feasibility:
The licensed copy of the required software is quite cheap and easy to get. So from legal point of view the proposed system is legally feasible.

Software and Hardware Requirements
Hardware:
1. Soil Moisture Sensor
2. Room Temperature & Humidity Sensor (DHT-11)
3. Jumper Cables
4. Breadboard
5. Raspberry Pi

Software:
1. Operating System
2. Python IDE
3. AWS Cloud Service

Design and Implementation
DFD:

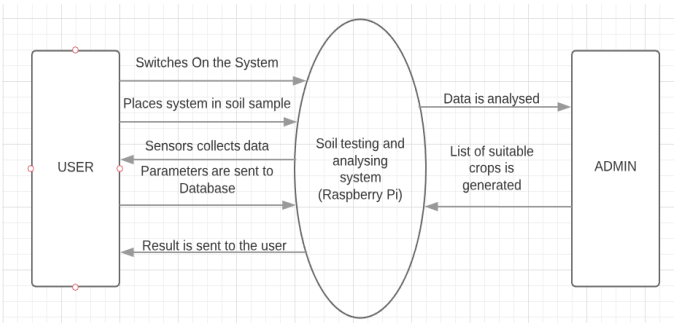

Fig 5.1:-Data Flow Diagram

Shown above is the Data Flow Diagram where the overall flow of data from user to database. As we can see user switches on the system and places it in the soil sample for getting the list of suitable crops.

Flowchart:

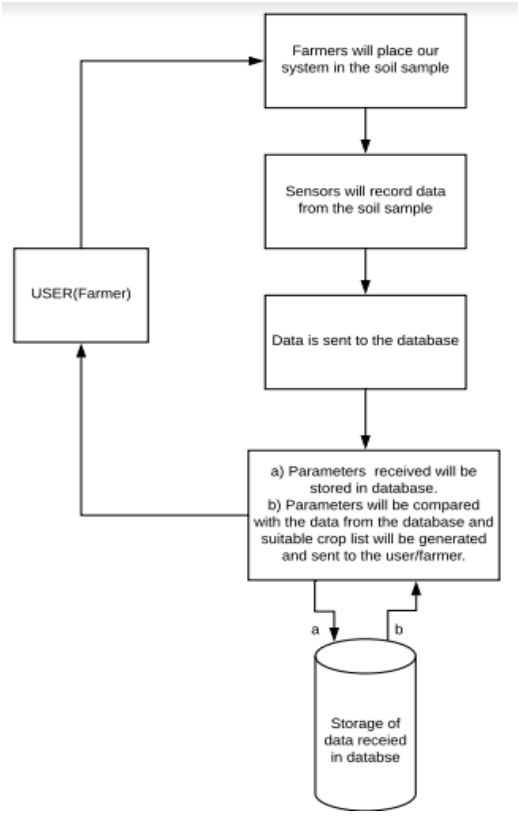

Fig 5.2:-Flow Chart

Results and Discussion:-

Output:

Through this we hope to achieve faster and efficient solution for soil testing which will reduce the time and cost. The expected result of this project will be to meet user's expectation and fulfill all the specified requirements. This project will help the users with appropriate decisions to unfold in the future. The project finding shows that a dataset of suitable crops is available and this dataset can be used further to analyze and generate specific results for the farmers.

Conclusion:-

Our system will thus help the Farmers in analyzing the soil sample conveniently and easily. As soon as he tests the soil in our system, our sensors will collect the data and send it to our database which will compare the parameters of the crops listed in the database. After comparing the parameters with the database of crops and their required parameters, our system will generate a list of crops whose parameters are satisfied by the soil sample. Our system is cheap, efficient and portable thus a Single system can be bought and shared by multiple farmers.

Future Scope

The future of our work has many areas of development and advancement. With developing technology, the requirement of the internet for analysis can be replaced by a mobile application. With advancements in AI and pattern recognition, the analysis can be on the mobile device itself. Connecting remote areas can be achieved without effort. We are also intending to make the system more efficient and faster to satisfy the customer.

References:-

1. Ravi Kishore Kodali, Archana Sahu; "An IoT Based Soil Moisture Monitoring on Losant platform"; IEEE 2016 IC3I, 978-1-5090-1/16.
2. Prachi Sharma , D.V.Padole, "Design and Implementation Soil Analyser Using IoT"; IEEE 2017 ICIIECS, 978-1-5090-3294-5/17.
3. Andac Demir; "Remote Monitoring of the soil quality with the Internet of Things"; IEEE 2017 ECE, 986-1-5520-3257-7/17.
4. R.Sujatha, R.Anitha Nithya; "A Survey on Soil Monitoring and Testing in Smart Farming using IoT and Cloud platform"; IEEE 2017 IJERA, 2248-9622,pp.55-59.
5. Komal Bodake, Rutuja Ghate, Himanshi Doshi, Priyanka Jadhav, Balasahab Tarle: "Soil Based Fertilizer Recommendation System using IOT"; June 2018.