Cloud Based Light Intensity Monitoring Application

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***Abstract*— We have built a Kotlin-based mobile application, which tracks the intensity of sunlight using the Proximity Sensor present in the Android Phone and stores the data in AWS Cloud. This light intensity data can be used by farmers to classify their crops based on their light needs such as low, medium, and high light requirements. This dynamic light intensity data is also used to calculate the DLI (Daily Light Integral) used in Greenhouses.**

We have used Kotlin and XML for the Android ApplicationProgramming. The intensity data collected from the mobile application is stored in AWS DynamoDB using Lambda Function.

Keywords*— *Android Application, AWS Cloud, ProximitySensor, DynamoDB, Lambda Function, Aggrotech

I. INTRODUCTION

As we all know, light plays an important role in agriculture. Monitoring light intensity data will be one of the keys to successful and high-yielding agriculture. We propose a mobile application through which light intensity data can be monitored remotely using cloud computing. Cloud Computing is a web-based technology that uses a central remote server to store information and applications [1].

Cloud computing comprises the computation, software, data access, and storage services that may not require end-user expertise in the physical location and the structure of the system that is delivering the services [2].

Some benefits of cloud computing in agriculture include: Data Readiness anytime and anywhere, Local and global communication, improve economic condition of the Nation, Enhance the GDP of the nation, Ensure food security level etc. [3].

This technology helps us to store the collected data in the database abstracting the user (Farmer) from the functioning of the various techniques used in the backend. Cloud computing is essential in storing the data from the farmlands as we will be adding diverse sensors in the future, data from which will also add up to the existing data to formulate an integrated database and process, which requires an enormous amount of computing power and storage which will befulfilled by cloud service providers like AWS

In some months the manufacturing of certain green house crops is limited due to the less light intensity that is composed

in the climate. During this time, we experience short days andlow light intensity.
Light can be measured directly (one at a time) or measured continuously all through the day and merged to form a mathematical sum [4]. Later on, the compiled value is the daily light integral (DLI), which determines growth of the plant and its attributes such as plug and liner rooting, girth of the stem and number of flower and branches. As we know thedirect light intensity is essential while taking decisions to consider when to switch on or off high-intensity torch, open and close retractable shade screen, and add or remove the screens.

II. Problem Statement

1.Extortionate light during the midsummer can give rise to heat stress and impede photosynthesis, particularly for agricultural crops like soybeans [5]. Hence, it is quintessentialto precisely compute light so from that we can articulate and enhance our own growing conditions and constraints. Less light could also affect the growth, development, and yield of the crops

1. There might be a long-term effect of light on crop growth, development, and yield [6].
2. Small scale farmers do not have proper scientific methods to analyze their crop growth which puts them at disadvantage compared to large private companies.
3. Scalable and affordable equipment are rarely available and often subpar

III. Materials Used

A. Application Development:

- XML: The extensible Markup Language (XML) is an imminent level for managing annals, particularly for the World Wide Web. The concept is to prevail over the drawbacks of HTML. XML is derived from the Standard Generalized Markup Language (SGML), the universal accepted level for signifying details regarding the structure and content of various types of e-documents [7].
- Kotlin: Kotlin is a coding language that works on the Java Virtual Machine (JVM) and completely

compatible with Java [8]. Kotlin was put together byJetBrains in 2010 to enhance the

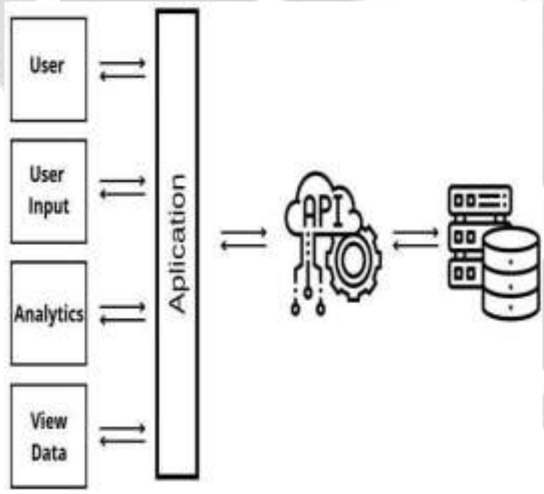

Fig. 1. Flowchart of the workflow

Coding acquaintance for the JVM. It is a multiplemodel language, assist both object-oriented and functional coding models. That is, it enables developers to associate them, as it the most up to date languages currently

- Android Studio: Android Studio is a software used for creating android applications.

B. Cloud Configuration:

- AWS Lambda: is an serverless service offered by AWS. By using AWS Lambda ensures that we needno to worry about the infrastructure instead organization can concentrate on their application. we have used to connect to the existing database to store all the relevant data in real time, we have created twofunctions which helps to store the data in Dynamo DB [10]

- AWS DynamoDB: It is relational database can be executed on a huge scale which also requires us to carry out the data stores seamlessly be increased across multiple servers and can tackle multiple breakdowns such servers, datacenters and network separators[11].
- RESTful Webservice: we have created REST API using AWS API gateway, where we have created both POST and GET request and connected to the application and the lambda. whenever the request is made the Lambda function starts executingaccording to the request sent. [13].

C. Terms used in Fig. 1.:

- User: Farmer or Client
- User Input: Light intensity data from the proximity sensor embedded in the smartphone
- Analytics: Various algorithms and parameterswill be used to analyze and show required results
- View Data: Results will be displayed in multiplegraphical representations

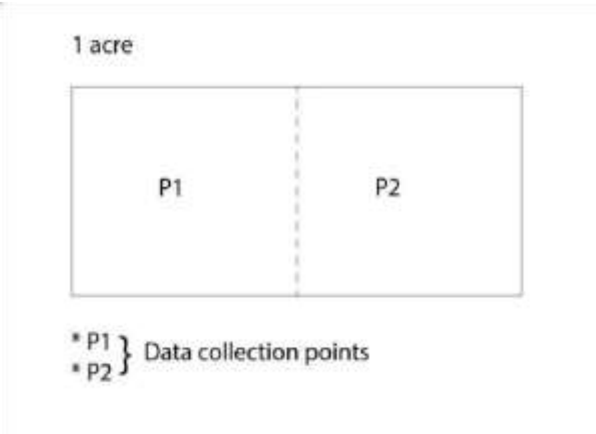

Fig. 2. Data collection points for 1 acre land

D. Hardware:

- Smartphone - Samsung M52 5G
- Android Version - 12
- Kernel Version - 5.4.147
- Sensor in the Device - Sensor Tek StK33911Ambient Light Sensor Version:1000 Range: 0.5400000215lx- 9999999lx

IV. WORKING METHODOLOGY

The user firstly should enter the data regarding the land area. The user should enter the number of acres of land and other parameters. For this prototype, we have limited the landarea to 10 acres of land. Based on the land area data that the user enters, we decide the number of upload points from where the user should upload light intensity data. The flowchart of the workflow is as illustrated in Fig. 1.

For example, if the user enters 1 acre then the user shouldupload the data from 2 data collection points as shown in Fig.
2. For 2 acres - 4 points, 3 acres - 6 points as shown in Fig. 3.,and so on.

This data will be uploaded 3 times a day so as to get accurate light intensity data. We use Retrofit API to upload the light intensity data from the app to AWS DynamoDB using the Lambda function, then the data is retrieved from DynamoDB and displayed in-app through API, by this whenever the user needs to view data, he can view through theapp.

Fig.3. Data collection points for 6 acres land

V. Future Work

- We plan to add much more physical sensors like: Electrochemical Sensors for Soil Nutrient Detection,Dielectric Soil Moisture Sensors and Airflow Sensors.
- We also plan to make the application much more sophisticated which is capable of handling multiple parameters collected by the added sensor.
- We plan to build an integrated system for smart farming
- Different IOT devices will also be introduced in the system which will improve the results. Precision agriculture can be made more decisive and capable with IOT-enabled technologies [14].
- We will ensure that the system will remain online 24*7, hence producing precise results.
- Hardware will be subject to change and upgrades. The software will improve overtime and will be available across different platforms.

VI. Conclusion

We propose an application through which light intensity can be monitored remotely using cloud computing. This application is a cost-effective method for the small-scalefarmers who has budget as an issue, to collect the lightintensity data.

This is especially beneficial for farmers who own a small areaof farming land and even beneficial for farmers who own largearea of land where they can monitor data simultaneously through the application.

As we will be storing all the data on cloud rather than storing it on a local device storage, data is more secured and easily accessible avoiding data loss and other such events. Throughthis application, the data can be stored longer period of time which can be used in future for data analysis. This dynamic light intensity data is used to calculate the DLI (Daily Light Integral) used in Greenhouses. Using this the farmer can configure the greenhouse accordingly so as to get better cropyield. Overtime this application will also help in understanding the local climate, thus helping combat climatechange.

VII. References

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