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Development of Mobile App for Estimation of Energy Input and Cost Economics of Selected Farm Operations

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A B S T R A C T

The present work is devoted to the development of an android application of cost of operation and energy calculation for rice production. It will help to schedule future development by understanding the feasibility of the individual operations and machines involved in those farm operation. Cost of operation contents specify the name of a cost group. "imputed costs" and "variable cost". A function of energy input is the crop yield, it can be applied directly and indirectly. Direct energy is needed to perform different crop-related tasks. The key products for indirect energy help is the energy used in the processing, packaging and transport of fertilizers, crops, machinery and pesticides. The algorithm is a set of words that specify the operation that a variety of rules are intended for the development of an algorithm is a critical step in solving a problem. Algorithm development was carried out in formally and visual able in nature. The algorithm for cost economic and energy inputs in agriculture production is developed to use that as a blueprint for mobile app. The app is an Android-based framework, created using Android Studio, the official Integrated Development Environment (IDE) for the development of Android applications. The aim of work is to create the energy and cost estimation app for farmers that helps analyze energy trends and the cost of various rice cultivation operations. The app named as ECOCAL-farm energy and cost calculator where E stands for energy, CO stands for cost of operation and CAL stands for calculator.

Introduction

In India, agriculture is the primary source of livelihood. According to Indian agriculture and allied industries report about, 58% of Indian population's livelihood is based on agriculture. India is expected to achieve the ambitious goal of doubling farmer's income by 2022. Indian food and grocery market contributes 70% of retail sales occupied the 6th position in the world (Indian Agriculture and Allied Industries Reports, Nov 2020). The Agri. Export from India are likely to reach target of US $ 60 billion by year 2022 (APEDA report). Modern agriculture requires an energy input at all stages of agriculture production such as direct energy like farm machinery, water

management, irrigation, cultivation and harvesting. Auditing of energy and cost of operation required skilled person and due to low literacy in farmer they think that are not necessary. Due to that they not visualize the point of concentration and where they have to need more concentration for best output. Another effect of this they not understand perfectly the pro and cones of the step and where they have to put more energy or less energy.

The progression in Indian agriculture is directly proportional to the Indian economy and vice versa also true. In the arena of Indian agriculture mobile app is the best option to increase Indian production. The invention in the technologies in the field of agriculture domain are not getting to the farmers because of most of the farmer are illiterate or due to unawareness of proper source of information. Hence farmer not acquis possible rate of production. Presently there are hundreds of application for agriculture that solve problem and help producers, farmers, and big agriculture companies to gather valuable data, manage crops, observe fields from above and create smart strategies for optimizing their process.

Indian Council for Research on International Economic Relation studied impacts of mobile phones on farmers across several Indian districts highlights the key role played by mobiles in lowering transaction costs and raising the income-levels of farmers, by efficiently addressing their immediate agricultural-information requirements.

Mobile phones enable farmers to access this information from a host of information providers such as scientists from seed and pesticide companies, cooperative committee office-bearers, input dealers, government agriculture extension officers, market-commission agents/traders, veterinary doctors, and so on.

Farmers will now be able to hire farm machineries including tractors at an affordable price through an app based mobile application like people hire Ola and Uber taxis over mobiles. The government launched multilingual app based service - CHC Farm Machinery for Custom Hiring Centre's (CHCs). This service, will facilitate local farmers the use of shared resources including tractors and other farm machineries at affordable prices.

Related Works

The impacts of factors on the final productivity of agricultural enterprises has been worked on by a large number of Indian and foreign scientists.

Narechania (2015) proposed a smartphone application, Kisan Vikas, using ICT and supporting e-governance by providing ongoing information on agriculture, weather predictions, crop prices, news, government aid lines, and an inventory database manager.

Kaur (2016) developed an agricultural scheduling system. It is an Android-based app that Punjab farmers can conveniently use because its user interface is in Punjabi, a regional language.

Ghanshyam *et al.*, (2016) developed an Android Agriculture Assistance App for agricultural operations. This framework combines digital internet, networking technologies and GPS systems that provide farming that is productive and smooth.

Modi *et al.*, (2018) developed Computer software for the rice and wheat cropping method that deals with energy auditing.

Materials and Methods

Data collection and preparation

Development of computer or smart phone application require development of suitable algorithm. For the calculation of cost of operation and energy inputs in rice cultivation adopted standard methodology are proposed by Singh, 2017; IS 1964-1979 and Singh and Mittal, 1992 respectively. Five main phases are part of our algorithm development process.

Obtain a problem summary.

Analyze an issue.

Create an algorithm at a high level.

Modify the algorithm by incorporating more details to it.

Algorithm review.

App Development Life Cycle

App development life cycle is a cyclic process that outlines the development process of mobile app. It gives the detailed procedure i.e. planning, designing and development, testing, deploying an app for building, brings into play and maintenance of app.

ADLC includes the following activities: -System analysis

Feasibility analysis

Requirement analysis

System Design

Coding

Testing

Implementation

Before going to development of mobile app a block diagram is prepared for ECOCAL-farm energy and cost calculator which are shown in Fig 1. Which represents the app function in graphical manner. And admins work flow is also represented in graphical manner shown in Fig 2.

In development program app formula and steps, predefined data in the system and which data are provided by the user are decided. Selection of predefined and input data are considered according to variability of data. In general manner data are taken predefined which show very minor variability and which show high variability are taken as input.

Fig 3 represents the list of operation, predefined data and input data in one system that is ECOCAL. This Fig shows only the system of cost of operation calculation. In same manner another system is prepared for energy calculation.

Development tool

For the proposed aforementioned mobile app development platform named Android studio is used to develop. Android Studio is Google's Android operating system's official integrated development environment (IDE), based on JetBrains' IntelliJ Concept software and specifically designed for Android development. Many virtual androids are created in platform for testing the app.

Results and Discussion

Development of computer or smart phone application required algorithm. To accomplish the research objective for calculation of cost of operation and energy in rice cultivation are adopted standard methodology are proposed by Singh, 2017; IS 1964-1979 and Singh and Mittal, 1992 respectively. Developed app helps farmer in planning and analyzing the cost incurred and energy consumption. This can be easily use with the help of android smartphone. Algorithm was developed for calculation of cost of operation and energy utilization pattern in rice cultivation. Used as a blueprint for app development.

Development of Mobile App

The process of building mobile applications for use on mobile devices is known as mobile app development. These programs can be pre-installed or downloaded and installed later by the user. This app is developed in Android studio platform using java as a coding language.

Fig.1 Block diagram of ECOCAL app

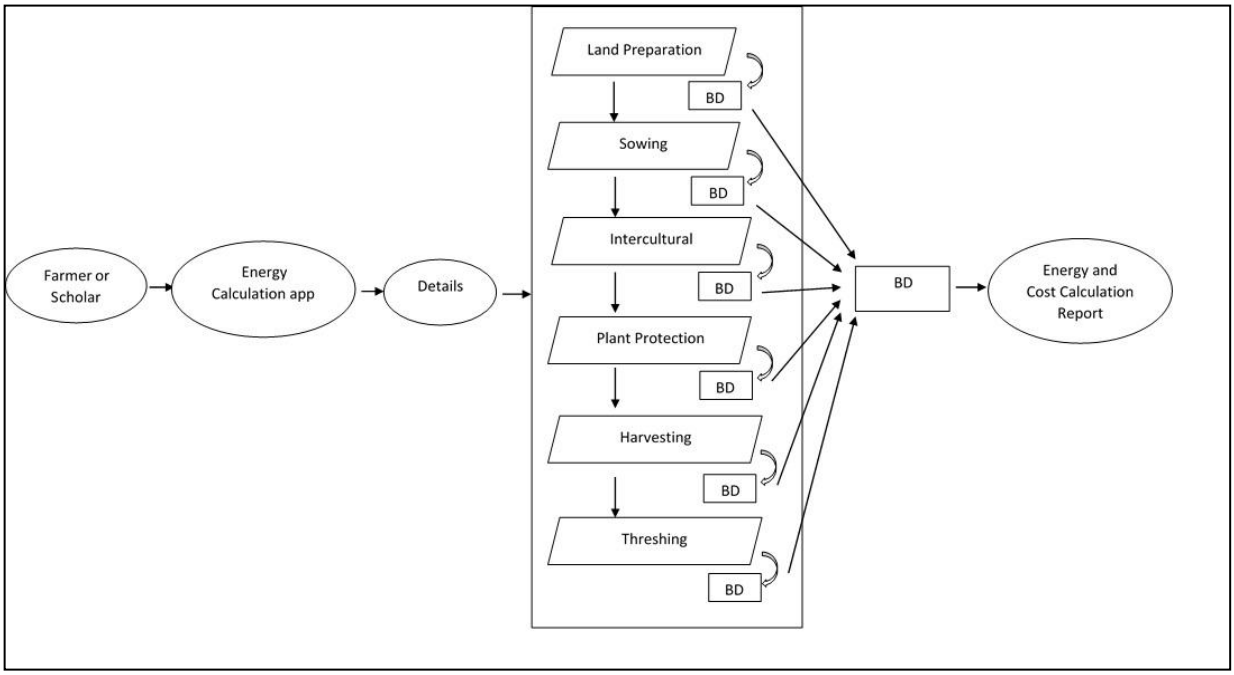

Fig.2 Block diagram of ECOCAL app

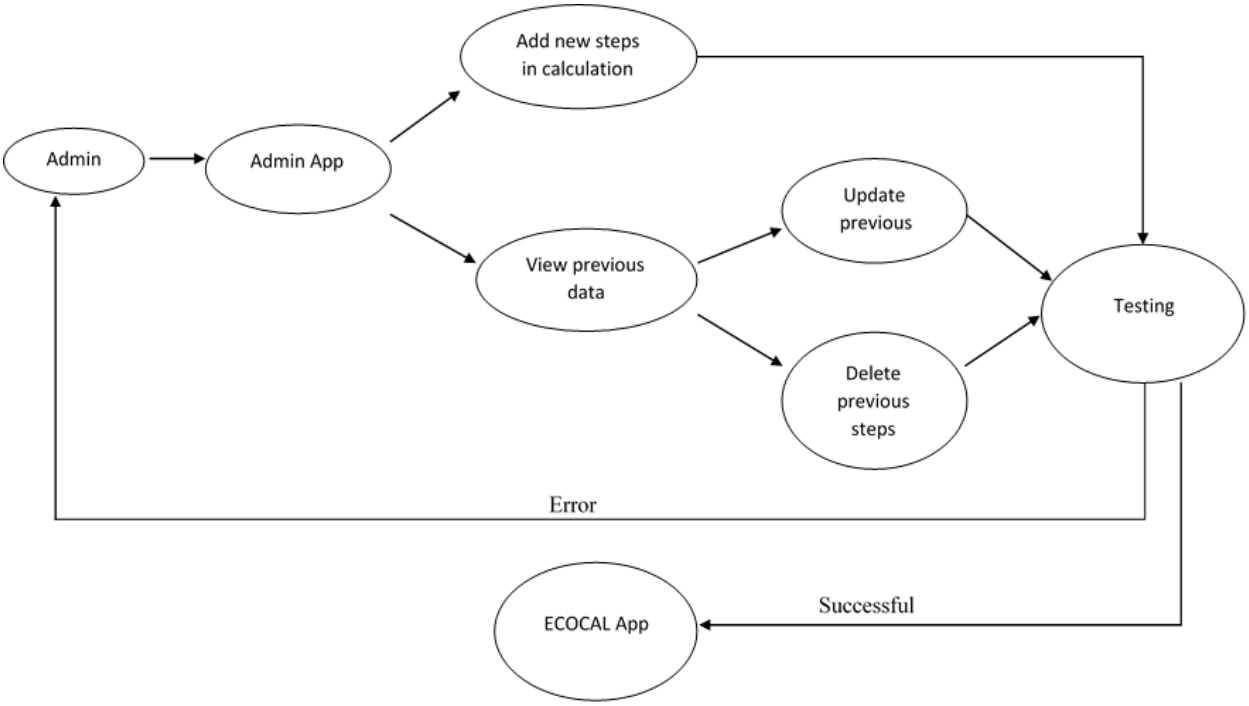

Fig.3 Decision tree for cost of operation calculation

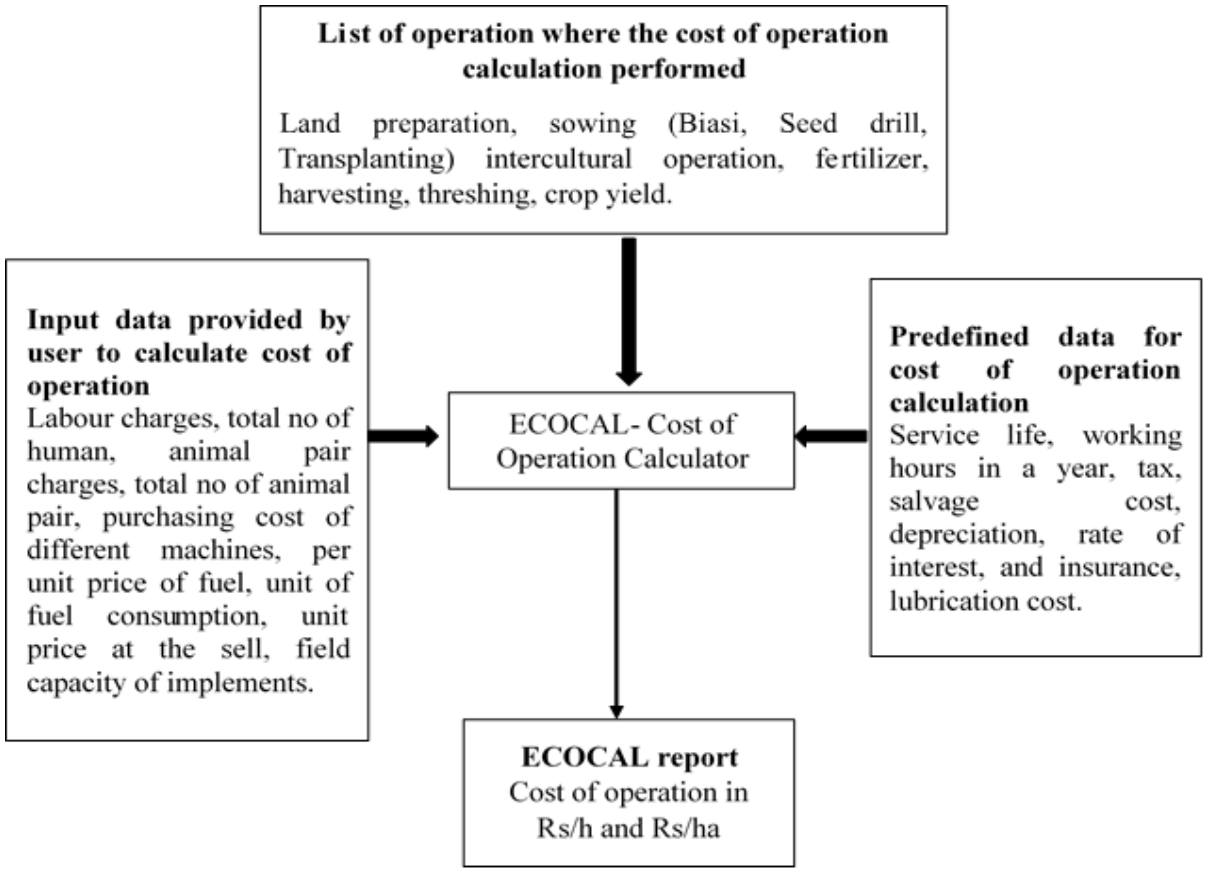

Fig.4 Chronology of ECOCAL app calculation
(a)Land preparation (b) Sowing (c) Intercultural operation (d) Harvesting (e) threshing (f) Yield

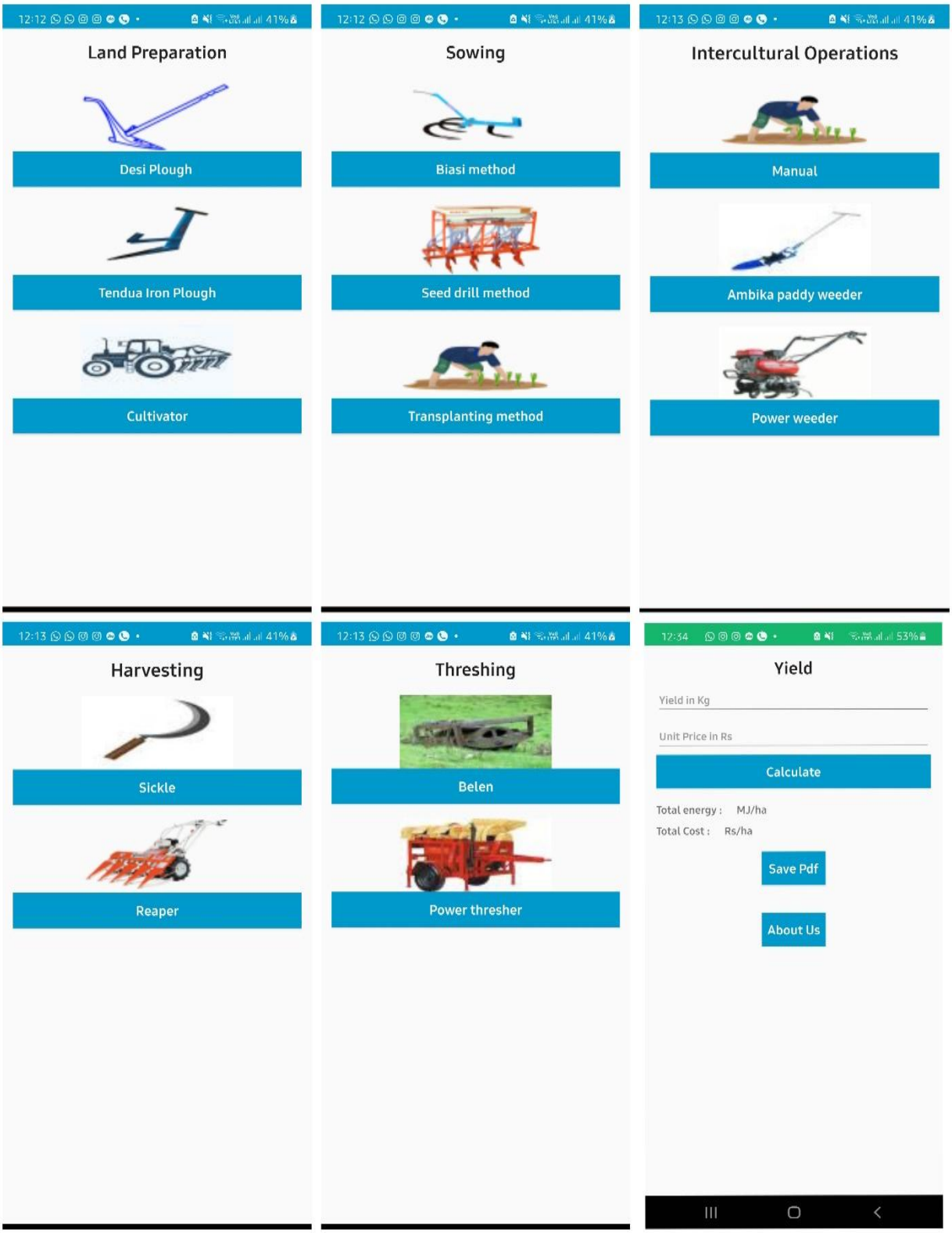

Fig.5 Shows the sample report of ECOCAL app. The report display what implements are selected for specific operation and their energy and cost of operation in Rs/h as well as Rs/ha if user provide field capacity.

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ECOCAL Report

Name of Farmer/Scholar : GAJENDRA
Institute : IGKV
Village/City : RAIPUR
Mobile No : 00000000000
Khasra No : 525

Energy and Cost according to Operation :

Farm operations	Implement used	Energy Required in MJ/ha	Cost of Operation in Rs/hr	Cost of Operation in Rs/ha
Land Preparation	Cultivator	2016.8223	852.85	947.61115
Sowing	Rotavator & Transplanter	2503.507	1944.65	6240.5713
Intercultural	Power Weeder	330.93256	539.5	5395.0
Fertilizer	Manual	1304.71	(Human only) 62.5	(Fertilizer) 636.0
Harvesting	Reaper	403.03757	622.0	1555.0
Threshing	Power Thresher	2166.2834	1169.0	0.0
Total		**8725.293**	**5190.5**	**11542.51**
Yield		58800.0		100000.0

Note- This report is generated by ECOCAL developed by SVCAET.

Here are some screen shots of the energy and cost of operation calculator different operation in rice production shown in Fig. 4. The app shows photo of the implement that show the app looks good and easily identifiable. While using the ECOCAL app the end result is output in pdf format and that can be easily sent through social media.

The use of app was very easy, just select implement which are listed in app for specific operation and by providing some inputs which are asked by app and click on calculate button. The result of cost of operation calculation are displayed in Rs/h and energy in MJ/ha. If user want cost in Rs/ha then click on Rs/ha and providing only field capacity, the cost of operation in Rs/ha are displayed. After performing all the calculation step user get a report in pdf format that can be easily shareable through social media.

In algorithm writing, the algorithm has been successfully developed for energy utilization pattern of different cropping system of paddy crop and cost of operation algorithm writing is also in research work and done and written algorithm performs their works accurately and there is not any difference in the manual calculation result and algorithm generated report.

The ECOCAL app user interface is user friendly, easy in operation by providing least input data and output is in table form so the collection of all operation energy and cost of operation are easy to study and understand.

The app was developed using android studio app development platform by using java as a coding language. Designed system of ECOCAL app was tested with past Visual Basics programmed and all the results were found to be perfectly matching.

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