

Mobile App for Ergonomics Assessment

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Abstract

Agriculture plays an important role in Indian economy. Enterprise based agriculture is important to utilize the available resources in best possible way. The agricultural activities performed by different workers/farmers are done in inappropriate way which can lead to the physical stress of worker's body and many potentially serious problems. Many researchers have conducted the research to study the problems faced by agricultural activities but all the evaluation and analysis is done by manual process which is very time consuming and cumbersome.

Need arises for fast efficient app which evaluate and analyze the problems related to agricultural activities. Hence, android based mobile app "Ergon" have been designed and developed. The mobile app have been developed using Android based technology. It evaluates and analyze the problems and gives the solutions. The app has been rigorously tested by using the statistical and engineering measures with various sample field data.

Keywords: Ergonomics, Agriculture, Fatigue, Stress, Production, Engineering, Analysis, Standard Deviation, Mean, Variance, App, BHI etc.

I Introduction

Agriculture is the prime sector for Indian economy as more than over 70% of the rural workers depends upon agriculture.

Agriculture is prime source of livelihood for rural population in India. Being an unorganized sector, agriculture is one of the drudgery prone occupations due to lack of access to improved agricultural technologies. In this sector most of the farm activities are carry out by farmers and are therefore subjected to very strenuous conditions of work that leads to both physical and psychological stress.

The working conditions lack essential facilities forces adoption of static and neo-neutral postures and unsupported positions, dependence on muscular force and strength that make the work very laborious and energy intensive. Farmers are subjected to such workloads every day, resulting in various physical disorders and health issues. The evaluation of agricultural activities [1] and tools on the basis of ergonomics parameters are essential to reduce drudgery.

Evaluators are performing the ergonomics protocol manually need arises for android based mobile app for evaluating agricultural activities on ergonomics which not only evaluates but also analyze the agricultural activities with the best possible solution.

II Design and Development of Mobile APP

Mobile APP have been developed using Android technology. The type of software includes Android Platform, Android Studio IDE, Programming Languages, Firebase, JAVA Libraries, SQLite and related AVD (Android Virtual Device) tools [2,4,6,8].

Android is an Operating System (OS) based on Linux Kernel with a Java programming interface consisting of several necessary components as shown in figure 1. The major components include: a complete stack of OS, middleware and applications, Android SDK (Development Kit) which provides all the necessary tools to develop android applications. Development of mobile app needs knowledge of the entire architecture of

Android. App are written mainly in Java and compiled to bytecode format within the built environment of Android Studio. When the application is installed on a device, the bytecode is compiled by the Android Runtime (ART) to the domestic format used by the CPU.

Brahler [4] describes the main goals of the Android architecture are efficiency and performance, both in the execution of the application and in the implementation of the old application. Android is structured within the variety of software stack comprising applications, an OS, middleware, services, run-time environment, and libraries. Every layer of the stack, and also the corresponding elements within every layer, are strongly integrated and thoroughly tuned to contribute to the optimum application build up and execution environment for the devices.

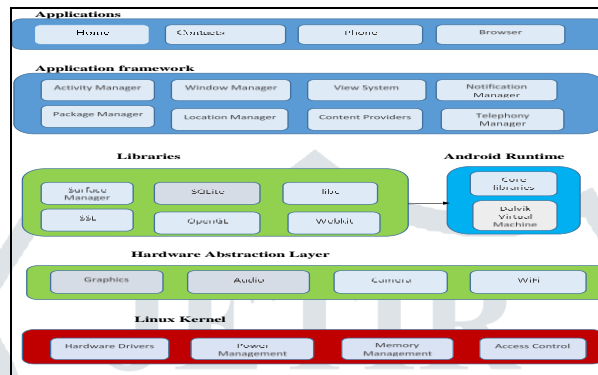


Figure 1: Android os architecture

Architecture for Mobile App

The app named as 'Ergon' has been developed under the android environment. The mobile app is connected with the firebase which provide database services (Cloud Firestore Beta) for data storing purpose and also created web services. The web services provide the accessibility of the database to the mobile app.

The Android app consists of one or more components which are written as Java classes. Communication between the app and firebase is depicted in figure 2 and the flow of information in the presented model as describe below

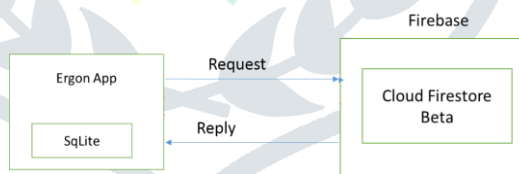


Figure 2: APP Architecture

III Experimentation

The mobile app 'Ergon', has been developed using the Android technology. It is Ergonomics based app for evaluating agricultural activities through Ergonomics Protocol. This app is very useful not only for farmers and researchers but also for all the people who are related with agricultural activities.

Features of the Application

The 'ERGON' app has been successfully developed and tested with the data of the farmer with respect to particular agricultural activity. This app is having the attractive features such as Registration and Login Form for agricultural activities and farm machinery testing through ergonomics parameters, provision of the information related to available farm equipments/tools and machineries, Testing of agricultural equipment/farm machineries for assessment of drudgery prone activities [5,7]. Analysis through statistical [3] and engineering measures.

Home Screen and Selection of Activity

Figure 3 describes the home screen of ‘ERGON’ app.

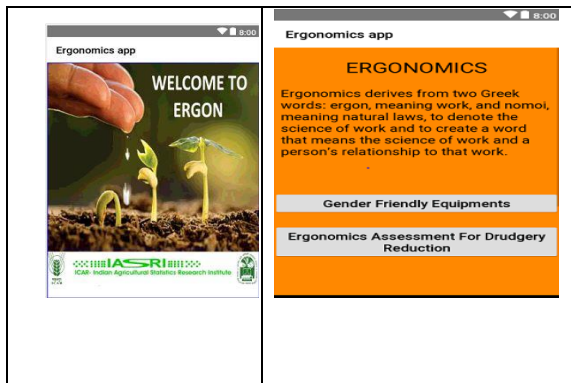


Figure 3 : Home screen of Ergon app

Database activity for gender friendly equipments

Database of gender friendly equipments collection and used by farmers. It contains various information related to equipments or machines viz., Suitable crop, capacity of equipments, make, source, price etc.

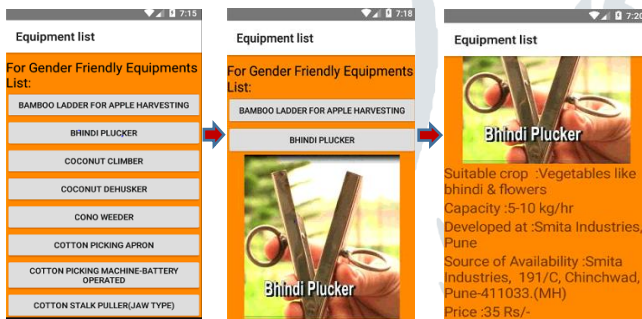


Figure 4: Database of farm equipment

Log In and Sign Up Screen It gives the registration process of the APP.

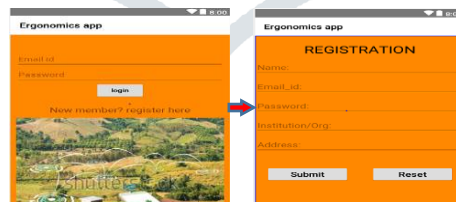


Figure 5: Registration: login and password

Create new dataset activity It creates various dataset and activities.

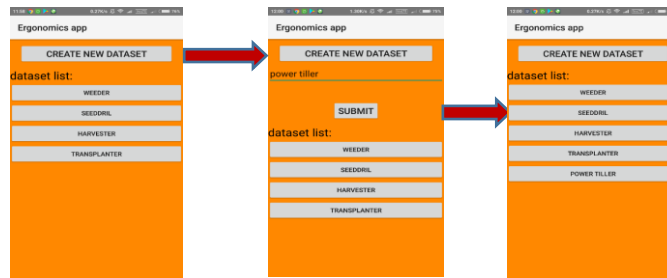


Figure 6: Database of farm equipment

Farmer’s Information

It gives farmer’s information viz., farmer name, age, district, gender, pulse rate, body temperature, blood pressure systolic and diastolic etc.

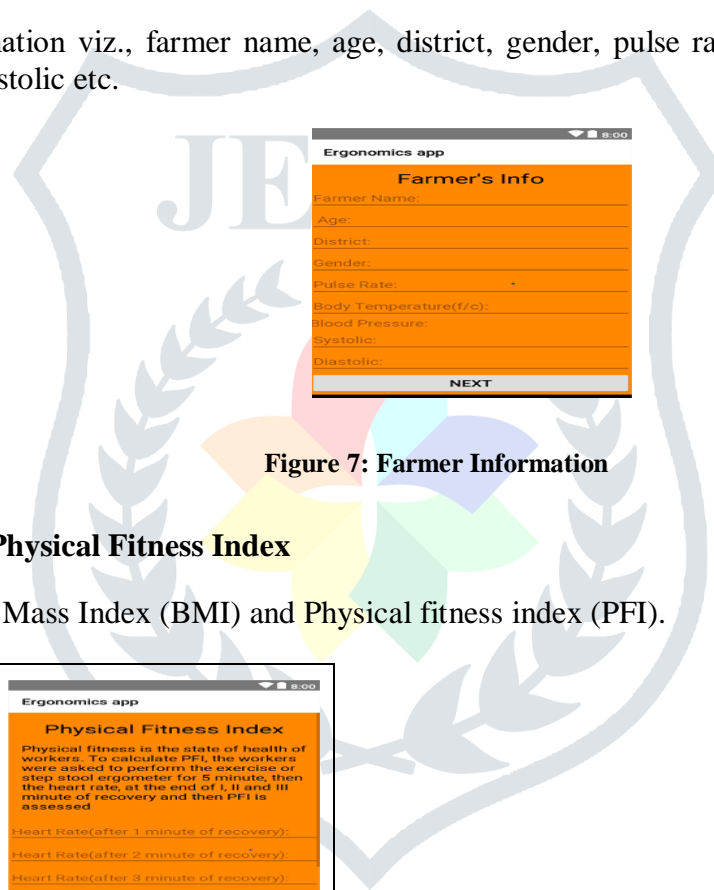


Figure 7: Farmer Information

Body Mass Index and Physical Fitness Index

Figure 8 describes Body Mass Index (BMI) and Physical fitness index (PFI).

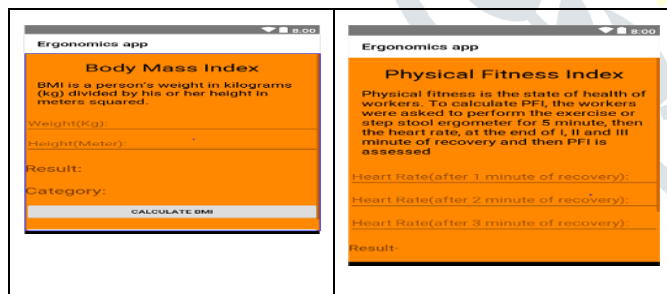


Figure 8(a): BMI (b) PFI

Agricultural Activities

The various agricultural activities viz., sowing, harvesting, weeding, threshing, land preparation, fertilizer application, transplanting, hoeing and other agricultural and allied activities are evaluated and analyzed through both the traditional (manual) and App method.



Figure 9 (a) Traditional Method (b) APP (Equipment) Method

The Traditional method is very time consuming and less efficient and the Equipment (APP) method reduces stress, drudgery as compared to traditional method shown in Figure 9. This APP has been rigorously tested for all agricultural activities. E.g. the below analysis is for 10 sample agricultural data which were used for evaluating drudgery in field during particular activity (weeding) and analysis through engineering and statistical measures the equipment (Four Row Weeder) are used for performing weeding activity in the field, equipment reduces the drudgery of farmer compare to traditional method. One can easily analyze through APP that the particular equipment is suitable or not for the user.

Heart Rate											
Subjects	Resting	Working	Recovery	Resting	Working	Recovery	CCR	AHR	TCW	PCW	
1	72	121	81	2.738	10.259	4.138	9	49	793	788	49.6
2	81	125	81	4.239	10.617	4.139	9	42	800	940	48.2
3	79	119	81	3.841	10.201	4.477	4	40	600	854	42.2667
4	78	121	72	3.661	10.219	3.988	10	42	645	819	48.8550
5	76	129	85	3.384	11.791	4.785	9	51	791	891	51.6
6	82	130	81	4.159	11.26	3.789	9	48	730	729	48.6
7	81	121	81	4.159	11.129	4.141	11	40	600	779	49.5115
8	78	124	81	3.364	10.898	3.411	11	48	720	731	48.8667
9	81	121	84	4.239	10.219	4.056	9	40	600	825	49.2
10	79	120	91	3.841	11.124	3.789	12	47	785	717	47.8
Mean	78.2	121.4	81.1	3.763	10.888	4.044	7.1	45	675	802.2	49.44

Heart Rate											
Subjects	Resting	Working	Recovery	Resting	Working	Recovery	CCR	AHR	TCW	PCW	
1	72	113	81	2.728	9.267	4.129	9	41	610	624	41.6
2	71	111	98	2.569	8.929	6.862	27	40	600	627	41.8
3	71	115	81	2.368	9.265	4.477	12	44	680	672	44.8
4	72	115	80	2.728	9.565	4	8	43	645	651	41.5313
5	75	121	79	3.205	10.519	3.682	3	46	690	691	48.2
6	71	102	79	2.569	7.488	3.841	8	31	465	479	31.5313
7	71	101	81	2.569	7.339	4.159	10	30	450	480	30.6667
8	78	119	72	3.364	10.201	2.728	-4	43	645	641	42.7333
9	79	118	78	3.841	10.862	3.682	-1	39	585	584	38.9333
10	74	109	81	3.046	8.611	4.159	7	35	525	532	35.4667
Mean	75.2	112.4	81.1	2.918	9.1516	4.1749	7.9	39.2	546	595.9	39.7207

Figure 10: Comparisons

Conclusion

More than 70 % of the rural households depend on agriculture [1]. Farmers pursue a number of survival strategies to earn enough cash to feed and maintain their families. Drudgery is generally conceived as physical and mental strain, agony, monotony, time consuming and hardship experienced by farmers while performing agricultural activities. Therefore, assessment of agricultural tools and machineries with ergonomics parameters helps in evaluation and risk of drudgery in farm.

The recommendation is given based on selected ergonomics protocol of agricultural activity by comparing evaluating, analyzing and comparing by both the methods and the optimum result is recommend to the farmer/user.

The APP has been rigorously tested evaluated and analyzed for all agricultural activities and number of field data sets of varied farmers and results shows tremendous improvement and benefit by the evaluation with analysis method of this APP.

References

- [1] Arjun, K. M., "Indian agriculture-status, importance and role in Indian Economy", International Journal of Agriculture and Food Science Technology, 4(4), 343-346, 2013.
- [2] Android Studio: "The Official IDE of Android", <http://developer.android.com/studio/index.html>.
- [3] Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Prentice Hall, Upper Saddle River, New Jersey, 1979.
- [4] Brahler, S., "Analysis of the android architecture", Karlsruhe Institute for Technology, 1-8, 2010.
- [5] International Labour Office, In collaboration with the International Ergonomics Association Ergonomic checkpoints: Practical and easy-to-implement solutions for improving safety, health and working conditions. Second edition. International Labour Office, Geneva, 2010.

[6] Kumar, K. N., Akhi, K., Gunti, S. K., & Reddy, M. S. P., "Implementing smart home using firebase", International Journal of Research in Engineering and Applied Sciences, 6(10), 193-198, 2016.

[7] Lantzou, T., Koykoyris, G. and Salamasis, M., "FarmManager: an android application for the management of small farms", Procedia Technology, 8, 587-592, 2013.

[8] Smyth, N., "Android Studio 3.0 Development Essentials-Android 8 Edition", Payload Media, Inc., 2017.

[9] Vogel, L., "Android Development Tutorial", 2013.

[10] Vogel, L., "Android SQLite Database and Content Provider-Tutorial. Java, Eclipse, Android and Web Programming Tutorials", 2010.

