

Application of IoT for Monitoring of Accidents in Agriculture

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Abstract

An IoT based agricultural accidents monitoring system has been developed to know cause and analysis of accident also to estimate losses due to agricultural accidents. It has capability to feed and upload data along with live photographs from the spot of accident and from the place of investigation. The system consists of mobile app and a server-based software. Android Studio and Adobe Dreamweaver was used for development of android app for creating, publishing, and managing websites and mobile content while MySQL, J2EE technology were used to develop web applications, CVS is a version control system used for Source Configuration Management (SCM). Eclipse was used to develop packages and Apache Tomcat for web server environment in which Java code can run. The developed multi lingual application is user friendly with multi-level security and can be operated by persons using any android-based mobile phone. The system can generate reports as per the access authentication. The analysis includes accidents type and nature, total number, farm machinery related, hand-tools related and other accidents. Apart from research organizations this system can revolutionize safety in agriculture through manufacturers, policy makers, insurance companies for implementation of more safety features, safety standards on the equipment, creating awareness whereby bringing down accidents to the minimum level for more safe tomorrow in the field of agriculture.

Key words :

Agricultural accidents have been a serious issue in the agriculture sector of the country (Kumar et al., 1998). With the objective to increase the food grain production to feed the growing population, the farm mechanization is being promoted at the larger scale in the country (Gite *et al.*, 2020). This involved use of numerous types of farm equipment for various operations to tackle the constraints like timeliness, labour shortage, saving in inputs, etc. Many a times, family members of the farmers and farm laborers face risks, mainly because most of the work done on the farm is tedious, energy and time consuming. For operation of the advanced machines requires experience and skill. Lack of this, the accidents may occur (Kumar *et al.*, 2008). Accidents in agriculture

are a worldwide problem. A survey on accidents in agriculture was launched in the state of Madhya Pradesh. Central Institute of Agricultural Engineering, Bhopal conducted agricultural accident survey in Madhya Pradesh during 1995-96, 2004-05 and 2013-13, where fatal accidents are reported as 9.2%, 6% and 10.5% respectively. Such data would help in making more logical estimates for the economic impact of agricultural accidents (Agrawal and Potdar, 2019). Keeping in view the above and on the basis of the data generated during the Agricultural Accident Survey, "Survey of Agricultural Accidents and Creation of Data Bank" has been done.

Methods for the study of accidents include statistical and science analysis, the study of safety attitudes and safety behavior, near-crash studies, speed and work experiments, interviews

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and many others (Anon. 2002). Tractor is often involved in accidents in agricultural field work. Combine harvesters, feed processing machines and other types of equipment also cause considerable injuries. Various types of agricultural accidents occur while using different tools and machinery in agricultural mechanization, which results in loss of agricultural work (Nag and Nag, 2004). Surveys are essential to know about these agricultural accidents. Academic study and survey in agricultural accident surveys, especially question surveys, can be lengthy and may involve hundreds of questions that take hours to answer (Kiranmayi *et al.*, 2022).

Compiling long surveys is a time consuming and tedious thus making it error prone during data entry. To address this problem, the widespread use of smart phones and mobile devices presents a possible solution. Mobile apps are the next leading tool for scientific research, with the potential to facilitate analytics on the go.

IoT based Agricultural Accident Survey Monitoring System/Mobile Application that allows to analyze and participate in surveys electronically in a safe, simple and easy to use. Collected data is easily exported to spreadsheets for later statistical analysis, displacing physical collection of survey responses and manual data entry.

This allows for additional confidential protection and prevents data entry errors while maximizing participants' convenience. The mobile application facilitates data collection ranging from simple surveys to long multi-type studies and assists in study and data collection.

These apps are mainly focused on data analysis of accidents with machinery and equipment in agriculture. The primary data is collected through interview and questionnaire approach.

Materials and methods

Internet based software has been used for IoT based app and website creation. All-in-one visual development tool used to create, publish and manage Adobe Dreamweaver website and mobile content

(IoT) based app : Android Studio has been used to develop the Accident Survey Mobile App. Android Studio is the official integrated development environment for Google's Android operating system, built on the IntelliJ IDEA IntelliJIDEA software from Jet Brains and designed specifically for Android development.

Database / Web Software : My SQL Database is an object-relational database management system, which is used to store all the master and accident survey data in this application. This application uses J2EE technology which is mainly used to develop web applications in Java by taking the help of HTML pages or specific applet and defining Java-based applications.

CVSvs is a version control system used for source configuration management (SCM). Eclipse is used to develop packages for software Mathematica. The development environment includes the Eclipse Java Development Tools (JDT) for Java.

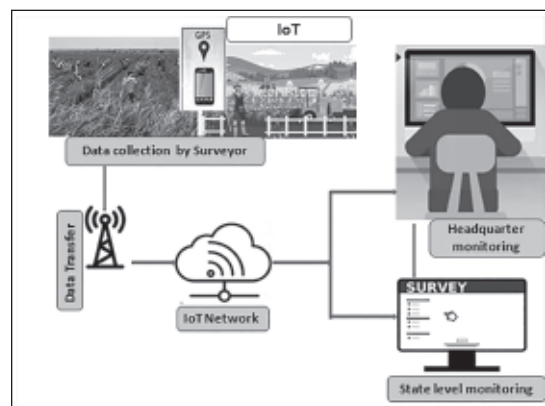


Fig. 1. IoT based agricultural accidents monitoring system

Eclipse has been used to develop packages and Apache Tomcat for web server environments in which Java code can run.

Results and Discussion

Multilingual (Hindi, English, Tamil, Punjabi, Oriya, Marathi) app is user friendly with multi-layered security, can be operated by anyone using any Android based mobile phone and generate reports as per system access authentication. could. The analysis includes the type, nature, total number of accidents, information related to agricultural machinery, manual equipment and other accidents.

A secure, simple and easy-to-use app to help you create and analyze surveys on Android and

server-based software web application platforms. Provisions have also been made for email based login authenticity, Aadhaar and bank details. The mobile application is a three-tiered system that can be used for surveying villages, the app also has the capability to enter data, upload photographs and record the length of time from where the data has been collected.

Part-I 1 of the survey proforma will be used for collection of basic information of the village and Part-II will be used for collection of detailed information on the incident and Part-III will be used for collection of information of Victim III covered in II . The App has a provision to edit/correct/store the data locally on the mobile before submitting it to the server.

These survey answers will be uploaded through Android App (IoT), in which key information such as total accidents, severity of accidents, nature of accidents, causes of accidents, age of victims, educational status, effects of accidents etc., and pictures of injuries Will take and upload through app. After the survey is completed, this information (database) will automatically be stored in the web software, using which the data can be analyzed, managed.

Web software, enables users to create surveys with ease. Users can specify the name/title and type of survey they want to create

The backend software, Agricultural Accident Survey Software can be accessed through the link. This software is user restricted and authentication is required to access the software. It has three levels of certification, coordination cell (administrator), state level certification (AICRP center administrator) and village level certification (area investigator).

The data entered through "Agril Accidents Survey App" (IoT) can be accessed through this software to view, correct and generate reports.

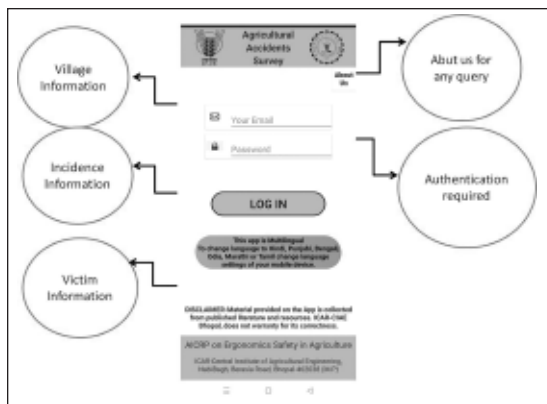


Fig. 2. Developed Android based Mobile app



Fig. 3. Agriculture accident information analysis backend software

Table 1. Parameters recorded during agricultural accident survey

Village basic information	Incidence information	Accident victim information
Population of village	Date and time of accident	Victim information
Agricultural labor information	Place of accident and number of victims	Work on the machine involved in the accident
Net cultivated area	Category of accident	Severity of accidents
No. of Machines/Equipment	Nature and reasons of accident	Type of victim's injury
Village crop details	Photos of accident	Photos of victim

The software can be used to generate reports of incidents, number of victims, classification, factors, economic losses etc.

The backend can be used to help change passwords, add state administrators to monitor survey progress, and add/block admins to add surveyors to perform survey tasks. In addition the software has the capability to analyze and generate reports of tables, villages, states and all over India as per certification.

Conclusions

Agricultural mechanization as well as

increasing application of other agricultural inputs has increased productivity and production on farms. But, the unintentional neglect of ergonomic aspects in the design and operation of various tools and machinery has also led to many casualties and injuries due to accidents while carrying out various agricultural activities.

Although some accident surveys were conducted by collecting data on agricultural accidents in the country, it needs to be continued to monitor the impact on agricultural operations. Surveys are widely used to collect information from research studies. However, this process is

time-consuming and error-prone, therefore, taking into account the extent and severity of the problem in quantitative terms, IOT based agricultural accident monitoring systems have been developed.

This collected information will be used by the research organizations, apart from the research organizations, to provide compensation to the insurance companies, to implement more safety features through policy makers, safety standards on equipment, etc. to the agricultural machinery manufacturers. can revolutionize security in agriculture through, Due to which awareness can be created among the agricultural machine users and farmers, so that agricultural accidents can be brought in the area of safe tomorrow by minimizing them. Being a multilingual app, it is easy for the client to use and it tracks the live location, thereby proving the accuracy of the app information. Accidents can be prevented by technical, human and organizational measures.

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