



## A Social Justice Dynamic Data Base Model for Students of Technical Education and Industrial Training

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### Abstract

Punjab has basically agriculture based economy and is a relatively prosperous state now opened up for other sectors like garment manufacturing, textiles, tool and die making, information technology and food processing. For providing skilled man power to these sectors the state has three tier technical education system; Industrial Training Institutes (ITI), Polytechnics and Engineering Colleges. Economically weaker students have mostly average school grades. Therefore, government is funding their tuition fee for skill training through various scholarship schemes. Large numbers of students apply for scholarships every intake and generate large amount of student data consisting of enrollments, scholarships, academic content, literature search, testing, results and finally placements. Such data require lot of security, integrity and scalability and remain available for decision making and analysis. In this paper a new information and communication technologies based social justice data base model for Polytechnic and ITI students for the state of Punjab is suggested. This model is easy to use through mobile phones, tabs, desktops and laptops. Future scope of such a model is discussed here for socio economic growth of the state of Punjab and country as a whole.

**Keywords:** Big Data of Students; Financial Assistance Technical Education; Student Data; Social Justice Model for Education; Industrial Training Model

### Introduction and Methodology

Indian State of Punjab has highest number of population of minority communities like Sikhs, Muslims and Christians. Historically Indian Hindus were divided into 4 basic divisions varans named as Brahman, Kashatria (Khatri), Vaesh and Shudra. The Brahmins were those who used to impart education, Kashatria (Khatri) were the people who were warriors and their task included defense services, Vaesh were farmers, traders and animal keepers and the Shudra were mechanics and laborers. Further they were divided into many castes within all these divisions. There were lots of social issues with such a big caste system as all were not given

equal rights leading to economic divide. Brahman and Khatri were rich and Vaesh, Shudra were average and poor respectively. In the 14<sup>th</sup> century first Sikh Guru Nanak dev ji educated the people for equal rights including teaching them gender equality. Modern day reformists like Dr. B. R. Ambedkar wrote Indian constitution providing equal rights to all in the post independence era, yet the centuries old caste system had deep footprints in the country [8]. Total population of Punjab was 27743000, as per the census of India in the year 2011 and the fresh projections suggest that in the year 2020, it may be near 30000000. Punjab has highest percentage of scheduled caste population amongst all other states of India. This

was 8860000, which was about 32% of the total population of the state. Similarly, percentage of OBC was about 31% of the total population. The remaining general categories on the basis of caste constitute 33%. As far as community based population is concerned the Sikhs constitutes 57.69% of the total Punjab population. They also represent minority community in India although at the Punjab state level they are in majority. The pie charts figure 1 to 5 shows the percentage of population on the basis of religion/community and caste in India and the state of Punjab. As per the 2011 census of India, for a total of 1.2 billions of population of the country, the scheduled castes and tribes, backward classes and minority community were having major numbers. The scheduled caste population was about 19.59% and scheduled tribes (ST) were 8.63% of the total population in India. Other backward classes (OBC) population was 40.94%. Similarly, population of minority community in India was about 20.5% which was a considerable chunk.

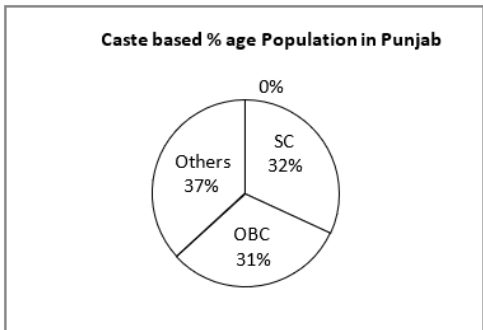


Figure 3: Caste population-Punjab 2011.

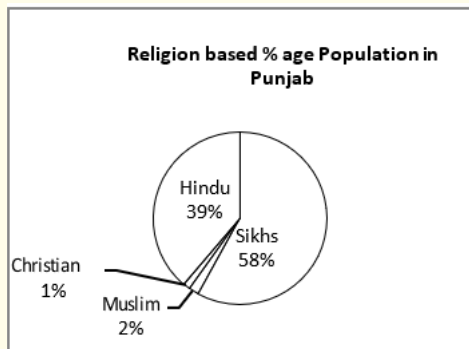


Figure 4: Community population-Punjab 2011.

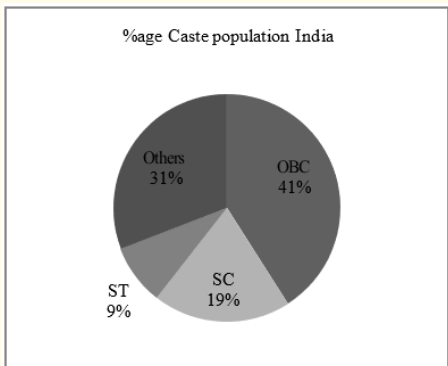


Figure 1: Caste population - 2011 census

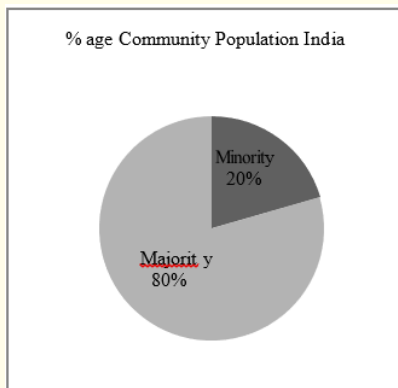


Figure 2: Community population - 2011 census.

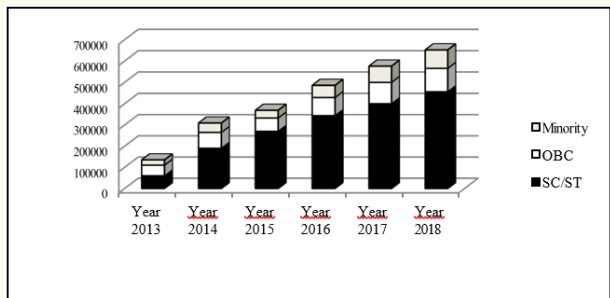


Figure 5: Students applying for financial assistance year wise in the State of Punjab.

The higher education system in the state of Punjab is largely based on university grants commission (UGC) guidelines for universities, which have large number of affiliated colleges across the state [1]. Similarly, All India council for technical education (AICTE)

regulates large number of engineering colleges, polytechnics, technical universities and their affiliated colleges. The certificate level skill/vocational courses are largely run by industrial training institutes (ITI) under the guidelines of director general employment and training (DGET) and the National council for vocational training (NCVT). The directorates of technical educations (DTEs) are state government organizations that are managing the technical education system at state level keeping in view of the guidelines of respective federal regulators. The ITI and polytechnics are affiliated to the state board of technical education and industrial training. Further there are many private ITI, polytechnics, engineering colleges and universities in Punjab. Central and state funded scholarship schemes are available for students of different economic status in the society on the bases of caste, community and financial status. Financial assistance is available for scheduled castes and backward classes, minority communities and also for general communities on the basis of merit cum means. The universities, colleges, polytechnics and industrial training institutes look for solutions to handle large amount of student data ranging from enrollments, scholarships, academic content, literature search, testing, results and final placements and also for analyzing data for future decision making. With the advent of online courses offered by many universities, the amount of data available to educational officials and students has increased many folds. The new database models are needed in today's world to support data mining approaches for increasing the efficacy of such large no of educational institutions [3]. In this paper, for providing scholarships to economically weaker sections, a new database model for Punjab state has been suggested, which is more secure, cost effective, reliable, easy to use and can handle ever increasing memory space requirements. Modern day open source tools like MongoDB coupled with cloud technology are used. Some characteristics of NoSQL databases are inherently schema-less and highly scalable. Also due to advances in the information and communication technology and faster internet facilities, it is much easier for institutions to approach out to more and more students and to attract them for admissions, academics and scholarships and other similar and related activities. Most of the scholarships schemes were designed for uplifting weaker sections of the society and also uplifting the minority communities with low income groups. Also, other general communities are covered on the basis of giving scholarships on the basis of merit cum means.

### Management of social justice model

#### Risk detection

Data security and information integrity is a big challenge in institutional data as the personal data and information of applicants

can be stolen online. For example, if national identity number (UID) of the student or bank accounts is stolen by hackers it can lead to financial loss to the applicant students. Leakage of such personal and classified data can lead to various scams. So, risk detection and analysis and using various security techniques like modern encryption algorithms are proposed to be inbuilt in the data mining system [3].

#### Performance prediction

The performance prediction of students whether he/she is continuing in his studies after availing the benefit of financial assistance need to be ascertained before granting the scholarship application for the next semester/year. His Board/University scores need to be linked using various data tools to the Data Base Management system. If he do not appear or pass any of the subjects his application is liable to be rejected till he passes the requisite no of subjects and re apply for scholarship of next semester/year. In the proposed study data alert has been implemented. Dropout rates can be ascertained while analyzing the data, so finally the decision making can be improved for further award of scholarships.

#### Data visualization

Technical educational data become more and more complex as it grow in size. Data can be visualized using data visualization techniques to easily identify the trends and relations in the data just by looking on the visual reports.

#### Intelligent feedback

Learning systems can provide intelligent and immediate feedback to students in response to their inputs which will improve student interaction and performance. It is proposed to implement a new framework that can be developed by linking application submission transaction for scholarship applications till the approval happens.

#### Technical education and industrial training conventional model

There are thousands of students applying for different financial assistance and scholarships every intake on the basis of caste, social status of families, and merit cum means or uplifting of minority communities etc.

#### Minority scholarship 10<sup>th</sup> class and above

The objective of the scheme is to provide financial assistance to the poor and meritorious students belonging to minority communities to enable them to pursue professional and technical courses. Scholarship is given to students to pursue degree and/or post grad-

uate level courses from ITI, technical diploma, professional, nursing, pharmacy, management etc. institutions. Scholarship is awarded to the students who have secured not less than 50% marks in the previous final examination and the annual income of the parents/guardian from all sources does not exceed INR 250000. A student should be resident of Punjab state and regular in attendance. Scholarship is not being given to more than two students in a family. Full course fee is being reimbursed for national listed institutions such as IIT's, IIM.

**Minority scholarship for schools class 1 - 10<sup>th</sup>**

The school students belonging to minority communities are eligible to apply for this scholarship. They must be studying in class 1 to 10 at a government/private school. The minimum percentage of marks to be obtained by them in the last qualifying examination should be 50%. Under this scheme apart from renewal, every year 3000000 new scholarships are provided to the candidates whose family income is less than INR 100000 per annum; a further 30% scholarship is only reserved for girls. The amount of scholarship under this School going minority students is INR 10000 - 10700 per annum.

**Fee waiver scholarship for ITI students**

This is another scholarship scheme for general category students who are meritorious and they may belong to any caste or community or religion. Under this scheme full tuition fees is waived off as per their merit in qualifying examination as for the first 5% top students and half of the tuition fees is waived off for next 5% top students.

**Fee waiver scheme for students of polytechnics and engineering colleges**

Full tuition fee is waived off for each AICTE approved Institution for 5% seats over and above the sanctioned seats for the students whose parent's annual income is less than INR 800000.

**Chief minister scholarship for government technical colleges**

This scheme was introduced in Punjab for students of only govt. Polytechnics and Engineering colleges in the year 2017. The students belonging to any category can claim this scholarship as it is meant for those students whose marks in 10<sup>th</sup> or ITI or 12<sup>th</sup> are above 60%. On the basis of their marks in qualifying examination, the tuition fee of the students is proportionately waived off. For instance, a student with 70% marks gets 70% scholarship/fee waiver.

**Post matric scholarship scheme for SC and OBC**

This scheme enables free education for ITI, Polytechnics and higher technical courses like diploma and degree in engineering, management and pharmacy. SC students and OBC students, whose parent' annual income is less than INR 250000 and INR 800000 respectively are eligible for claiming. Minimum qualification for applying is 10<sup>th</sup> pass from a recognized school or board.

**Conventional data base model**

There are thousands of students applying for different financial assistance and scholarships every intake. Also, there are large numbers of returning students. There are no of options and schemes available on the basis of caste, social status of families, merit cum means and uplifting of minority communities etc. as discussed above. The step by step procedure is as shown in figure 6 below which was currently in place.

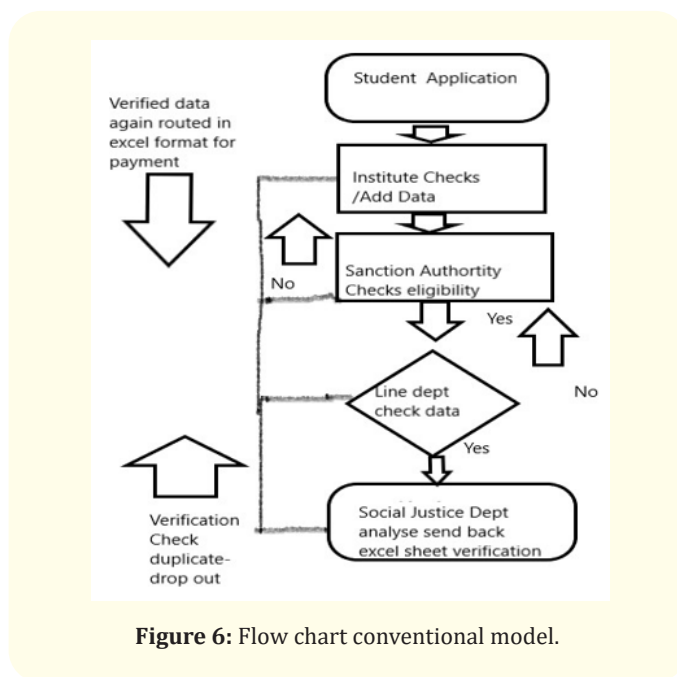


Figure 6: Flow chart conventional model.

**Implementation of new model**

The following Ford-Fulkerson algorithm for new database model describes it as: input: Applications form from students output: send checks f to banks for awards for each application (u, v) in Database do implement clustering approach to distribute the applications while there exists appropriate application to scholarship. return f

It is based on the following example:

Here follows a longer example of mathematical-style pseudo code, for the ford-fulkerson algorithm:

Algorithm ford-fulkerson is

input: Graph  $G$  with flow capacity  $c$ , source node  $s$ ,

sink node  $t$

output: Flow  $f$  such that  $f$  is maximal from  $s$  to  $t$

(Note that  $f(u,v)$  is the flow from node  $u$  to node  $v$ , and  $c(u,v)$  is the flow capacity from node  $u$  to node  $v$ )

for each edge  $(u, v)$  in  $GE$  do

$f(u, v) \leftarrow 0$

$f(v, u) \leftarrow 0$

while there exists a path  $p$  from  $s$  to  $t$  in the residual network  $Gf$  do let  $cf$  be the flow capacity of the residual network  $Gf$

$cf(p) \leftarrow \min\{cf(u, v) \mid (u, v) \text{ in } p\}$  for each edge  $(u, v)$  in  $p$  do

$f(u, v) \leftarrow f(u, v) + cf(p)$

$f(v, u) \leftarrow -f(u, v)$ .

The new model is cloud based platform using virtualized cluster of servers over data centers over SLA [6]. Dynamic resource provisioning of the servers storage and the networks is cloud computing basically. The student fills in the application details from his/her mobile phone/laptop. The UID server authenticates his/her identity from UID (Unique Identification) number and opens up the application form. The student fills it up, attaches and uploads eligibility documents, and submits it online. College/university server checks his/her academic, enrollment and performance credentials and forwards his/her application online to district sanctioning authority. District sanctioning authority ascertains the eligibility documents and sanctions the student claim which goes to the line department. The line department collects all claims checks authenticity of district sanctioning authority, university/college affiliation and recognition status and the upper limit of amount claimed, finally checks attendance performance from the linked university/board server and send the claims for releasing payment to the department of social justice. The new database model is shown in figure 7. The department of social justice sends the money to UID linked bank account of the student through internet banking as the account no and IFS code data available in the student application. Many students are doing multiple times same activities year after

year till they pass out. This kind of Big data generated ranging from admission, claiming financial assistance, attendance; performance etc. is stored in mongo cloud and available for decision making and analysis by the line department for arranging funds, estimations, budgeting and other decision making analytics. Mongo DB data base architecture in the new database model is more secure than MySQL based old data base model where lot of server memory and some manual processing of re-verifying the performance of student was required. Also, manual deleting fake/duplicate claims takes time and there were delays in releasing the scholarships and financial assistance to the students account [2].

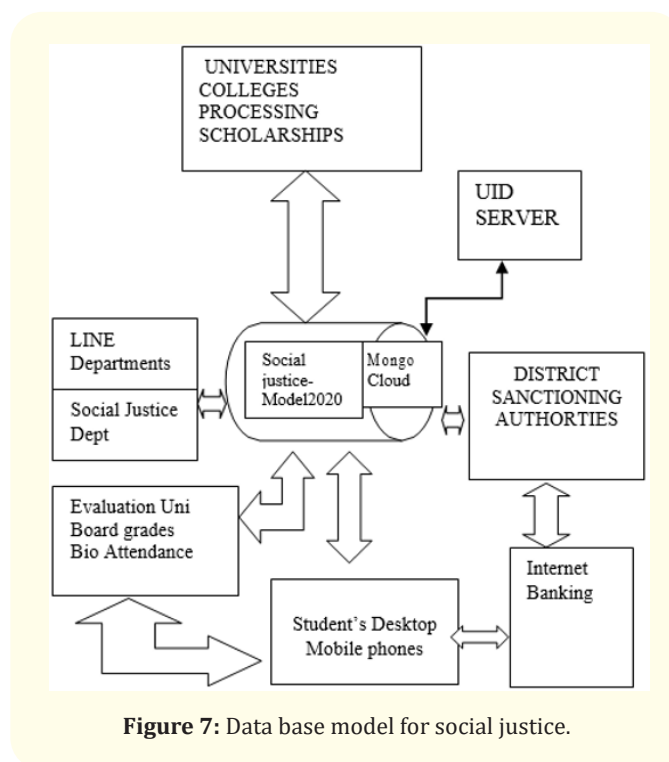


Figure 7: Data base model for social justice.

### Hardware and software specifications

The new data model require only a server and the application software giving access to mongo cloud platform, which can be hired for need based memory requirements. Existing national informatics (NIC) server is sufficient for controlling the activity which hosts the software application controls. The application software shall be connecting all the existing servers like mongo cloud, university/board server for student performance query, internet banking and (unique identification authority) UID server to student mobile phones, laptops or tabs. For this software app the student can in-

install on his mobile phone or use laptop to access the app from internet using normal browser.

All the data can be added and processed simultaneously using the app interface. The hardware parallel processing layout diagram is given as simple illustration (Figure 8).

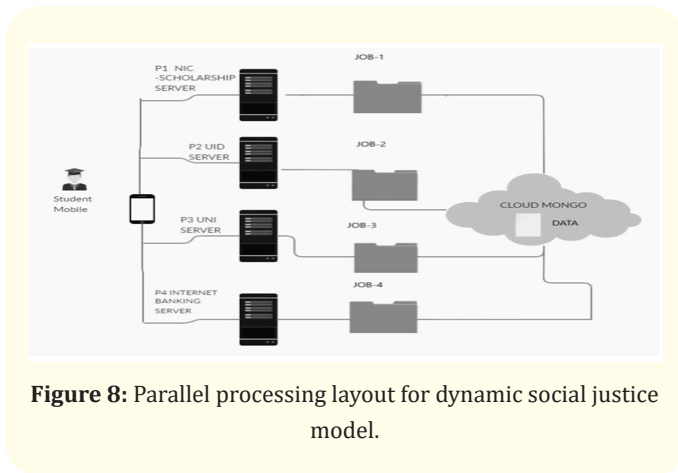


Figure 8: Parallel processing layout for dynamic social justice model.

In the following sections for developing a computer and mobile application the basic algorithms for importing existing data to Mongo DB are given.

### Importing existing data to new model

#### Importing CSV file into MongoDB

Create a folder on disk C – c:\importMongo then Download the file “ImportDataMongo.rar” from the Google drive then Extract file ImportDataMongo.exe from “ImportDataMongo.rar” in the folder: c:\importMongo then copy here the CSV file which you want to import to Mongo in the folder - c:\importMongo then launch command prompt and change folder to - c:\importMongo. Run the file c:\importMongo\ ImportDataMongo.exe

Note: the CSV file after import will be move to the folder c:\importMongo\Archive

**Checking the imported data in MongoDB:** Launch the application Compass from MongoDB. Click on Sample\_StdRec Click on stdRecords Click on Table.

### Results and Discussion

Punjab technical education and Industrial Training is providing scholarship to weaker sections of society, one such scheme which attracting maximum no of students is post matric scholarship scheme. This scheme enables free education for scheduled

caste (SC) students and other backward class (OBC) students. The students can apply for scholarship as per eligibility every year. The payment is being made directly to the UID linked bank accounts of students/institutes by the department of social justice and empowerment of minorities, Punjab designated as implementing department. The data for eligible students is processed by Punjab technical education department (DTE) which is designated as one of the line department. The following consolidated data table 1 and 2 shows year wise scholarships claimed by SC/OBC students in the Punjab technical education system. A look on the table 1 shows lot of money is being disbursed to the students and there are considerable no of students applying for such financial assistance every year. Dropouts and duplicate are also of considerable numbers. Similarly, students of other line departments like medical education, higher education and school education are also applying for the same as all the students seeking any kind of education are eligible for scholarships if they satisfy the general eligible conditions as outline above. The new dynamic data base model enables that duplicates are weeded out at the first instance using UID identification and dropouts can be weeded out using online university/college server being connected to mongo cloud. If any student drops out or his attendance is not continuous the system will not allow for transferring scholarship money for next semester until the student completes requisite attendance and his/her performance requirements. Also ease of operation and saving of time and disk space happens. Earlier conventional data management models were not that robust as these were stand alone scheme specific models and the financial implications were involved and there were data security risks involved as UID numbers and bank accounts apart from personal information of the students are part of student personal data. The new database model would help eliminating duplicity and drop outs and shall provide inter se data analysis opportunities to the state with other line departments and other scholarship schemes including with the other 29 states of the country offering similar scholarship schemes. This system would help them remain serious in their studies and the performance and required attendance before availing next semester/year scholarship amount.

Year	Numbers	Claimed Amount	Drop out/Duplicate Numbers
2014-15	57440	2489978482/-	8283
2015-16	54276	2608049719/-	3538
2016-17	64029	3108739314/-	6342
2017-18	56825	2846101493/-	7698
2018-19	38885	2005609086/-	3207

Table 1: Year wise SC students and claims in INR.

Year	Numbers	Claimed Amount	Drop out/Duplicate Numbers
2014-15	9854	477288913	1373
2015-16	9153	447747836	451
2016-17	2448	121241411	289
2017-18	952	45566433	110
2018-19	435	21513161	37

**Table 2:** Year wise OBC students and claims in INR.

### Conclusion

It is successfully concluded that the new database model based on big data technologies for Polytechnics, ITI and other students for social justice will help in weeding out duplicity of claims with other scholarship schemes of the state and the country. It also helps in transparency in processing the student claims as no manual interface with students and authorities. It also helps with increased data security and authorized access of data due to capabilities of using MongoDB based tool including saving lots of hardware memory space as the cloud technology is used and need based cloud server can be hired on rent. So, it will help in reducing costs related to adding hardware like memory discs and associated software. Considerable improvements in data query times can also be achieved. Management of bulk data through practical approaches by building a new data base model using MongoDB, an open source tool which is a cross platform document oriented database tool for managing and analyzing big data was used for analyzing real time data sets of Polytechnics, ITI and other students. The new data base model is flexible enough to cater to any number of additions of new scholarship schemes state and national level like persons with disabilities based scholarship can operated through same model. This may save them cost and time apart from avoiding possible frauds and scams. In future all the students may use smart phones for all kinds of educational activity, so this data base model will come handy for them. Also in future the usage of combinations various parallel programming models based on Hadoop, MapReduce, PACT etc. for various data analytics techniques could be explored to accelerate the analysis of educational data for social justice objectives as these technologies even cater to the unstructured student data from social media networks, there by accelerating the economic growth. This will help in building scalable models in the field of education and may provide a better scope of improvement in the field of Educational analytics as the unstructured data from social media networks can also be taken into account to know the student’s future

interests as using platforms like MongoDB may also help in even building applications on social media networks thereby handling unstructured and structured students data with more flexibility.

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