Research Paper

Development of model for an intelligent agent-based student support system

[1]Ovwonuri Abraham Oghenemega., [2]Amanze Bethran Chibuike., [3]Agbasonu valerian chinedum., Agbakwuru. A. Onyekachi

[1]*Department of Software Engineering, School of information and Communication Technology, Federal university of Technology, Owerri, Imo State, Nigeria.*
[2,3,4]*Department of Computer Science, Faculty of Physical Sciences, Imo state University, Owerri, Imo state, Nigeria*

Abstract
This work "design an intelligent agent-based student support system" is a help desk system that acts as a single point of contact between students and support team staff of an educational institution. In open and distance learning institutions in Nigeria, most often students are confronted with difficulties in registration, missing results, in-accurate e-wallet account balances, not being able to login to the portal, not knowing what is required from the student in some course, etc. once a student encounter any of these problems, resolving it becomes a big challenge. So, this research work develops a system that utilizes an accurate ticket classification intelligent agent model to associate a help desk ticket with its correct service from the start and hence minimize ticket response time, save human resources, and enhance user satisfaction. The work presents a web-based application for student support services that will enable students to raise tickets on issues confronting them in open and distance learning system. The system prioritizes students support tickets and automatically assigns it to the designated staff for response. Also it integrate SMS on the platform to alert support team once a ticket is raised by the student and also build a knowledge based system for an intelligent agent based system that will enhance the performance of the student support services by automatically responding to students queries that corresponds to a previous query that has been responded to. The methodology adopted is the object oriented and design methodology (OODM) and PHP-MySQL with java script was used in the implementation.
Keywords: Students, SMS, Payment portal and Intelligent Agent

I. INTRODUCTION

Support service is one of the ingredients that evaluate the effectiveness of an institution in carrying out their duties of empowering the society with adequate knowledge. Effective student support services in higher institution enhance the student learning experience and also contribute to their academic success. A support service is one of the important factors in education quality assurance. It helps in decreasing the rate of drop out and increases the diversity of student's experience. The support service is what connects the students to the institution and gives them sense of belonging. Students that do not get these supports are likely to give up their studies. Good Support systems helps in producing a complete graduate with the characteristics of a complete individual. It provides the missing link between the Institution and the students. Looking at the open and distance learning in Nigeria, most often students are confronted with difficulties in registration, missing results, in-accurate e-wallet account balances, not being able to login to the portal, not knowing what is required from the student in some course, etc. once a student encounter any of these problems, resolving it becomes a big challenge. Most often they do not know who to talk to in other to get the accurate answer to their challenges. The online portal as obtained in Nigerian open and distance learning has no provision for student's online interaction with management of the institution or directors of studies. So, this is a hug problem challenging the easy and flexibility of the program as planned by the institution authorities. To solve these problems confronting the open and distance learning, a ticketing system for student support services is required. A ticketing system is a support service tool that helps institutions to manage their services and support cases. It creates an organized communication channel that significantly improves productivity in an organization. The system or app creates a

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'ticket' which documents customer requests and interactions over time, making it easier for support member in a unit to resolve complicated issue. The use of ticketing system helps in responding to service request in a timely manner and improves support services. Since we know that issues such as human mistakes and technological failures/breakdown are bound to occur as we carry out our duties, ticketing system helps us to solve these problems as quickly as possible and also ensure that the right people are notified as they occur. It will help us keep track of all the issues that are being resolved in different unit of the institution. Also, when students raise ticket for support services, it requires that the system support staffs of the institution responds to the issues raised by the student. Responding to these issues needs to be timely in other to make it effective. This is because most of the issues confronting the students are time bound. Once they did not get the required response on time, the portal might close and responding to the issue may no longer yield the required results. Hence, the support team is faced with the challenge of prioritizing the tickets to know which one to give urgent attention so as to make the system look more responsive and timelier. Also, some of the issues raised by students may have been answered in a previous ticket raised by another student. How best the student support services can detect that similar question has been answered in the past remains one of the challenges that need to be resolved in other to make student support services more effective. To achieve this, an intelligent agent-based approach is required. To achieve the set target of this research work, intelligent agent-based methods were developed to aid in promoting effective and efficient student support services for open and distance education. So, this thesis proposes a new framework that is powered by virtual assistance that aids in student support services. The proposed framework allows student support team to respond to tickets raised by students at any time. The system also automatically priorities the tickets and assign it to the appropriate staff responsible for responding to such issues raised. The system developed has the capacity to improve student / staff relationship in open and distance learning institutions and thereby offer quick responses to issues raised by students. This will in effect reduce the rate of drop outs from the program and enhance the learning system. This research builds system that encompasses all into a single mode whereby a student log in his request and gets response as quickly as possible within the time stipulated. Timely response to their queries gives them sense of belonging since most of them combine their studies with office workload. While the request is being key in, the systems learns the queries and based on the responses generates a frequently asked questions and answers for the subsequent related request. In open and distance learning institutions in Nigeria, most often students are confronted with difficulties in registration, missing results, in-accurate e-wallet account balances, not being able to login to the portal, not knowing what is required from the student in some course, etc. once a student encounter any of these problems, resolving it becomes a big challenge. Most often they do not know who to talk to in other to get the accurate answer to their challenges. The online student portal as obtained in Nigerian open and distance learning has no provision for student's online interaction with management of the institution or directors of studies. So, this is a huge problem challenging the easy and flexibility of the program as planned by the institution authorities. Support services in higher institution remains one of the effective ways of improving the learning experience of students. Poor and ineffective student support system in Open and Distance Education leads to the following:
1.   Creates a poor communication between the institution and the student
2.   Isolates the learner from the activities of the institution especially when there is an issue to resolve
3.   Brings delay in responding to complaints from the students
4.   Lack of proper documentation of the processes involve in resolving student's complaint
The aim of the study is to develop an intelligent agent -based student support system. The specific objectives are as follows.
1.   To design a web-based application for student support services that will enable students to raise tickets on issues confronting them in open and distance learning system
2.   To develop a system that prioritizes students support tickets and automatically assigns it to the designated staff for response.
3.   To integrate SMS on the platform to alert support team once a ticket is raised by the student
4.   To build a knowledge-based system for students queries and the responses from the support team
5.   To develop an intelligent agent-based system that will enhance the performance of the student support services by automatically responding to students queries that corresponds to a previous query that has been responded to

II.   REVIEW OF RELATED LITERATURE
Feras (2021) proposed a help desk system that acts as a single point of contact between users and IT staff. It utilizes an accurate ticket classification machine learning model to associate a help desk ticket with its correct service from the start and hence minimize ticket resolution time, save human resources, and enhance user satisfaction. The model is generated according to an empirically developed methodology that is comprised of the following steps: training tickets generation, ticket data preprocessing, words stemming, feature vectorization, and machine learning algorithm tuning. Nevertheless, the experimental results showed that

including the ticket comments and description in the training data was one of the main factors that enhanced the model prediction accuracy from 53.8% to 81.4%. Furthermore, the system supports an administrator view that facilitates defining offered services, administering user roles, managing tickets and generating management reports. Also, it offers a user view that allows employees to report issues, request services, and exchange information with the IT staff via help desk tickets. Moreover, it supports automatic email notifications amongst collaborators for further action. Yet, it helps in defining business processes with well-defined activities and measuring KPIs to assess the performance of IT staff and processes.Antonio et al. (2020) proposed for creating a recommender system to support higher education students in the subject enrollment decision. They were of the opinion that higher education plays a principal role in the changing and complex world of today, and there has been rapid growth in the scientific literature dedicated to predicting students' academic success or risk of dropout thanks to advances in Data Mining techniques. Degrees such as Computer Science in particular are in ever greater demand. Although the number of students has increased, the number graduating is still not enough to provide society with as many as it requires. The study contributed to reversing the situation by introducing an approach that not only predicts the dropout risk or students' performance but takes action to help both students and educational institutions. The focus is on maximizing graduation rates by constructing a Recommender System to assist students with their selection of subjects. In particular, the challenge is addressed of constructing reliable Recommender Systems on the basis of data which are both sparse and few in quantity, imbalanced, and anonymized, and which might have been stored under imperfect conditions. The approach was successfully applied to create a Recommender System using a real-world dataset from a public Spanish university containing performance data of a Computer Science degree course, demonstrating its successful application in real environments. The construction of a support system based on that approach is described, its results are evaluated, and its implications for students' academic achievement and for institutions' graduation rates were discussed. Through the construction of the decision support system for students, they intended to increase the graduation rates and lower the dropout rate.Ratthida and Limpiyakorn (2019) presented a paper titled "Development of IT Helpdesk with Micro services". They proposed an IT helpdesk is the system that allows users to submit service requests for reporting problems or their requirements to IT teams for trouble shooting. The paper presents a design of IT helpdesk with micro service architecture to promote scalability of the system. The implementation includes the classification service that automatically categorizes tickets to the associated IT teams for support. The thesaurus database is utilized for clustering the request subjects. The benefits of the proposed approach were to enable the scalability and fortify the availability of the system. They recommended an improvement of the classification service, and the enhancement of the Ticket to enable attachment with a ticket as a future research update.In a research titled "Machine Learning Based Support System for Students to Select Stream (Subject) ", Kapil (2019) said that selection of subject/stream is crucial for students because further their career proceeds according to their selection. Mostly subject/stream selection cannot be changed in the further career. Inappropriate selection of subjects due to parental pressure, lack of information etc. can lead to limited success in the selected stream. Guidance for subject/stream selection based on information of successful scholars of their stream and information of students such as interest, family background, previous education and other associated can enhance the success in career. A data mining and machine learning based methods were developed on the above information. Data from the different institution and students of two different streams were used for training and testing purpose. Different machine learning algorithms were used and methods with high accuracy (86.72) were developed. Developed method can be extended and used for different subject/stream selection was their recommendation.Albert et al. (2020) in their research said that in handling internal complaints, some companies have implemented a helpdesk system while some other processes are still carried out manually. The helpdesk ticket is categorized manually by human operators. This procedure is prone to an error resulting in many tickets bounced to the wrong business unit and delaying the complaint handling. They proposed an automated problem categorization based on the title of helpdesk ticketing using machine learning is studied. The results show that the random forest classification has the highest accuracy value of 82%.Paraskevi (2014) proposed a Web-based Information Technology Support System for 1st and 2nd semester students for the department of Food Science in Technological Educational Institution (T.E.I.) of Thessaloniki, Greece. The learning model that has been used is a combination of objectivist and constructivist methods. The said that after discussions with students and lecturers it has been noticed that the main problem was the inefficient student's prerequisite knowledge, the lack of supported materials and the limited time during lecturing for supporting students during lecturing. Accordingly, they decided to redesign the course according to learner-center design, based on problem-based learning approach firstly (in order to study their attitude and also to identify their needs) and secondly, according to the results to design a Web-Based Information Technology Student Support System. The application of part of the Web-based Information technology system has shown a positive effect on students learning approach.Al-Hawari (2019) developed a machine learning based help desk system for IT services management for King Saul University. The system was able to define user roles and responsibility, classified the tickets according to the services offered by the IT department using machine

learning classification. This system does email automation but they did not consider the case of using short message services in delivering the feedback. In Nigeria where light and cost of internet connectivity is high, short message services(SMS) is required because the student may not be on the internet 24/7 to monitor the outcome rather once he/she sees the update, can then check to the outcome of the request. The support system being considered will take care of using the short message services in giving update to both student and the help desk officer.They proposed a system for university of Lagos that will enable users to obtain information regarding the university support services, store records of request for proper documentation. The system that will find, analyze and eliminate common problems in the institution. Also, the system will help to measure the efficiency of the institution in resolving issues using the key performance indicator. Also, this system did not also look at the use of short message services in sending update to both the student and the help desk officer.

III.   MATERIALS AND METHOD

For effective implementation of this project, some web application languages will be used to design the student support system. These includes; Hypertext Markup Language (HTML), Hypertext Preprocessor (PHP), MySQL, Cascaded Style Sheet (CSS), Java Script, Dream weaver, and Fireworks. Dream weaver is an HTML-based application that is used to generate graphical user interfaces. The scripting language behind the development of the system is PHP and JavaScript. JavaScript is used to add functionality beyond standard HTML to a web page. It adds interactivity to website. MySQL is used together with PHP in website development and is open source software. These are the materials needed to actualize the projects objectives.

Object-oriented analysis and design methodology (OOADM) will be adopted in this research work, and it is a set of standards for system analysis and application design. It uses a formal methodical approach to the analysis and design of information system. Object-oriented design (OOD) elaborates the analysis models to produce implementation specifications.

IV.   ANALYSIS OF THE PROPOSED SYSTEM

The proposed system was designed to create platforms for student support services. In the system, students are expected to raise tickets for their complaints or questions. Both students and intending students can use the features of this system but at a different level of access. Once a ticket is raised, the system stores it in the database and automatically sends an email and short message services (SMS) to the support team personnel responsible for answering to such questions or complaint. Every ticket raised from this system is categorized so as to know where and who to channel the complaint to for response. When the ticket raised is responded to, it equally sends and SMS to the student that raised the question that the complaint has been responded to. All complaint / questions with their responses are documented and stored in a database. The questions with their responses are used to build a knowledge base upon which the machine learning will draw its knowledge and respond to issues raised by students automatically. This means that the new system offers self-service once a ticket raised by a student has similarities with that which has been responded to previously by the support team and is also found in the knowledge base. To this end, the new system will always query the knowledge base each time a new ticket is raised to see if similar complaint / question has already been responded to. Where the similarities exist, the system automatically responds to the complaint otherwise the ticket will be categorized and prioritized and forwarded to the support team personnel responsible for such questions. The prioritization of the tickets raised by the students will be according to the urgency attached to such tickets by the intelligent agent. Different types of issues needing support has different priority level assigned to it. So once the ticket is submitted by the student, the system will automatically assign priority level to it and this determines the ticket that will get response first before others. By implication, the support team responds to tickets according to their priority. The order of response is not by first come first serve but according to the priority (urgency) attached to the ticket by the system developed. The new system has facilities to time the tickets. It captures the date and time when the ticket was submitted and equally captures the time the ticket was responded to. This will help the system to generate report on how timely a ticket was responded to and also it will access the performance of individuals assigned with the task of responding to the tickets.
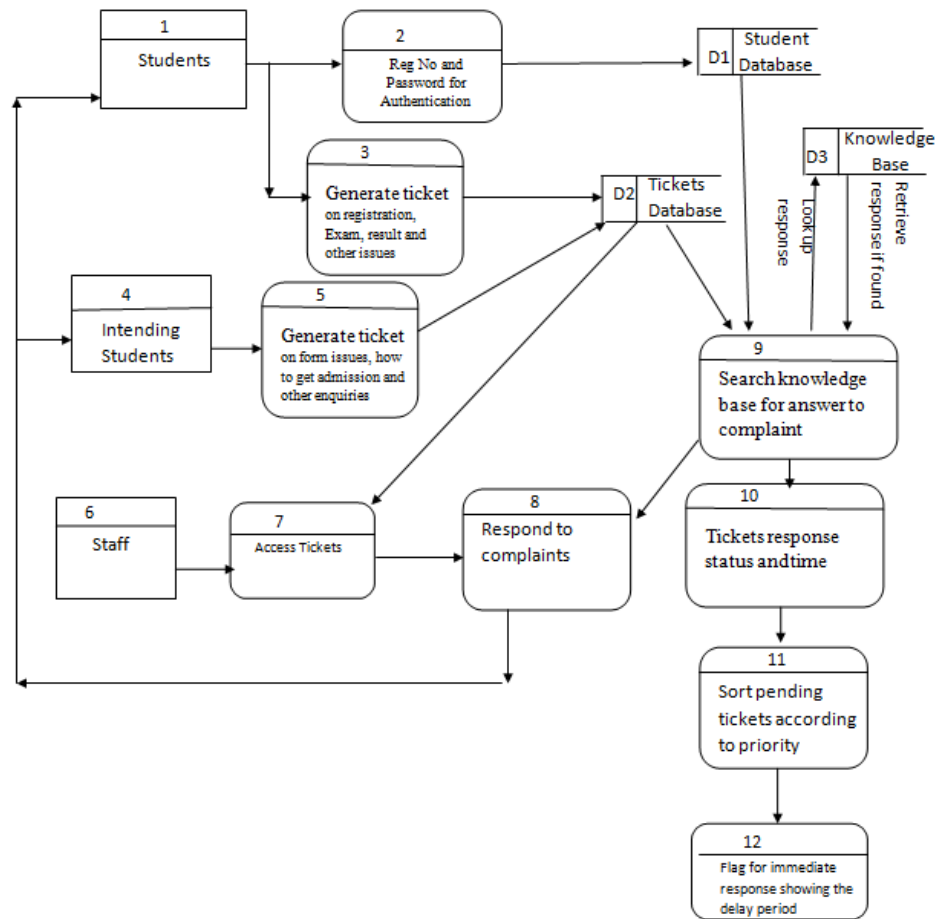
Data Flow Diagram (DFD) of the Proposed System

Figure 1: Data Flow Diagram of the proposed system

V. Result and Discussion

The software performance was tested using speed of data retrieval and accuracy of ticket classification and prioritization. The intelligent agent data is built from the ticket information that is stored in the database. The ticket's basic information (entered via the screen) and description are stored in the TICKET database table. The TICKET table is also associated with a TICKET Response table to save the ticket related comments that were exchanged by collaborators. Each ticket is identified by a unique ticket id and is associated with a student id.

The student support system captures and produces a lot of useful data that enables the measurement of various key performance index (KPIs) that aid IT management and staff in decision making. Examples on some of the measured KPIs are:
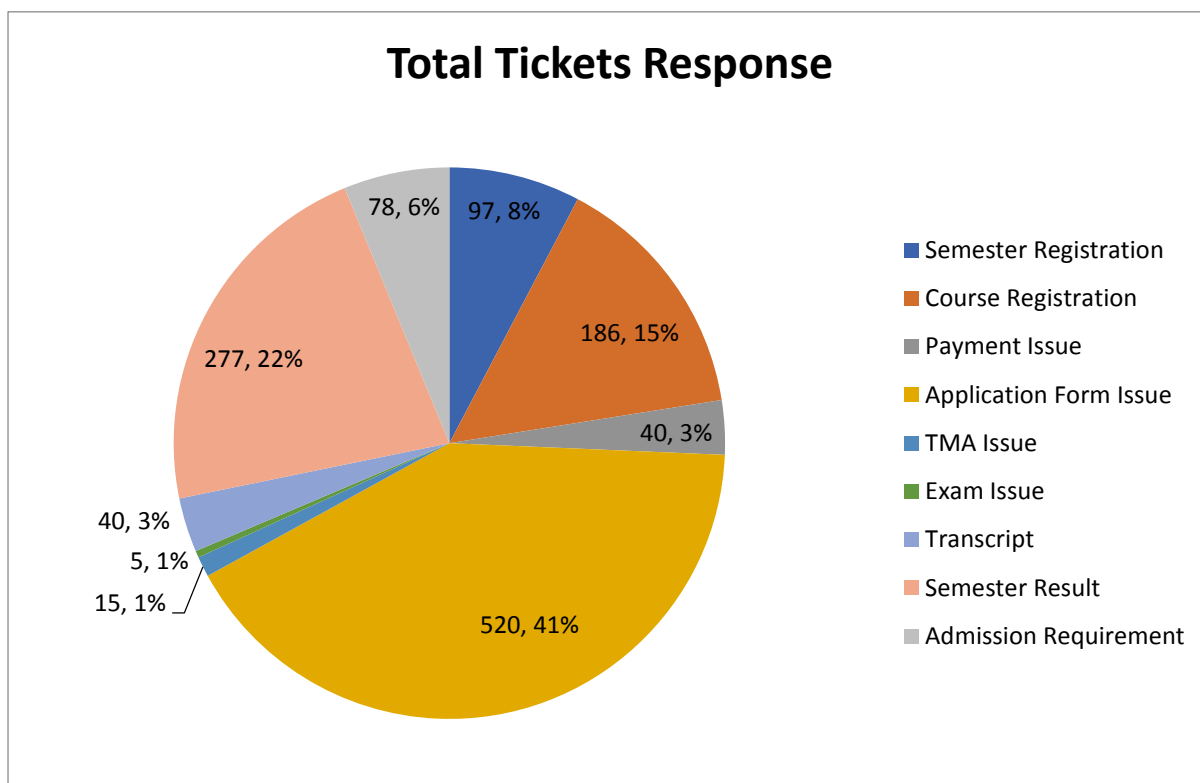
Number of Tickets Responded To
This KPI is used to find the total number of tickets responded to during a selected period of time. Table 1 and figure 4.23 shows the response rate to the tickets logged in the system within the period.

Table 1: The Total Number of Tickets Responded to During the Selected Period

Ticket Category	Total Tickets
Semester Registration	97
Course Registration	186
Payment Issue	40
Application Form Issue	520
Test Issue	15

Exam Issue	5
Transcript	40
Semester Result	277
Admission Requirement	78
Total	**1258**

Figure 2: The total number of tickets responded to within the test period

From figure 2, it can be seen that 6% (78) of the support ticket raised by the student's bordering on admission requirement issue was responded to. 22% (277) tickets raised in on semester result issues was responded to. 3% (40) tickets on transcript issues was responded to, %1 (5) tickets is on exam issues was responded to, 1% (15) tickets on Test issues was responded to, 41% (520) tickets on admission application issues was responded to, 3% (40) tickets on payment issues was responded to, 15% (186) tickets on course registration issues was responded to, while 8% (97) on semester registration issues was responded to.

Average Responded Ticket Time
This KPI is used to find the average tickets response time during a selected period. Table 2 and figure 3 shows the percentage of tickets not responded to in the system within the period.

Table 2: Average Responded Ticket Time

Ticket Category	Average Tickets Response Time(mins)
Semester Registration	5
Course Registration	7
Payment Issue	2
Application Form Issue	15
Test Issue	15
Exam Issue	5
Transcript	5

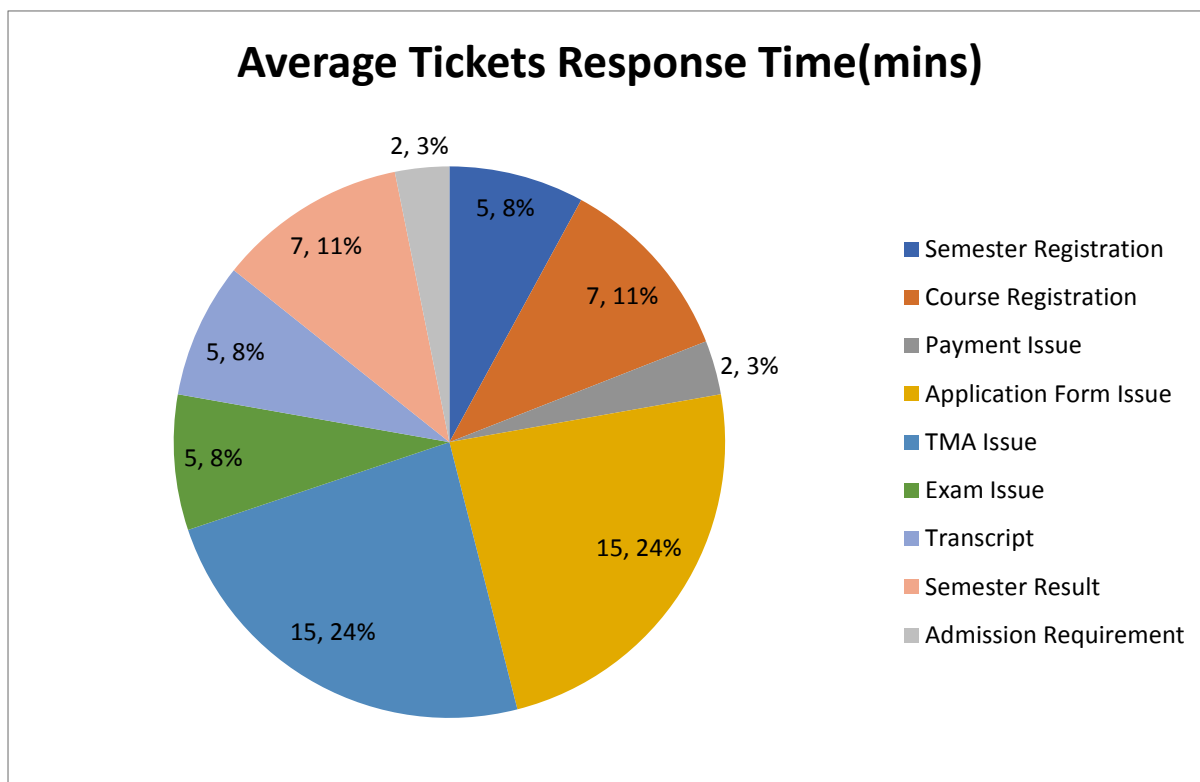| Semester Result	7
Admission Requirement	2

Figure 3: Average Responded Ticket Time

From figure 3, it can be seen that average ticket response time is high in application form and Test issues; 15 minutes each.

VI.   Conclusion

Student's support system is a critical issue in most universities in developing countries. Timely access to information and security of the information is very crucial for effective implementation of electronic data management. This project developed an intelligent agent-based student support system that provided a platform for students to generate tickets for their complaint and receive answers in real time or shortest possible time. In the system, students are expected to raise tickets for their complaints or questions. Once a ticket is raised, the system stores it in the database and automatically sends a short message services (SMS) to the support team personnel responsible for answering such questions or complaint. Every ticket raised from this system is categorized so as to know where and who to channel the complaint to for response. When the ticket raised is responded to, it equally sends an SMS to the student that raised the question that the complaint has been responded to. The implementation of the intelligent agent-based student support system assists in creating an auto-responder system that responds to student's complaint automatically. The intelligent agent makes use of the knowledge base system from the previously answered questions.

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