RESEARCH ARTICLE OPEN ACCESS

Use of NFC Technology in Audit Processes and a Mobile Application

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ABSTRACT
Nowadays, many business processes have been carried over to the internet with the widespread use of mobile devices, and communication between employees and many business processes are run on technology platforms. The mentioned use brings along speed gain in the flow of information, but there are many explanatory agenda in terms of the accuracy of the data. System weaknesses are available to be used by a particular sector and they also have the risk of disrupting the integrity of the overall reports. For this reason, the fact that the system has developed a control mechanism that can verify itself apart from human declaration will also lead to an increase in the confidence in it. In the operation of the application, the audit personnel perform their exit from the mobile devices by contacting the NFC in the central branch. This process provides a general control over the exit times in the database and the optimization process is carried out within the branches to which the auditor is connected. The ant algorithm was used in the process of optimizing data. The filtered data is listed under the route button and an audit trail list is created to the controller. The supervisor comes into contact with the NFC sticker located at that checkpoint and enters the inspection form in the mobile environment. In this way, it is proved that the supervisor has reached the relevant point with only the contact-working verification mechanism.
Keywords: NFC, Tag, Mobil Device, Ant Algorithm

Date Of Submission: 20-05-2019 Date Of Acceptance: 03-06-2019

I. INTRODUCTION

It started to be manufactured in wearable clothes or devices in the information age with the advancement of technology. However, including televisions, telephones, watches, digital wristbands and shoes are able to send data instantly to the virtual world. All these technological developments shed light on the emergence of different applications with different devices. The common theme of these devices is the data. With the ease of access of the data in the mobile environment, many business solutions have been developed and these solution models have brought a lot of ease.

There is a large deal of internet usage in the world with the development of infrastructures day by day and internet access via mobile lines. Therefore, systems can be fed with instant data through mobile devices or online websites, and integral and useful data can be accessed quickly. While this speed at the point of data is available to be used for sharing and confirming information for staff performing field control, controlling of audit personnel by employers is facilitated by the support of label technologies [1,2].

Specific algorithms are used to optimize the data obtained during this audit process and to ensure its beneficial use. It has been seen that the problems can be solved successfully with the Ant Colony Optimization (ACO) which is one of the optimization algorithms. It was first applied to the Traveling Salesman Problem (TSP). It was observed that ACO was very effective in the solution of TSP, which was defined as starting from one point and returning to all points once and returning to the same point by the shortest way. ACO is inspired by the behavior of real ant colonies. One of the essential elements of the technology is the pheromone chemical which is used as a communication tool and shows the quality of the solution in the problems. Pheromone is the hormone that real ants use as a communication and navigation tool [3].

Label technologies, which lead to the collection of clear data obtained from optimization methods from the field, are also developing day by day and put at the disposal of humanity. Among these technologies, Near Field Communication (NFC) are short-range wireless communication protocols.

This technology enables to transfer about 424 Kb of data per second at 13.56 MHz operating frequency between devices with a maximum distance of 10 cm. Considering the wide range of

application areas, it is seen that NFC technology is used frequently and expected to be used in payment applications. Since it is a technology that works with contact outside of the payment systems, proof of the physical presence of persons at checkpoints is also available within this technology [4].

Although the easiness of the development processes is found in every sector, the use of previously discovered solutions in different methods continues to be put into operation via algorithms. The ant algorithm used in the project; It is used in health, logistics, finance and many other sectors and new applications are being developed.

In the health sector, an ant algorithm was used in the process of filtering the electronic imaging signal to remove noise and correcting slippage in the baseline. Parametrically attached to the average of odor, the clusters are separated from each other, although the algorithms have different results because the ants move randomly, the nearest neighborhood is used to determine the sign belongs to which class, and quality results have been obtained [5].

In another study; scheduling problems have been solved by a study in which the ant colony algorithm is included. 110 sample workflow scheduling problems were examined by combining different modified hybrid applications of ant colony algorithm on an application developed in C # language [4].

The new method developed for workflow scheduling problems has been found to provide better results than other solutions in the literature. A total of 110 workflow problems of various dimensions, which are used as test problems in the literature, have been solved 10 times [5].

Container transport has increased significantly as supply chains reach a global level. Nowadays, 90% of the cargoes are transported through containers and an average of 250 million containers are transferred to ships to be delivered to the requested venues. The importance of containers in transportation has led to the search for the best utilization of existing container volumes as well as applications such as route optimization and load consolidation to reduce the transfer budgets of logistics companies [6].

The problem was first designed in the form of a graph in order to solve the problem of the container loading with the Ant Algorithms. The problem of loading a container with n-boxes was perceived as a graph with n nodes and positioned a box at each point virtually. Each of the rounds visited by the ants is considered to be placed in a virtual box on each node and the installation process is activated by calculating the occupancy rate by taking into account the container dimensions and the container size without overlap between boxes [7].

Another field in which the ant algorithm is used is the automotive sector; The automotive industry has a two-sided assembly line, and is widely used in the manufacture of vehicles, such as trucks and buses, as well as large vehicles. Mixed model lines are also used in order to meet the special requests of the customers. The ant colony algorithm was used to maximize line efficiency in the project that handled the most efficient use of lines and efficient solutions were produced [8].

Sample studies about the use of NFC label technology with various methods, which is another part of the article are available below;

NFC and NFC tags can be used as an alternative to signature. The project which is used as an alternative to signature and NFC tags are used to read the cards. The project aims to reduce the possibility of students signing each other instead of transferring their location and device information to the database [9].

It is a radio frequency identification method (RFID) in another technology that is widely used outside of NFC technology (Radio Frequency Identification) (RFID). Vehicle recognition, tracking and positioning processes have been managed with radio frequency signals for vehicle tracking processes, which is one of the fields where this technology is used. The obtained results can be used instead of GPS data in determining the location and location of the vehicle and it has been shown that a more economical study can be used in the field processes. In this process, air conditions and physiological obstacles were tested at the point of access to radio frequency signals during the follow-up of the vehicles and it was determined that there was no result that would disrupt the application [10].

In another study using radio frequency technology, it is aimed to reach a drinking water centrifugal pump and water tank via radio frequency. Two sensors are used in the tank where the centrifugal pump is receiving water. With the sensors located at the upper and lower points, the opening and closing processes of the pump are activated. The low cost is a priority in the mentioned study and the level of water has been managed in a healthy way with the wireless communication method of the pump, which is 1600 meters away [11].

As stated in the literature, the conformity of the determined technology to the solution of the current problems, the cost of return and the time-saving processes are important. In this study, the data collected from the field via NFC technology was optimized by using ant algorithm. Programs for computers and mobile devices were developed and

C# and java were used as programming languages. On the database side, Microsoft SQL is used. In addition, the database of the developed software was kept in an environment with global access, and field personnel were provided via mobile devices and field studies were carried out instantly to the database.

II. SIMILAR WIRELESS TECHNOLOGIES

Bluetooth technology is designed for wireless communication within a 10-meter range with mobile phones, laptop and other communication devices. It provides a network connection with devices used for data transfer according to the intended use. Bluetooth headsets can be shown as examples of this definition.

Wireless network technology is designed for local area networks and is a replacement for wired networks in the communication of communication devices within a distance of up to 100 meters.

ZigBee is able to follow up to 100 meters in domestic and industrial applications as of general use. RFID consists essentially of an RFID tag and reader. The RFID tag is comprised of a silicon chip, antenna, and coating that allows it to detect radio frequency broadcast queries and respond to queries it detects. The chip incorporates the information contained in the label's object. The information on the radio frequency is transmitted to the reader via the antenna. It can be positioned by means of chip and antenna coating [12].

III. AN OVERVIEW TO ANT ALGORITHMS

The main purpose of the ant colony algorithms, which was first introduced by Marco Dorigo, is a solution created by the ant-communities of pheromone hormones, inspired by the methods of finding the closest path between food sources and nests. Dorigo based on the mathematical model of ant communities' habits first revealed the traveling seller problem and obtained positive results. The ant colony algorithms were then evaluated by other developers and have reached the present day and have been accepted for a wide range [5].

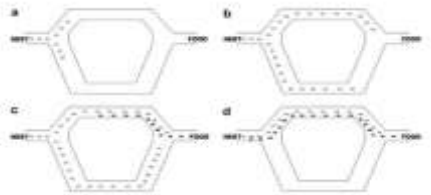

Figure 1. Schematic representation of the wayfinding process of ants [13]

III. THE USE OF ANT ALGORITHMS LOGIC IN THE PORJECT

In this study, the control personnel launch out by contacting with the NFC, which is located in the central branch via their mobile devices. NFC points are located at each point that he will visit in the field. When he reaches one of the points he visits, he contacts the NFC label, listing the audit process and showing that he has physically reached the relevant point. Visits of all supervisors in the field between points are learned by the system and the optimization process of the data obtained at this point is carried out with Ant Algorithm. With this algorithm, the filtered data is distributed to the tables in the database for the most efficient use of the obtained controller information.

Among this information recorded by classifying;

• ID (Column that makes registration unique)
• UserID (Column showing which user has been audited)
• FromSube (Column representing the branch to be audited)
• ToSube (new branch column for audit)
• CikisZamani (Column representing the exit time from the completed branch)
• VarisZamani (Column showing the time of arrival of the new auditor to the new branch)
• Gecen_Zaman (Column showing the transportation time between two branches)

Information is kept. However, the control periods between the supervisors are calculated by keeping the arrival times between the points and are used in the performance evaluation reports. The algorithm used in the project below is detailed in the code.

Visual representation of data structure as an example in the table is available below (Figure 2).

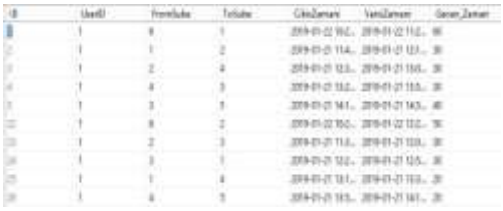

Figure 2. Ant Data Table

IV. WHAT IS NFC SUPPORTED AREA CONTROL PROCESS OPTIMIZATION?

NFC technology, which enables non-contact communication on mobile devices, is now used in many sectors including payment and product promotion.

For example;

- Smart Poster applications with NFC
- Electronic key applications

- We can display ID card applications.

In addition to these uses, field processes that are required to be set up by control method based on transferring the key data to the reader via the label are made available to be managed via mobile devices.

The Field Audit application works on two platforms, mobile and desktop. System-defined field personnel provide access to the system via mobile devices (Figure 3). The movements of each controller on the system are recorded with that user ID.

Figure 3. Mobile Home Screen

After the field supervisor has entered the system, there will be two options (Figure 4). The "Route" option which is above the reading modes, reflects the control list that the supervisor will follow in the field, the "Check In" option represents the beginning of the NFC control process, which will start when he leaves the center and when he arrives at the point he will check.

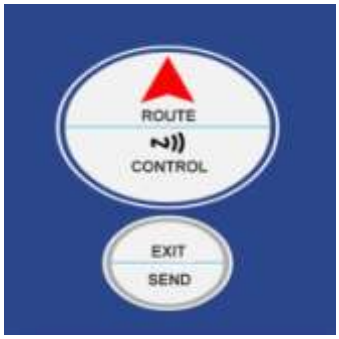

Figure 4. Opening Modes

When the point to be controlled in the field is reached, a checklist is created by reading the NFC / Square code in the control point of the region to be inspected (Figure 5).

Figure 5. Mobile Control Screen

The supervisor updates the list by providing on-site checks, adding images to the checklist with image capture and certain faults can be added to the report by marking on the control boxes. In case of multiple auditing on the site, the alarm button is provided so that auditors can communicate in case of emergency. When the relevant button is pressed during the audit, vibration and audible warning are working on other auditors (Figure 6).

Figure 6. Alarm Status

At the end of the audit, the list is registered with the Send button and the information about these records is accessible through the panel. The visuals obtained during the inspection are kept in the database and the notes taken and the fault graph are presented as the most recent audit report (Figure 7).

Figure 7. Administration Panel

By applying ant algorithm to the information learned in the field an audit guidance list is created in the light of the date and time information obtained from the previous audits of the audit personnel (Figure 8).

Figure 8. Visit List

During the controlling, multiple photos are taken and attached to a single audit. These images can be downloaded to the computer where the management panel is installed (Figure 9).

Figure 9. Photo Download Feature

In the panel where the branches and supervisors involved in the system are discussed collectively, we can see which branch depends on which auditor. The motion records of the auditor are also collected in the transaction list and submitted to the managers' information (Figure 10).

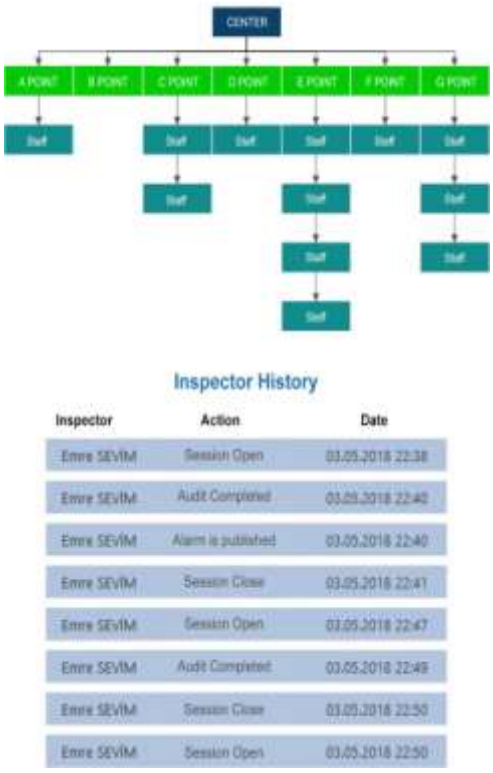

Figure 10. Control Tree and Motion List

V. CONCLUSION

As a result, field control via mobile devices stores the correct information based on the contact base with NFC points. In addition to this information, the arrival times between the central branch and the checkpoint are calculated based on the date and time obtained during the contact and learning is carried out for subsequent controls. With the ant algorithm, the data obtained from these studies are subject to specific guidance. With the database which is open to global access, the personnel in the field are kept up to date. All processes between supervised point and supervisor are recorded with photos, text and designated checklists. Lists can be created differently for those points, or a general list can be created for all branches.

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Emre Sevim" Use of NFC Technology in Audit Processes and a Mobile Application " International Journal of Engineering Research and Applications (IJERA), Vol. 09, No.05, 2019, pp. 57-62