

Management System for Integration of the Disabled on the Labour Market

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Abstract: People with mental disabilities (mental disorders, mild brain dysfunction) face barriers to employment, leading to higher unemployment rates and economic inactivity. Incorporating a workplace technology system may help create a disability-inclusive environment. The paper presents an ICT solution for social enterprises, focusing primarily on cafés or restaurants. It is designed to help reduce the need for supervision of employees with mental disabilities in order to increase their autonomy. The proposed system records activities and provides an employee with information on which action to perform and how. The primary goal of the proposal is the monitoring of activities and the interactive transmission of instructions. The presented system is based on the Internet of Things (IoT) and includes advanced information technologies – cloud messaging, mobile applications, web applications. The employee with a disability will be equipped with a smartphone using a specially designed application. By a notification sent to the mobile phone, the employee will be immediately informed about the task assigned. The mobile application will help an employee carry out the task visually (sequence of instructions expressed in text, pictograms). In order to confirm the completion of the task, a sensor is placed at the desk location, which, when the mobile device is attached, registers the employee's presence at the desk where the task is to be performed. The Unified Process (UP) methodology was used to design an information system. The context diagram describes the relationship between the proposed system and its environment, a data flow diagram shows the dynamics and control information. The system is designed to be universally applicable in other workplaces. It may be used to help people who cannot communicate with other employees due to a lack of knowledge of the local language at the workplace.

Keywords: management system, disability, ICT, social enterprises, employment

1. Introduction

For the majority of people with disabilities, it is challenging to find and sustain steady employment, as they need more supervision and cooperation with assistive staff to manage their work tasks (Manzoor and Vimarlund, 2018). Especially people with psychological and mental disorders find it difficult to interact with their social environment and need help (not only in the work area) to organise and identify their tasks but also to carry them out (Meşhur, Filiz, 2016). Employment of such workers is associated with extensive use of job assistants who help persons with disabilities to perform their designated work tasks efficiently and adequately (Yıldız, 2010). However, considering the potential of this workforce segment, employers need to endeavour to leverage abilities of workers with disabilities (Bonaccio et al., 2020; Lindsay et al., 2018; McKinney, Swartz, 2021).

Currently, in the Czech Republic, there is over 1.1 mil. people with disabilities, 15% of them have mental and psychological disorders. This group of disabilities is defined as *"the people who need mental health services, disability benefits, and/or workplace accommodations for a psychiatric diagnosis or mental/emotional distress that has substantially limited one or more major life activities"* (Ostrow, Nemec and Smith, 2019). According to the Czech Statistical Office (2019), only 15% of people with these disabilities declared to have no problems concentrating and focusing on everyday activities. When asked about thinking and concentration during more demanding activities such as work tasks, respondents reported higher difficulty levels. More than a quarter of people with mental or psychological disabilities could not do such complex thinking. In contrast, only 7% were able to manage them without difficulty.

IT technologies are used in a wide range of everyday activities. Implementing IT technologies can create an effective and efficient application for practical use. This also applies to the use of mobile devices, the features of the mobile operating system and the use of possibilities of the notification system (cloud messaging). Cloud messaging is a messaging solution via the Internet. Mobile technologies are highlighted in other works. Smart mobile phones have seen dynamic development and are a current trend (Musil and Novotny, 2015) and mobile

devices are becoming more and more popular in the field of daily activities (Musil, 2017). Notifications and cloud messaging are used in conjunction with a mobile application to implement new event notifications in the following works: (Firdaus et al., 2019) (Heryandi, 2018), (Rocha et al., 2020), (Zhao et al., 2014).

The aim of this paper is to present a design of a system intended to be used in a café operated by a social enterprise. By its technical design, the proposed system will allow higher employability of selected groups of employees from the PWD (people with disabilities) category, namely a group with psychological problems, mild brain dysfunction, etc. The system based on monitoring of activities and interactive transmission of instructions and information will help people from the above-mentioned groups of PWD to reach higher employment potential (expanding the possibilities of employing people with the above-mentioned handicaps) and will reduce their stress about whether they are doing the job correctly, as the proposed system will "advise" them what work activity they should do and how. Technically, the system will use modern communication technologies and elements from areas such as the Internet of Things (IoT), mobile technology and low-power wide-area network (LPWAN). The system is designed to have the broadest possible use and application.

2. Methodology

The UP (Unified Process) methodology is used to design an information system for the Management System for Integration of the Disabled. It is based on the SEP industry standard – Software Engineering Process. The UP is an abbreviated designation of the USDP (Unified Software Development Process) industry standard. It is a generic process for the UML - Unified Modeling Language. It is a basic, generic and open methodology that can be adapted to any project's scope. The UP methodology must be adapted to the goals and conditions of the given development, i.e. used standards, templates, tools, and others. The Unified Process (UP) means controlled requirements and use cases, risk management, an architecture basis, and an iterative and incremental process of SW product development. The UP is divided into individual iterations, each of which goes through five basic work processes: setting requirements, analysis, design, implementation, testing, iteration in UP (Schmuller, 2001).

A context diagram is used to describe the relationship between the system and its environment. A data flow diagram is used to describe the dynamics and control information. The following diagram is already in the UML. The class diagram describes the system's static structure and shows data structures and operations on objects and the relationships between the objects. A Use Case Diagram shows the behaviour of the system as seen by the user. The purpose of the diagram is to describe the functionality of the system.

The IS shows the design of the optimal model of the information system for café staff management. The model describes internal processes together with external processes that cooperate and interact with each other.

The context diagram (Figure 1) describes the relationship between the system and its environment. External objects affect the IS in the form of the manager, operator, customer, bank and cash desk. The action list is linked to the information system.

2.1 List of external context diagram objects:

Manager is a person who manages the operation of the café.

Customer is a guest who calls the staff.

Staff with disabilities includes the disabled workers who serve customers.

The data flow diagram includes control information and describes system dynamics. The model shows the individual activities of the IS in detail. The presented model (Fig. 2) is represented by a data flow diagram that includes control information and describes the system's dynamics. The model shows the individual activities of the IS in detail.

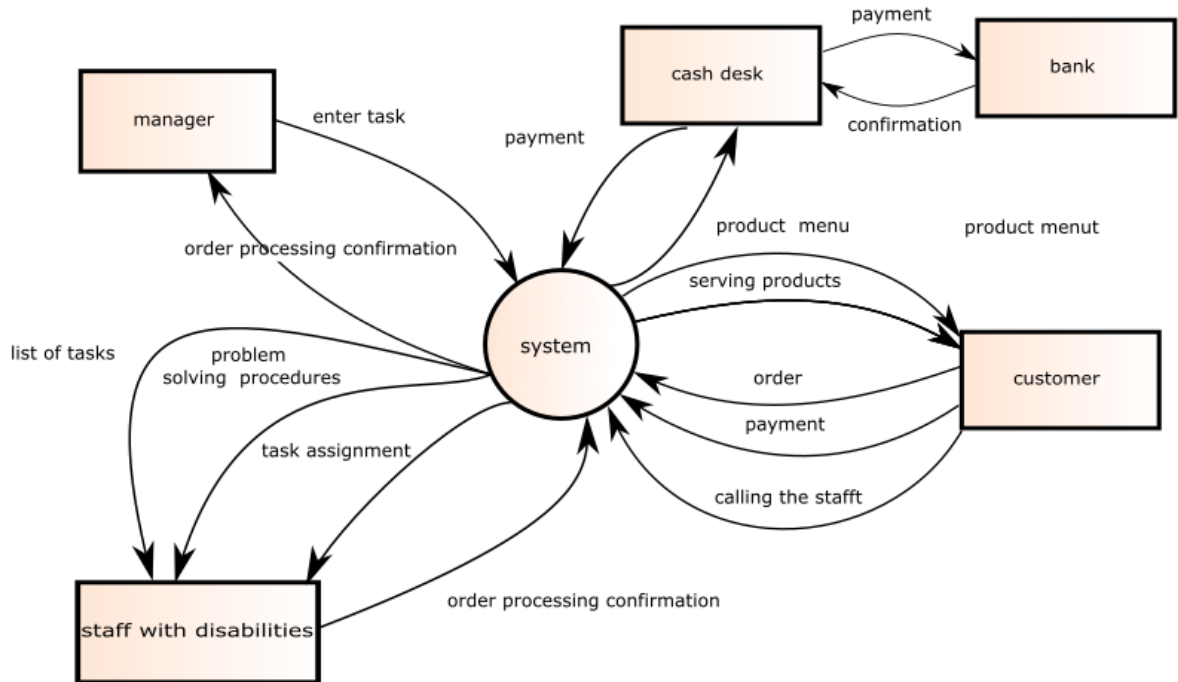


Figure 1 Relationship between the Management System for Integration of the Disabled and its environment

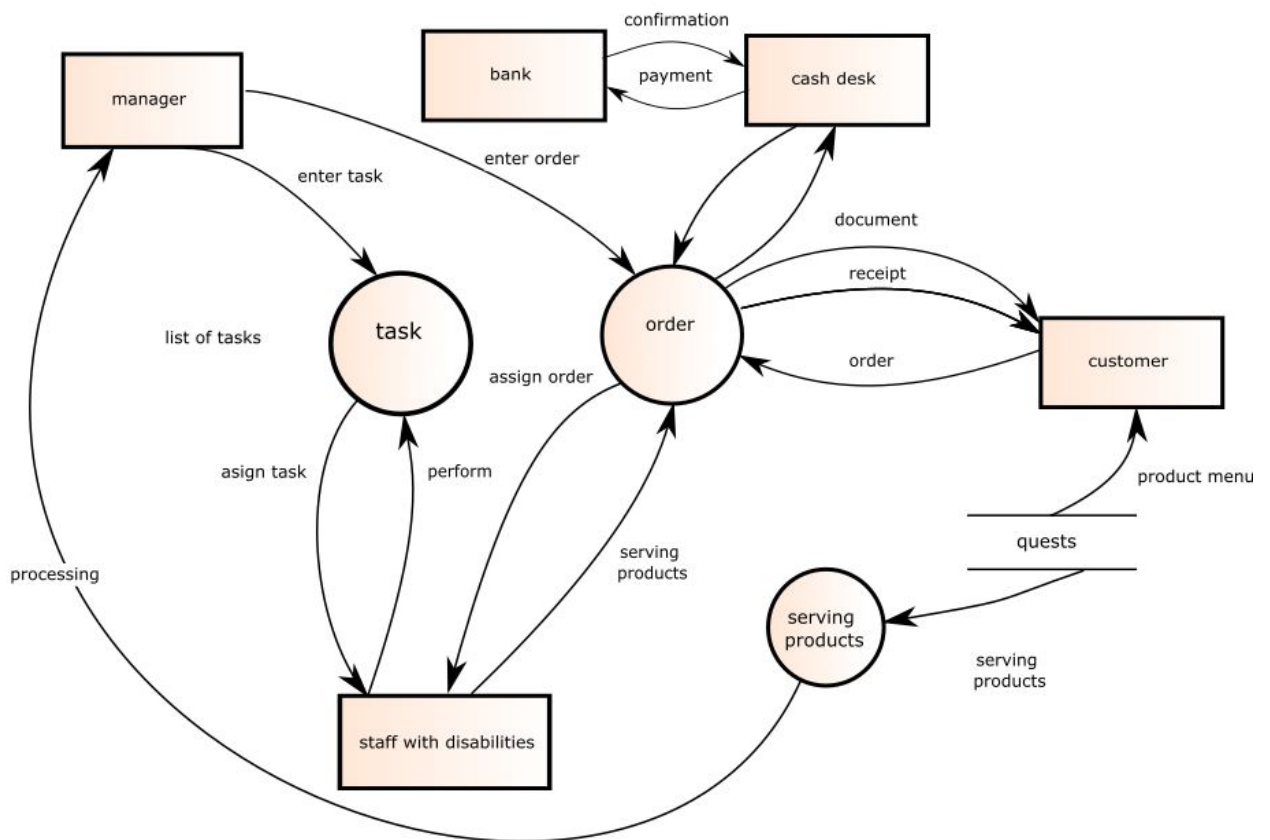


Figure 2 Data flow diagram of the Management System for Integration of the Disabled

3. Design of the Information System

The following chapter describes a system designed for employing people with disabilities. It presents UML diagrams that depict the proposed system.

3.1 System description

The whole system works on the premise that disabled persons work under the management of an operations manager. The manager assigns them certain tasks. The system will allow the worker (disabled person) of the café to navigate in the café to carry out the assigned work tasks. The worker will be equipped with a smartphone with an app. In the form of a notification, the worker will be informed immediately about the task. The mobile application will help the worker to carry out the task in a visual way (sequence of instructions expressed in text, pictograms). The instructions will also include the procedure for preparing the ordered goods. The instructions will contain partial steps leading to a resolution of the entire task (order preparation, dish removal and table cleaning). In order to confirm the completion of the task, a chip will be placed at the table location which, by attaching a mobile device, will record the presence of the worker at the table where the task was to be completed. Alternatively, the task completion will be confirmed directly using the smartphone. The FCM (Firebase Cloud Messaging) system will be used to send notification of a new task to the smartphone. Tasks can be entered by the supervisor via the mobile app or via the desktop app.

As a support tool for recording the tasks performed, sensors will then be placed around the workplace which, when the operator's display unit is approached, will interact with this unit to notify the control centre that the worker has been at that location (distance is measured). The control centre will be manned by an operations manager who will be responsible for the operation – through the control unit, the manager will give instructions to the individual workers and at the same time check the fulfilment of their tasks (both on the basis of the information from the display units of the individual PWD workers and on the basis of the information from the sensors placed at the workplace, as well as by visual inspection).

This system design will be configured for use in café operations that may employ disabled workers.

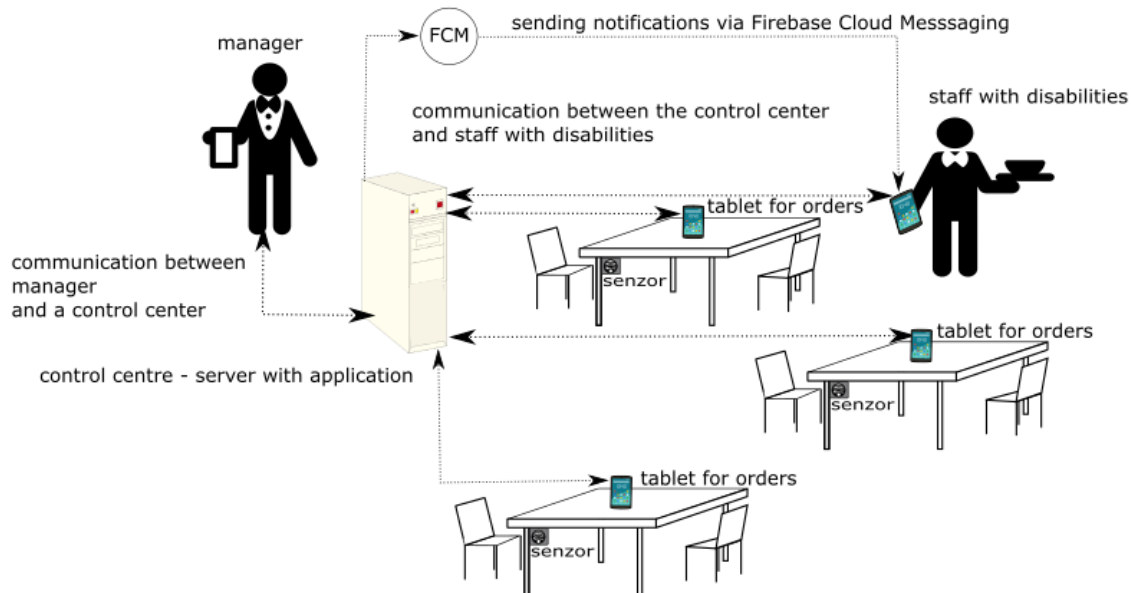


Figure 3 The diagram of the café operations for staff with disabilities.

3.2 Use Case Diagram

The Use Case Diagram shows the behaviour of our system as seen by the user. The diagram aims to describe the system's functionality, i.e. what the client expects from it. The diagram tells what the system should be able to do. The Use Case diagram is shown in Figure 4 and consists of use case, actors and the relationships between them.

In our case, we have three active actors: Guest (customer), Supervisor (manager), and Employee (worker with disability), then two passive actors cooperating with the system: Tablet (for making an order by a guest) and Cloud Messaging System (for notification sending or receiving). A guest is an unregistered customer who can see a menu, make an order (through a café worker or through a tablet without a worker), and pay for an order. The employee (the worker with disability in our proposal) manages orders or other tasks (tasks related to the operation of the café) such as cleaning tables, washing the dishes, preparing orders or their parts. The employee is an actor who handles the actual order (or another task) with the help of the tablet, which provides steps leading to the solution of the task. An employee has to manage assigned orders or other tasks. A supervisor is a manager (since the employment of staff with disabilities requires professional supervisor). The supervisor is another worker that manages tasks. He or she inputs tasks to the system and decides who manages (performs) the task. Through the system, he or she checks the task status (task completion status). Unlike the customer, the staff with disabilities and the supervisor are registered users in the system. A tablet or Cloud Messaging (CM) are passive actors (users). The tablet is connected to the system via a mobile application. Through the application, it enables orders entering, other task entering or calling the staff. The mobile application (installed in the tablet) helps to manage the work. Cloud Messaging mediates notification sending after task entering to the system. The staff with disabilities receive instructions and they manage orders or another task related to the operation of the café. The supervisor reads tasks and he receives confirmation indicating a task is executed.

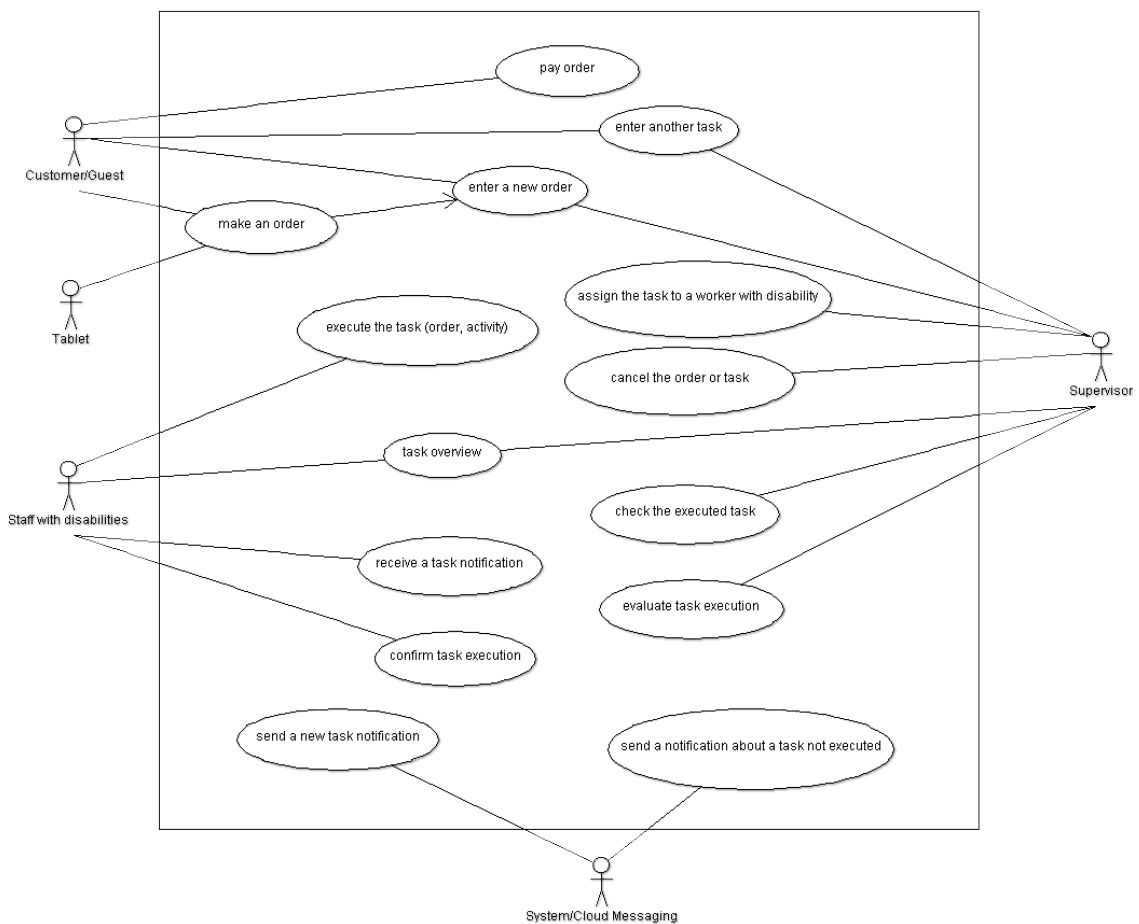


Figure 4 Use case diagram

3.3 Class diagram

The conceptual level for implementation is shown in Figure 5 by a class diagram. The class diagram describes the static structure of the system, shows data structures and operations with objects.

The supervisor (manager) enters a list of menu items in the Restaurant offers. The quest (customer) selects menu items in the menu. The order items are shown in the relation between Order and Menu. The staff (with disabilities) deliver the order to the table. The place of order is a table. A task is both in the Activity (task) and in

the Offer (task). The staff with disabilities perform tasks that are entered to the system and assigned to the staff. The customer pays for the orders.

In addition to the relations, the system provides a list of tasks, a list of closed tasks or open tasks. The system is able to provide overview of work activities of a selected worker.

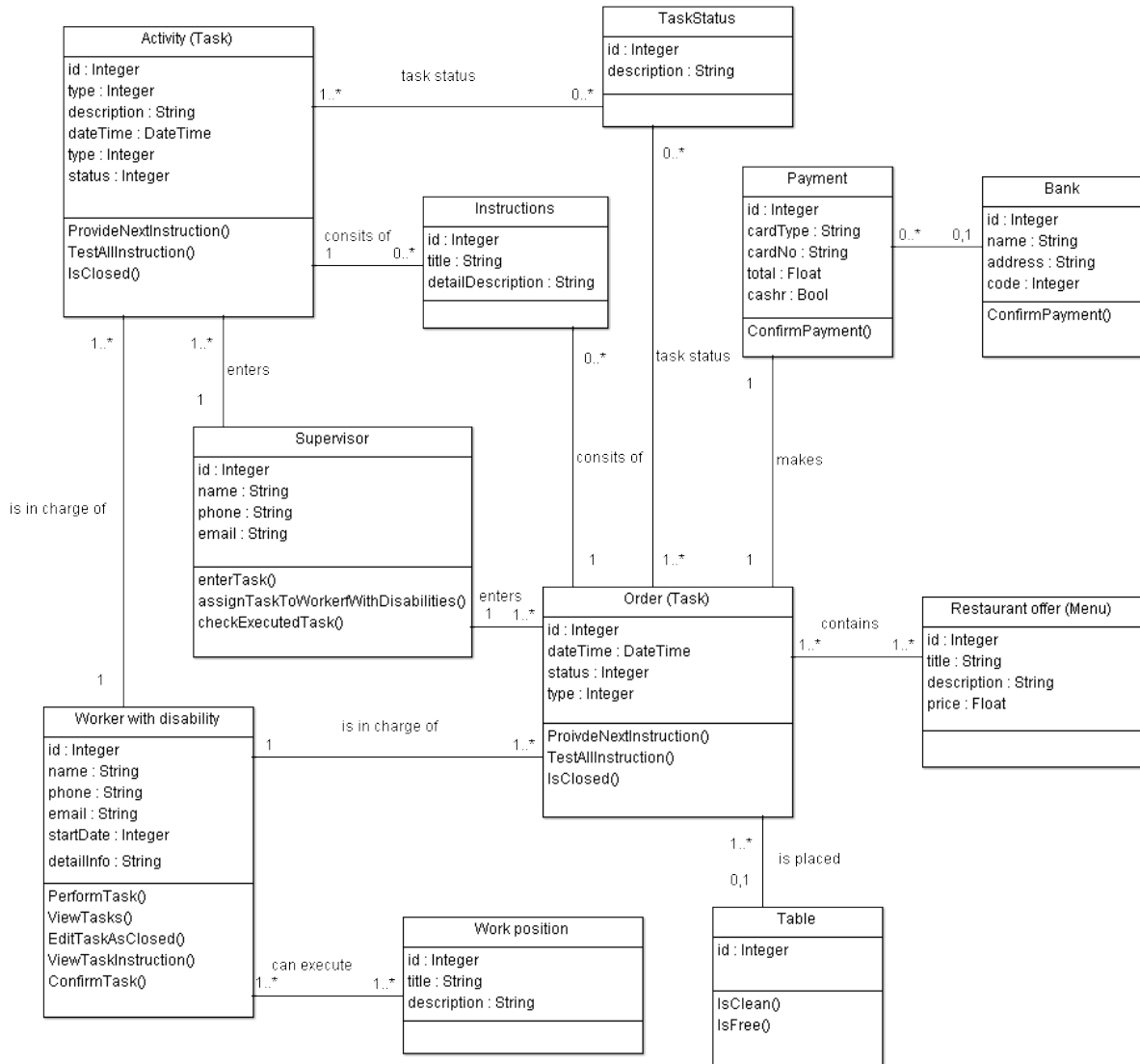


Figure 5: Class diagram for information system

4. Conclusion

The paper presents a proposal for a system for the service of a café operated by a social enterprise, which by the technical solution will enable higher employability of selected groups of employees from the category of people with disabilities. According to Lindsay et al. (2018), benefits of hiring people with disabilities include improved profitability (e.g., profits and cost efficiency, turnover and retention, reliability and punctuality, employee loyalty, company image), competitive advantage (e.g., diverse customers, customer loyalty and satisfaction, innovation, productivity, work ethic, safety), inclusive work culture, and skills awareness. Secondary benefits for people with disabilities include improved quality of life and income, increased self-esteem, expanded social networks and a sense of belonging.

The main contributions of this paper are as follows:

- The presented use case diagram describes the behaviour of the proposed system as seen by the users. The diagram aims to describe the system's functionality, i.e. what management can expect from it.

- We have proposed an optimal model of an information system for managing the operation of a café staffed by disabled workers. The presented model is a data flow diagram that contains control information and describes the system's dynamics.
- Based on the conceptual model, an information system for optimized procedure management was designed in the form of a class diagram.
- Communication between the staff, information system, manager and customers is illustrated in Figure 1 and Figure 2.

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