optimized on the basis of a rational choice of the current density, voltage and the time of its manufacture.

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DISTRIBUTED AUTONOMOUS DELIVERY SYSTEM BASED ON MOBILE ROBOTS WITH WIRELESS CHARGING

Nowadays with increasing amount of parcels around the world big courier deliver services meet problems with sorting systems. Conveyor is well known and commonly used solution in this case. It is simple to implement and use. But main disadvantage of such approach is the fact that system has fixed amount of inputs and outputs. Every day load on separate parts of conveyor system is not fixed. While production of conveyor system it is quite complex to determine design that would be able flexibly adapt to variable load.

At this moment many companies give preference to systems based on mobile robots. So called line following robots (where robot follows colored lines on the floor) are commonly used due to the simplicity of construction. The next step was made by using cameras to track position of each robot. This gives ability to make the system that can dynamically change its structure and adapt to current needs. Companies like Amazon have made a big step in this area and showed advantages of such approach [1].

This paper presents delivery system based on two wheeled mobile robots. The detailed diagram of this system is shown in the fig.1.(a) and fig.1.(b).
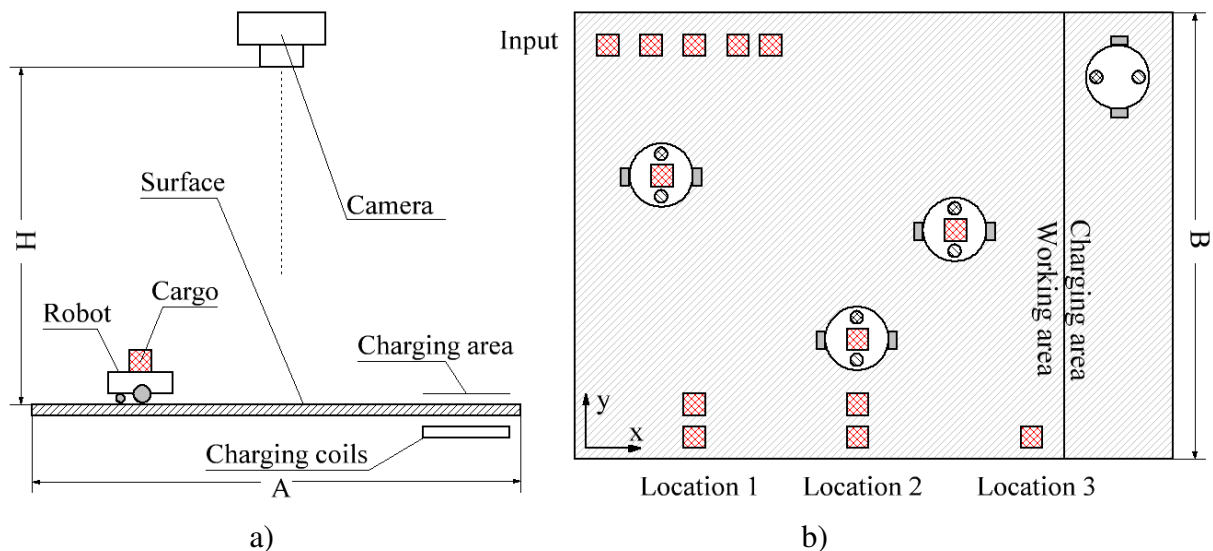

Fig. 1 – Appearance of delivery system front view a) top view b)

The main part of sorting system is based on the array of two wheeled mobile robots [2]. Due to their full maneuverability they can move around all working area and carry baggage to every place.

To avoid collisions in robots movement and improve overall effectiveness of the system the program for personal computer was written. By the means of cameras program knows the exact position of each robot and can find the best trajectory for them all. To estimate the position of robots they have special colored marks on the top. Such approach was practically verified in [4].

Next problem that should be solved is power supply of the robot. As it is fully mobile it has no external wires that could be used for power supply. In this case accumulator can be used, but its charging is major issue. Nowadays quite popular approach to solve this task is wireless charging. As there is no need to have direct contact charging can be even made while robot is moving. Power transfer is made by the means of specially designed transmitting and receiving coils. Main drawback of such approach is high price of the system due to amount of transmitting coils that should be used. For low cost systems it would be better to make special charging areas. The level of charge is monitored by the control program. When this level is low the robot is directed to the charging area and its duties are taken over by another robot.

The main part of charging device is z-source converter. In this topology z-source network is acting as quasi sinusoidal generator and its inductances are used as transmitting coils to transfer energy to the robot. In the receiver the current is rectified and filtered before being used for charging accumulators of the robot.

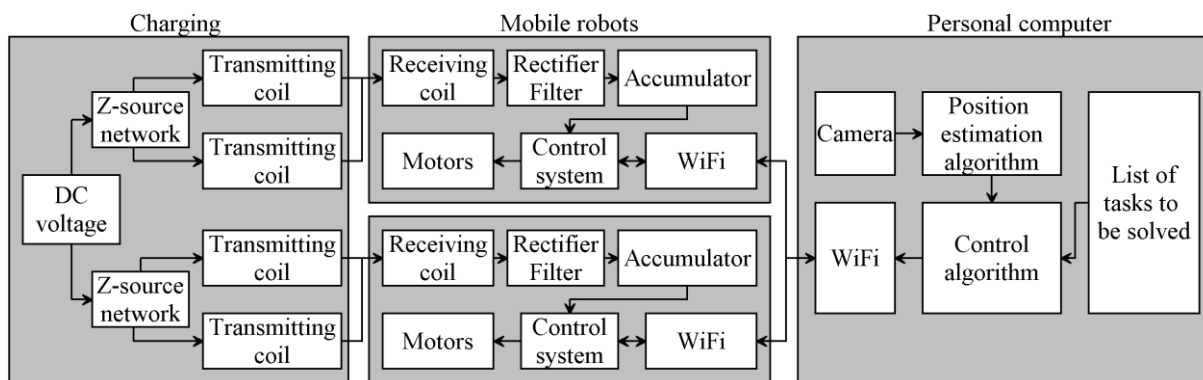Fig. 2 represents functional diagram of delivering system.

Fig. 2 – Delivery system functional diagram

Proposed solution covers all necessary delivery tasks and gives more flexibility in comparison to conveyor. By using mobile robots system performance rapidly increased. Involving wireless charging area reduces all possible delays caused by accumulators discharging process and improves overall reliability of the system.

Simplicity of control is implemented by cameras. Special position estimation algorithm gives ability to use cheap cameras which significantly reduces price of system.

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