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Automated Guided Vehicle Navigated using Fuzzy Cognitive Maps and Intelligent Space

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Abstract: The emerging concept intelligent space (IS) offers the use of mobile autonomous devices like vehicles or robots in a very broad area without necessity for these devices to own all necessary sensors. From this reason also new navigation methods are developing, which aim to offer maybe not accurate but first of all cheap and reliable solutions for a wide variety of devices. This concept deals with the examination of possibility to interconnect RFID tags with sensors. The signals produced by these two technologies are often affected by uncertainty and incompleteness we use fuzzy logic for their processing as well as control of the entire navigation process. For this purpose a special type of a fuzzy cognitive map was proposed. The concept describes real navigation experiments with a simple vehicle and evaluates them by selected criteria. From our results and their explanations and conclusions for potential future research are sketched.
Keywords: intelligent space, RFID tags, a fuzzy cognitive map, sensors.

I. INTRODUCTION

Ninety-eight present of all microprocessors are manufactured as components of embedded systems. However, by building intelligence mechanisms on top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functions, well beyond those available. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand.

Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. The board can be controlled by sending a set of instructions to the microcontroller on the board. By implementing the coding with Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

II. LITERATURE SURVEY

Modelling and dead lock control system presents a colored resource-oriented Petri net (CROPN) modeling method to deal with conflict and deadlock arising in automated guided vehicles (AGV) systems. It can handle both bidirectional and unidirectional paths. The former offer additional flexibility, efficiency, and cost saving when compared with the latter. Yet, they exhibit more challenging AGV management problems. Unlike jobs that can enter and leave automated manufacturing systems, AGVs always stay in the system. By modeling nodes with places and lanes with transitions, the proposed method can construct CROPN models for changing AGV routes. A control policy suitable for real-time implementation is presented. . For example, many semiconductor manufacturers have used AGVs to implement truly flexible MHS. However, AGV management becomes a challenging problem especially when bidirectional paths are used to gain efficiency and flexibility on the factory floor. It is well known that deadlock may occur due to limited resources in automated manufacturing systems (AMS), leading to a system wide standstill. This paper classifies deadlock into two types. One is caused by the competition by parts for the manufacturing resources, such as machines, buffers and MHS. It occurs during the part processing. The other type is due to the competition for nodes and lanes by AGVs when multiple AGVs are used in MHS. Petri nets (PNs) are used for deadlock analysis. Methods are developed to synthesize live PNs for AMS so that the resulting controllers are deadlock free. Deadlock detection and recovery techniques allow deadlock to occur and then detect and recover from it.

Effective sequencing and scheduling of the material handling systems (MHS) will have a good impact on the productivity of the

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productive system. The material handling cannot be neglected while scheduling the production tasks. It is necessary to take into account the interaction between machines, material handling systems and computer. In this context, this paper attempts to link the operation of automated guided vehicles (AGV) with the production schedule and suggests a heuristic algorithm that employs vehicle dispatching rules (VDR) for conflict resolution. The verse considered in this paper are: shortest operation time (SPT), longest operation time (LPT), longest travel time (LTT) and shortest travel time (STT). The performance of the VDRs in the proposed heuristic is compared with make span criteria.

Radio frequency identification (RFID) has been widely used in supporting the logistics management on manufacturing shop floors where production resources attached with RFID facilities are converted into smart manufacturing objects (SMOs) which are able to sense, interact, and reason to create a ubiquitous environment. Within such environment, enormous data could be collected and used for supporting further decision-makings such as logistics planning and scheduling. This paper proposes a Big Data approach to excavate frequent trajectory from massive RFID-enabled shop floor logistics data with several innovations highlighted. In the front side RFID-Cuboids are creatively introduced to establish a data warehouse so that the RFID-enabled logistics data could be highly integrated in terms of tuples, logic, and operations. At the middle side, a Map Table is used for linking various cuboids so that information granularity could be enhanced and dataset volume could be reduced. At the last part, spatio-temporal sequential logistics trajectory is defined and excavated so that the logistics operators and machines could be evaluated quantitatively. Finally, key findings from the experimental results and insights from the observations are summarized as managerial implications, which are able to guide end-users to carry out associated decisions.

III. PROPOSED SYSTEM

The proposed system includes giving information about automated guided vehicle to navigate the correct location. This system includes designing a cognitive map for the intelligent action cards. A neural Network helps with classification of tag signals based on RSSI measurements. Evolutionary approaches as optimizing methods try to minimize the localization error. In correspondence with IS our approach tries to utilize a combination of intelligent action cards as well as further robotic means to find a proper balance between sensors of these two groups. In future, one of the most significant criteria will be economical effectiveness of solutions, too. Our approach enables navigation also for simple devices not owning complex sensors. This work comes from our earlier papers dealing with object identification using the so-called smart floors and navigation with help of a cognitive map. Its basic idea is based on a combination of a grid comprised of passive intelligent action tags for robot (vehicle) localization and sonars for obstacle avoidance. Further, we will deal with the use of a sparse tag grid supplemented by odometer for overcoming distances between intelligent action tags.

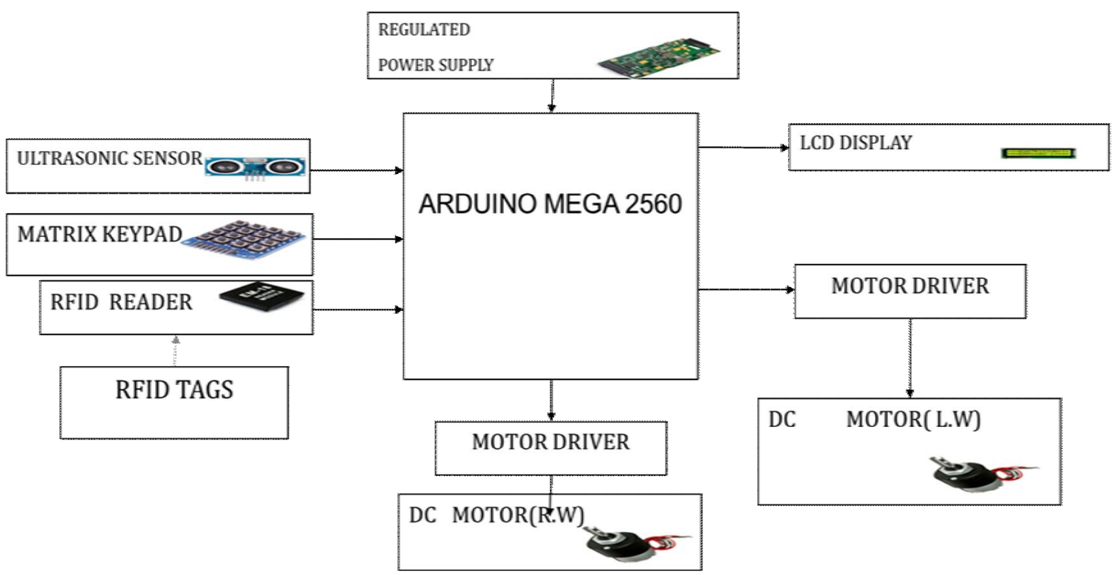

Fig 1 Proposed system block diagram

A. Algorithm

STEP 1: Click the menu button.
STEP 2: Set the X,Y,-X,-Y directions .
STEP 3: Select the required unit.
STEP 4: Move forward till the tag is found.
STEP 5: Read the tag.
STEP 6: Repeat this until the respective unit is found.
STEP 7: End the action.
STEP 8: Stop the process.

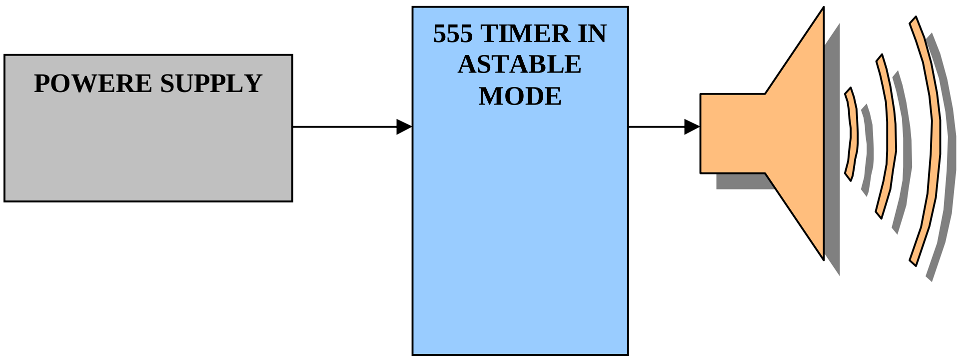

Fig 2 Ultrasonic Transmitter

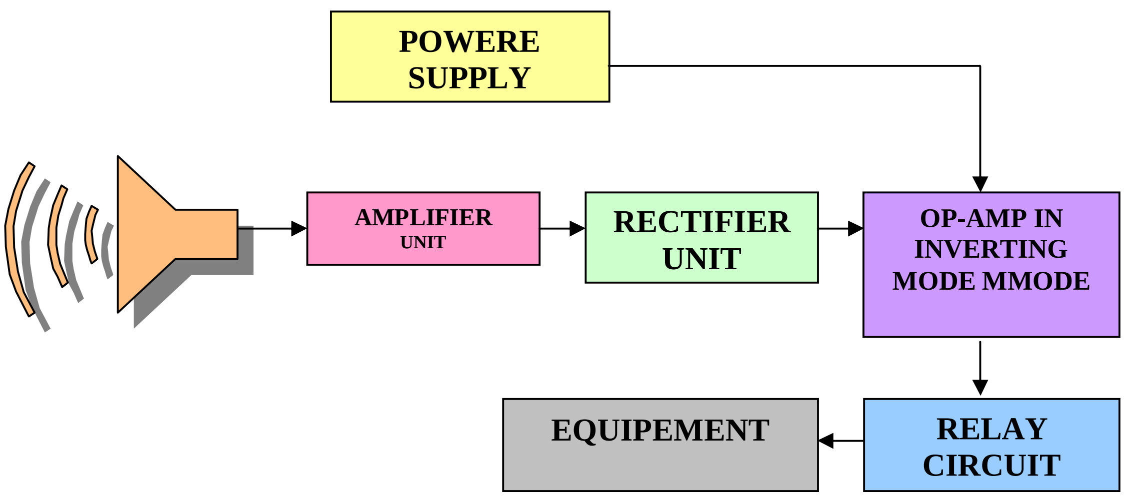

Fig 3 Ultrasonic Receiver

When switch S1 of transmitter is pressed, it generates ultrasonic sound (or) Wave. The sound is received by ultrasonic receiver transducer. These signals are amplified by transistors T3 and T4. The amplified signals are rectified and filtered. The filtered D.C Voltage signal is given to the inverting pin of Op-Amp IC2. The non-inverting pin of IC2 is connected to a variable D.C voltage via preset VR2 when determines the threshold value of ultrasonic signal received by receiver for operation of relay RL1. When transistor T5 conducts, it supplies base bias to transistor T6. When transistor T6 conducts, it actuates the relay.

B. LCD Display

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal .An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the

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liquid crystal molecules to maintain a defined orientation angle. One each polarizes are pasted outside the two glass panels.

C. DC Motor

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hd rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors. There are two conditions necessary to produce a force on a conductor: **-** The conductor must be carrying current. **-** The conductor must be within a magnetic field. The right-hand rule for motors states that when the forefinger is pointed in the direction of the magnetic field lines, and the center finger is pointed in the direction of current flow, the thumb will point in the direction of motion. The function of torque in a DC motor is to provide the mechanical output to drive the piece of equipment that the DC motor is attached to. Torque is developed in a DC motor by the armature (current-carrying conductor) being present in the motor field (magnetic field).

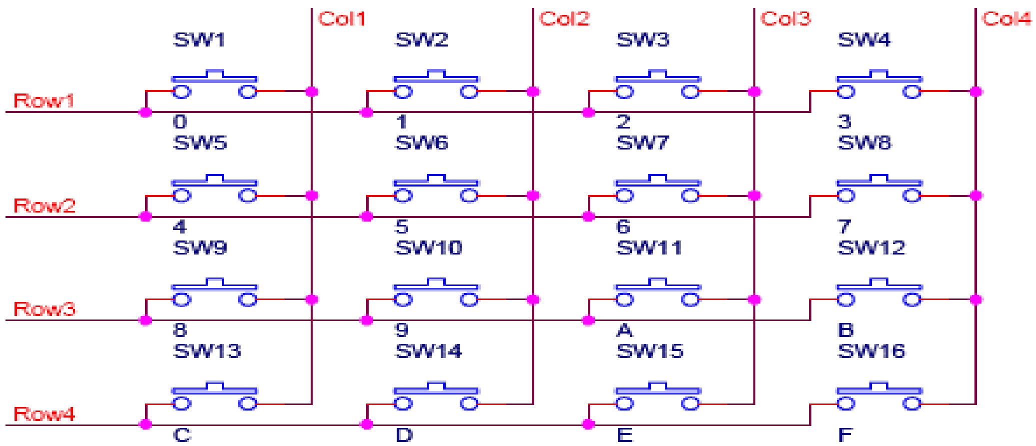

Fig 4 Matrix keypad

IV. RESULTS AND DISCUSSIONS

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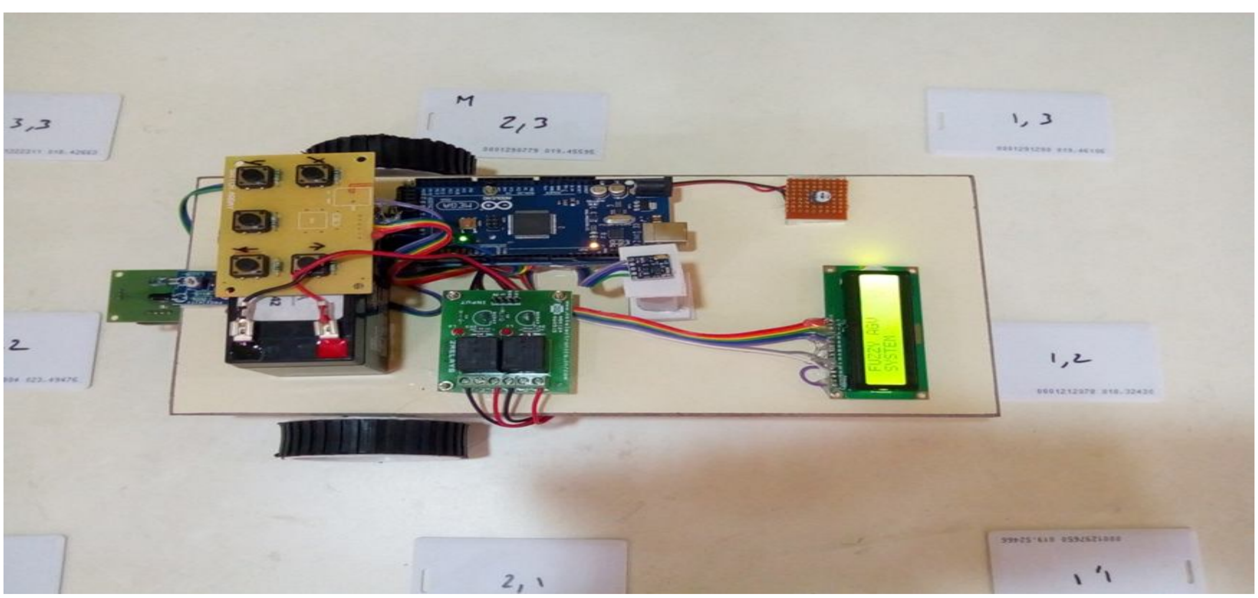

Fig 5 proposed system output

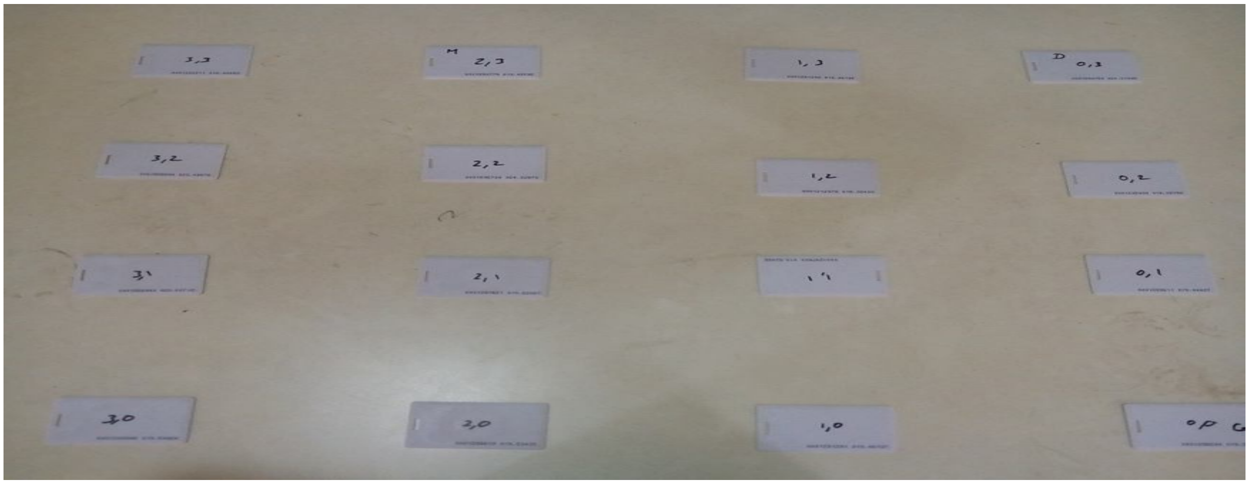

Fig 6Arrangement of RFID tags

Based on the Fuzzy system four inputs are provided: Left distance(X direction); Right distance (-X direction); Front distance (Y direction) and Heading angle(position of the AGV in relation with the target destination).Experimental data sets were created for the specific application of the AGV available for the research. Each of the four decision making system that were developed were successfully. Afterward the required training and learning is completed, it is expected that these decision making system can be guided by themselves without any human intervention guide a mobile robot or AGV in unknown and unstructured environment. The hardware of the practical implementation of the above discussed navigation has been designed.

V. CONCLUSION

A navigation system has been developed which can be fed with information gathered from the environment using an array of sensors.IR sensors are used to provide the distance of an obstacle from the AGV. The Magnetometer is used to provide the orientation of the AGV with respect to the target destination .The output of the proposed navigation system is to reach the correct location. The hardware consisting of the dc motors, driver circuit, magnetometer, and potentiometer. Firstly the Fuzzy logic can be further optimized to reduce the error in the training.

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