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RESEARCH ARTICLE

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AUTOMATED MORTUARY MANAGEMENT USING PLC AND SCADA

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ABSTRACT

In India, the word mortuary itself gives an awkward feeling to people because of its unhygienic conditions, corpse not properly maintained, stored and retrieved. With forgeries in disposal of cadaver has been going on and on, this paper provides the ideology for legitimate database management of cadavers, automatic storage and retrieval, decomposition regulation and the system to eradicate the illegal activities in mortuaries. At present the technicians use ladders, lifts and stretchers to place the bodies in the storage chambers. Assistants find it to be a tedious task when they carry the carcasses that are to be placed in chambers at greater heights. So it is the right time to throw light on this issue by bringing in modernization to improve its condition. This system utilizes PLC and SCADA for automating the functions such as storage and retrieval of bodies in mortuaries along with their forensic information management and communication, so that the forensic department would function in a more safe and secure manner. For decomposition regulation, the optimum corpse temperature is monitored and if any change in temperature, the cadaver is disposed from morgue immediately. This would also eradicate the difficulties faced by attendees and would provide better and healthy working environments. The storage and retrieval process is managed using 3-axis motor robot controlled by PLC for automation.

Keywords—Corpse, PLC, SCADA,3 axis robot, decomposition.

I. INTRODUCTION

The developed system aims at improving the currently prevailing facilities in the morgue. The proposal aims at better and healthy environment for cadaver management. This improves safety, security and provides a better working environment for the forensic technicians. The system consists of storage chambers where the cadavers are to be stored. These are designed in such way that these form a matrix of rows and columns. IR sensors are placed inside the chambers to update about the availability of the body. This can be visually seen in SCADA. The horizontal movement is performed by the X axis motor that makes the Movable Elevator setup to reach a particular position sensor. Once the position is identified, the position sensor stops the Movable Elevator. Now the vertical movement is performed by the Y axis motor that lifts the entire setup to that particular chamber. Now the Z axis motor performs the horizontal movement that is perpendicular to

the X axis movement that places the cadaver exactly inside the chamber. The retrieval is a reverse process of the storage process and is done by the instructions from the operator unlike the storage process. This is because the operator has to choose the body that has to be retrieved and hence is an auto-manual process.The Forensic information management is carried out when the patient is declared dead and is bought to the mortuary. Body tags are generated at the hospital before coming to the mortuary. This contains basic information about the body before internal and external examination. Internal examination deals with the vital organs and finding the cause of death in medical terms. Once it is done the PC at the mortuary which is also connected to the server at the hospital is updated i.e., the body tags are now updated. This makes the system secure and maintains a database.

II. EXISTING SYSTEM

In the existing system the attendees use ladders, hydraulic lifts and stretchers to place the bodies in the storage chambers. Mortuaries also lack hygiene which in turn affects the people working in it. Assistants find it a tedious task when they carry the cadavers that are to be placed in chambers at greater heights. Due to poor refrigeration facilities and lack of security, the bodies are at times delivered to the wrong person or swapped. When the bodies are not claimed, which are stored for a longer period of time are sent for anatomy studies. These are a few images of the supportive tools that are used presently:

Figure 2.1 Stretchers chambers

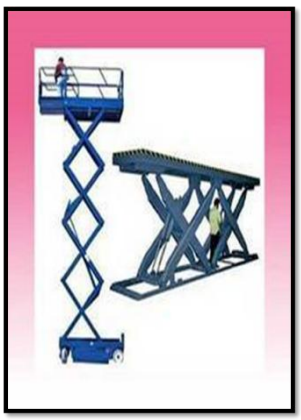

Figure 2.2 Hydraulic lifts

Figure 2.3 Stretchers Chambers

III. DEMERITS OF EXISTING SYSTEM

The proposed system is an effort to curb the demerits in the present scenario. The following are a few disadvantages that are involved.

- Man power requirement is high.
- Lack of proper refrigeration chambers.
- Lack of hygiene and security.
- Cost of labor is high.
- Lack of database management.
- Lack of security systems.

Generally not all bodies are taken to the mortuary, only medico-legal cases such as homicides, suicides and Road Traffic Accidents (RTA).The main source of national mortality data are vital registration systems. Since these are not maintained properly in the present scenario. Hence this proves the requirement of a secured database.

III. PROPOSED SYSTEM

In the proposed system all the functions which were earlier manually controlled is now automated with improved efficiency and security. In the proposed system the forensic technicians need

not carry the cadavers either to store or retrieve .A Tri-axis Functional Movable Elevator conveyor setup (ECS) is constructed to store and retrieve the bodies to/from the storage chambers. The ECS can move in X, Y & Z axis to perform the functions of storage and retrieval. The storage chambers are designed in such a way that they can detect the presence or absence of bodies and correspondingly instruct the PLC. The ECS has a base plate to provide the base for the cadaver boxes. Sensors are provided at base plate of ECS, all shelves of the storage chambers and at few other positions to provide the desired accurate functioning. SCADA is designed to provide the desired human-machine interface to the operator. Through this design one can easily supervise, control and have data acquisition anytime. PLC is used to provide the necessary control functions for the entire process. The desired logic is programmed and loaded into the PLC's memory to initiate its action.

IV. MERITS OF PROPOSED SYSTEM

- Reduces man power
- Eliminates labour cost
- Better working conditions
- Better safety and security
- One time investment
- Time saving
- Eliminates disadvantages produced by conventional XI.

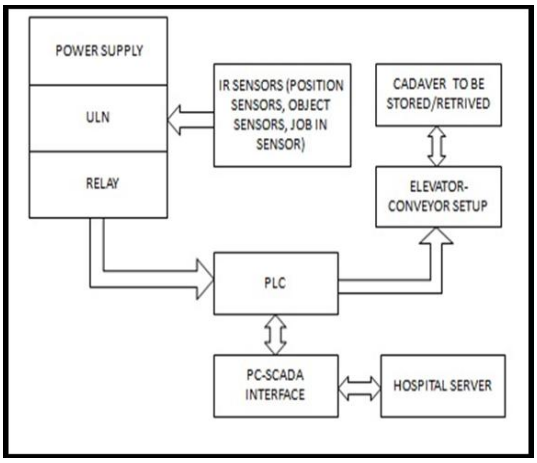

Figure 4.1 Block Diagram

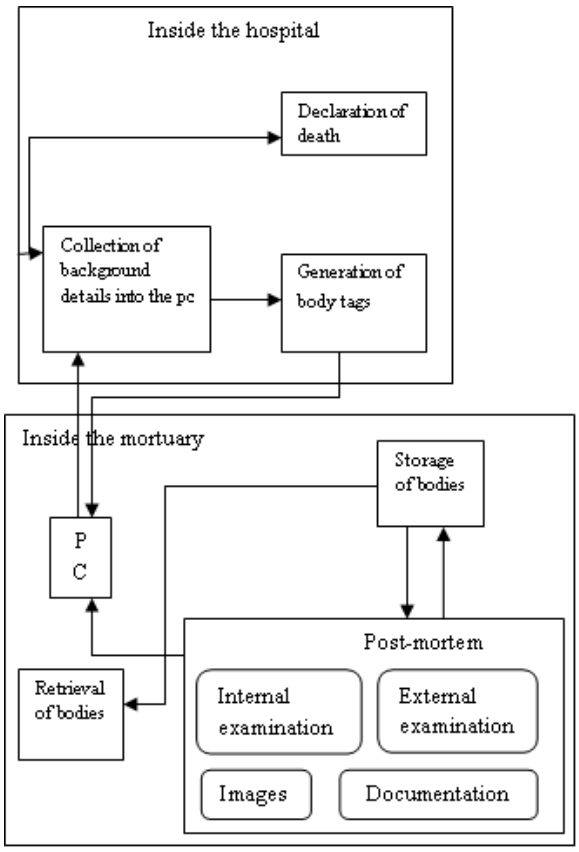

Figure 4.2 Process Diagram

A. STORAGE CHAMBERS

First, a matrix of shelves is designed for storage of cadavers. Each shelf can hold one cadaver in each of them. Inside each shelf, there are IR sensors which are used to indicate the presence and absence of cadavers. These are built in such a way that they can be expanded in the future, if it is required to do so. Since the storage is designed by way of rows and columns, separate IR Sensors are placed to determine the particular column from where the cadavers are to be retrieved or going to be stored. And these IR pairs are technically known as Position sensors. The cadavers are preserved at correct temperatures based upon the decay rate. For longer period of storage, negative temperatures are used and for shorter period of storage, positive temperatures are being used. All the IR sensors output is fed to the PLC so that it can assist the storage and retrieval of cadavers. These outputs are made visible to see using the Human machine interface that is SCADA.

Figure 4.3 Storage Chamber

B. MOVABLE ELEVATORS

Basically, the Movable Elevator is capable of a Tri-axial motion that is moving in three different dimensions namely X axis, Y axis and Z axis. X axis motion is used to move the cadaver from or to the storage chamber. The Y axis motion is used to lift the cadaver through an altitude and to select the particular row of the chambers. This is followed the Z axis movement which is used to place or retrieve the cadaver from a particular chamber. For a rigid and safe transfer of the body, an Electro- Magnet is used which holds on to the metal plate which is attached to the box that contains the cadaver. The Tri-Axial motion is made possible with the use of three motors which are connected to the PLC and actuated by the program. The Electro-Magnet which holds onto the box is being energized and de-energized by the instructions from the PLC.

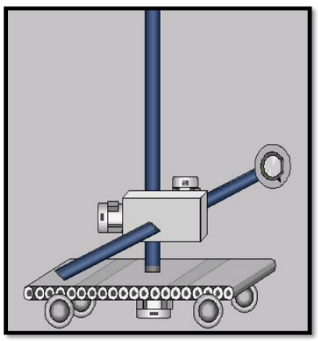

Figure 4.4Animated design of MES

Figure 4.5Actual Design of MES

C. PLC

A Programmable Logic Controller, PLC or Programmable Controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. The abbreviation PLC and the term Programmable Logic Controller are registered trademarks of the Allen-Bradley Company (Rockwell Automation). PLCs are used in many industries and machines. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. A PLC is an example of a hard real time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.A Programmable Logic Controller (PLC) is an industrial grade computer that is capable of being programmed to perform control functions. The programmable controller has eliminated much of the hardwiring associated with conventional relay control circuits. The programmable logic controller is designed for multiple input and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs for the control and operation of manufacturing process equipment and machinery are typically stored in battery-backed or nonvolatile memory. A PLC is an example of a real-time system since the output of the system controlled by the PLC depends on the input conditions. It is small and inexpensive compared to equivalent relay-based process control systems. Modern control systems still include relays, but these are rarely used for logic

In addition to cost savings, PLCs provide many other benefits including:

- Increased Reliability
- More Flexibility
- Lower Cost
- Communications Capability
- Faster Response Time
- Easier to Troubleshoot

VI. SOFTWARE USED

SCADA-WONDERWARE INTOUCH (v10.1)

SCADA (Supervisory Control And Data Acquisition) is a type of Industrial control system (ICS). Industrial control systems are computer controlled systems. SCADA systems historically distinguish themselves from other ICS systems by being large scale processes that can include multiple sites, and large distances.

A. COMMON SYSTEM COMPONENTS

A SCADA system usually consists of the following subsystems:

- A human–machine interface or HMI is the apparatus or device which presents process data to a human operator, and through this, the human operator monitors and controls the process.
- A supervisory system, gathering data on the process and sends commands to process
- Remote terminal units (RTUs) connecting to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system.
- Programmable logic controller (PLCs) used as field devices because they are more economical, versatile, flexible, and configurable than special-purpose RTUs.

B. WONDERWARE INTOUCH (v10.1)

Wonderware In Touch 10.1 is the quickest and easiest way to create human-machine interface (HMI) applications. In Touch is a component of the Wonder ware Factory Suite. In Touch applications span the globe in a multitude of vertical markets including food processing, semiconductors, oil and gas, automotive, chemical, pharmaceutical, pulp and paper, transportation, utilities, and more.

By using InTouch, one can create powerful, full-featured applications that exploit the key features of Microsoft Windows, including ActiveX controls, OLE, graphics, networking and more. InTouch can also be extended by adding custom ActiveX controls, wizards, generic objects, and creating In Touch Quick Script extensions.

In Touch consists of three major programs, the In Touch Application Manager, Window Maker and Window Viewer.

The In Touch Application Manager organizes the applications that is created. It also is used to configure Window Viewer as an NT service, to configure Network Application Development (NAD) for client-based and server-based architectures, to configure Dynamic Resolution Conversion (DRC) and/or distributed alarming. The DB Dump and DB Load database utilities are also launched from the Application Manager.

Window Maker is the development environment, where object-oriented graphics are used to create animated, touch-sensitive display windows. These display windows can be connected to industrial I/O systems and other Microsoft Windows applications.

Window Viewer is the runtime environment used to display the graphic windows created in Window Maker. Window Viewer executes In Touch Quick Scripts, performs historical data logging and reporting, processes alarm logging and reporting, and can function as a client and a server for both DDE and Suite Link communication protocols.

C. WORKING OF PROPOSED SYSTEM STORAGE

The box that contains the cadaver is placed on to the Movable Elevator setup at the home position. As the entire process is visualized through SCADA, the empty chambers are easily located. After collecting information from SCADA, the Movable Elevator setup is instructed by PLC. The motor responsible for the X axis motion is actuated and moves towards the chamber; after reaching the position the motor responsible for the Y axis movement is actuated and it moves through an altitude; after reaching the particular row, the motor responsible for Z axis movement is actuated and hence stores the corpse in the selected chamber. After storage process is complete, the Movable Elevator setup comes back to the initial position. The IR sensor placed inside the chamber sends signal to the PLC and updates the status in the SCADA.

RETRIEVAL

This is a reverse of the storage process. After collecting information from the SCADA about the location of the cadaver, the PLC sends signal to

the Movable Elevator setup. The motor responsible for the X axis motion is actuated and moves towards the chamber; after reaching the position the motor responsible for the Y axis movement is actuated and it moves through an altitude; after reaching the particular row, the motor responsible for Z axis movement is actuated and hence retrieves the corpse from the selected chamber. The Movable Elevator setup comes back to the initial position with the cadaver. The IR sensor placed inside the chamber sends signal to the PLC and updates the status in the SCADA.

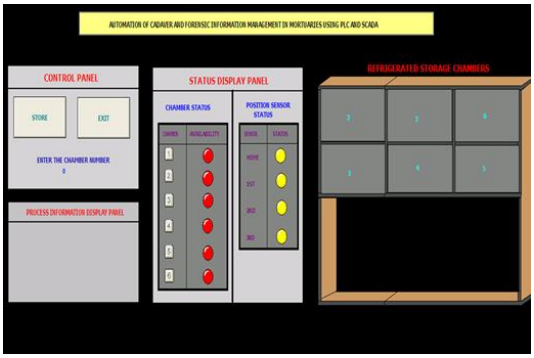

Figure 4.1 SCADA Design of Proposed System

VII. CONCLUSION

An automated system for cadaver and forensic information management was developed with the use of PLC-SCADA and backward methods that were practiced over the years have been eliminated. The cadaver management was done using a Movable Elevator setup that can move in three dimensions namely X, Y and Z axis. An efficient common database was developed to manage the forensic information through SCADA. As a result the developed system reduces the labor to the minimum possible level.

A drawback is that a skilled labor is required to operate the PLC and thus the developed system. But the system provides highly improved working at a mortuary and also reduces the labor cost drastically.

Another drawback was the development time which depends on the number of chambers that are to be erected. Further the cost of the PLC and thus the entire developed system depends on the number of storage chambers. It would be a better option to give up on the cost for better safety and security.

The developed Forensic Information Management System eliminates any kind of mishap such as swapping of dead bodies, missing of a corpse and many more. So, when taking into account of all the prevailing conditions over the years, it can be concluded that this sort of an automated system is highly required and should be practiced.

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