International Research Journal of Emerging Trends in Multidisciplinary
ISSN 2395-4434
Volume 1, Issue 6 August 2015
www.irjetm.com

AUTOMATION OF CARASS MANAGEMENT IN MORGUE USING PLC AND SCADA

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Abstract

In developed nations, doctors don't hesitate to dine at mortuaries whereas in India people fear to enter there. As per a recent survey 67% of death polls are due to unnatural reasons. Such victims are taken to the Mortuaries for autopsy. Hence mortuaries need a healthy environment to do the same but to the disgrace the present situation of mortuaries in our country is pitiful. The mortuaries also lack forensic technicians, good storage facilities, proper maintenance, security, proper forensic information management. At present the technicians use ladders, lifts and stretchers to place the bodies in the storage chambers. Mortuaries also lack hygiene and sanitation which in turn affects the people working in it. 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 high time to throw light on this issue by bringing in modernization to improve its condition. The main objective is to automate the entire functioning of mortuaries using automation tools like PLC & SCADA. This would replace all the manual operations which could be performed automatically. This proposal aims to automate the functions such as storage & retrieval of bodies in mortuaries along with their forensic information management and communication, so that the forensic department would function in a more safe & secure manner. This would also eradicate the difficulties faced by attendees and would provide better and healthy working environments.

INTRODUCTION

DESCRIPTION OF THE SYSTEM

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 ie, the body tags are now updated. This makes the system secure and maintains a database.

EXISTING SYSTEM

In the existing system the attenders use ladders, hydraulic stretchers to place the bodies in the storage chambers. Mortuaries also lack hygiene which in turn affects the people

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working in it. Assistants find it a tedious task when they carry the cadavers that are to be place in chambers at greater heights. These are a few images of the supportive tools that are used presently:

LADDER

HYDRAULIC LIFTS:

LACK OF STORAGE:

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.

DEMERITS IN THE 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.

LITERATURE SURVEY

PAPER1: Anastasia Burke, Divij Durve and Monique Marks, "Forensic Evidence Management Information Systems (FEMIS)", 2010.

The Forensic Evidence Management Information System (FEMIS) is a web based system that houses data on a centralized database in order to store all forensics evidence in one receptacle. The forensic evidence may include pictures of suspects, fingerprints, handwriting samples, etc. The proposed database will keep track of who has handled the evidence in order to reduce the risk of mistrials related to evidence tampering or evidence went missing.

This paper emphasizes the need for secured and a common database for the storage of forensic information.

PAPER 2: MONASH UNIVERSITY AND WHO "Fatal injury surveillance in Mortuaries and Hospitals", Australia, 2012

This is a manual developed by World Health Organization in collaboration with Monash University. This involves the Injury mortality data collection.

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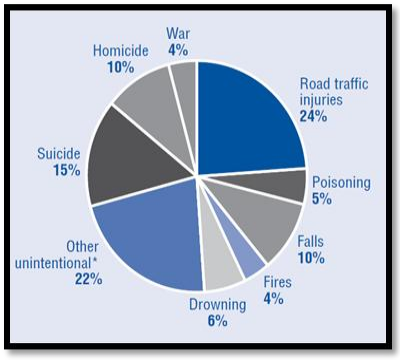
It is well documented that injuries are a global preventable public health problem. According to WHO's Global Burden of Disease (GBD) estimates, 5.1 million people worldwide died as a result of injuries and violence. This accounts for around 9% of the world's deaths and 27% of all deaths among children aged 5–14 years. The majority of injury-related deaths are unintentional or "accidental" with road traffic crashes, falls and drowning ranking among the main causes.

Suicide is the leading cause of violence-related injury deaths, followed by homicide.

Injuries may be classified as intentional such as interpersonal violence, self-harm, Legal intervention and war or civil insurrection, unintentional such as road traffic injuries, burns, falls, drowning or poisoning or of undetermined intent.



STATISTICS OF MEDICO LEGAL CASES

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.

PAPER3: COMPU GROUP "Mortuary Management system", MALAYSIA, 2012

This is a journal published by Compu-Group Medical Association. It highlights about the bad maintenance and lack of facilities in the mortuaries. Attenders 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 to be a tedious task when they carry the cadavers that are to be placed in chambers at greater heights. Hence, it emphasizes on the need for proper cadaver management system and better supporting tools for the transfer of cadavers in a much improved and healthy environment.

PROPOSED SYSTEM

As explained earlier it is thus understood that some change has to be made to this existing system. This change can be made through automation**.**

DESCRIPTION OF THE 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.

BLOCK DIAGRAM

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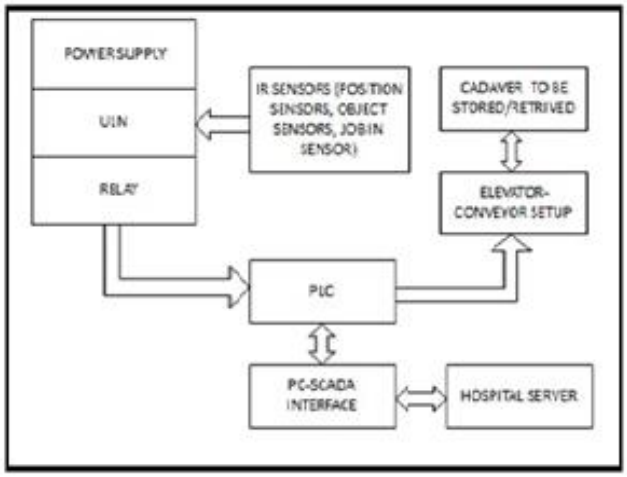
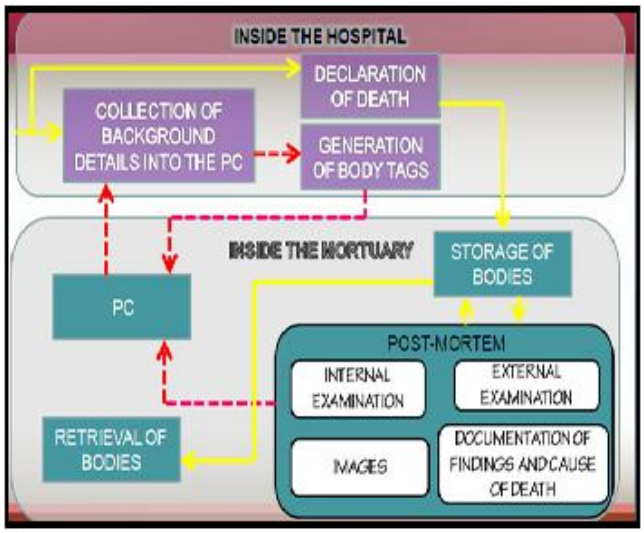


PROCESSDIAGRAM



The automation of the carcass in morgue involves two process. They are:

• Process inside the hospital

• Process inside the morgue

PROCESS INSIDE THE HOSPITAL:

The doctors declare the death of the patient. The details of the patient is entered in the computer. The details about the carcass is maintained in the computer so that it can be used for future reference .Once the details about the carcass are entered in the PC, a body tag is created. The generation of the body tags helps to eliminate the disfiguring

PROCESS INSIDE THE MORGUE:

After the declaration of the death the carcass is moved to the morgue. Then, the carcass is stored in the freezing chamber. The diseased bodie are stored in the freezing chamber until it starts decaying. The alarm is fixed in the freezing chamber which indicates when the diseased body starts decaying.

The bodies can be retrieved from the freezing chamber whenever required like during autopsy, or if it decays. All the details about the carcass is maintained in the database.

MERITS

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

EVIDENCES OF IMPROPRER MANAGEMENT

International Research Journal of Emerging Trends in Multidisciplinary
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Volume 1, Issue 6 August 2015
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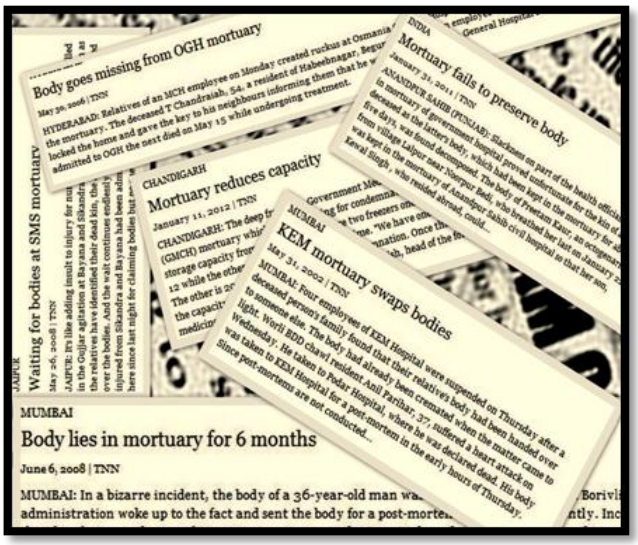
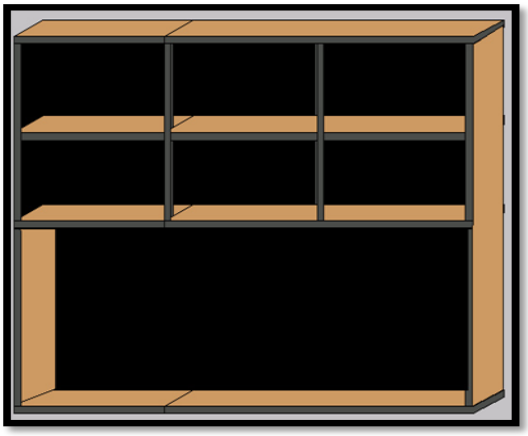


CONSTRUCTION

1. STORAGE CHAMBERS:

Firstly a matrix of shelves is designed for storage of carcass. Each shelf can hold one carcass in each of them. Inside each shelf, there are IR sensors which are used to indicate the presence and absence of carcass. 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 carcass are to be retrieved or going to be stored. And these IR pairs are technically known as Position sensors. The carcass 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 carcass. These outputs are made visible to see using the Human machine interface that is SCADA.

ANIMATED DESIGN



ACTUALDESIGN

2. MOVABLE ELEVATOR:

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 carcass from or to the storage chamber. The Y axis motion is used to lift the carcass 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 carcass 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 carcass. The Tri-

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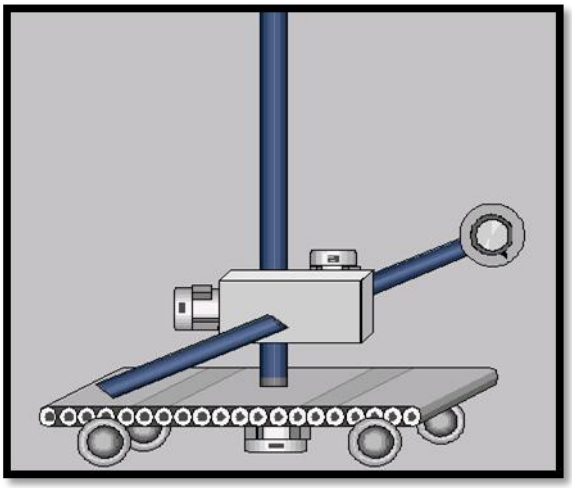
Axial motion is made possible with the use of three motors which are connected to the PLC and actuated by the program. The Electro-Magnet which holds onto the box is being energized and de-energized by the instructions from the PLC.

ANIMATED DESIGN OF MES:



ACTUAL DESIGN OF MES:

WORKING

STORAGE:

The box that contains the carcass 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 a 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.

3. RETRIEVAL:

This is a reverse of the storage process. After collecting information from the SCADA about the location of the carcass, 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 carcass. The IR sensor placed inside the chamber sends signal to the PLC and updates the status in the SCADA.

SOFTWARE DESCRIPTION

This chapter describes the software's used in our project. PLC and SCADA are the software used along with their link software.

***PLC*:** PLC is programmable logic controller 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

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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.

OMRON CP1E:

OMRON CP1E-N40

FEATURES:

- Easy connection with computers using commercially available USB cables
- With E30/40, N30/40/60 or NA20 CPU Units, Add I/O by Connecting Expansion I/O Units.
- With E30/40, N30/40/60 or NA20 CPU Units, Add Analog I/O or Temperature Inputs by Connecting Expansion Units.
- Quick-response inputs
- Input interrupts
- Complete High-speed Counter Functionality.
- Versatile pulse control for Transistor Output for N14/20/30/40/60 or NA20 CPU Units.
- PWM Outputs for Transistor Output for N14/20/30/40/60 or NA20 CPU Units.
- Built-in RS-232C Port for N/NA-type CPU Units.
- Mounting Serial Option Boards or Ethernet Option Board to N30/40/60 or NA20 CPU Units.
- Built-in analog I/O, two inputs and one output, for NA-type CPU Units.

SCADA-WONDERWARE INTOUCH

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.

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.
- SCADA is used as a safety tool as in lock-out tag-out.
- 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.

WONDERWARE INTOUCH (v10.1)

WonderwareInTouch10.1 is the quickest and easiest way to create human-machine interface (HMI) applications. InTouch is a component of the Wonderware FactorySuite. InTouch 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 InTouch QuickScript extensions.InTouch consists of three major programs, the **InTouch Application Manager, WindowMaker and WindowViewer**

The **InTouch Application Manager** organizes the applications that is created. It also is used to configure WindowViewer 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 DBDump and DBLoad database utilities are also launched from the Application Manager.

WindowMaker 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.

WindowViewer is the runtime environment used to display the graphic windows created in WindowMaker. WindowViewer executes InTouch QuickScripts, 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.

RESULT AND 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 developed system aims at improving the currently prevailing facilities in the morgue. The proposal aims at better and healthy environment for carcass management. This improves safety, security and provides a better working environment for the forensic technicians. 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.

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 disfiguring 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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