

Mobile Operated Robotic Medical Trolley

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Abstract— Operating theatre or ward is a place in a hospital where surgical operations are conducted on patients by surgeons or ward boys. In the Operating theatre or ward, the surgical equipment is placed on stainless steel table or on surgical instrument tray. However, during the operation accidents can occur where the surgical tools placed near to the surgeon could be accidentally be hit by them during the surgical operation. This may cause the surgical tools to fall on the floor which may lead to injuries. Hence, this project presents an automatic medical trolley for surgeons or ward boys to grab operating tools easily. This trolley also help to collect the garbage and offer the food and medicines to the patients. This trolley can be controlled remotely using IOT by any person. The proposed system is implemented for automatic medical trolley movement using Arduino Uno R3. The invention provides an automatic medical trolley which comprises automatic guidance, a wireless controller, an obstacle avoiding detection device, a touch screen controller via smart phone, an IP camera, a trolley, an integrated power supply and a processor. The trolley with stainless steel shelves is ideal for use in clinical environments and operation theatres. Medical equipment is loaded in the trolley, the wireless remote drives the trolley to move forwards and backwards. Automatic visual guidance is achieved via an IP camera attached to the trolley and a touch screen controller via a smart phone. A large amount of space and a large number of materials are saved, the workload of medical workers will be greatly relieved, and the working efficiency will be improved.

Keywords: Medical Trolley, Mobile Operated Robotic

I. INTRODUCTION

This trolley also help to collect the garbage and offer the food and medicines to the patients. This trolley can be controlled remotely using IOT by any person. Operating theatre or ward is a very busy area and a very clean area which is always called as a “sterile”. The surgical equipment tray is designed in order to lay all the surgical tools on it. The procedure’s flow will become smoother if the equipment they need all in one easy to access on the tray. Recently, there are many careless cases occurred in the hospital for instance in the Operating theatre or ward.

The messy condition of the operating tools on the tray and the position of the tray next to surgeon could make the surgeon feel uncomfortable and suffocating which could lead the surgeon concentration to be disturbed. Safety is one of the important things to consider especially at the workplace because without it, the serious injuries or death could take place [3]. Workers injuries could affect the quality of the company or business state due to it will cause the insurance rate increased, other employees may be distracted and the

productivity will be lost due to the accident. Accidents occur is because one choosing the wrong method of procedure or due to poor execution.

Accidents can occur anytime and anywhere such as in the Operating theatre or ward. For instance, the usual cases happened in the operating room are anesthesia mistakes, operations on the wrong side of the body part and the surgical tools left inside patient’s body which lead to loss of a patient’s life [6]. The injuries not only could happen to patients but to surgeons or ward boys and other people inside the operating room as well. For example, the surgical tools placed near to surgeon could be accidentally be hit by them during surgical operation.

Many researchers have studied on smart trolley but many have been applied in supermarket. Reference [7] proposed smart trolley in mega mall where the component used are optical sensor as the sensor to detect obstacles and AtmelAT89V51 microcontroller. Reference [8] proposed smart trolley using RFID to speed up the purchase of product. The smart trolley will detect the items using tag card and the tag card will send information about the total price to the counter during payment.

Reference [9] proposed a smart trolley follower that follows and track line using vision based technique. The component used in this project is the ATmega microcontroller and blobbing technique as the tracking and detecting sensor. Reference [10] proposed a trolley that follows customer during shopping activities. The component used is the IR transmitter, IR receiver with a microcontroller. Reference [11] proposed a shopping trolley that can follow customer during shopping with giving information of the item located in the mall. The component proposed are the Arduino Mega as a microcontroller with ultrasonic sensor as the object detector. The RFID technology and Bluetooth module are proposed as the receiver for the instructor.

In this paper, automatic medical trolley movement is designed to assist the surgeon and nurse in the operation theatre. This project involved the implementation of hardware and software design. The Arduino Uno R3 is implemented as the microcontroller for the hardware design that control the input and output instruction. Ultrasonic sensor is used as the obstacles detector to avoid trolley collide with object during the movement. Power window motor is used as the movement component in this project. The IP camera with Wi-Fi module is applied as a monitor system for the nurse to put medical equipment during the surgery is conducted. This paper contains five section. Section 2 proposed the flow process of the proposed methodology in detail. Section 3 discussed the result of the implementation of hardware and software development toward the automatic medical trolley and Section 4 conclude the work presented.

A. Hardware Implementation

A hardware implementation is used that includes battery, wireless switch, smartphone, control unit, Arduino Uno R3, Relay, Ultrasonic sensor and motor. Figure 2 below shows the system architecture of this project. The system architecture used consists the power supply to power up the control unit. The wireless switch and smartphone is used as to send information to the control unit. The control unit will control the movement of the trolley based on the object detector, relay and motor. Table 1 shows the parameter and description for the project proposed.

B. Software Implementation

The software implementation is needed to control the Arduino Uno R3. Firstly, each command needs to be declared at the top of each coding. The first coding is declared to activate the ultrasonic sensor. Figure 4 shows the source code to power on the ultrasonic sensors. After the ultrasonic is configured successfully, the sensor will detect any obstacles in the maximum range of 400 to 500cm. The source code is built to the Arduino Uno R3 to control the movement of the trolley. The Arduino Uno R3 is then connected to the relay to move the motor in forward, reverse, right or left direction. This system is also designed to stop the trolley when the obstacles are detected by the sensors.

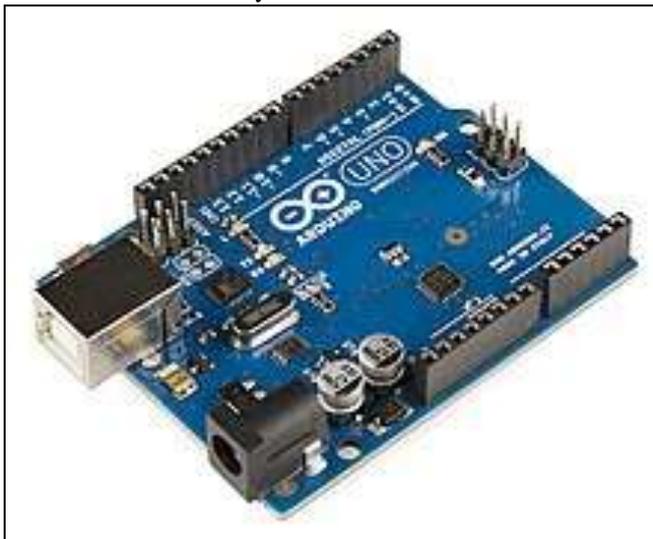


Fig. 1: Full source code of the software implementation



II. RESULTS AND ANALYSIS

Arduino Uno R3 is used as the main microcontroller to interface with all hardware used in this project. A touch screen controller via a smart phone is used as an instructor for the automatic medical trolley to move. An IP camera with Wi-Fi module is used as a transmitter and receiver data between a touch screen controller to monitor the movement of automatic medical trolley in and out from the Operating theatre or ward. The power window motor allows the automatic medical trolley to move according to the instruction given. Thus, the automatic medical trolley can lead surgeons or ward boys and nurses during surgery. In order to prevent the automatic medical trolley colliding with other object, ultrasonic sensors are used to avoid collision. Figure 6 shows the automatic medical trolley of this project.

The welfare of operating within any engineering environment is of the prime importance. All experiment carried out were expected in a safe manner with no negative effect on health and wellbeing. Health and safety during producing this product is about measures designed to protect the health and safety of the general public who may be affected by these activities. Product safety is a term used to describe policies designed to protect people from risks associated with thousands of consumer products they buy and use every day. Therefore, safety and health measured has always been the consideration before producing this automatic medical trolley.

Arduino Uno R3 is implemented as the main controller to interface with all hardware used in this project. It is used to process the input from the instructor and transmit data to the power window. The Arduino Uno R3 is a sensitive microcontroller where several precautions must be considered. The maximum voltage applied to the Arduino Uno R3 is 5.5 volt where it does not exceed 12 volts to avoid overload voltage and it is applied on direct current only. The input and output pins were not shortening to avoid overcurrent condition on both input and output pins. The pushbuttons or switches were connected to the Arduino Uno R3 using pull up and pulldown resistor. The schematic includes the connection of Arduino Uno R3 to ultrasonic sensor, relays and motor.

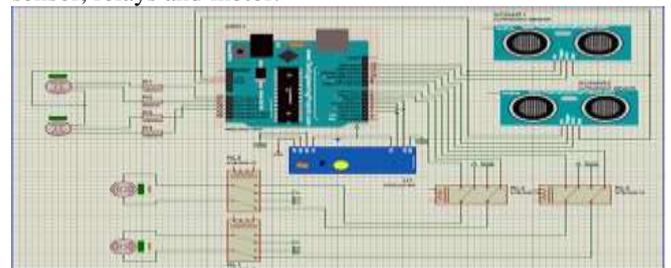


Fig 2 schematic circuit of hardware and software implementation of automatic medical surgery trolley using Proteus.



Fig. 3: Actual Working Diagram

When the torque of the power window motor is decrease, inertia impact is reduced. This precaution is considered to avoid medical stuff fell down when the trolley moves and stop. The other precaution is considered is the tyre surface. The tyre surface was modified to have a higher grip so it can enable the trolley to move to the location without sliding to other place.

Several wires were used in connecting the battery with the relay and the power window motor. The end of each wire is implemented with the connector. The connectors used are made from reinforced insulation where the protection is provided by single or basic insulation but has the same protective properties as double insulation between two cables when connected. It is due to prevent from the current leakage. Thus, it can be last longer and it is a proper way to connect between two cables.

III. CONCLUSIONS

In conclusion, an automatic medical surgery trolley is developed to assist surgeons or ward boys to reach medical equipment during surgical operation. The automatic medical surgery trolley system is developed with a microcontroller based on Atmega328 called Arduino Uno R3. The Arduino Uno R3 receive input signal and delivers output to the relay and power window motor to move the automatic medical surgery trolley. The automatic medical surgery trolley move based on the ultrasonic sensor where the sensor will move whenever no object is blocking the wat through the location. An IP camera with Wi-Fi module is attach as the monitoring system for the nurse to move the trolley in and out from the Operating theatre or ward.

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