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DEVELOPMENT OF ARDUINO SMART CLOTHES HANGER EMBEDDED SYSTEM FOR DISABLED

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ABSTRACT

Daily household chores may not be an issue for a normal and young individual. However, it could be a big issue for those people who have physical limitations such as aged and disabled people (e.g.: wheelchair-bounded individual). Inventions of assistive device or technologies that can help them to perform their daily activities are very crucial for them, so that they can become more independent hence increase their self-confidence. One of the daily chores is laundry activity. Thus, a Smart Cloth Hanger for Disabled using Arduino Embedded System is proposed in this paper specifically to cater the needs of disabled individuals. This device can automatically push out the hanger during sunny day and reversely pull it in during rainy day. Other than that, it also has the function of moving the hanger vertically (up and down) to make it easy for the disabled individuals especially those who are wheelchair-bounded to hang and retrieve their clothes. This projects use Atmega328P-PU to install all coding program that will give instructions to conduct this system properly. Voltage regulator LM7805 is also used to regulate the supply at 5V. Several sensors are used in this project, such as rain sensors and Light Dependent Resistor (LDR) sensors. Other than that, DPDT switch is also used to connect with the secondary motor in order to move the hanger vertically. It is hoped that the device can assist the disabled for a better quality of life and further increase their sense of independence.

Keywords: assistive device, smart hanger, rain sensor, LDR, IC ATmega328P-PU, LM7805, DPDT switch.

INTRODUCTION

Assistive devices and technologies are those whose primary purpose is to maintain or improve an individual's functioning and independence to facilitate participation and to enhance overall wellbeing [1-4]. Well-designed high quality assistive devices or daily living aids that support independent living for the handicapped and disabled, seniors or those with a medical condition or injury should make life easier and safer for these people (aged and disabled). Examples of assistive devices and technologies include wheelchairs, prostheses, hearings aids, visual aids and specialized computer software and hardware that increase mobility, hearing, vision or communication capacities. In many low-income and middle-income countries, only 5-15% of people who require assistive devices and technologies have access to them [2-3]. Furthermore, the availability of assistive devices for the disabled individual is still limited. One of the types of assistive devices that is still lacking are household chore assistive devices. More inventions of household assistive devices will definitely help disabled individuals to improve their quality of life [5-6].

With the current uncertain weather phenomenon, it is difficult to find a perfect timing for drying out clothes. Thus, it is essential to have a system that can help the aged and disabled individuals to independently do their laundry. An ideal system would be a system where the height of the hanger can be adjusted according to their ability and a system, which will automatically retrieve the clothes if it suddenly rain. As an example, a wheelchair-bounded individual will find it difficult to hang his or her own clothes with the existing traditional method. Thus, having a system which has a hanger that can be moved vertically will definitely help them. Furthermore, they do not need to pick up their clothes in a hurry if it suddenly raining with the proposed system as mentioned above. Not only it will help them in their daily household chore activity, but this system will also minimize the risk of them to be exposed to unnecessary injuries.

Very few inventions related to cloth hanger or cloth-drying mechanism meant for disabled individuals have been proposed and patented. In 1986, Todd Brickhouse has patented a cloth hanger, which was designed for handicapped persons. This cloth hanger is provided with a U-shaped handle portion extending downwardly to enable the usage of the hanger in a conventional closet. It was designed especially for handicapped individuals confined to a wheelchair, who cannot easily reach the bar in an ordinary clothes closet for the purpose of hanging up clothes [7].

As for the studies on the needs of assistive devices for disabled persons, in [8] discussed on the need and solutions of home automation device and service robots for elderly and disabled individuals. Based on their studies, the respondents were more interested in accessible living in general. As for particular features, aids for mobility and lifting were the most important feature for them followed by aids and feature for other household and communication activities.

There were also some robot based assistive devices being proposed for disabled persons. As an example, in [9] presented a manipulator service robot for disabled and elderly. The robot itself is an arm that has control electronics built in. The arm is a separate unit that can be connected to sockets in different locations (wheel chair, kitchen wall or bedroom ceiling) for operation. The robot gets its power through the socket. It is a lightweight autonomous service robot for disabled and elderly people to help in their daily living environment. Other than that, in [10] proposed the use of remote controlled service robot

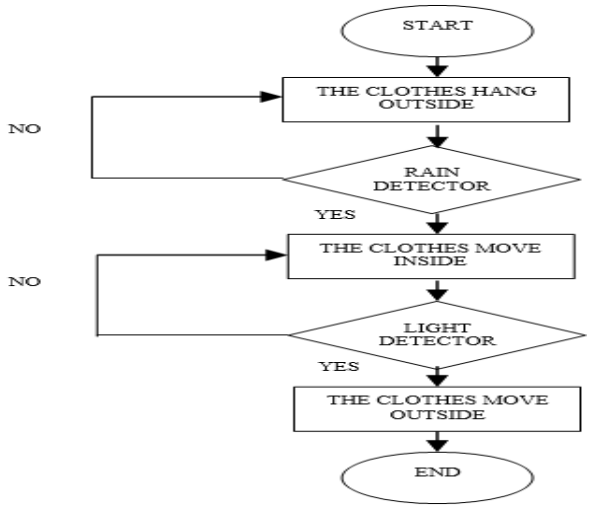
for fetching objects in home environment for physically challenged individuals.

The main objective in this project is to design a prototype of smart cloth hanger for handicapped or disabled individuals. In this paper, the first part brief about the introduction and literature from previous findings. Second part explains about the methodology of the project. Next, results and discussion and then followed by the conclusions.

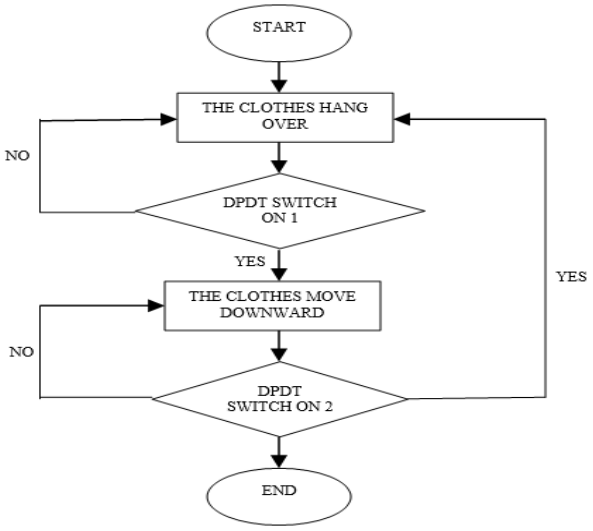
METHODOLOGY

This system consists of two parts, moving the hanger vertically and/or horizontally. Figure-1(a) shows the flowchart for the motor 1, which is moved by using LDR and two sensors. Motor 1 will move the hanger horizontally. The first sensor acts as a water detector. When rain touched the water sensor, motor 1 will be activated and this automatically moved the hanger inside. The second sensor is a light sensor that detects the light with LDR. When the LDR detects light, motor 1 will be activated and move the hanger outside. For this situation, the hangers move out for drying purposes.

The second system is a mechanism for moving the hanger vertically. Figure-1(b) shows the flowchart for motor 2. This motor consists of two DPDT switches to move the hanger. When the DPDT switch 1 is turn ON, the hanger will move down and by turning ON DPDT switch 2 for will move up.



(a)



(b)

Figure-1. Flowchart for (a) motor 1, and (b) for motor 2.

Block diagram

Figure-2 illustrates the block diagram for the project. When the power supply is connected to the power circuit, the power supply provides AC to DC power adapter which is converting 240 V AC to 5 V DC voltage. LDR sensor and water sensor is combining in power circuit.

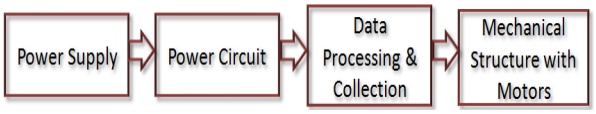


Figure-2. Block diagram of smart clothes hanger.

The Arduino system is function in data processing and data collection. It functions as a main controller in this system. When the LDR sensor and Water sensor is function (either ON or OFF), the Arduino will process the data and will trigger the mechanical structure which is motors to fully function.

Circuit design

Based on the simulation in Figure-3, the overall operation of this circuit is centralised by IC ATmega328P-PU. The function of this circuit is when ATmega328P-PU activated the voltage regulator LM7805 to regulate the voltage supply from 9V to 5V that are suitable for IC that are used.

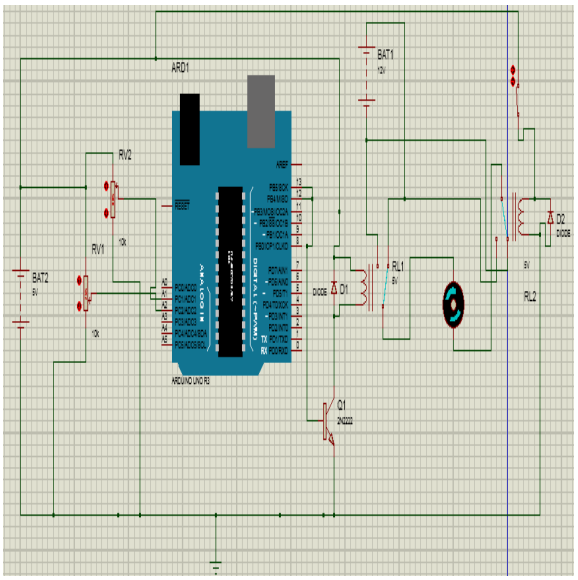


Figure-3. Simulation circuit layout.

The circuit in Figure-4 depicts the connection of the components used in this project, which include two input sensors; LDR and rain sensor, a voltage regulator LM7805, comparator and an IC ATmega328P-PU. The voltage regulator will regulate the voltage supply from 9 V to 5 V that suited for IC for this system. This circuit used two input sensors that are known as LDR and water sensor as shown in this figure. These inputs are connected to pin 24 and 25 of ATmega328P-PU. With the existence of light, the LDR decrease or when the water sensor was detect the rain, the resistance increase. Figure-5 shows the DC motor connection. This circuit needs two 5V relay to run the DC motor in reverse or forward.

RESULTS AND DISCUSSIONS

In this research work, it contains two sensors; first is water sensor and second sensor is LDR. The water sensor function as a rain detector and LDR sensor function during sunny day. Figure-6 shows the proposed smart closed hanger device. It contains of woods represent as a hut, shaft, function to move the hanger outside and inside and iron rode to hold the shaft and hanger. The location of the motor 1 and motor 2 as depicted in Figure-7.

After the simulation was successful, next step is on the hardware design. The Arduino is connected via USB to water sensor and LDR. The circuit also attach at the shaft of smart hanger's hut. Water sensor and LDR sensor was connected from Arduino (input) as a switch. When the circuit detected water, it will automatically become close circuit and the shaft which attach to the motor will be rotated and caused the hanger to move inside the hut.

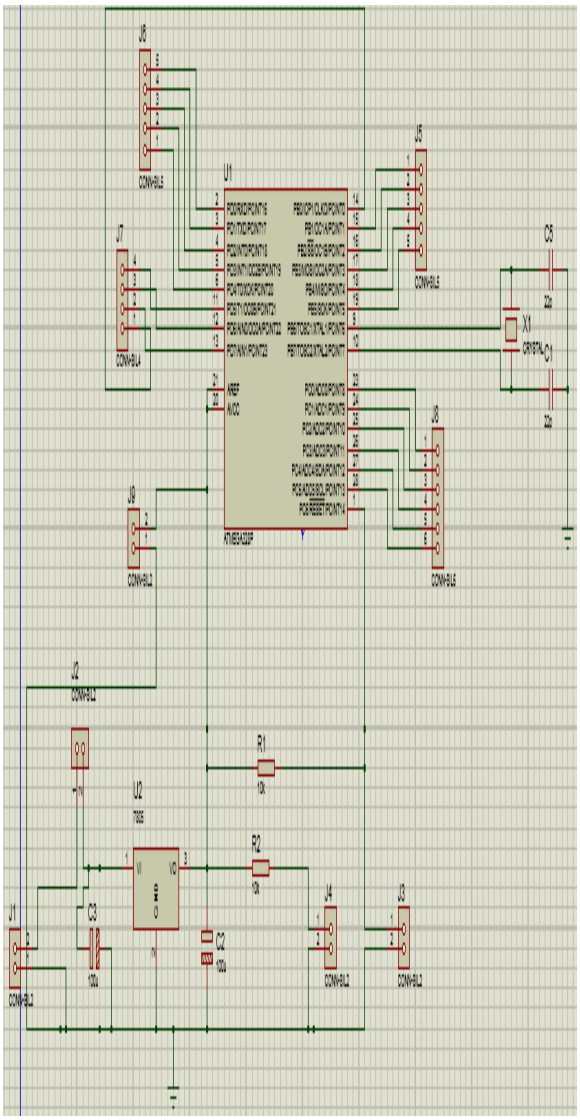


Figure-4. ATmega328P-PU circuit.

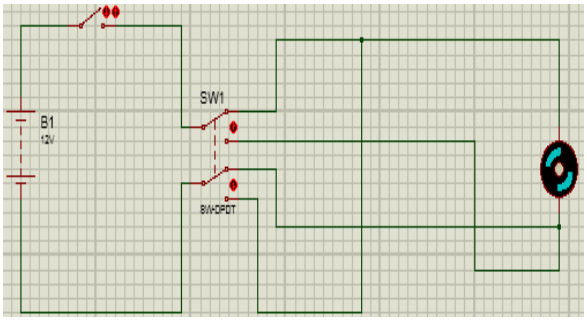


Figure-5. Basic circuit DC motor.

Figure-6. The proposed smart clothes hanger for disabilities.

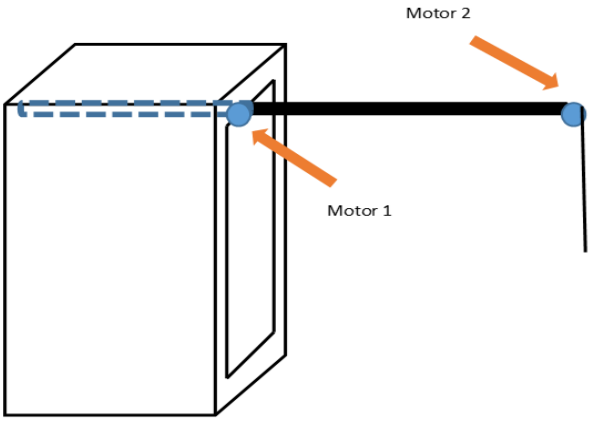


Figure-7. Outline of the smart clothes hanger for disabilities.

Table-1. Configuration of the two cases.

Case	Sensor	Condition	Explanation
1	LDR	ON	The clothes move outside
	Water sensor	OFF	
2	LDR	OFF	The clothes move inside
	Water sensor	ON	

In order for smart clothes hanger project to function very well with Arduino, the 2 cases are identified as shown in Table-1. First case, when the LDR detect the light (ON) and no water detect (water sensor OFF) the clothes move outside. Second case, when water sensor is ON and LDR is OFF the clothes move inside which is in real situation in raining day.

CONCLUSIONS

This project is to develop and design the smart clothes hanger for disabled individuals. In addition, this project is also to introduce how to use the Atmega328P with the clothes hanger. The movement of the motor for this project is controlled by coding program of IC Atmega328P. Besides, the sensors that are connected with this IC are to measure the rain and light. When the sensor were detected, the motor will running automatically. We also added second DC motor to move horizontally that are control by DPDT switch for moving forward and reverse. Furthermore, this project is more focus on helping the user who is disabled/wheelchair bounded.

REFERENCES

[1] Leopold, A. Lourie, H. Petras and E. Elias. 2015. The use of assistive technology for cognition to support the performance of daily activities for individuals with cognitive disabilities due to traumatic brain injury: The current state of the research. Neuro Rehabilitation. 37(3): 359-378.

[2] K. M. Marasinghe, J. M. Lapitan and A. Ross. 2015. Assistive technologies for ageing population in low-income and middle-income countries: A systematic review. BMJ Innovations. 1: 182-195.

[3] L. K. Haymes, K. Storey, A. Maldonado, M. Post and J. Montgomery. 2015. Using applied behaviour analysis and smart technology for meeting the health needs of individuals with intellectual disabilities. Developmental Neuro rehabilitation. 18(6): 407-419.

[4] S. Alper and S. Raharinirina. 2006. Assistive technology for individuals with disabilities: A review and synthesis of the literature. Journal of Special Education Technology. 21(2): 47-64.

[5] S. Gupta, G. A. Hawker, A. Laporte, R. Croxford and P. C. Coyter. 2005. The economic burden of disabiling hip and knee osteoarthritis (OA) from the perspective of individuals living with this condition. Rheumatology. 44(12): 1531-1537.

[6] J. Brown and K. L. Flood. 2013. Mobility limitation in the older patient: A clinical review. Journal of American Medical Association. 310(11): 1168-1177.

[7] Todd B. 1986. Clothes hanger for handicapped persons. United States Patent US 4, 582, 233.

[8] Harmo P., Taipalus T., Knuuttila J., Vallet J. and HalmeA. 2005. Needs and solutions-home automation and service robots for elderly and disabled. In: IEEE/RSJ International Conference on Intelligent Robots and System. pp. 3201-3206.

[9] Gimenez A., Jardon A. and Balaguer C.2003. Light weight autonomous service robot for disabled and elderly people to help in their living environment. In: International Conference on Advanced Robotics. pp. 1074-1079.

[10] Taipalus T. 2001. Using remote controlled service robot for fetching objects in home environment. Master thesis, Helsinki University of Technology, Finland.