The Smart IV Stand Design Though Human Tracking Mobile Ro bot System by CdS Cell

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Abstract. Vision-based recognition of the object as a general interface gives us high cost and complicated problem. This research suggests human tracking system by Arduino, and Laser-CdS cell system track wire that pass laser line. In this paper, we review existing literature on application systems of recognition which involves many interdisciplinary studies. We conclude that our method can only reduce cost, but is easy way to trace people's location with the use of wire. Furthermore, we apply several recognition systems including CdS-based mobile robot that is applied iv stand used at the hospital effectively.

1 Introduction

You may see a lot of hospitalized patients. A lot of technologies have been deve loped to help the patients, as well as robots which care the patients. Such medical ro bot development has been mainly researched in advanced countries like the US, Germ any and Japan and expanded as the possibility for realization and commercial values have been verified [1][2]. In such trend, a lot of concerns have been raised over the length of the IV always around the hospitalized patient. However, most studies which have covered the issue are related to how accurately the IV solution is regulated.

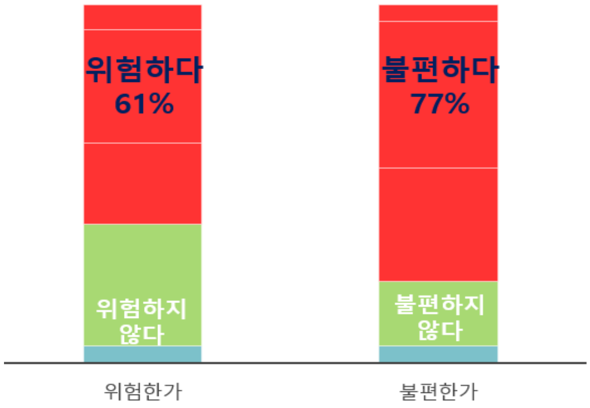

Figure 1 Survey on the satisfaction of the IV length-1

However, the survey showed that there existed problems in the length of the IV stand which held the solution needed improvement. The survey for the satisfaction of the IV holder length for 100 subjects who experienced the stand (Figure 1) showed that 61% of the respondents answered that the experience was dangerous and 77% said they felt inconvenient.

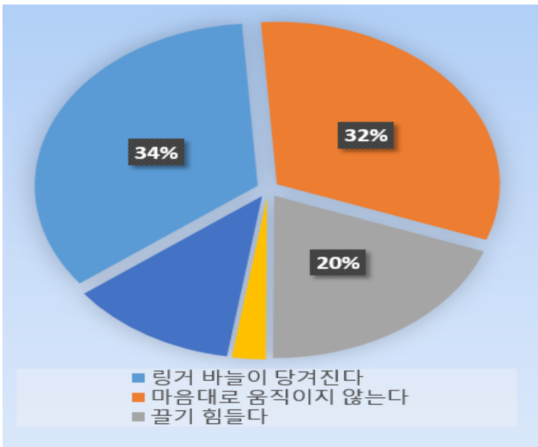

Figure 2 Survey on the satisfaction of the IV length-2

Also, 34% of the subjects answered they felt pain due to pulling the syringe and 32% of the people showed unsatisfied with not moving the stand on their willingness. The following 20% people pointed out difficulties in pulling the stand by them and, 2% answered that it did not fit the subject and the remaining 12% answered "I could not use one hand" and "It takes a lot of space in the bathroom". Based on the survey, the study recognized a lot of problems in the existing IV stand pulled by one hand and sought to produce a smart IV stand which introduced electronic system to solve the problem.

2 System design

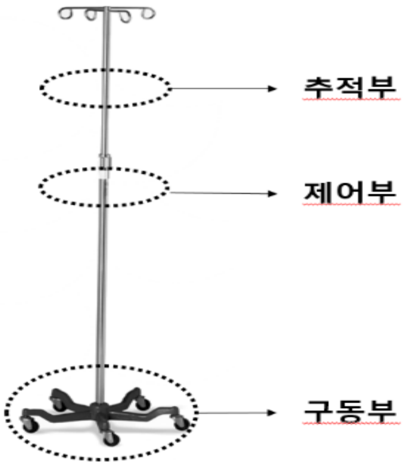

Figure 3 Schematic view of the smart IV stand

The smart IV stand system (Figure 3) consists of the tracing part, control part a nd motor part. The tracing part collects the data to find out the direction and locatio n of the patient by tracing the movement and the control part performs the interactio n with the stand and enables the patient directly to operate the stand. Lastly, the mot or part moves the IV stand in the direction and speed of the patient if the system ca tches where the patient is headed for by the tracing and the control parts.

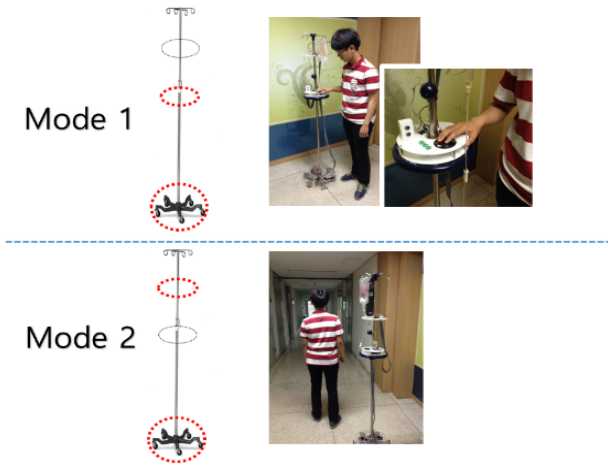

Figure 4 2 modes of the smart IV stand

The smart IV stand equipped with these parts performs its function for the patien t with 2 methods as shown in Figure 4. First is for the patient to directly operate th e IV stand. The patient adjusts the speed and the direction of the stand through the part which interacts the patient and the stand on the control part, leading the stand to move where the patient is headed. Second is to move the stand by recognizing the patient movement only through the tracing part. The reason for implementing 2 metho ds is to effectively move the IV stand based on the patient judgment.

2.1 Tracing part design

The purpose of the tracing part is to recognize the patient and understand the pa tient location. It recognizes and traces the patient through the image recognition or im plements the method with the Laser Radar for the tracing. However, these methods re quired high cost and may not be implemented in the stand system with the cost of 1 00,000 KRW. That is why the study introduced the Laser Module and the CdS Cell t o configure the IV stand system.

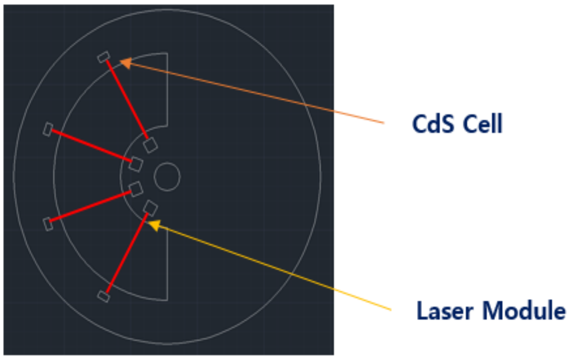

Figure 5 Tracing part drawing

The tracing part design is shown in Figure 5. There is a hole with the shape of semi-circle on the disk and a rope passes through it. And a lot of laser modules an d CdS cells are attached to detect the stand rope moving in the hole. The moving ro pe blocks the lase emitted from a lot of laser modules, failing the CdS cell to recog nize the laser. This changes the resistance of the Cds cells and recognizes the movem ent of the stand rope. The movement of the rope has certain relation with the patient, enabling to recognize the patient motion through the Laser-Cds cell system.

2.2 Control part

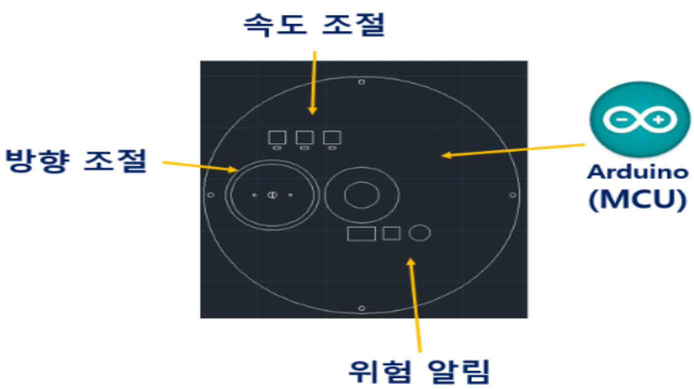

Figure 6 Control part drawing and implementation

The purpose of the control part is to make the patient manipulate the IV stand e asy, help the patient move the stand as the patient wishes and control the movement of the IV stand. The system introduced buttons for the patient's convenience and conn ects the disk to the variable resistance to adjust the direction by the disk movement. Also, the system adds the alarm function activated by a simple button considering the special environment of the hospital. All the operations are controlled by the Arduino.

2.3 Motor part

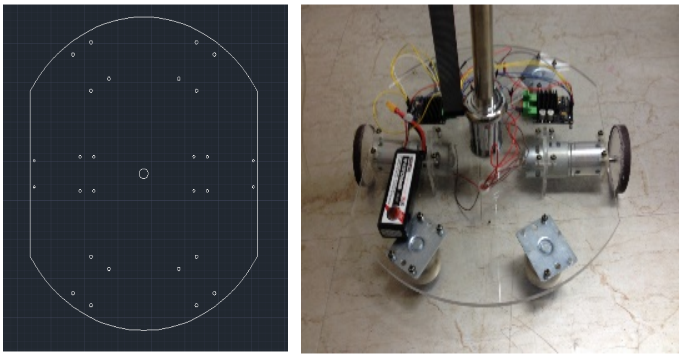

Figure 7 Motor part drawing and implementation

The motor part concentrates on safely moving the IV stand. To this end, 6 joints including 4 ball casters and 2 motors support the IV stand from the floor and the 2 motors and motor drivers adjust directions and speed.

3 Function test

3.1 Driving on the slope

First, the smart IV stand shall safely move on the uphill an downhill because th ere are uphill and downhill in the hospital due to the construction and other road s for the wheel chair instead of steps. The study tests whether the system works in this environment.

Figure 8 Uphill test

It shows that the system safely operated on the uphill and downhill with the slope of 10 degrees like the flat place.

3.2 IV stand operation

As mentioned above, there are 2 modes of operating the IV stand. The first one is t o operate the IV stand by the patient. It was confirmed and only some calibrations w ere required to smoothly operate the stand like driving a car. The second mode rever sely traces the patient movement with the rope. The assumption is required that the p atient is always beside the IV stand. It means that the laser located at 12 o'clock is blocked by the IV stand because the patient rotates by the stand to change the directi on to the right, moving the stand to the right side. Also, the straight speed of the pa tient becomes slower than then IV stand if the patient moves to the left, blocking the laser located at 6 o'clock by the IV rope and leading the stand to turn to the left.

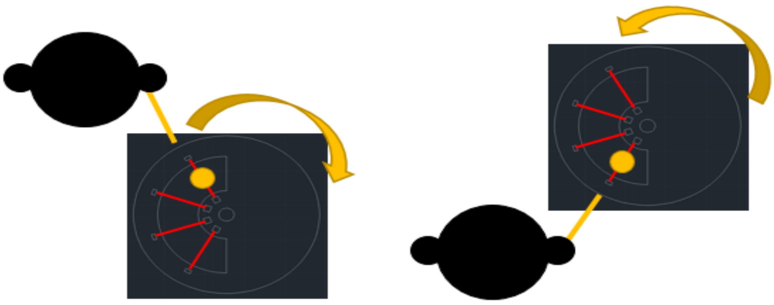

Figure 9 Operation mechanism for the tracing part on the stand

3.3 Alert

Problems exist everywhere in the hospital and the method is required for the patien t to immediately seek help around in the case that the patient faces a problem. To th is end, the system loudly activates the alarm if a patient pushes the alarm button or t he stand system does not detect the patient movement for a certain period of time.

4 Conclusions

The smart IV stand proposed by the study performed the survey on users of existing stands and utilized the engineering system to establish better model in the aspect of functionality, convenience and stabilization. In particular, the equipment was manufactu red with the CdS cell to recognize the user direction in the manufacturing process. A lso, the system reflected the elements to activate the direction, speed and alarm using the Arduino considering the user convenience. It means that the smart IV stand refle cted the understanding of the medical equipment from the user viewpoint called the h uman interface. The IV stand which automatically follows the patient movement feelin g uncomfortable is expected to be distributed to more hospitals and help patients enjo y safer and more convenient environment in the hospital.

5 Reference

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