Team Description Paper

Ziqi HU
Nankai University Tianjin
Ziqihu00@gmail.com

***Abstract*—Nowadays, smart phones have wider and wider application fields which makes things connected with each other closely. This paper presents a robot application occasion combined with WeChat in nursing house. The tasks of robot are divided into two parts: one is to delivery medicine to specific patient and the other is check and communicate with specific patient. The operator doesn't need to come to the ward himself but manipulate robot through WeChat remotely. Firstly, laptop logs in WeChat with robot's account using QR code. And then the operator uses his own WeChat account to send task commands. Once laptop's WeChat receives task commands, the robot will execute what commands ask. Experiment results show that through this way, operator can send commands and receive the condition report easily and remotely.**

Keywords-WeChat; ROS; ItChat; speech regonition; turtlebot navigation; emotion analyis

I. INTRODUCTION

Internet techniques have grown rapidly with varieties of communication applications appearing. One of the most famous social communication apps is WeChat which is applied widely in China. People can use WeChat do a lot of things such as talking with friends thousands miles away, paying for goods in supermarket and share life time with others *etc*. on the other hand, the aggravating trend of aging population makes more and more elder people choose nursing house as their retirement places. However, taking care of such a big amount of elder people is not a easy work without robots' assistance, which motivates us to come up with a idea of send robots to do some daily work like delivery medicine and check patients' condition every hour. By such way, a lot of labor cost can be saved. This paper proposes a novel application which combines WeChat and robot together to finish specific tasks in nursing house.

Using WeChat to connect human and robots has a lot of advantages. Firstly, almost every people today have WeChat on their smart phone, which means they don't need to download other apps to support communication work. Secondly, WeChat has great portability which can be easily combined with ROS system. Thirdly, WeChat uses internet not LAN to send and receive messages, which means people can manipulate robots from a long distance even at home. Based on the advantages mentioned above, we proposed a novel application based on WeChat platform and ROS system which help people finish daily work in nursing house.

Actually many researchers have noticed such problems mentioned at the beginning. And lots of schemes to cover these problems have been raised. For example, M. Carraro *et. al* propose an open source robotic platform for ambient assisted living which enhance home assistance services for elderly people [1]. N. DiMaria *et. al* propose the eldercare robotics revolution-explaining robotics for eldercare which use a TurtleBot2 and a NAO robot to develop a number of ways in which robots might be used to improve the health and safety of an elderly person within his/her own home [2]. S. Hening *et. al* propose an assistive living robot, which is affordable and can be steered over the internet by family member to remotely monitor and help assess the wellbeing of an older relative living alone [3].

The rest of the paper is organized as follows. In Section II, the experiment platform is introduced in detail. In Section III, subsystems of this WeChat-based robot application will be put forward. Section IV presents experimental results to demonstrate the performance of the presented application. Finally, the conclusions of this paper are made in Section V.

II. EXPERIMENT PLATFORM

As for the experiment platform, we use TurtleBot2 as shown in Fig. 1 and Fig. 2. TurtleBot2 is the world's most popular low cost, open source robot for education and research. This second generation personal robot is equipped with a powerful Kobuki robot base, a dual-core netbook, Orbbec Astra Pro Sensor and a gyroscope. All components have been seamlessly integrated to deliver an out-of-the-box development platform. Since we need to take picture of patient and communicate with patient, we add Xtion and microphone to TurtleBot2.

Figure 1. Three perspectives of TurtleBot2.

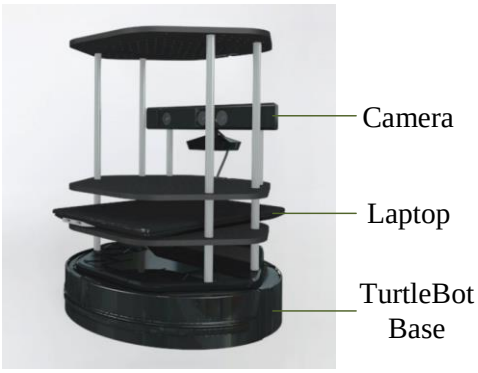

Figure 2. Turtlebot2

III. SUB SYSTEMS OF WECHAT-BASED APPLICATION

A. *WeChat Sub System*

Utilizing WeChat to give orders to robots is one of the advantages of this project, which enabled people to manipulate robots from a long distance. In order to achieve this objective, the itchat package is imported into programs. Itchat is an open source API for WeChat, a commonly-used Chinese social networking app, accessing personal WeChat account through itchat in python. A WeChat robot can handle all the basic messages with only less than 30 lines of codes. And it's similar with the itchatmp (API for WeChat massive platform). In this project, we connect WeChat with ROS. Firstly, an operator signs up the WeChat with a robot WeChat account on laptop using QR code. Then the orders are sent using operator's WeChat account. Once the orders are sent, they are extracted into feature-words that the laptop can understand what kind of task is received. Then the task is translated into ROS messages to publish into ROS topics. At the same time, the navigation part receives the content of task and executes specific programs. Once the robot reaches the patient, imaging processing part takes the pictures of the patient and send back the images through WeChat to the operator so that operator can overview the patient's status without check by himself. The network structure is shown in Fig. 3.

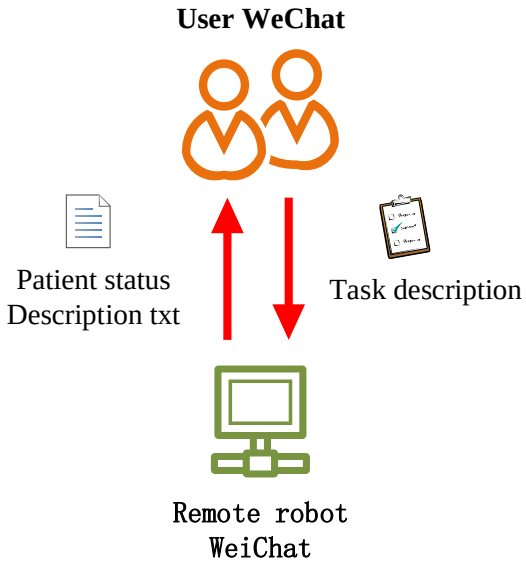

Figure 3. Network structure of WeChat-based application.

To be specific, in the beginning the operator sends a message to robot's WeChat such as '*go to delivery medicine to patient 1*'. Once robot's WeChat receives the message, laptop will extract the key words of the sentence such as '*delivery*', '*medicine*' and '*patient 1*'. By analyzing the key words, laptop chooses to send specific task type information into rostopic on '*/task_content*' and '*task_num*'.

B. *Vision Sub System*

The visual subsystem is designed to obtain the facial information of the patient, which can be used to analyze the patient's gender, age, expression, emotion, complexion, etc. This system uses the emotion analysis as the core module. To be specific, the robot takes a picture when the '/patient_reach' topic arises. Then the picture is analyzed by the Baidu AI system using online communication. Afterwards, the Baidu AI system returns the keyword selected by the user, which includes the emotion analysis. Finally, the analysis result is sent to WeChat, through which the nurses can obtain the state of the patient in real time. The flowchart of the visual subsystem is shown in Fig. 1.

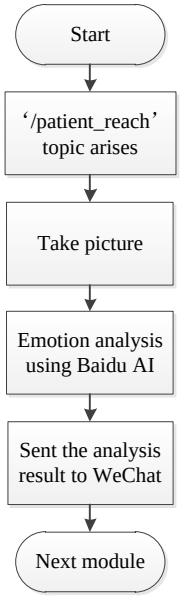

Figure 4. The flowchart of the visual subsystem

When receiving the *'/patient_reach'* topic, the *take_pic.py* file is run to take a picture of the patient. Then the picture is sent to the Baidu AI system using *gender_predict.py* file to make the emotion analysis. After analyzing, the results and the picture are sent to the WeChat.

Baidu AI has many useful technology, it is a platform that contains image processing, natural language processing, speech recognition and other advanced technology. The precision of the Baidu AI is high enough to make the right decision in scenario such as in this paper. However, the Baidu AI is a online tool, when the internet is poor, it takes longer to receive the results. As a result, the widespread use of the Baidu AI has to wait for the coming of 5G era.

C. *Speech Sub System*

We implemented the voice part based on the speech recognition module provided by xfei_asr and sound_play. This part can determine the way to greet the patient based on the results of the expression recognition. For example, if the patient is identified as unhappy, the robot can comfort the patient to express concern for him. In addition, it can also assist in the daily inspection work, such as asking the patient's body temperature, blood pressure and other signs, to generate a txt document, which will be transmitted to the doctor through WeChat to help him make a judgment.

In the details, by modifying the iatt_publish_speak.cpp file of the xfei_asr package, we build a publisher to send the

recognized voice content every 15s, and then build a subscriber through the msg.reader.py file, subscribing to the message and making an analysis based on its content , such as the body temperature or blood pressure information, and record them in a txt file. When finished, send the generated txt file out to the doctor.

D. Navigation Sub System

In navigation part, we use *move_base* and *amcl* packages to make robot navigation among fixed points on the map. Once WeChat send task type information through '*task_content*' and '*task_num*', robot will decide which point to move to. Once robot reaches the target point, it will send messages in topic '/patient_reach'. Vision parts and speech parts will join into the flow.

IV. EXPERIMENTS

To fully test the performance of our system, we test it on TurtleBot2 in a nursing-house-simulated environment. Firstly, we set the robot at the beginning point and execute launch files. The laptop logs in WeChat with *jack* account using QR code. Then the operator sends message '*Go to delivery medicine to patient 1*' to jack's WeChat. Once jack receives the message, it first moves to the medicine place to take the medicine and then reach the patient 1. When robot reach the patient, it takes a picture of him and analyses the emotion of the patient. After that, it will communicate with patient to ask for his condition. At last, robot sends back the picture of the patient and a txt file which descript the condition of the patient. The WeChat log is shown in Fig. 5.

V. CONCLUSIONS

This paper proposes a novel WeChat-based robot application, which enables people to manipulate robot from a long distance. This application can be used in nursing house assist people delivery medicine and check patients' condition. In practical term, we test the perform of our application on TurtleBot2. The experiment results show that robot can receive the messages from the operator and understand the specific task. In the execution term, the robot finishes each part of work perfectly and at last send back the condition files of the patient. In forthcoming efforts, we will apply this WeChat-combined system to wider fields. Future work will also focus on the improvement of the performance of the robot.

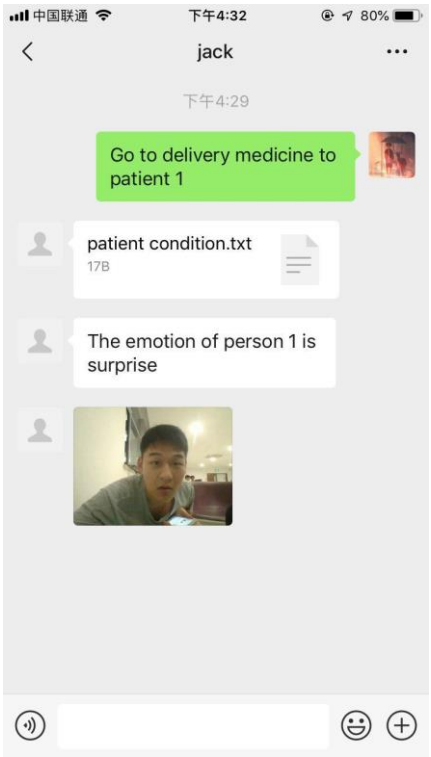

Figure 5. WeChat logs.

REFERENCES

[1] M. Carraro, M. Antonello, L. Tonin and E. Menegatti, "An open source robotic platform for ambient assisted living," Department of Information Engineering, University of Padova Via Ognissanti 72, 35129, Padova, Italy.

[2] N. DiMaria, K. Tan, B. Salgado, W. Su, G. Vesonder, "Eldercare robotics revolution-explaining robotics for eldercare," Proceedings of *2017 IEEE 8th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference*.

[3] S. Hening, P. Cottrell, M. Teoderescu, s. Kurniawan, P. Mantey, "Assistive living robot: a remotely controlled robot for older persons living alone," Proceedings of *the 6th International Conference on PErvasive Technologies Related to Assistive Environments*.