Patient Monitoring and Assistance using Robotic ARM

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Abstract - **In the present pandemic situation constant monitoring of patient's body parameters such as temperature, pulse rate and oxygen level etc. becomes difficult to nurses. Hence to overcome this we implemented a robot which can monitor and assist the patient using Robotic Arm. In our paper we are monitoring pulse rate, oxygen level and temperature of the patient by using respective sensors and also with the help PI camera capturing live image or video of the patient and can be monitored continuously. If any changes in patient's physical conditions it will be uploaded to cloud and alerts monitoring person through SMS. Here the robot can assist the patients by supplying medications, juice & fruits using Robotic Arm. By using BLUEDOT app the wheels can be moved to RIGHT, LEFT, FORWARD & BAKWARD and the robotic arm in the developed system has five Degree of Freedom (DOF), to operate this robot arm MIT inventor app is used. Hence it removes the problem of monitoring the patients suffering from communicable diseases.**

Keywords: Raspberry Pi3, Robotic Arm, Temperature sensor, pulse sensor, BLUEDOT

I. INTRODUCTION

As the technology is improving day by day, life span of people is also increasing gradually which leads to the population increase, it became a necessity to monitor the patient's health conditions of people for their healthy lifestyle. Improving health care have become one of the most important factor in medical industry. Without quality monitoring it is impossible to monitor the conditions of patients, though there are millions of medical centres across the world, it's difficult there to provide attention to each and every patient, especially patients who are suffering from communicable diseases like Covid-19, Hepatitis B, it is practically very difficult to monitor the conditions of those patients because of fear of infection.

According to recently conducted survey 122 per 100,000 die because of lack of attention during their bedridden time. Thus patient assistance and monitoring become an important thing to meet the objective of achieving the patient satisfaction. So the current method of providing assistance and monitoring patient is not satisfied, hence medical industry is looking for new advancement in technology to overcome the above mentioned problem, our paper proposes a Robot which continuously monitor the conditions of patients and thus became an advancement in medical industry.

Health is the one of the global challenges for humanity. Recently, the patient monitoring systems is one of the major advancements because of its advanced technology. In the traditional approach they need to visit the patient's ward for checking necessary parameters. Robots serving various tasks in the health and social care sectors. Active hospitals are interested with shortening the patient's waiting room and reducing the burden on doctors and nurses. Health monitoring system offers a lot of benefits to people life we need daily observation. New uses for medical robots are created regularly, as in the initial stages of any technology-driven revolution.

II. LITERATURE SURVEY

P.Shubha, M.Meenakshi, 2019[1] , implemented health care Assistive Robot , which mainly focuses on the design & development of the assistive robot for the disabled and for the patients in need. Mohammad Farag, Mohammad Hayyan Alsibai, 2019[2] proposed Getting a handle on and situating task for particular consistent an Articulated Robotic ARM is utilized for object discovery and restriction, vision guide robot has greater capacity, usefulness and adaptivity in mechanical sequential construction systems than ordinary robots. Yi Zhang, ZhiCheng Xiao, Xuexi Yuan, 2019[3], proposed the deterrent aversion of two wheeled versatile Robot dependent on DWA calculation. Robot snag aversion has been generally concentrated since the development of portable Robot yet toward the starting this haven't concentrated as a different innovation. Ryo Saegusa, Hirokazu Ito, Duc Minh Duong, 2019[4], proposed the Human Care Rounds Robot with contact less breathing

estimation. This portrays the human estimation framework for independent rounds robot pointing actual help for care staff filling in as nursing and clinical offices. Stephan Muhlbacher Karter, Mathias Brandstotter, 2017[5], examined about the contactless control of a kinematically excess chronic controller utilizing tomographic sensor. The movement direction joined with the joint repetition empowers the robot to respond on the contribution of the human in the specific way.Milan Shan, Viraj Rawal, Jay Dalwadi, 2017[6], designed high-performance line following robot. Fundamentally, line following robot is a self-governing portable framework which follows line which has an alternate tone from foundation. Victor Ababii, Viorica Sudacevschi, 2014[7], proposed the sensor network configuration dependent on the portable multi robot framework. Framework geography is a disseminated figuring engineering comprises of Local Area Network (LAN), with Wireless Access focuses (WAP), a bunch of expert versatile robots with entryway highlights. Ali Ravari, Ahmad Fakharian, 2013[8], proposed about the way following and Obstacle aversion of a FPGA based versatile Robot by means of fluffy calculation, this fluffy calculation is executed on the FGPA based portable Robot called MRTQ, which could be viewed as installed for line following and Obstacle evasion reason. Cheonshu Park, Sangseung Kang, 2012[9], examined about the assistance robot framework for senior consideration. This presents a senior consideration robot framework for senior individuals. A senior consideration robot framework give human robot communication application and checking administration. The ZigBee innovation is utilized for this biomedical checking.

III. METHODOLOGY

In this methodology section, it contains two parts such as hardware and software requirements. Where all the parts are assembled to accomplish the function of monitoring and assistance task [10]. Our proposed Robotic system is designed to perform task based on the instructions provided by the person who is controlling the system
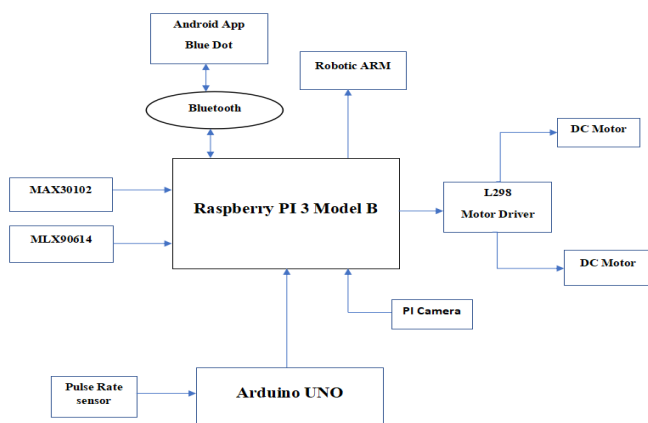
A. BLOCK DIAGRAM

Figure 1: Block diagram of Patient monitoring using Robotic Arm

In this paper, we are using Raspberry pi 3 module for the communication between the robot and the monitoring person [11]. Robot are connected with the motors, driven by the L298 Motor drivers which in turn, drives the wheels of our proposed Robot, operated by Android app known as Blue dot with the established Bluetooth connection with raspberry pi module. Initially the Robot starts to move, Pi camera which is connected to the raspberry pi module used to capture livestreaming of the surroundings. Sensors such as MLX90614 used for contactless temperature measurement of the patient, MAX30102 & Finger pulse sensor which is connected to Arduino UNO for analog to digital conversion are used for measuring Pulse rate, oximetry of the patient respectively. The obtained readings are sent to Raspberry pi module, which in turn alerts the monitoring person with an SMS. Robotic Arm with 5 DOF is used to provide medications, juice and fruits to the patients, an assistive task carried out by Robot is controlled by the dedicative MIT inventor app.

1. HARDWARE REQUIREMENTS

A. Raspberry Pi 3 Model B+

Raspberry3 model B+ belongs to a family of third generation computers.it widely used because of its high processing speed and it is a pocket size controller. It is a 64 but processer which is operating at frequency of 1.4 Ghz. It has microSD port for loading required operating system for its application. It has 40 pin general purpose input output header. And has a operating temperature of range 0°c to 50°c. This processer weighs around 75g. This segment is a microchip which requires a working framework to manage it. Raspberry Pi authoritatively gives Raspbian OS (Operating System). Likewise, they give NOOBS (New out of the Box Software) OS for Raspberry Pi. We can likewise introduce different other outsider variants of OS like Ubuntu, RISC OS, Windows 10 IOT Core, and so forth Raspbian OS is an Operating framework accessible for nothing to utilize. This OS, proficiently improved, to use with Raspberry Pi. Raspbian have GUI which incorporates apparatuses for Browsing, Python programming, games, and so on We should utilize SD (Secure Digital) card (least of 8 GB) to store. Raspberry Pi is more than PC, as it gives admittance to the on- chip equipment.

Figure 2. Raspberry Pi 3 board

B. DC Motor

DC engine as displayed in the beneath figure utilizes Direct Current to create mechanical rotational development. At the point when it changes over electrical energy into mechanical energy then it is called as DC

engine and when it changes over mechanical energy into electrical energy then it is called as DC generator. The functioning standard of DC engine is relies upon the way that when a current conveying conductor is set in an attractive field, it encounters a mechanical power and starts pivoting. Its revolution bearing relies upon Fleming's Left Hand Rule. The beneath figure shows dc engine which is utilized to make development. In this system, two dc motors are used which can be driven by motor driver module.

Figure 3: DC motor with wheel

C. Motor Drive Module

PI can not drives the dc engine straightforwardly. The current and voltage esteems are not coordinated with regulator and dc engines. So engine driver is given to drive the engine . The L298N displayed in figure 4 is an incorporated single circuit in a 15 lead multiwatt and Power bundles. Due to its a high ebb and flow, high voltage with double full-connect driver which is intended to acknowledge standard TTL rationale level sand drive inductive loads like DC, venturing engines, transfers, solenoids. Two empower inputs are given to dynamic or deactive the gadget autonomously. In each extension the producers of the lower semiconductors are associated together and the individual outer terminal can likewise be utilized for the association of an outside detecting resistor. supply input is likewise given to that, so the rationale works at a lower voltage

Figure 4: L298 Driver Module

D. Arduino UNO

Arduino uno is here used as analog to digital coverts since Raspberry capable of accepting only digital inputs [13]. It is belonging to the mega processor family.
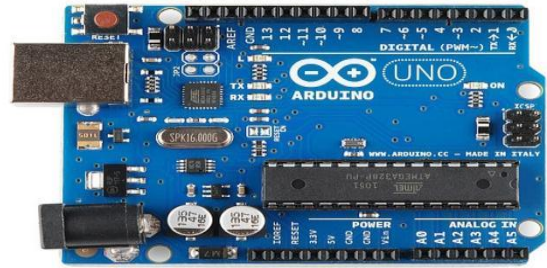

Figure 5: Arduino UNO

It has 6 analog inputs and 14 digital pins It works at the frequency of 16Mhz. It consists of a power jack, USB connection and a reset button. It can able to read the input whenever it reads the input the light will glow in the sensor, and it sends the message then this message is become to an output

E. Max 30102 pulse sensor

It is used to measure the heartbeat of the patient. It has a programmable sample rate and LED power for power saving mode. It has – 40°c to +85°c operating frequency range. This device can be turn off by a software without using standby current and it is highly sensitive device
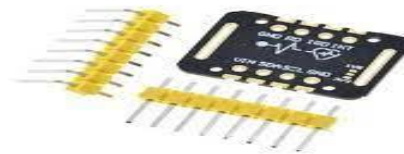

Figure 6: Pulse Sensor

F. MLX90614 Non-contact infrared temperature sensor

MLX90614 temperature sensor is used to measure the temperature without getting contact with the body it uses IR signals for this purpose. It has an operating frequency of range -70°c to 382.2° c. It is available both in 3V and 5V version. It has a supply current of 1.5 mA.

Figure 7: Temperature Sensor

G. Robotic ARM

Robotic Arm is a type of pre-programmed component. It performs similar operations of human arm. This arm executes job quickly and effectively [14]. Based on join type robotic arm is categorized into Cartesian robot, collaborative robot, cylindrical robot, spherical robot and SCARA robot. Cartesian robot is a pick and place robot

we employed in our project. Which is used for serving medications to the patient.

Figure 8: Robotic ARM

2. SOFTWARE REQUIREMENTS
A. Python

Python is a modest opensource programming language. It was picked for an assortment of reasons as it contains numerous benefits. Python programming comes introduced effectively on the Raspberry Pi working framework, Raspbian. OpenCV is viable with Python for simpler turn of events. Python can run OS orders and can be utilized for web-improvement.

Figure 9: Python logo

\ #### B. Open CV:
Open CV is a cross stage library utilizing this we can foster ongoing PC vision applications. It is mostly centered around picture preparing, video catch and examination including highlights like face and article location

C. BLUEDOT:
BLUEDOT is Android app available in the Google Play store. It works as a Bluetooth remote for the Raspberry Pi, allows us to control our Raspberry pi projects wirelessly, it's a Bluetooth remote & python library. The movement of the Robot is controlled by this app wirelessly. The directions such as forward, backward, left and right movements of the motors are controlled with this application.

D. MIT App Inventor

MIT App Inventor is an open-source web application which permits the clients to make programming applications for Android OS. Indeed, even with restricted programming information and experience, anybody can undoubtedly make an Android Application. With the usage of such apps we can easily control the joints of Robotic Arm wirelessly.

IV. FLOWCHART
The working principle of our proposed project is as illustrated in the above flow chart. Raspberry PI module which is coded with respect to Blue dot application, initiates when it is provided with a Bluetooth network. The

livestreaming of the environment is captured by PI camera, if the Bluetooth connection is established at the moment, livestreaming is captured and movement of the Robot is being controlled with the help of the application (Left, Right, Front, and Back).

Once it is released, the entire system pauses w.r.t movement and it will move automatically in forward direction by time delay as we programmed, then the primary objective is carried out such as delivering medicines, foods etc., and also contactless monitoring of patient's readings such as temperature, pulse rate, oxygen level. These Readings are uploaded to the cloud for future reference and also alerts medical staffs through SMS.
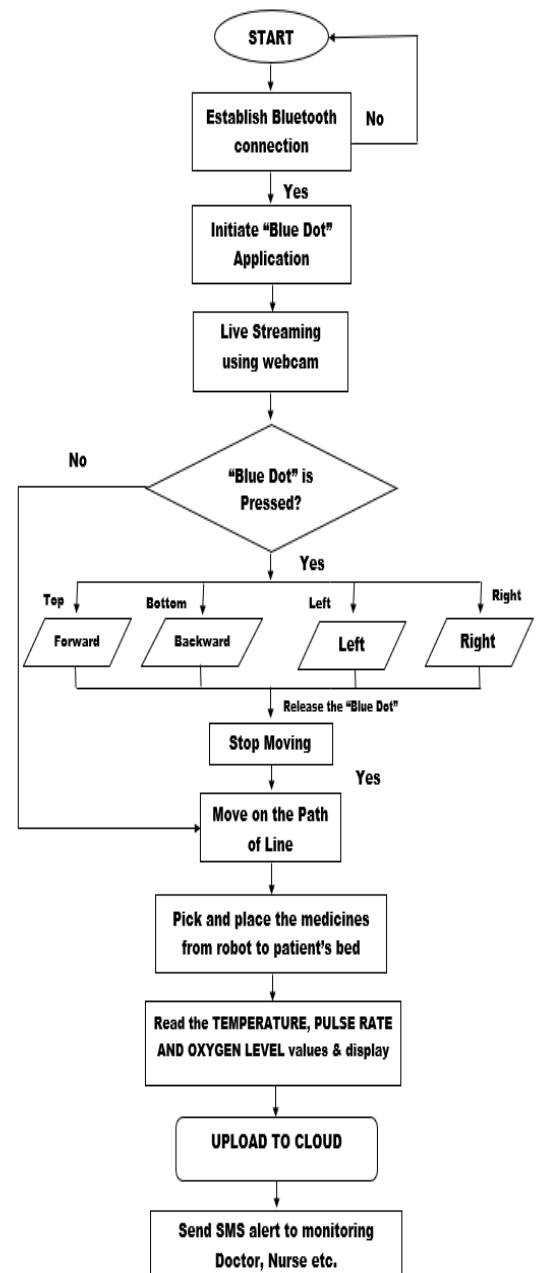

Figure 10: Flow diagram of proposed system

V. EXPERIMENTAL RESULTS

Our paper describes the system used to monitor the conditions of patients by robot so that results in decreasing the fear of effect of communicable diseases and screen attached to the Arm of the robot is used to establish communication between patient and doctor results in indirect monitoring of patients by doctor can be carried out, entire system is contactless which ensures contactless assistance and monitoring of patients.
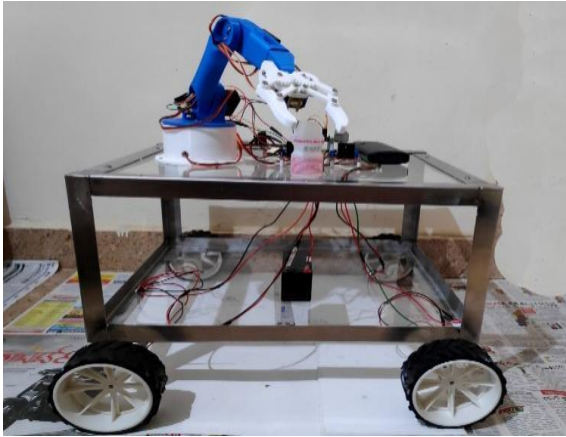

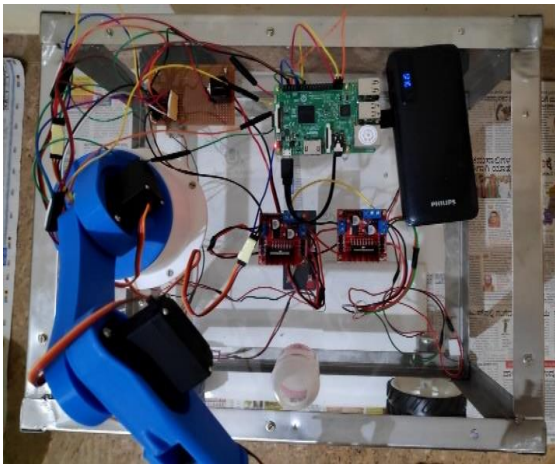Figure 11: Patient monitoring and Assistance using Roboti ARM

Figure 12: Circuit connections of proposed work

VI. CONCLUSION

In this review, the patient monitoring systems is proposed which monitors pulse rate, temperature and oxygen level and supplies the medications, juice and fruits can be done using Robotic Arm. The specialist's staying at a distance can monitor the patient condition so that he can save the life of patient. The idea of the patient monitoring system using robotic arm is a contribution in the field of medical science and it will reduce health issues.

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