IOT ENABLED ROBOTIC ARM

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Abstract— *The need for IOT enabled robots exists in applications like industries, medicine, construction and various other fields to reduce the work load of humans. This project looks upon to reduce the man power requirement (nurses) and is completely automated and feasible system which takes lesser time and accomplishes the given task. The project aims at delivering medicines at hospital rooms on right time. It is proposed to achieve by a robot equipped with necessary equipments to measure the various parameters to pick and place the required object. The prototype model is based on RASPBERRY PI and it consists of IR sensor and driver circuits.*

Keywords— Robotic Arm; Medicine Delivery; IoT Enabled

1. INTRODUCTION

For the people who are indulged in electronics as a profession who kind off happens to have more interest in robotics this project is the key in which most of precise work which humans cannot do repeatedly, this is where a robotic arm or we can say a pick n place robot comes into picture. A Robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing a translational (linear) displacement. The internet of things (IoT) is the network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

2. RELATED WORKS

Object Detection and Recognition for a Pick and Place Robot - Vision based control of the robotic system is the use of the visual sensors as a feedback information to control the operation of the robot [A. Ellgammal, 2].

Smart Robot Arm Motion Using Computer [Bilal Iscimen, 3] - In this study computer vision and robot arm are used together to design a smart robot arm system which can identify objects from images automatically and perform given tasks.

Pick and Place Industrial Robot Controller with Computer Vision [Pratiksha Andhare, Sayali Rawat, 6] – In these days, most of the robots operate in a pre-coded cycle, to the best, the cycle waits for a few input sensors to further along cycle.

Internet of Things [IoT] Based Robotic Arm [Kaustubh Gawli, 7] - The ongoing revolution of Internet together with the growing robotics in many activities of everyday life. Internet of things has taken over all the heavy loads from human to itself.

Wireless Control of Pick and Place Robotic Arm Using an Android Application [Muhammed Jabir. N. K, 11] – This work is designed to develop a pick and place robotic arm vehicle with a soft catching gripper for safety reasons. The robotic vehicle is android application controlled for remote operation.

3. CONSTRUCTION AND WORKING

Raspberry pi and robotic arm are the key components of the system. The Raspberry pi acts as the computing unit and along with the gripper unit it performs the function of picking and placing an object. The Raspberry Pi is powered using a 1080Mah battery.

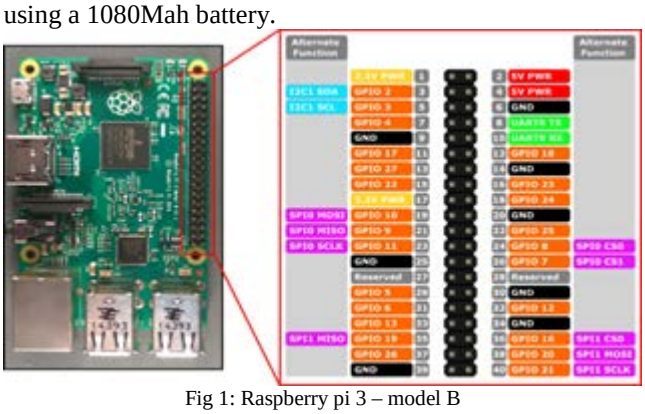


Fig 1: Raspberry pi 3 – model B

The processor speed in the pi module is 700MHz to 1.2GHz. The processor is interfaced with the motor driver module to drive the motors of the robot. Overview of the system design is presented in this section.

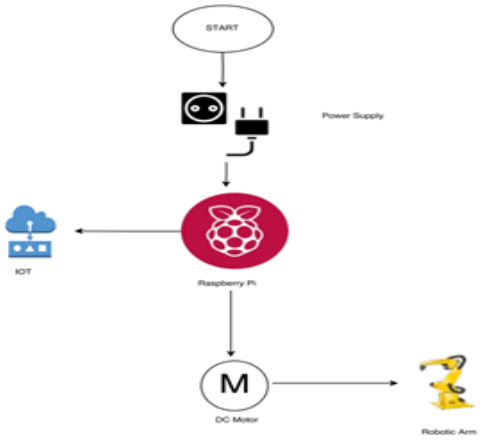


Fig 2: Block diagram

Five relays each for one motor has been connected to the pi, in that four is given to the motor which helps to move the robot and the other is given to the arm. The two limit switches one at the top and other at the bottom is fixed near the arm. A power battery is used as a supply for the dc motors. Four DC motors are used to control the base movement of the robot and the other one is used at the arm to lift the object (medicine tray). The motor used for the movement of the arm is power window motor.

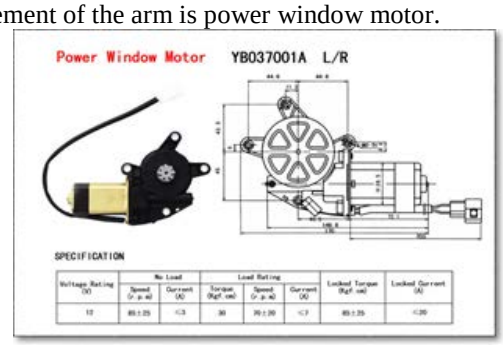


Fig 3: Power window motor

IR sensors are used for object detection in both the case of tray detection and obstacle detection as well. The sensitivity of the sensors can be altered using the potentiometers accordingly.

Fig 4: IR sensor

The motor which is fixed at the top and it is responsible for the arm movement and lifting actions. Once the medicine is placed in the tray, a signal is sent to the raspberry pi via IoT. Then the movement of the robot starts to pick the medicine tray that needs to be delivered. The arm then detects the tray, picks it and moves to the respective destination as per the details given in the hospital database. Once the robot reaches the destination it places the medicine tray and returns back to its initial position. Again the robot picks the medicine tray and moves towards the destination to place the object. This process is continued till the details that are given is completely executed. And, when the whole actions are executed, the robot is made to reach its initial position and stops.

Fig 5: Pick and place robot with the electronic setup

Glass relays are used to drive the four wheel drive base of the robot. Two additional relays are used for the power window motor functioning. A separate battery supply of 12v is used as the power source for driving the dc motors. The raspberry pi module is powered up with separate battery source in order to avoid damage due to reverse leakage current.

4. OUTPUT

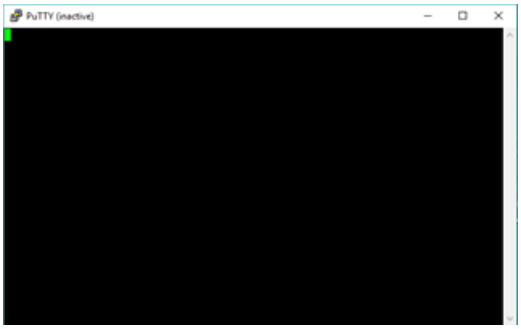
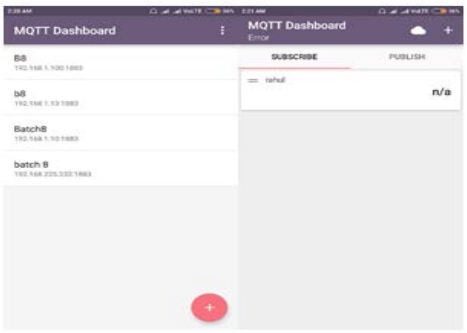


Fig 6: Simulation Output

The simulation of the project is done with putty software and the compilation of the program is also monitored using putty software. The figure above is the simulation window of the putty software.

The output monitoring of the robot can also be done using android application. One such application is called as “MQTT Dashboard”.



This application is used to remotely monitor the status of the robot by interfacing the application with the robot using WiFi communication. By this way of communication an effective bridge is formed between the mobile device and the robot using the cloud gate as the intermediary source for the active communication link. Here in this android application it is possible to remotely operate the robot either by just monitoring or controlling as well. Once the device and robot are in the effective link the mobile user has to subscribe the robot's database for monitoring purpose. In case of remotely accessing the robot the mobile user acts as the publisher and publishes the instructions to the robot through the cloud gate link. Based on the range of the WiFi network the accessing node range of the mobile device varies.

5. APPLICATIONS

•For Defense Operations:

The robotic arm is remotely controlled so
that it can be equipped to a robot which can explore inaccessible or hazardous area and do a dangerous task.

•In hospitals:

A robot which performs the various complex operations with minimal invasion, higher accuracy and flexibility are used in robot assisted surgeries. The robots used for such surgery have extreme higher cost because of their sophisticated software and hardware.

This type of robots can also be used as assistants for delivering medicines in the hospitals with high accuracy based on the requirement.

•In industries:

They can be designed to develop a pick and place robotic arm vehicle with a soft catching gripper that is designed to avoid extra pressure on the detected object for safety reasons.

They can also be used as load carriers in warehouses to pick and place various loads from one place to another.

6. CONCLUSION

The aim of this work is the development of wireless IoT enabled pick and place robotic arm such that it can be used in hospitals for delivery of medicines. It is a IoT interfaced system in which Raspberry pi – model B and glass relay based motor drivers are predominantly used. The maximum weight that can be carried by this robot depends on the capacity of the DC motors used. It can be made very useful and interesting by interfacing the robot with other specific applications such as surgical assistance in hospitals and using metal detectors, wireless cameras, night vision cameras…etc., for finding the bombs and proper visual assistance in military applications.

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