BUTLER ROBOT WITH MULTIWIRELESS CONNECTIONS

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Abstract

The project is a butler robot which is a robot that can provide services in a restaurant, like any butler or waiter. The robot can move and be controlled through human supervision using a wireless camera. Moreover, the robot also contains two wheels to help with movement in all directions, two human-like arms and a tray for holding food and drinks in one hand. Not only that, the other hand can make some body language contact with customers. The robot has many equipment attached, including camera, sensors and other electronic devices like DC motor, that work together in order to achieve wireless connection and mechanical movement. Also, the robot is supervised by a human and can take customer orders using several push buttons for different foods and drinks.

Keywords: Acrylic, Arduino, Dc Motor, Wireless camera, Analogue Joystick

INTRODUCTION

Robots have existed for less than 50 years; however, the thought of insentient creations shows a sincere bid whose accomplishment is far older. It was not until the 1950s and 1960s that real robots came to exist. As the inventions of transistors and integrated circuits grew, brains were put into the brawn of pre-existent machines by the computer industry. In 1959, with the unveiling of a computer-controlled milling machine, came researchers' illustration of the possibility of robotic manufacturing (Yeole, Bramhankar, Wani, & Mahajan, (2015).

During the past 30 years, Robotics as a field, has changed greatly. Despite George Devol's development of the first programmable articulated arms for industrial automation and their creation as commercial products by Joseph Engleberger in the 1960s and 70s, it was not until the 1970s and 80s that mobile robots with several degrees of autonomy gathered much attention (Bekey, & Abney, 2008).

A robot is a prototype that is mechanically and electronically designed and programmed by computers to perform a particular task. When it comes to performing certain tasks, humans show some limitations. However, robots can perform those tasks efficiently and in the absence of taking many breaks. A few primary abilities that a robot must have are: the ability to move from one place to another, the ability to power itself using battery, solar power or any other power supply, and the ability to perform assigned tasks using through intelligence gained from programming (Velrajkumar, Raja, Hossen, & Jong, 2017).

The integration of robots into working tasks (especially repeated ones) that were initially performed by humans is becoming more and more common. There are two fields; industrial and service, into which robots can generally be classified. A service robot works semi or fully independently to perform services, except manufacturing, that are functional for human and equipment well-being. In contrast, the internet and Wi-Fi are increasingly becoming the most used resource. Also, a robot's body is mechanically built and in order to build the seller and guard robots, electrical components were also made use of (Premkumar, & Nigel, 2015).

LITERATURE REVIEW

(Mapuskar, 2017) proposed a robot controlled by hand motion as it is easy to use and handle. A hand-motion controlled robot's arm; which is mounted on a robot car, can lift a required object from safe distance. The movement of the car and the arm's motion are both controlled by the accelerometer. Accelerometer based wireless robot arms are developed based on wearable accelerometers.

(Maity, 2017) put forward a review of robots controlled through mobile phones, using android applications like Arduino and Bluetooth, which move the robot upwards, backwards, and to the left and right sides. Bluetooth has not only altered the way in which people use electronic devices at home or at the workplace but has also shifted use of electronic devices from traditional wired electronic equipment to wireless equipment. Here, we are utilizing Bluetooth communication interface microcontroller and android application.

(Mahesh, 2017) Presented the observed and controlled of mechanical movements through remote system by utilized a web program and getting to a website page. To indicate improvement deceivability of the articles, a camera is fitted on the robot. The programming dialect of the robot is dependent on the LINUX stage which will be interfaced with Raspberry Pi board. The Passive Infrared Sensor (PIR sensor) recognizes a man or a question enters an observation region. Also, by discerning the increase in smoke level in the climate, the smoke sensor differentiates the fire accidents. In addition, the ULTRASONIC sensor can provide accurate measurements of stable non-contact distance that ranges from 2 cm to 4 meters.

(McGinn, 2017) inquired into the effect of the built environment on the manual control of domestic service robots. A simulation of a domestic robot control scenario was created in virtual reality. Moreover, in addition to evaluating the performance of fifty inexperienced users, questionnaires were used to record the users' personal experiences. It was discovered using quantitative and qualitative analysis, that unskilled users regularly fail at tasks that involve navigation-based robot control.

(Singh, 2017) Designed for spying purpose used android Operation System (OS) component for remote operation, dangerous area like war field, disasters, and area covered by terrorism, for underground tunnel surveillance etc. where human cannot enter. An 8051 microcontroller (AT89S52) is used for the desired operation. To move the robot forward, backward and to the left or right, commands are dispatched to the recipient, using android application device at the transmitting end. Moreover, two motors are interfaced to the microcontroller and used for the movement of the robot, at the receiving side.

(Louis, 2017) constructed a robot that closely observes human activity in war zones or during rescue operations so that there is a decreased risk of being attacked by the enemy. In addition, the robot is comprised of night vision and a wireless camera that can send out videos of the war field, so that any harm or loss to human life is prevented. When setting foot in an unfamiliar domain, military men put a big risk on their lives. For the defense sector, the robot will be a suitable machine as it will help decrease the risk of both; losing human lives, as well as illegal activities. Not only that, prior to entering, the robot will also inform military men and armed forces of the conditions in a territory. Moreover, it can also help in numerous rescue operations, to save manpower and monitor dangerous locations. The chief benefit of this project is that the robot can be controlled effortlessly using only a blue control screen app in an android mobile.

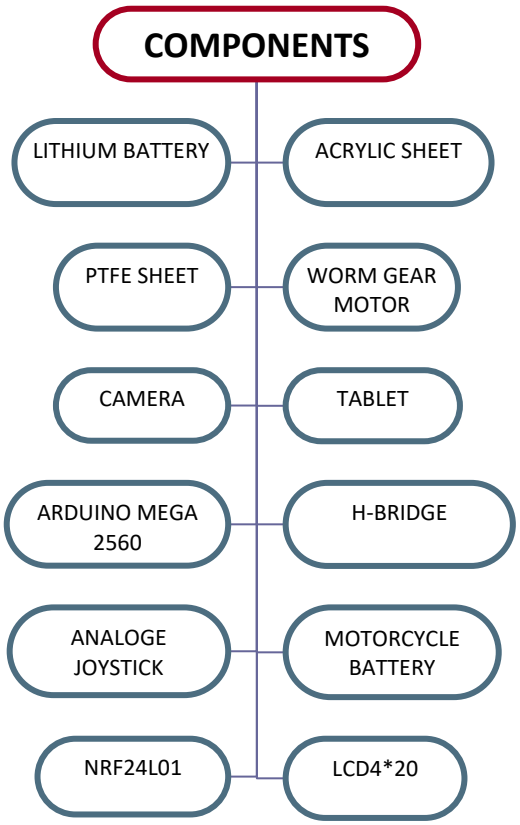
(Chandrakumar, 2017) introduced a wireless interface that can control a robot using voice and gesture commands via a computer. Also, this project comprised the development of an android application for the purpose of remote operation. In order to move the robot forward, backward and left or right, commands are sent to the receiver using a device with the android application. In addition, to accomplish remote operation, any device including a smartphone and tablet, that operates on an android OS and has a Graphical User Interface (GUI) based touch screen operation, can be used.

(Bhardwaj, 2017) presented a concise idea on how robots operate to serve humanity. The chief motive of this paper is to plan and construct a robot that is controlled by humans, using several technologies like android application, the Internet, Bluetooth, etc. Furthermore, there will be an android, with a mobile phone that will be used for transferring data, placed inside it. Also, the android will be regulated using the Internet, by Personal Computer (PC).

PROBLEM STATEMENT

The problem is of managing a restaurant venue that needs a butler who we call "captain" in Iraq. The butler performs at least three functions or finds solutions to three problems. The first function is taking orders from customers, the second is delivering food and finally the third is making use of some sort of marketing skills to bring customers back to the restaurant. Our butler robot will perform additional functions, one of which is using the experience of old human butlers. As our robot is human controlled; it can be supervised by old, experienced butlers who are unable to labor as a result of physical limitations. In this way, old human butlers' experiences can be used, and retirement can be postponed. Secondly, any robot can replace human resources; therefore, one experienced butler, controlling the robot while sitting in an air-conditioned room, can perform the work of at least three human workers. As a result, human resources will be replaced with the robot. Moreover, there are the economic and financial issues. Replacing three workers by one robot and one experienced butler, will result in a salary-cut for workers in a restaurant. Also, another crucial factor to consider is health care. As the robot's cleanliness surpasses human cleanliness, owing to the intensive cleaning system, the robot is cleaner and therefore, preferable in food-related health care services. In addition, this robot also solves the marketing issue. As the robot is a new technology, it will gather hype from customers as customers will want to see how they'll be served by a robot. Consequently, the robot will support in a restaurant's marketing and will help gather customers. Lastly, the final issue solved by this robot is of making errors in work and inefficiency. As the robot is basically a machine, so it is normal to expect work that is fast and of high quality, from it. The robot will not forget orders nor make delays, as it will be operated using push buttons.

DESIGN MODEL



HOW TO CONNECT THE COMPONENTS

Science camp which is Iraqi maker space and represents the Iraqi version of maker movement. It is a place where maker entrepreneur's students know ventures find the facilities like space, tools, knowledge, machines and open source culture. Science camp provided maker and fabrication lab high tech digital fabrication services.

A makerspace is a cooperative place of work, within a school, library or a separate public/private facility. It is a place for creating, learning, exploring and sharing, and makes use of tools that are high-tech, or no tech. Makerspaces are accessible by adults, businessmen and even children. They have a wide range of maker devices; comprising of, 3D printers, laser cutters, Computer Numerical Control (CNC) machines, soldering irons and sewing machines. Moreover, these spaces are assisting those who require analytical 21st century skills in the areas of Science, Technology, Engineering and Math (STEM). These spaces not only give hands on learning, but also assist with critical thinking skills as well as improve self-confidence. Out of the many skills gained at makerspaces are skills including, 3D printing, 3D modeling, coding, robot, and woodworking. Moreover, makerspaces also encourage entrepreneurship and are being used as incubators and accelerators by newly established businesses.

Currently, we are as students need the maker space in this project, we continue with the maker space to design (SAM-QN) robot to provide everything we need for the design. For the (SAM-QN) robot design we used the (Computer Aided Design (CAD) / Computer Aided Manufacturing (CAM)) model in digital fabrication.

Digital fabrication is a type of manufacturing process where the machine used, is controlled by a computer. The most common forms of digital fabrication are CNC machining, where typically, shapes are cut out of wooden sheets; 3D printing, where objects are built up out of layers of metal or plastic; and laser cutting, where materials like metal are burnt or melted by a laser beam.

Digital fabrication which is the process of perusing mechanical parts by CNC machines and 3D printers. In our project the (SAM-QN) robot we use subtractive manufacturing which is the CNC parts digital fabrication. The process is about converting ideas into 3D models, using 3D software like 3D studio max and (CAD/CAM), and any CAD software can produce something similar. Then, we use this 3D model to produce a (CAD/CAM) software called G-code; which is the files that tack in by the CNC machine, to cut out these 3D models into tangible objects in the reality.

As a basic idea we designed (SAM-QN) robot in all its dimensions, using 3Ds MAX 2019 program, as shown in the figure 4.1, figure 4.2, figure 4.3, figure 4.4, and figure 4.5.

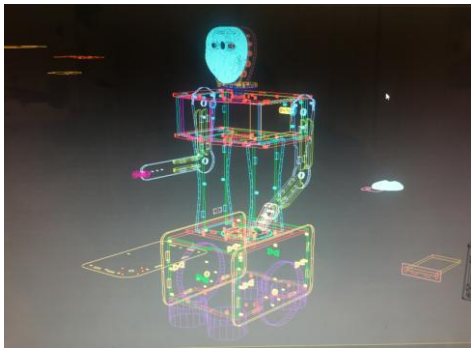


Figure 4.1

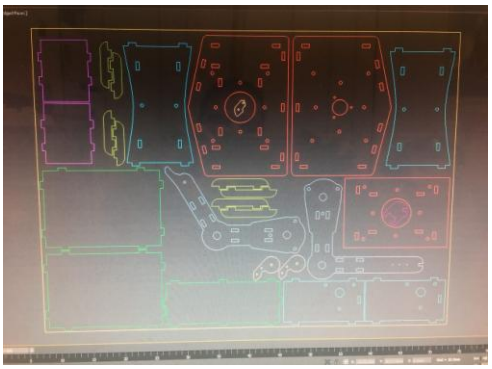


Figure 4.2

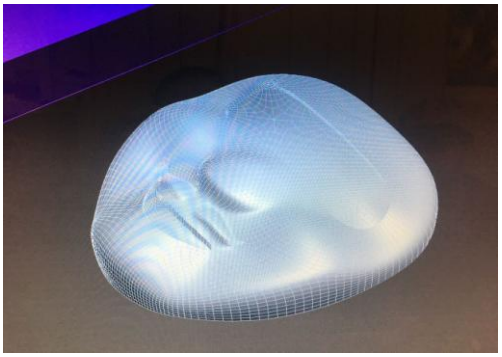


Figure 4.3

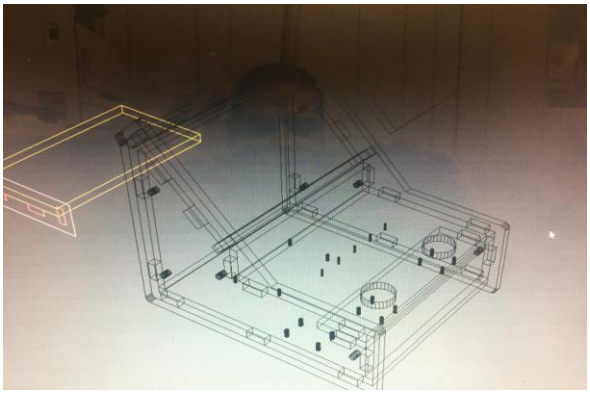


Figure 4.4

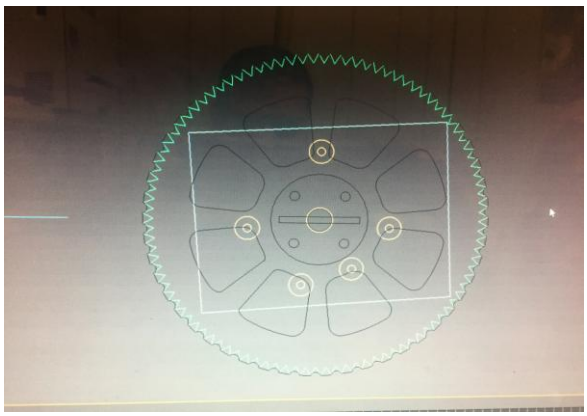


Figure 4.5

One of the strongest 3D design programs developed by Autodesk, is 3Ds Max. The program can create images while the designer imagines and moves them from a three-pronged perspective; for example, building robotic parts, creating cars or any image in the designer's imagination. 3Ds Max software can provide professional 3D modeling features in many approaches. In our project we use "Polly modeling approaches" for industrial design for our robot's parts.

In science camp which is the Iraqi maker space we build the part of the robot by two of many of CNC machines we have. In figure 4.6., we use the laser cutter CNC because we decide to build the robot's body and many of its mechanical parts from acrylic 8mm thickness. So, this type of material is suitable to be called laser CNC because it will provide us with a very clear, paresis sharp cut, so that our (SAM-QN) robot is like many universities' project prototypes. It is clear to provide the ability to see what is going on inside and to make very precise parts.

Figure 4.6

The other material we use for wheels is the Teflon, which is about 22mm in thickness. We decide to use this Teflon material because it is well cutter by router CNC (3 axis CNC) as shown in figure 4.7. Moreover, it is suitable for using as a wheel's ability to prosiest well not like other part like (aluminium or steel) and its somehow quite not so noisy.

Figure 4.7

When we prepared cutting the parts in to 3D studio max we try to calculate every things related to the part and how it is fit with the author part and even the electronics will attach on, so in our design we will find many holds and very precise cuts to put every things any place and fit each part to gather. Off course the assembly parts can be regarded is the most fanny and easy part because it is related to assembly well design and already fitted and simulated in 3D software how to fit which each other ,so it was just lick ale go or passel game to attach every things to gather as shown in the figure 4.8.

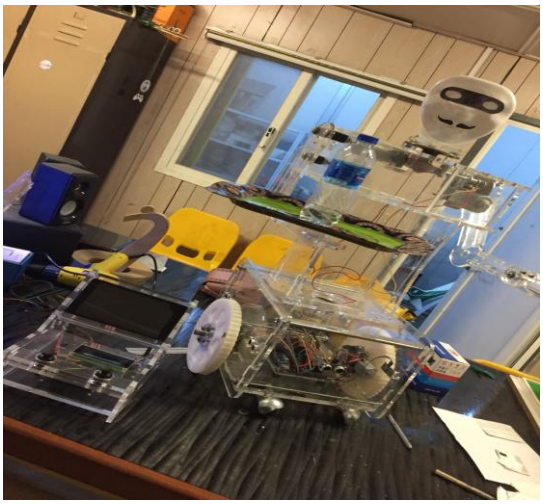


Figure 4.8

PROCESS MODEL

(SAM-QN) robot designed as a butler robot offers a work similar to human work. The Arduino Mega2560 board represents the heart of robot which is responsible of all the activities done by the robot. It is also the heart of the controller which we control the movement of the robot and dealing with customers. As shown in code below.

```
include <SPI.h>
#include <NewPing.h>
#include "nRF24L01.h"
#include "RF24.h"
#include "printf.h"
//Ultrasonic pins
#define TRIGGER_PINF  34
#define ECHO_PINF     35
#define TRIGGER_PINB  36
#define ECHO_PINB     37
#define TRIGGER_PINR1  38
#define ECHO_PINR1     39
#define TRIGGER_PINR2  40
#define ECHO_PINR2     41
#define TRIGGER_PINL1  42
#define ECHO_PINL1     43
#define TRIGGER_PINL2  44
#define ECHO_PINL2     45
```

```
#define MAX_DISTANCE 200
  void Stop(){
   digitalWrite(R1,LOW);
    digitalWrite(R2,LOW);
    digitalWrite(L1,LOW);
    digitalWrite(L2,LOW);
   }
  void Forward(){
    digitalWrite(R1,HIGH);
    digitalWrite(R2,LOW);
    digitalWrite(L1,HIGH);
    digitalWrite(L2,LOW);
   }
  void Backward(){
    digitalWrite(R1,LOW);
    digitalWrite(R2,HIGH);
    digitalWrite(L1,LOW);
    digitalWrite(L2,HIGH);
   }
  void Right(){
    digitalWrite(R1,LOW);
    digitalWrite(R2,HIGH);
    digitalWrite(L1,HIGH);
    digitalWrite(L2,LOW);
  }
  void Left(){
    digitalWrite(R1,HIGH);
    digitalWrite(R2,LOW);
    digitalWrite(L1,LOW);
    digitalWrite(L2,HIGH);
   }
  void headRight(){
    digitalWrite(head1,HIGH);
    digitalWrite(head2,LOW);
```

```
void buttonPressed(){
  reading1 = digitalRead(1);
    if (reading1 == HIGH && previous1 == LOW && millis() - time1 > debounce) {
    Menu[0] = Menu[0]++;
    time1 = millis();
    }


    previous1 = reading1;
```

A controllers designed to be controlled remotely by first joystick that will controls the movement of the wheels in all direction (front, back, right, left) as shown in this programing code. The movement of hand to up and down of (SAM-QN) robot additional to head movement to left and right controls by second joystick as shown in this programming code

```
#include <SPI.h>
#include <LiquidCrystal.h>
#include "nRF24L01.h"
#include "RF24.h"
#include "printf.h"
#define wheelsX A0
#define wheelsY A1
#define head    A2
#define hand    A3
RF24 radio(6,7);
const byte addresses[][6] = {"00001","00002"};
int data[4];
int inArray[6];
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void writeLcd(){
        lcd.setCursor(0, 0);
        lcd.print("Burger: ");
        lcd.setCursor(8, 0);
        lcd.print(inArray[0]);
        lcd.setCursor(0, 1);
        lcd.print("Juice:");
        lcd.setCursor(5, 1);
        lcd.print(inArray[1]);
```

```
lcd.setCursor(0, 2);
 lcd.print("Water: ");
 lcd.setCursor(8, 2);
 lcd.print(inArray[2]);
 delay(20);
 lcd.setCursor(8, 0);
 lcd.print("   ");
 lcd.setCursor(5, 1);
 lcd.print("   ");
 lcd.setCursor(8, 2);
 lcd.print("   ");
```

This controller contains NRF24L01 to sending the instructions to the (SAM-QN) robot. The (SAM-QN) robot also contains NRF24L01 when it receives any of the commands it will implement them immediately. The robot has two types of wheels, the small ones that help to move in all directions and large revolving through the dc motor which in turn takes power from the battery. The H-bridge connect with the dc motor to determine robot direction. As well as the head and hand.

CONCLUSIONS

The name of our robot is (SAM -QN).The butler robot mean a robot can provide services in restaurant like any other butler or waiter. The robot is taking the order from the costumers, do food delivery and also some sort of marketing skills to keep the costumers return by to the restaurant. The robot consist of two part first is the hardware, second is the software. The hardware part consist of several components designed and connected together, this component are arduino mega 2560, lithium battery 3800mAh, H-bridge, acrylic sheet, PTFE sheet, worm gear motor, camera, analog joystick, motorcycle battery, LCD4*20 and nRF24L01, the assembly parts can be regarded is the most fanny and easy part because it is related to assembly well design and already fitted and simulated in 3D software. The software part consist of programing codes that made the parts of robot movement.

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