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FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY

Computer Engineering Department

Friendly Robot

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DEDICATION:

To the great Palestine and its heroic martyrs, to patient Gaza and steadfast Jenin, to every Palestinian who is stationed in this holy land.

ACKNOWLEDGMENT

First of all, we would like to thank our supervisor, Dr. Sufyan Samara, and a big thank you to all our teachers during this stage, they have all our respect and appreciation, and great gratitude to our families, our first supporters in the most difficult times, no words can do them justice, to all our friends, companions on this journey, all our love.

DISCLAIMER STATEMENT

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Abstract

Friendly Robot, an interactive robot designed for children to encourage them to do their necessary daily tasks by having a companion who does these tasks with them so that they do not feel lonely or bored. This robot also develops communication skills in children by sending voice commands to the robot or receiving sounds from it. It also contains an entertaining game that the child can play with the robot to develop his mental skills. To add a safety feature to this robot, it is equipped with a monitoring system through a camera and an application that transmits to the mother the child's condition and what he is doing on the device. The mother can also send specific commands to the robot through the application, such as the eating or studying position to encourage the child to do so. This robot can move in different positions through commands from the mother or child to enhance its interactive relationship with the child. It also contains educational and encouraging audio clips.

Chapter 1 :Introduction

1.1 GENERAL BACKGROUND

In recent years, the widespread spread of smart devices, especially among children, has led to the emergence of several problems and symptoms in children, such as their lack of communication skills, communication, and forming relationships, in addition to their weak ability to concentrate, their increased mental confusion, and weak mental abilities due to sitting for long hours in front of screens as a future only, without interaction, in addition. Because they are unable to even perform basic daily tasks.

1.2 OBJECTIVES

The main goal of this robot is to have an interactive companion for the child, so that he can communicate with him and send and receive commands in addition to encouraging the child to carry out the necessary daily tasks. In addition to that, it should be an entertaining companion who plays with the child, and at the same time it is a safe device in terms of content and communication. Continuing with the mother

1.3 SIGNIFICANCE OR IMPORTANCE OF YOUR WORK

The importance of this project lies in the presence of an interactive and safe companion with the child, who works to enhance his abilities and skills and also enhance his mental activity, which is extremely important and has a major impact on the child’s ability to achieve and raise the level of his psychological and mental health.

CHAPTER 2: Theoretical Background and Previous Work

2.1 THEORETICAL BACKGROUND

The involvement of children in interactive games is undoubtedly very important in terms of mental and physical health, increasing mental capabilities, and also improving their ability to engage in society and form relationships. With the widespread spread of technology, integrating children's games with modern technology is a must and must be done to raise the level of efficiency of these games. To get out of the circle of games that exist only for entertainment and move to another path in terms of their benefit and importance

2.2 PREVIOUS Studies of kids robot

During the past forty years, there have been actual and tangible developments in the world of children's robotics, and there has been a qualitative shift and actual interest in this field, in recognition of its importance.

[1] Leonardo da Vinci was not only a renowned artist, he was also well known for his inventions. In 1495, da Vinci devised plans for a mechanical knight, The sketchbook was discovered in 1959 and re-creations of the designs produce a pulley and cable powered knight that could sit, move its arms, and raise its visor. It is unknown whether the machine was actually created while da Vinci was alive [2] In 1921, the word "robot" first appeared in a Czech play titled *R.U.R - Rossum's Universal Robots*. The English word for "robot" comes from the Czech word "robota",

which The play imagines a factory of human-like machines revolting against humans after being overworked.

[3] In 1954 George Devol and Joseph Engelberger patented the The arm entered mass production in 1961 and the arm became very popular. In 1966 the arm, alongside its inventors, were guests on NBC's Tonight Show and performed tricks such as pouring drinks and conducting the band. A General Motors factory of Unimate arms can weld 110 car frames in one hour, more than double the speed of any other factory.

2.3 Earlier coursework

The electricity and electronics courses and their laboratories had a great impact on us and on our skills that helped us complete this project in terms of dealing with energy sources and the amount of voltage required for each piece to maintain its efficiency, in addition to the controllers courses such as microcontrollers, which contributed to our knowledge of the best type of controllers for each electronic piece, including It is compatible with its job, and what contributed to the completion of this project and its research is the critical course. We learned all the research policies and steps of correct scientific research and coordinated them in the correct manner.

CHAPTER 3: METHODOLOGY

3.1 STANDARDS AND SPECIFICATIONS (CODES)

The design and implementation of this project was within the correct engineering standards in terms of standards of durability,

safety and quality. In this part, we will explain these standards and how we followed them.

3.1.1 THE IEEE 802.11 STANDARD

Our robot includes the internationally recognized standard IEEE 802.11, which allows wireless communication between the robot controller and the smart device via Wi-Fi technology, in addition to its ability to connect to widely known smart devices. It is also an easy device for users to use and is also safe for children.

3.2 Constraints:

3.2.1 economy :

We set a cost ceiling from the beginning of work on this project, which was $500, but during the work we purchased parts of poor quality, so we were forced to dispose of them and repurchase others, which increased the material cost of this project, in addition to some parts that did not prove their effectiveness from a mechanical standpoint. We also replaced it, which increased the cost

3.2.2 ENVIRONMENT:

Our project is generally environmentally friendly as it relies on clean energy sources, especially rechargeable batteries

3.2.3SOCIETY:

The project is usable by all segments of society by mothers, fathers, and children, and it can also be used by many institutions that care for children.

3.2.4HEALTH AND SAFETY:

This project gives priority to the safety of the user, whether adults or children

3.2.5MANUFACTURABILITY:

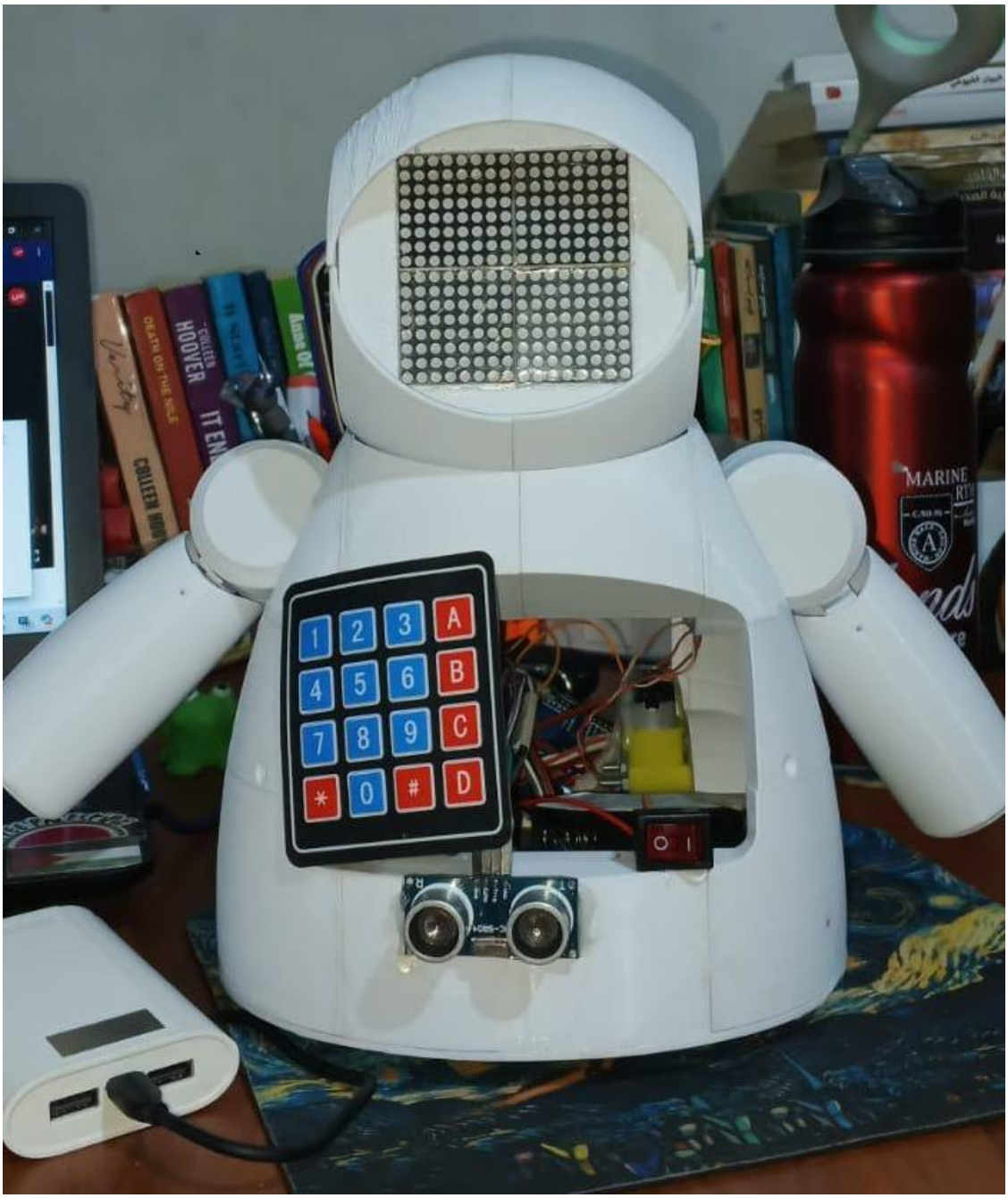
This project is manufacturable and contains all current manufacturing and product quality standards

3.2.6SUSTAINABILITY:

This project achieves sustainability standards so that it can be implemented, developed and worked in all environments

3.3 DESIGN

The design is characterized by its durability and flexibility, as the outer structure is made of reinforced plastic and printed with 3D technology, and it is also flexible in terms of movement, so that the wheels move easily and flexibly, as well as the arms via the servo motor, and it has an acceptable and appropriate shape.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3.4 TOOLS AND TECHNOLOGIES

In this project, we used different tools, whether software or hardware, until we verified the ideal final form of this robot and the integration between the tools to show results correctly. In this part, we will explain all the tools used and the function of each of them.

3.4.1 hardware component

Arduino Mega 2560

A microcontroller board based on the ATmega2560 is called the Arduino Mega 2560. It contains 16 analog inputs, 4 hardware serial ports (UARTs), a 16 MHz crystal oscillator, 54 digital input/output pins (of which 15 can be used as PWM outputs), a USB connector, a power jack, an ICSP header, and a reset button. because of its extensive collection of features, it is an allinclusive microcontroller solution for our project's demands. Considering how many connected devices must connect to the microcontroller

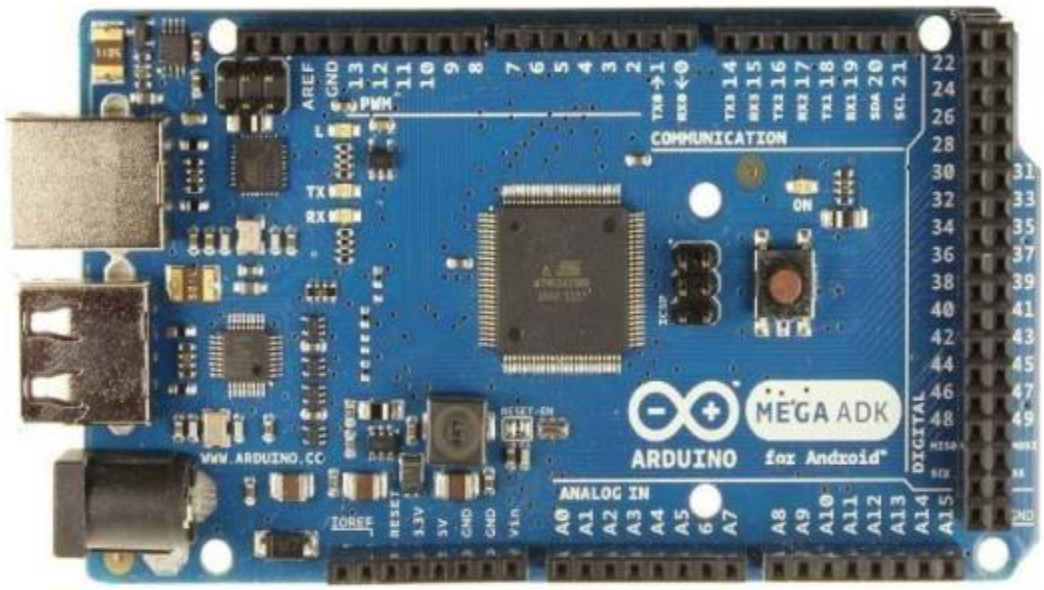

Figure 3.1 : Arduino mega 2560

Raspberry Pi 3 Model B+

The Raspberry Pi is a tiny computer that is approximately the dimensions of a standard deck of cards. The device utilizes a system on a chip (SoC) that combines the central processing unit (CPU)

and graphics processing unit (GPU) onto a single integrated circuit. Additionally, the random- access memory (RAM), USB ports, and other components are directly soldered onto the board, resulting in a comprehensive all-in-one packaging.It represents the brain of the system, we utilized it to access the complex libraries for image

processing like the OpenCV, the camera module integrated to it capture images for analysis, then -uses the OpenCV library the pre-trained Haar cascade classifier to detect face in the captured frame, and run pre-trained deep learning TensorFlow Lite model for the child emotion detection.In Addition, we used Raspberry Pi to help with voice recognition, so it records audio from aconnected microphone and then uses Google's speech recognition API to convert the recorded audio into text.

Figure 3.2: Raspberry Pi 3 Model Bi

DC Motors:

DC motors are electrical motors that operate on direct current They are fundamental components in robotics, automation, and other projects where mechanical movement is required Their simplicity and ease of control make them suitable for our project

Figure 3.3: Dc motor

SG90 9g Micro Servo Motor 180

The SG90 9g Micro Servo is a widely-used, lightweight servo motor capable of rotating around180 degrees (90 degrees in either direction). It functions similarly to a regular servo, but in a smaller size.

Figure 3.4: SG90 9g Micro Servo Motor 180

H-Bridge (L298n) :

The H-Bridge, exemplified by the L298N module, is an electronic circuit crucial for controlling the speed and direction of DC motorsɲ It facilitates bidirectional control, enabling motors to move forward or backward Widely used in motor driver modules, the
H-Bridge is an integral component in projects like ours.

Figure 3.5: H-Bridge (L298n)

The ultrasonic sensor

The ultrasonic sensor is an electronic device that uses ultrasonic sound waves to detect the distance to a target object and transforms the reflected sound into an electrical signal. The sensor determines the distance to the target by measuring the time interval between the emission and receipt of the ultrasonic pulse.

Figure 3.6: The ultrasonic sensor

Raspberry pi Camera Module v1.3

This camera module its compatible with the Raspberry pi. We attached it to the Raspberry Pi via the MIPI CSI camera port. The camera module was used to record frames for face expression recognition.

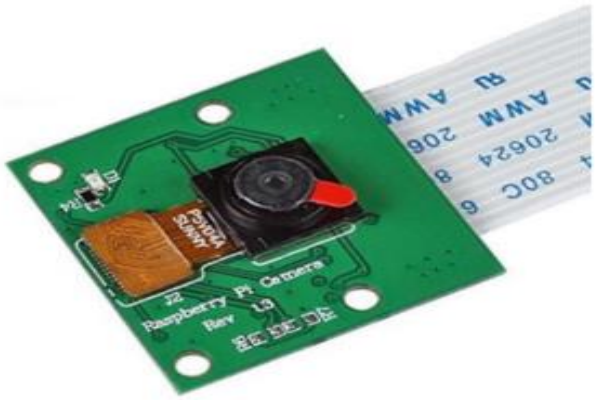

Figure 3.7: Raspberry pi Camera Module v1.3

Keypad

The keypad is an input device that allows users to enter data or commands into electronic systems by pressing buttons arranged

in a grid or a linear fashion We used it for entering commands to the robot to navigate, localize etc

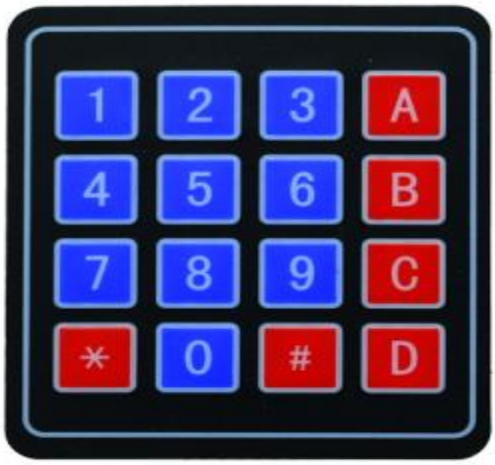

Figure 3.8:keypad

Power Banks :

Power banks are portable energy storage devices equipped with rechargeable batteries They serve as convenient sources of power for charging electronic devices on the go, such as smartphones, tablets, and other USB-powered gadgets Power banks are widely used to ensure continuous device operation when away from traditional power sources.

Figure 3.9: power bank

- Rechargeable Lithium Batteries :

Rechargeable lithium batteries utilize lithium-ion technology, offering high energy

density and the ability to be recharged multiple times These batteries are commonly employed in
various electronic devices, providing a reliable and rechargeable power source Their versatility makes them suitable for applications ranging from consumer electronics to electric vehicles

Figure 3.10: Lithium Batteries

8*8 dot matrix display

Dot Matrix LED 8×8 is an array of LEDs that you can display particular numbers, letters, and shapes on it. Dot matrixes are indicated by the number of rows and columns. The most popular type of Dot Matrix is its 8×8 type, which provides 64 LEDs in 8 rows and 8 columns.

To control Dot Matrix, there are modules based on MAX72xx ICS which need to connect to 4 digital pins instead of 16. You can also connect multiple Dot Matrix (up to 8) to each other without needing any extra pin and cascades them.

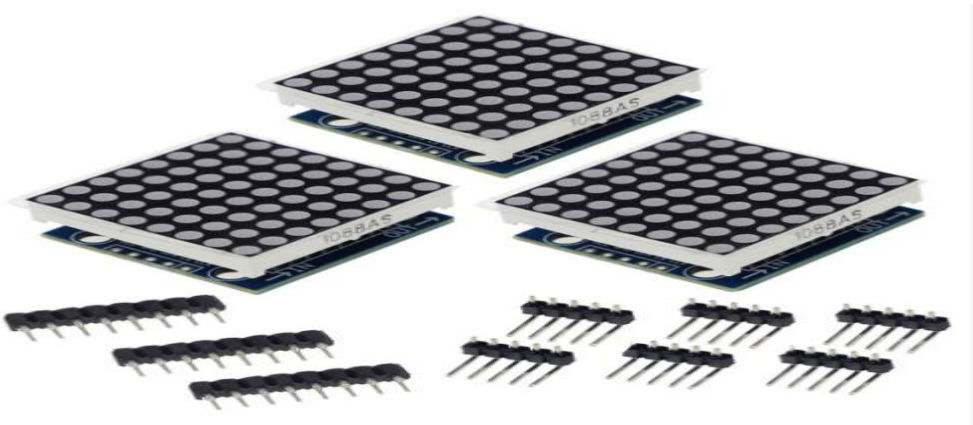

Figure 3.11 :Dot Matrix Display

On-off switch

on-off switch when its function is to open or close an electrical circuit in a stable manner.

Figure 3.12 :on-off switch3.

Chapter4:result and analysis

At the end of this project, we obtained a smart interactive robot that receives commands via voice or via the keyboard and executes them, whether the outputs are on the screen or are movement commands or audio clips. It also receives commands via the application and carries out certain operations and sends information. Also specified through the application. We faced several difficulties during the implementation of this project in terms of dividing the voltage due to the presence of two controllers, the Arduino and the Raspberry Pi. We also faced the problem of the small number of pins in the Arduino Uno, so we resorted to changing it to the Arduino Mega.

Chapter5:Conclusions and Recommendation

6.1 Summary

We have created a smart interactive robot intended for children. It is smooth to handle, safe, and has a sturdy structure. It contains a series of operations that are carried out via a set of commands, whether voice commands or input from the panel. At the end of this project, we achieved our goal of creating this robot that enhances the child's mental activity and is He has a companion who helps him and encourages him to perform daily tasks, and he is connected through the mother's application to give her notifications about the child's condition.

6.2 Recommendations

1. From the beginning, choose high-quality parts that are suitable for the task you are going to do

2. Study the voltage and current required for each piece before starting to work on it so that it is not damaged and you are forced to replace it

3. Make sure that each piece is working properly using a multimeter before connecting it

4. Install the wires after verifying their locations by soldering, because they can be easily removed and cut.

6.3 What we have learned

1. How to choose the appropriate controller for each job so that it performs it well

2. We learned to program Arduino and Raspberry Pi well

aand directions.

6.4 Future Work

As a development for this project in the future, we are adding additional sensors to the robot, such as a temperature or smoke sensor, to send additional notifications to the mother to increase safety, and also the possibility of adding other games such as XO or arithmetic games to increase mental activities, and we can also add several mods as needed to suit the situation. The child and his age

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