Development of Reduced Human Intervention Delivery Robot for Covid-19 Pandemic

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Abstract-Artificial Intelligence is being used to create a delivery robot for the Covid-19 epidemic. Automation is an area that has spread its branches nearly everywhere in the service industry, and it has now been extended to the pandemic scenario. In order to eliminate human interaction, we want to develop a robot to deliver items. Our delivery robot uses artificial intelligence to identify the best route.

Keywords—Artificial Intelligence, Intervention, Raspberry pi, GSM, Security, Sanitation, Hygienic.

I. INTRODUCTION

Rapid technological change is unavoidable. Automatic delivery robots are becoming more common in an increasingly digital environment. A self-driving automobile is a vehicle that perceives its surroundings and navigates without the assistance of a human driver, and it is a hot issue in computer vision research. This project focuses on the creation of a sensing and control system that will allow the robot to navigate around its surroundings using a camera to track down the locations the robot's Decision System sends orders to the Sensing and Control system, which then feeds sensor data back to the controller. This study differs from earlier line follower studies in that the robot may be summoned from several rooms and instructed to carry items and transmit messages using a joystick. The robot also has a number of features, including an alarm system that can alert the user when the robot has arrived at its destination, an LCD and keyboard that allows the user to select a destination, and an emergency system that activates if the robot is subjected to a security breach. The PIC microcontroller 16F877A is in charge of all activities. The focus of this study is on AI-assisted robot delivery of goods.

The literature review provides insight into past Robot delivery approaches that have been created or attempted. It provides information on the different papers and publications that researchers have produced. The Algorithm offers a quick overview of the technologies that will be utilized in the implementation. The methodology provides an overview of the Robot's operation, as well as the phases involved in the process, which are depicted in a flow diagram. The image processing with the Raspberry-Pi camera and the CNN algorithm's operation will be defined by the technique's implementation. The robot performance variables such as trajectory completion accuracy, heading angle precision, and detecting range are discussed in the results section.

II. LITERATURE SURVEY

The author of this work [1] made a suggestion. During the COVID-19 epidemic, one of the most hard-hit industries was the catering sector, which was forced to rely on delivery and takeaway services to make ends meet. Traditional takeout's, on the other hand, demand customers to wait in line, order, and pick up their meals, resulting in needless human contact and inefficient service. To overcome these shortcomings, we propose a contactless meal order and takeout service (Mots) automated system powered by AI-assisted smart robots. In our Mots system, we create bump-free schedules for grouping robots into numerous non-colliding moving batches using the Welsh-Powell coloring method. Under simulated situations for various cafeteria sizes and shop popularity disparities, simulation findings demonstrate that our Mots solution can successfully enhance takeaway efficiency and raise service accuracy, raising company profits by up to 95.4 percent, as compared to typical takeaway. Our tests show that Mots can also handle a sudden influx of patrons in a short period of time. We've also built a proof-of-concept prototype to show how our Mots automated operations work.
In order to better user-oriented service delivery, offer a soft service robot, e-SBOT, according to the author in paper [2]. It acts as a "bridge" between a user and a plethora of

external services. It assists in the discovery of relevant services and the construction of coarse-grained service solutions by detecting a user's explicit and implicit intentions and requests For intention reasoning and service solution planning, both a global and a personal knowledge graph are used. Sensors are built to respond to the ever-changing nature of external services and resources. The user's cognition might be greatly enhanced by using e-SBOT. This article provides a brief overview of the technological hurdles, architecture design, and important theoretical issues that e-SBOT faces. This article provides a brief overview of the technological hurdles, architecture design, and important theoretical issues that e-SBOT faces. This document just provides information on the project's execution, but it is not carried out in practice.

The author of paper [3] stated that a major goal of today's e-economy is to create a system for the flexible and personalized conveyance of products. Autonomous electric cars offer a viable option for this duty in metropolitan and densely populated regions, while also addressing environmental concerns. While transport robots are widely used in interior contexts, autonomous vehicles are rarely seen outside. In this work, we address this gap by adapting and transferring robotics principles to autonomous cars for usage in the outdoors. We demonstrate an autonomous vehicle that can safely operate in urban areas while also effectively delivering packages. We'll focus on a scalable and reliable mapping and navigation procedure that serves as the foundation for the delivery vehicle's capabilities. Furthermore, we present preliminary findings from the system's implementation in two urban situations. This article describes an autonomous vehicle that can safely operate in urban areas while also effectively delivering items. According to the study, they use GPS navigation to transport packages outside of the environment, but this has yet to be applied anywhere, and nations like India find it difficult to install autonomous robots due to our dense population.

III. ALGORITHM USED

Artificial intelligence is a science and technology that combines fields such as computer science, biology, psychology, linguistics, mathematics, and engineering to create intelligent machines. The development of computer functions associated with human intelligence, such as thinking, learning, and problem solving, is a primary focus of AI. Artificial Intelligence is a method of creating a computer, a computer-controlled robot, or a machine with artificial intelligence, or software that thinks intelligently in the same way that intelligent humans do. AI is achieved by first researching how the human brain works, as well as how humans learn, decide, and operate when attempting to solve a problem, and then applying the findings to the development of intelligent software and systems. Artificial intelligence, in its most basic form, is a subject that combines computer science with large datasets to solve problems. It also includes the sub-fields of machine learning and deep learning, both of which are commonly addressed when discussing artificial intelligence. These fields are made up of AI algorithms that aim to develop expert systems that can make predictions or categories depending on the information provided. There are two forms of artificial intelligence.

Narrow AI is another name for weak AI. Artificial Narrow Intelligence (ANI), often known as AI, is AI that has been trained to do specialized tasks. The majority of today's AI is driven by weak AI. This sort of AI is everything from weak, therefore ‘narrow' would be a better characterization.; It allows a wide range of applications, including Apple's Siri, Amazon's Alexa, IBM Watson, and self-driving cars.

Artificial General Intelligence (AGI) and Artificial Super Intelligence (ASI) make up strong AI (ASI). Artificial general intelligence (AGI), sometimes known as general AI, is a hypothetical type of AI in which a machine possesses the same intellect as humans and has the capacity to solve problems, learn, and plan for the future. Artificial Super Intelligence (ASI), sometimes known as superintelligence, would outperform the human brain's intellect and abilities.

IV. METHODOLOGY

The goal of this project is to create a Smart Delivery Robot that can deliver items in a safe and sanitary way without the need for human interaction. A robot's operation is depicted in the block diagram below. It includes a PIC 16F877A microcontroller, a Raspberry Pi, a camera, a keypad, an LCD, an L298 motor driver, a relay, a buzzer, and a GSM module for sending OTP to the receiver.

Because it links to communication devices like GSM, Raspberry-Pi, and L298 Motor Driver, the PIC 16F877A Microcontroller serves as the project's heart. When a destination is specified, the Raspberry Pi camera finds a short path to the target and begins moving toward it. When the robot approaches the destination, an OTP is produced using the GSM system to confirm the package's security. When the robot gets at its location, the buzzer serves as an alert mechanism.

The image processing of the robot system is done using simple CNN techniques. The Raspberry-Pi interfaced camera compares real-time path photos with previously supplied path images saved in the system using CNN techniques. When the real-time photos are matched with the specified images, the robot begins to move in the correct direction.

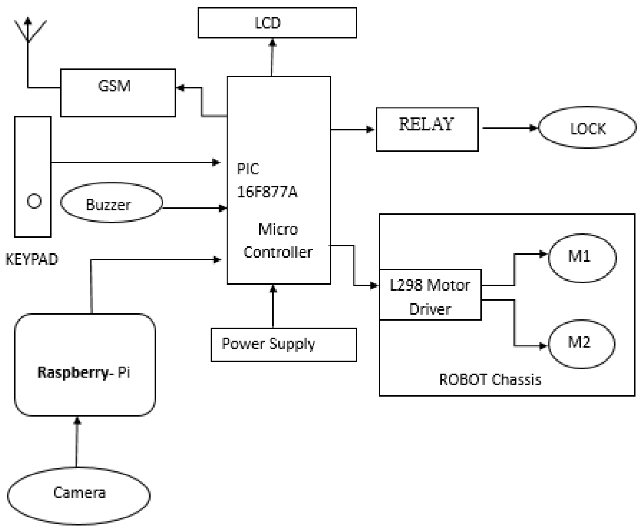

Figure 1: Block diagram

A) FLOWCHART

The complete work cycle of Smart Delivery Robot is represented in Fig.2

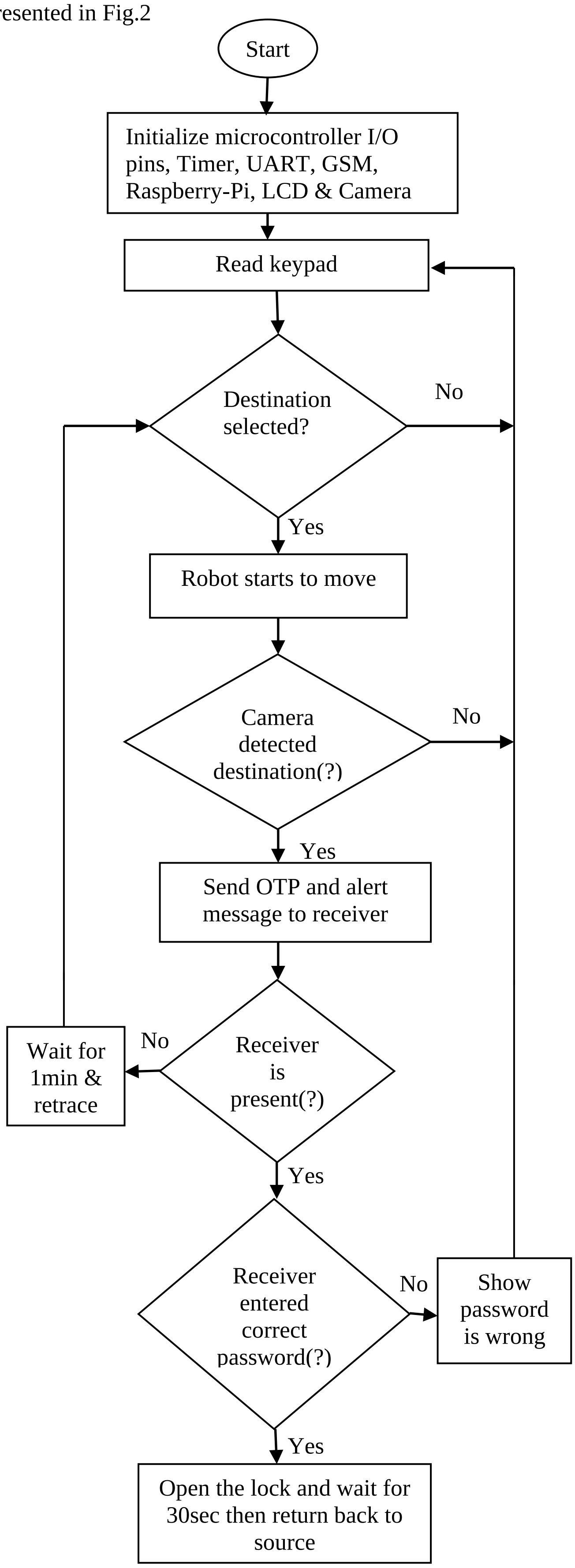

Figure 2: Flow Chart

Step-1: The robot will be turned on.

Step-2: Initialize the microcontroller I/O pins, TIMER, UART, GSM & LCD display, Raspberry pi & Camera.

Step-3: The inputs will be given to the robot, and then with the help of camera, the robot will recognize the path for the destination.

Step-4: After the inputs are received, the robot checks for destination. If the destination is selected, then the robot starts to move towards the destination.

Step-5: If the destination is not selected then the robot will not move and will ask robot to select destination.

Step-6: When destination is selected, the robot will recognize the path and starts moving.

Step-7: When the robot reaches the destination, it will notify the receiver with a sound and SMS with pin will be sent.

Step-8: Once the robot reaches the door, the receiver should enter the correct password. When the correct password is entered then the package will be delivered or else the emergency SMS alert will be sent to the source.

Step-9: If the receiver is not present at the destination, the robot waits for a period of 1minute.

Step-10: After reaching the source same procedure will be repeated for other deliveries.

V. IMPLEMENTATION

CNNs are a type of Deep Neural Network that can detect and categorize certain characteristics in images, and they're commonly employed for image analysis. Image and video recognition, image classification, medical image analysis, computer vision, and natural language processing are only a few of their uses. The mathematical function of convolution, which is a specific form of linear operation in which two functions are multiplied to generate a third function that indicates how the shape of one function is affected by the other, is denoted by the word "Convolution" in CNN.

Figure 3. Flow of Image process

The process of collecting an image with a sensor (such as a camera) and turning it into a controllable object is known as image acquisition (for example, a digital image file). Scraping is a popular picture capture method.

Image enhancement is the process of improving the quality of a photograph in order to extract hidden information for further processing.

Image restoration also enhances the image's quality, primarily by eliminating potential corruptions to provide a cleaner version. This method is based on probabilistic and mathematical models and may be used to remove blur, noise, missing pixels, camera miscues, watermarks, and other blemishes that might interfere with neural network training.

Color image processing includes the manipulation of colored pictures in various color spaces. We can talk about RGB processing (when colors are allocated grayscale values) or pseudo color processing (when colors are assigned grayscale values) depending on the picture type (for images acquired with a full-color sensor).

Image compression and decompression allow you to change the image's size and resolution. Compression reduces the size and resolution of a picture, whereas decompression restores the image to its original size and resolution.

The forms and structures of the items in a picture are described via morphological processing. When producing datasets for training AI models, morphological processing methods might be employed. Morphological analysis and processing, in particular, may be used at the annotation step, when you specify what you want your AI model to detect or recognize.

The technique of detecting certain properties of specific objects in a picture is known as image recognition. Object detection, object recognition, and segmentation are common approaches used in AI image recognition. This is where artificial intelligence solutions really shine. You're ready to design, train, and test a real AI solution once you've completed all of these image processing steps.

The process of displaying and explaining processed data is called representation and description. AI systems are made to be as productive as feasible. An AI system's raw output seems to be an array of numbers and values that reflect the data the AI model was taught to create. You may transform these data into understandable visuals with the help of specific visualization tools. You may transform these arrays of numbers into legible pictures suited for further investigation using specific visualization tools.

VI. RESULTS

PIC Microcontroller acts as center of all operations taking place in the Robot. The Robot is programmed in such way that it operates in two states.

MICROCONTROLLER POWER STATUS	ROBOT MOVEMENT STATUS
LOW	REMAINS AT SOURCE
HIGH	STARTS MOVING TOWARS DESTINATION
LOW	STOP AT DESTINATION
HIGH	CONTINUES TO MOVE

Figure 4. Robot Movement condition

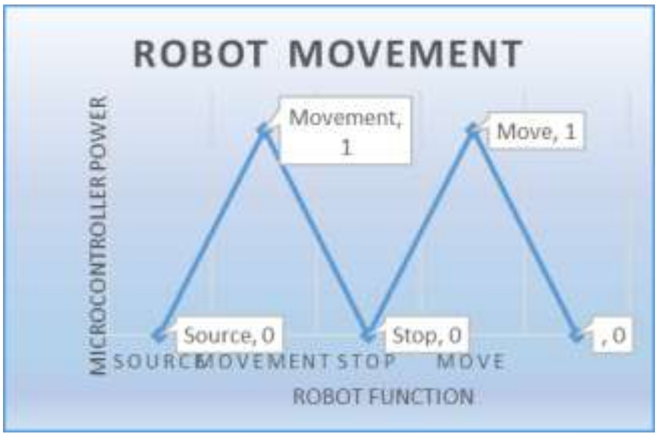

Figure 5. Robot function graph

The camera interfaced to Raspberry pi traces the path and identifies the destination from a particular distance.

DISTANCE	CAMERA STATUS
25cm	NO
25.5cm	YES
26cm	YES
26.5cm	YES
27cm	NO

Figure 6. Camera detection range

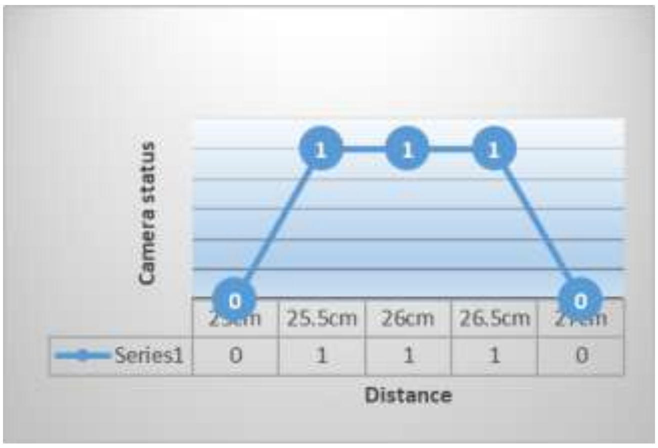

Figure 7. Camera detection graph

The GSM generates OTP when parcel delivery reaches the destination. The receiver should enter correct OTP in order to collect the parcel.

OTP STATUS	LOCK STATUS
MATCHED	OPEN
UNMATCHED	DON'T OPEN

Figure 6. Lock status

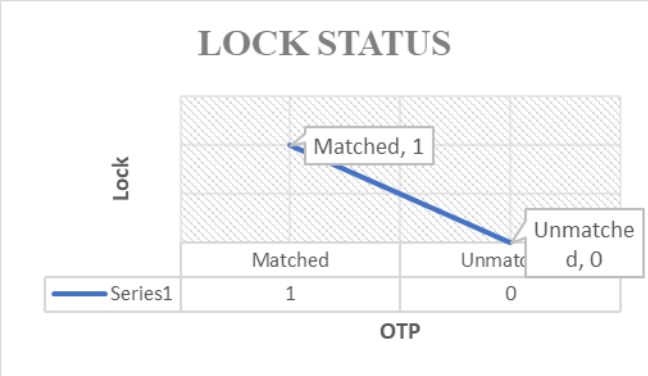

Figure 8. Lock status graph

The lock unlocks and shows a message to collect the parcel when the receiver enters the proper OTP. If the recipient types in the incorrect password, the robot shows an incorrect OTP that is not deliverable. The Robot waits one minute if the recipient is not present at the destination. If no input is supplied, the Robot will stop delivering and restart from the beginning.

Each time we ran the robot in the trajectory completion accuracy experiment, we also tested the password-protected container. Before running the robot, we updated the password and tested it once it completed its course. In all of the tests, the password-protected container performed flawlessly, with a 100% accuracy rate.

Test No.	No. of experiments	No. of times trajectory completed	Trajectory completion accuracy rate	Number of times password worked	Password accuracy rate
1	10	9	90%	10	100%
2	10	8	80%	10	100%
3	10	9	90%	10	100%
4	10	10	100%	10	100%
5	10	10	100%	10	100%
6	10	10	100%	10	100%
7	10	10	100%	10	100%
8	10	10	100%	10	100%
9	10	9	90%	10	100%
10	10	10	100%	10	100%

Figure 9. Trajectory accuracy

We measured the robot's real heading angles and the current heading angles following the motor drive in the heading angle accuracy experiment. The robot analyses the data and executes the move moment in accordance with the PI-recognition Cameras of the track heading front. We took ten samples and found that the heading angle accuracy ranged from 94.66 percent to 98.52 percent, with an average of 97.19 percent.

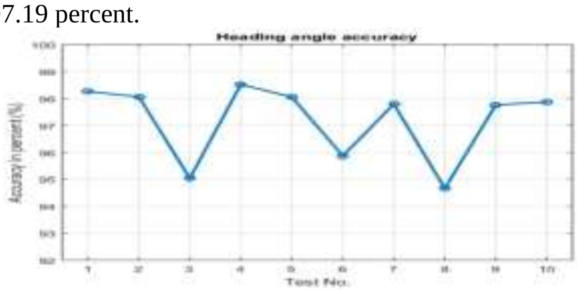

Figure 10. Heading angle accuracy

VII. CONCLUSION

During the coronavirus pandemic, we propose an AI-assisted robotic system that provides contactless meal order and takeout service (Mots). As preserving social distance has become the new normal, our technology seeks to reduce human contact while yet meeting dietary requirements with service promptness and accuracy. The antenna had to be installed on the transmitter and reception circuits in order to enhance the distance that could be covered by a series of data transmissions. We conclude that our study offers a viable and cost-effective method of delivering the robot without the need for human interaction. The project makes use of a variety of modern technologies, including the Internet of Things, robotics, and artificial intelligence. We can tackle one of the primary and developing problems of human existence and resource exploitation to some extent by integrating these technologies.

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