Covid Assistive Robot For Airport

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Abstract—A humanoid robot designed for Kochi metro. The primary purpose of the robot is station maintenance.It includes cleaning the station areas, crowd control in all the stations, passenger assist, and passenger safety. According to our idea, we assign one robot in each metro station. When the number of passengers in queue is more than 15, taking tickets is a difficult task. In a situation like this, the robot will move to the ticket counter and start vending tickets. It can generate e-tickets which can send to the passenger. If the passenger count is less, then the robot moves around the station with an active cleaning system. It can provide passenger assist like train time, ticket fare, and guide them to desired location when passengers ask(digital voice assist). There will be a system at the platform to monitor passenger and provide safety. If the passenger crosses the safety zone the system will give the safety precautions. The whole system can be monitored and controlled wirelessly. All the robot activities, sensor details, and passenger feedback will be uploaded to the cloud. The metro train is smart; by introducing metro bots the stations also become smart.

In times of spreading communicable diseases like Covid, this system has greater application. At current situation, a human assist is needed to check and sort the people having fever or any symptoms in areas like airport, hospitals and all. The chances of spreading diseases is very high during this situation. This risky take of human being can be replaced by a robot. This paper also provides solution for tackling the spread of communicable diseases like Covid.

I. Introduction

A humanoid robot resembles a human physical structure. It is actually designing a tool that is capable of working with humans and not trying to recreate human. By implementing robots, the workload of human can be reduced. The dangerous tasks done by the humans can be replaced by the robots. Thereby it will be a protection to the human life and health. Robots will not decrease the efficiency as the works get progress like humans. There will be greater advantage for humans by introducing the humanoid robots.

The current metro station is smart. The cleaning purpose is carried out by the humans itself. This can be replaced by robots such that the metro stations become more faster. This will be help full for the people who are engaged in the cleaning processes during late night shifts. There is also mechanism for providing crowd in the metro stations. When the passenger count is more than fifteen, the robot will be engaged in ticket generation mechanism and otherwise it will be doing the cleaning purpose. The metro bot can provide passenger assist and passenger safety for the travellers. It is specially designed to answer the queries of the passengers with the help of a chat bot.The passengers can details of the train timings, platform directions and any other queries by communicating with the robot.

This is not only applicable for metro stations. By altering certain algorithms it can be used for airports, malls and hospitals. In times of spreading communicable diseases like COVID, it is very dangerous to appoint a human to check the temperature level of the passengers arriving at the airports and hospitals. We can replace the humans work by a humanoid robot to sense the temperature level and then sort the people accordingly. This can be done by implementing a temperature sensing system in the robot so that there will be no worry of spreading communicable diseases and human life will be saved.

II. CASE STUDY

A. Crowd control in Metro Stations

1) Problem Statement: The hours just before office-timings (usually around 7 AM to 9:30 AM) experience an increment in the number of passengers inside each stations, which result in lengthy queues in front of ticket counters.Due to the unpredictable length of queues,many passengers could not get into the train at desired time and many could not report at their offices on time.

2) Solution: As part of the proposed system, a 'counting system' will be installed near the ticket counter,where the queue usually occurs.Our research indicates that during peak time,queue can get extended even up to more than 30 per-sons.The installed 'counting system' informs the Robot,when queue has exceeded 15 persons.The proposed solution is that,upon receiving acknowledgement from 'counting system', the Robot automatically navigates to the ticket counter and starts issuing tickets on its own.

3) Technical Implementation: The counting system consists of a light source and a photo-diode.As passengers pass through,interruptions occurs in the ray of light which is continuously received by the photo-diode and thus count is made.Likewise this unit always monitors the count of passengers in the queue at each instant. When the count exceeds 15,the counting system will upload the live count to an online cloud.The cloud service we used was 'Adafruit'.Using a cloud service, we can make the project internet-connected and also we can connect to other internet-enabled devices.

Metro Bot is authorized to access the data uploaded on the cloud,remotely.When the count is updated above 15,the Bot is acknowledged and it initiates a navigation algorithm to reach

the ticket counter. Then the Bot will act like an alternative source for issuing tickets and thus the delay for providing tickets is reduced.

B. Passenger assist by Metro Bot

1) Problem Statement: When circumstances in which the employee in 'Enquiry' section is not available in the station, passengers who are new to Metro station may find it difficult to locate ticket counter,find way to respective platforms,know about train timings,know about availability of trains on par-ticular time of any days etc. In these cases passengers feel unsatisfied about the Metro station environment.

2) Solution: If the Enquiry-employee is not present,the solution proposed is to simply approach the Metro Bot. If the passenger wants to know about train timings or any possible queries related to Metro trains, the Metro Bot will reply them with suitable answers,upon hearing their queries.Those who cannot find way towards any platform, will get assistance of the Bot by showing them the right way.

3) Technical Implementation: Voice assistant feature, nav-igation feature and the 'screen display' of the Bot will help the passenger to eliminate any of their confusions or con-cerns.These three features are essentially enough for enabling the Bot to be replaced as a Enquiry-employee in Metro stations.The efficiency of Metro stations also will be upgraded by the implementation of Metro Bots.

If a passenger,new to Metro Station,finds difficulty in gaining knowledge about train timings, he is then supposed to ap-proach the Bot and just ask his query.The bot will listen to his words and through 'Natural Language Processing'(NLP).It will process the words that he just said.

The Bot will be already fed with a Chat-Bot which enables it to speak replies,after hearing and processing the concerns of passengers.For the smooth functioning of Chat-Bot ,the system will be given access to a large database which contains all the possible queries that we can expect from passengers along with their suitable answers.After processing the words said by the passenger using NLP, the system will check for matches or 'tags' in the database.After finding the suitable match,the Bot will speak the respective reply.

If the passenger needs to know the way to a particular spot on the floor,the Bot utilizes its navigation feature.Using NLP the system understands that he needs a route to a spot and it activates navigation feature.The whole floor plan will be already stored in the system.If a person needs to go to Platform 1,the system will search and find easiest route towards Platform 1 from their current position and it speak to the person to follow it.Then the Bot will move in the formulated route.The person can then follow it and easily finds the way without any confusion. Also the Bot will consists of a "screen display' in its body.In this screen information about the next train,weather updates,latest news about Metro etc. will be shown.By this feature,these basic data will be always available to the users,even without having an interaction with the Bot.

C. Cleaning Mechanism in Metro Stations by Metro Bot

1) Problem Statement: Since majority of the cleaning labourers are women,the service of cleaning labourers are not available after 6 PM in Metro Stations.This pose a great challenge in the maintenance of hygiene ,during the crowded late-nights.

2) Solution: During the hours when cleaning labourers are not available, apart from Passenger-assist and Crowd-control ,the Bot serves a special service of cleaning the Station floors.A specially designed cleaning system is fixed at the bottom of the Metro Bot and it navigates according to the 'cleaning algorithm'.During the motion according to cleaning-algorithm ,it performs cleaning action with the help of the attached Cleaning system.

3) Technical Implementation: The cleaning system consists of Motor,a roller and two circular rotating-brushes.A space for collecting the waste materials and dust called the 'collection chamber' is also part of the cleaning system.During the motion of Bot,the rotating-brushes rotates due to the motor action and this will result in sucking up of dust and other particles.The waste materials will get accumulated on the collection chamber and when this chamber get filled with dust,it can be manually operated to empty the chamber. We already loads the floor plan to the system.Distance between walls,existing obstacles and all relevant features on the floor will be then automatically known to the Bot.The bot starts cleaning from any corners and then it moves to opposite wall.Bot knows the distance it has to move forward, in-order to reach opposite wall.When it reaches there, it takes a U-turn and continue its movement until the whole area is covered.If any passenger or obstacle accidentally appears before the Bot,'Obstacle avoidance algorithm' will get initiated and it will act accordingly.

D. Database Generation by Metro Bot

1) Problem Statement: Currently,Metro is collecting only the digital data of purchasing tickets.Now,Metro lacks a sci-entific method for predicting the future consequences of each plans and also for the suggestion of necessary development guidelines to be conducted immediately.A complete and func-tional database,containing every piece of in- formation about Metro Stations, is very much required for the proper foreseeing of upcoming development plans.

2) Solution: As a Robot is directly involved in the proposed project, Data collection can be made automatic and very easier.Using Metro Bot,a huge and complete database can be generated which not only contains money transaction records of tickets but also frequently asked questions by the passengers to the Bot,timings in which each staff is not available,most pre-ferred travel route of passengers and many more.By applying Machine Learning to this comprehensive database,scientific approximations about future can be formulated.

3) Technical Implementation: If implemented, the Metro Bot will be involved in almost all the activities happening in Metro Stations.So, Data collection from every activities can be done by the Bot itself,without manual help.If Bot is

not employed in Database generation, the only option left is to create digital data by a human.In this case, the employee should be worried about each activities and has to collect record data accurately without making errors.Employing human instead of a Robot has a probability for making errors, which seriously impacts the final output from the created database.

Actually, by creating a vast database, we are recreating Metro station in a digital data format.All the works and per-formances will be digitally recorded.Machine learning gives the system the ability to learn without being explicitly pro-grammed.

Machine learning approaches can be supervised, unsuper-vised or rein- forcement learning.

III. PROBLEM STATEMENT

In station areas, the cleaning activity usually done by the humans. It will be difficult for the late night workers. There is no mechanism to control the crowd over the stations. The stations also doesn't have passenger assist and passenger safety systems.

IV. PROPOSED SOLUTION

Our objective is to find a solution to design a "KOCHI METRO BOT". The primary purpose of the robot is station maintenance. It includes cleaning the station areas, crowd control in all the stations, passenger assist, and passenger safety.

V. BENEFITS OF USING KOCHI METRO BOT

- Lesser human intervention.
- Efficient way of crowd control
- Passenger assist and passenger safety
- Efficient method of cleaning

VI. DESIGN METHODOLOGY

One robot is assigned in each metro station. When the number of passengers in queue is more than 15, taking tickets is a difficult task. In a situation like this, the robot will move to the ticket counter and start vending tickets. If the passenger count is less, then the robot moves around the station with an active cleaning system. It can provide passenger assist like train time, ticket fare, etc when passengers ask. When there are more than 30 passengers at any station the crowd control will be difficult. So a robot from another station will come to that particular station and assist crowd control. After proper execution of the task the robot will return back to its station. The whole system can be monitored and controlled wirelessly. All the robot activities, sensor details, passenger feedback etc will be uploaded to the cloud.

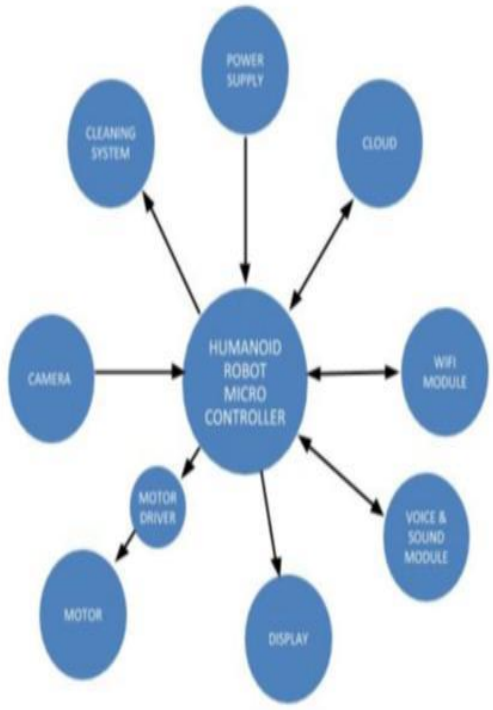

Fig. 1. Block Diagram

VII. BLOCK DIAGRAM

VIII. HARDWARE REQUIREMENTS

The hardwares used in the implementation of this system are: • Raspberry pi

- Voice recognition and sound module
- Pi display
- USB camera
- 4 motor, motor driver and wheel
- Cleaning system
- Robot body

IX. TECHNOLOGY USED

- Image processing: For finding the path of the device and to recognize various obstacles in the path.
- Robotic navigation: Robotic navigation is important for avoiding dangerous situations such as collisions and unsafe condition.
- Machine learning: To train the device to move with the previous data. After the trial run the proposed equipment will be self-driven and can make it into an unsupervised device.
- Mechatronics: For the actual movement of our device.

X. ALGORITHM

1. Start
2. Initialize sensors
3. Go to pre-defined starting point.

4. Initialize floor cleaning algorithm.
5. If the robot encounters an obstacle in front of it;
(a) Run obstacle-overtake algorithm.
(b) Go to step 4.
6. If passenger count becomes higher than 15 in the queue;
(a) Save the current position of robot.
(b) Go to ticket counter.
(c) Run ticket generation algorithm.
(d) After crowd control, go back to saved position.
7. If the robot encounters a passenger;
(a)Stop cleaning process.
(b) Start listening.
(c) Run voice assistant algorithm.
(d) Go to step 4.

XI. FLOWCHART

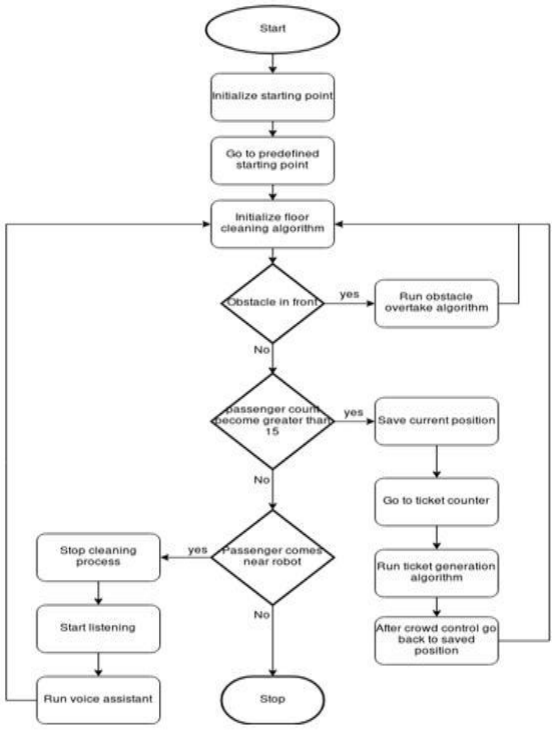

Fig. 2. Flowchart

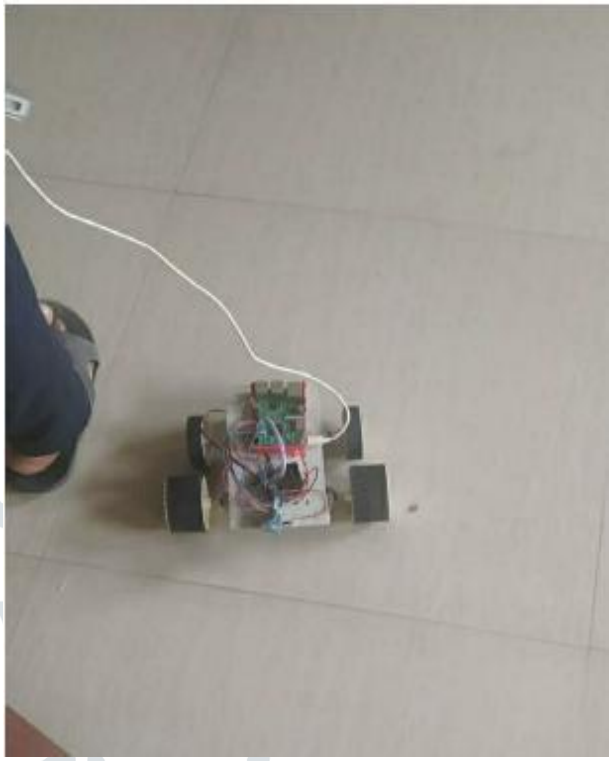

Fig. 3. hardware

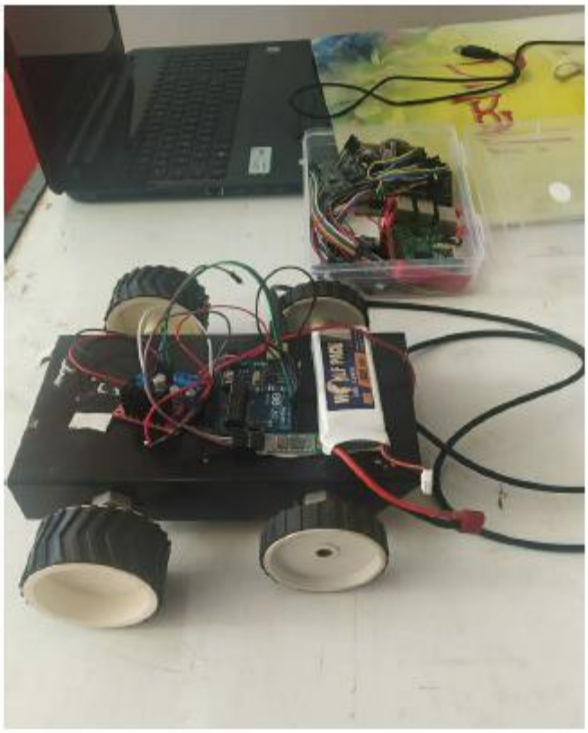

Fig. 4. hardware

XII. HARDWARE IMPLEMENTATION

The main controller used is raspberry pi. There are mo-tor drivers and dc motors used. The dc motors helps for controlling the movements of the robot. There are obstacle avoidance sensors used for detecting the obstacles in the path.The ultrasonic sensor is used for obstacle avoidance.For voice recognition mike is used in the system. The power is supplied by the LiPo battery which provide a DC 12 volt supply.

Fig. 5. 3D Model

Fig. 6. 3D Model

XIII. Application of System in Times of Communicable Diseases

The robot is working without human interface so there will not be any chances for spreading communicable diseases like Covid.

The ticket generation is online, so without contact people can take tickets in any situation.

A system for checking fever can be implemented on the robot so that a human is not needed for checking fever. This system can be implemented on the airports for recognizing whether the person has temperature or not without a human assist.

Usually people are checked whether they have fever before entering to the hospitals. This can also be applicable for hospitals for sorting people without a human assist.

By implementing the system there will not be chances for spreading communicable diseases in the above areas.

XIV. ADVANTAGES OF SYSTEM OVER OTHER TECHNOLOGIES

The current ticket vending mechanism is very slow and there is no system to maintain the crowd. The Kochi metro bot have many advantages over the existing technologies:

- The robot is fast and accurate.
- Cleaning process can be done faster and easily.
- Metro stations will become smart.
- Monitoring the stations is very easy.
- More job opportunities of employment for skilled labours.

XV. DISADVANTAGES

- By introducing this technology, there will be chances of unemployment for the unskilled labours.
- Platform cleaning must be done by humans, cannot be operated by robots.

XVI. FUTURE SCOPE

This system is not only applicable for metro, by altering some algorithm it is suitable for other commercial applications like :

airport
mall
hospitals.

XVII. CONCLUSION

In this paper, we have presented an ‘KOCHI METRO BOT” which is capable of station maintenance, passenger assist, passenger safety and ticket vending mechanism. The current ticket vending mechanism is very slow and there is no system to maintain the crowd. To make the metro stations more efficient, ‘KOCHI METRO BOT’ is proposed with active ticket vending mechanism and crowd control. The robot is safe and fast. The crowd over the metro stations can be easily controlled and could engage in active cleaning when there are fewer crowds. The metro bot can also provide passenger

assist and passenger safety. This system is not only applicable for metro, by altering some algorithm it is suitable for other commercial applications like airport, mall, and hospitals. By the introduction of Kochi Metro bot the monitoring of stations become easier and the Kochi metro become smart..

XVIII. REFERENCES

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