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End to End Data Transfer using security solutions for Mobile Robotics Communication

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Abstract: There is a tremendous velocity to the development of new mobile technology and gadgets. There are several mobile gadgets and technological options available on the market. Wireless networking is now one of the most widely used and critically vital mobile technologies. However, the development of this technology has not been fully exploited as a controller for mobile robots. Industry, production, and even security are all represented within the realm of robots. The articles herein detail the author's exploration and study of mobile technology as a controller for mobile robots. In this study, we focus primarily on contrasting different methods of data transport for mobile robot controller. Data Oriented Transfer Service (DOT), Distributed Parallel Storage System (DPSS), Grid File Transfer Protocol (GrFTP), and Black-Bus were some of the methods investigated. We suggest further research into developing a mobile robot controller using 4G mobile technology. Benefits to both users and mobile device makers from this study's findings to enhance mobile device usability are anticipated.

Keywords: Mobile Robot, Mobile Robot Controller, Wireless Communication, Mobile Technology, Data Transferring Technique.

I INTRODUCTION

Depending on the context of its deployment, a mobile robot may assume a variety of shapes and configurations. There are several universities and research centres devoted to robotics, and many of them are working on intelligent mobile robot systems [1-5]. In the modern world, robots can do everything from driving and walking to swimming and even flying. Designing and controlling a mobile robot requires an adequate sensor. This mobile robot is controlled by a wide range of mechanisms. Similar to [6], as wireless communication technology develops for mobile robots, it seems more likely that we will be able to command a robot housekeeper, wheelchair, or driverless automobile from the palm of our hand. The usage of 1G, 2G, or 3G mobile device or website technology is irrelevant.

Particularly for sectors that employ mobile robots to boost business, such as manufacturing and security, more research is required to vary the controller mechanisms of mobile robots. For a mobile robot to function independently, its controller must simultaneously process a large number of tasks. Motion control, sensing, planning, navigation, etc., fall under this category [7]. The most recent innovations in robotics enable remote operation of mobile robots.

Robots may be controlled using smartphones and other mobile devices. The reason it was picked is because it has certain capabilities with wireless data transmission technology[8]. Mobile devices with GSM or UMTS may utilise Bluetooth or wireless LAN to control an object while it is in close proximity to that object. However, this technique is useless over very great distances. That's why the mobile device will employ 4G connectivity to command the robot's motion. As stated in [9], 4G technology was selected as the mobile robot controller because it provides users with access to the Internet at rates of up to 2 megabits per second (Mbps). Faster delivery of video, audio, and data from a broadband wireless network of mobile phones to desktop and portable computers is made possible by this development in wireless telecommunications network technology. Applications such as high-performance wireless

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web and email, video conferencing, and multimedia services that combine voice and data streams are developed, as in [10]. As a result, the video call may be used to create a prototype for mobile robot control in real-time systems, allowing the user to see the robot's movement in real time. This allows the user to operate the mobile robot from afar, regardless of time or location.

Furthermore, both mobile robots and mobile technologies are utilized in the creation of this prototype, as is a data transfer technique. It will factor in the possibility of the mobile robot receiving data through 4G connections from other mobile devices. The data communication methods to the mobile robot are also part of this study. C, C + +, Java ME, and other modern programming languages will all be used in the prototype's development. Words used in computer programming. Development and, later, a prototype need taking the right approach. The suggested method of data transport may be tested in detail.

II RELATED WORK

Numerous approaches to controlling wireless mobile robots have been developed and are still in various stages of implementation in projects all over the world. Mobile robots can communicate with one another and with computers through wireless networks. A multi agent established inside the robot system, or a wireless computer, may therefore operate the mobile robot. Nonetheless, there are constraints. One drawback is that there is only one-way and half-duplex communication. Additional applications are not being developed for real-time use, as in [6].

2.1 Mobile Robot Controller

Fuzzy logic [11], neural networks [12], the World Wide Web [13], Bluetooth [6], and wireless [14] are only few of the existing mobile robot controllers.End-to-end Mobile Tele-Echo grapy Performance Analysis, as in [15], It has been accomplished to use an Ultra-Light Robot (OTELO) using the 3G communication network. Audio and video data transmission is a primary use case for several network protocols. User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Real-Time Protocol (RTP), and Real-Time Transport Control Protocol (RTCP) are all examples of transport protocols for audio and video data. Typically, a single video channel will use UDP as its transport protocol. In order to facilitate real-time applications, RTP has become an industry standard Internet protocol. The RTP management protocol is integrated with RTPC. Its purpose is to give quality-of-service feed-back for RTP session entries in the programmed. However, the system relied on RTP/UDP/IP protocols. The robot receives and sends data via the UDP/IP protocol. In Figure 1, we see the OTELO Mobile Robotic System linked through 3G.

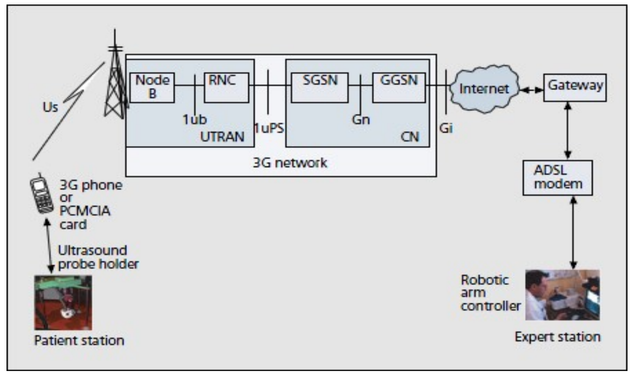

Fig 1- Robotic Mobile System OTELO

2.2 Mobile Communication

There has also been a review of mobile device technology from the first generation (1G) to the most recent iteration (3G) [16]. Analogue voice services at up to 2.4 kbps can be sent via a 1G wireless communications network. Using a mobile radio system frequency spectrum of 824MHz - 894MHz, Frequency Division Multiple Access (FDMA) is used here as an analogue frequency modulation scheme for 1G. Second-generation mobile networks use digital technology including Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). These days, many people choose for GSM networks, which use a hybrid of FDMA and TDMA called Global Systems for Mobile Communications (GSM). High-Speed Circuit-Switched Data (HSCSD), Enhanced Data Rates for Global Evolution (EDGE), and General Packet Radio Service (GPRS) are all components of 2G +. Third-generation wireless technologies (3G) are the worldwide consolidation of multiple second-generation wireless telecommunications systems, using a few key components and a network of satellites. The ability to bring together several cellular standards under a single roof is a major benefit of 4G wireless technology.

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When compared to 1G and 2G technologies, such as GSM, GPRS, and EDGE, a 3G telecommunications network or line is noticeably faster. Because of this, it is able to do a wide range of tasks that were just impossible with its predecessor. As in [10], a video call is only possible thanks to 4G technology, which also enables callers to view video images of their friends while chatting. However, both parties involved in a 4G call need to possess a 4G phone and pay for 4G service from one of the current telecommunications providers. Other forms of communication, such as wireless networks and the Internet, are included into this 4G system as well, according to [17].

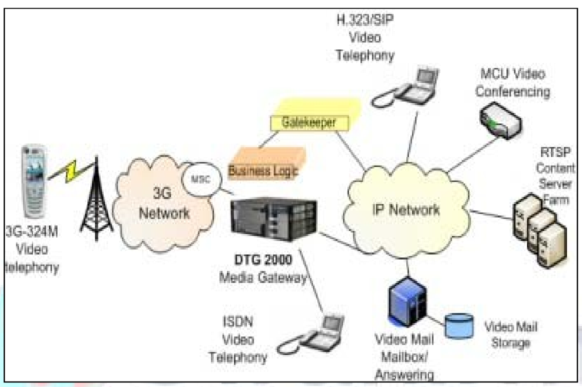

Fig 2- 4 Network

2.3 Data Transferring

Existing data transmission mechanisms, such as those used by mobile robots and mobile devices, have also been studied. A number of Different methods of data transfer, such as Data Oriented Transfer Service [18], The Distributed Parallel Storage System and GridFTP [19], and Black-Bus [20], are the subject of research

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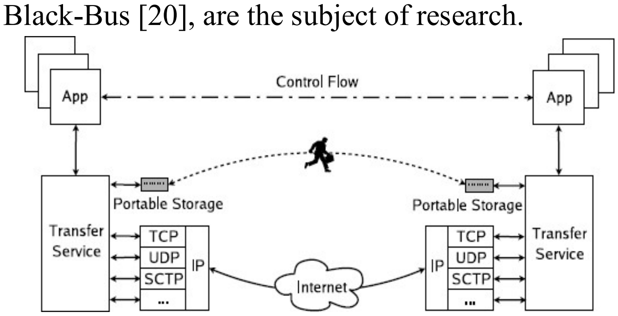

Fig 3- Contextual Analysis of the DOT

The DOT service architecture and implementation are shown in Figure 3. To make it easier for additional transfer methods to be implemented, DOT was created with a streamlined interface to a modular, plug-in-based architecture.

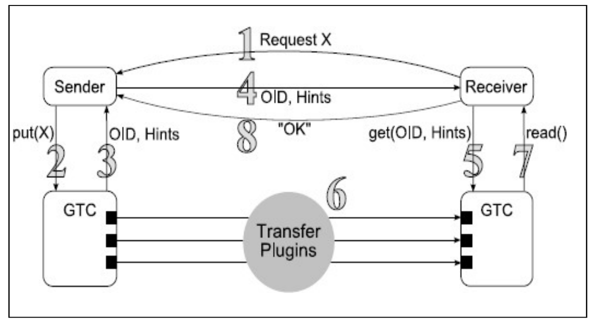

Fig 4- Data over TCP/IP (DOT)

a) The sender, the receiver, and the DOT transfer service are the three fundamental parts of a DOT-enabled data transmission, as shown in Figure 4. Process of this interaction:
b) The receiver starts the process by making a request for object X from the sender on an application level. The sender may not necessarily have started the transaction.
c) The sender puts in a call to its local GTC and sends object X to it through the put operation.
d) After the put is finished, the GTC sends back a hint set and unique object identification (OID) for X. Section 4.2.1 details these clues, which point the receiver in the direction of the data item.
e) The OID and the suggestions are sent through the application control channel from the sender to the receiver.
f) The receiver, via the get operation, tells its GTC to get the item with the specified object is identified.
g) The transfer plug-in the receiver's GTC go and get the item.
h) Object is returned to the caller.
i) The recipient resumes its application protocol after the transmission is complete.

DOT separates the two processes—content negotiation and data transfer—into more manageable chunks. The use of such a transfer service decreases the need for reimplementation at the application layer and makes it easier to integrate new transfer technologies. DOT's many advantages include a reduction of bandwidth

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consumption and the availability of novel features like multi-path or portable storage-based transfers.

The Distributed Parallel Storage System (DPSS) was designed with distant customers connecting via a WAN in mind. When a client employs DPSS, it sends a request to the "DPSS master" process, which then notifies the relevant "DPSS block servers" of the request and the location of the requested data block. After that, the server immediately returns the block to the client.

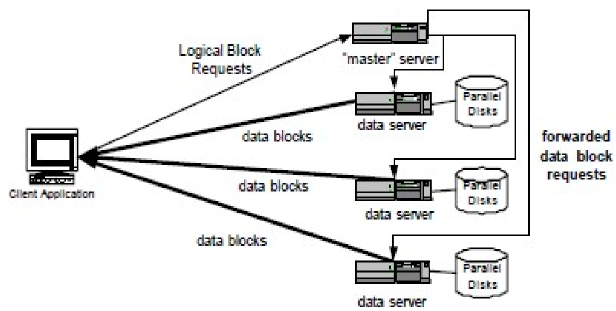

Fig 5 - Architecture for Striped Data Servers

Using these methods still requires additional time and familiarity that is not often accessible to the application developers.

The Grid File Transfer Protocol (GridFTP) is being built into the Globus Toolkit. GridFTP was designed specifically for high-bandwidth wide-area networks, so it can transmit large amounts of data quickly, safely, and reliably. GridFTP-based file sharing allows for both client-server and third-party file sharing. Data is sent between a local client and a distant server, as shown in Figure 6 of the client-server architecture. An interface must be provided by a local data warehouse in order to accomplish client-server transfer. An interface for accepting data must be provided if it is to be received.

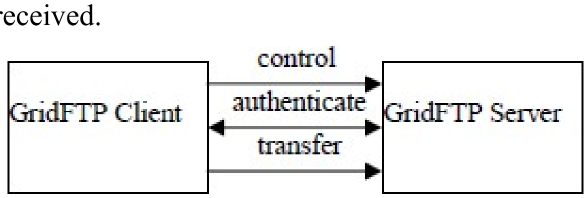

Fig 6 - Client-Server Network Design

Figure 7 depicts the architecture for external data transfer control. There are three components involved in a third-party transfer: a GridFTP client, a source server, and a destination server. The client initiates the transfer by opening two control channels, one to each server. GridFTP is an extension of the FTP protocol that allows for safe and efficient file transfer in a grid setting. Integrating Web services, GridFTP proposes the idea of Reliable File Transfer, which can increase the security of data transmission.

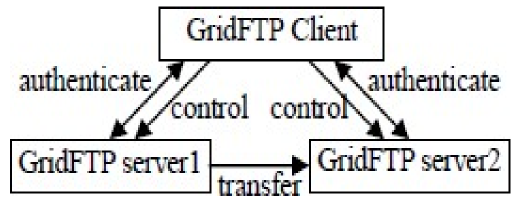

Fig 7 - Model for Externally Managed Data Transfer

Each piece of raw data is assigned a unique ID in Black-Bus, which is used as a type of routing information. Black-Bus architecture is seen in Figure 8. Black-Bus routers allow for any topology to be used, and each node is a CPU or piece of logic with sequencers. Black-Bus aims to transfer raw data like traditional buses or dedicated cable by doing away with the need for complex network interface controller on nodes. On a given path, raw data packaged into a single flit packet with a local identifier is transmitted over the physical channels.

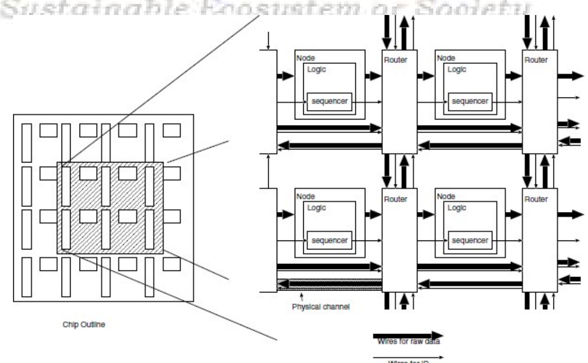

Fig 8 – Black-Bus Route Architecture

Typical instances of NoCs for streaming processing and numerical parallel programmed have an entry size that is fairly tiny relative to the size of the network, making it possible to execute Black-Bus data-transfer with just a few wires for ID transmission in a physical channel. Black-Bus has several benefits, including the fact that, in a 16-node system, the local ID may often be represented by no more than 3 bits, and that data transport costs can be cut by as much as 75%.

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III FUTURE WORK

The primary objective of this study was to develop a method of data transmission between mobile robots and mobile devices. The primary goal is to discover novel methods of commanding mobile robots. The second goal is to provide methods and algorithms for transferring information between mobile devices and the mobile robot. The third goal is to create working prototypes of control systems for mobile robots utilising mobile devices as evidence that the first two goals have been met. There are a number of stages in the evolution of this study. The waterfall model is used for prototyping.

To find a good controller for a mobile robot, we need to do some preliminary research utilising the rules and guidelines already in place. Existing mobile technologies like Bluetooth, Infrared, and others will be examined, as will the method of delivering data to the robot, as well as the technique of data transmission with portable devices. This is the stage at which suitable technology for the management of mobile robots must be identified.

There are usually a few steps involved in developing a prototype. Prototypes and the capacity to manually on paper assess customer response to the scene are crucial in the early stages of development. The prototype is more developed than the scenario and the user at this point in the process, which calls for the user to engage with the simulation. This process is continued until the prototype's designers are happy with the result. The suggested mobile technology will be used in the design and development of a controller for a mobile robot that receives its instructions via mobile devices. The motion will be carried out by the mobile robots in response to received instructions. Figure 9 depicts the planned prototype development.

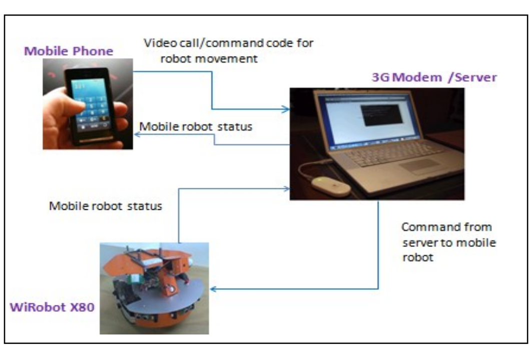

Fig 9 - Proposed Design

The layered framework architecture is shown in Figure 10. The structure consists of a user layer, a communication layer, and an execution layer. The user layer is the interface used by the user. Using a mobile phone, the user can see how the robot is doing and get updates on its status. The function of the communication layer is to update a mobile robot on its current location. There is a robot system in the action layer. All data is shared between the robot system and the server system through a connection.

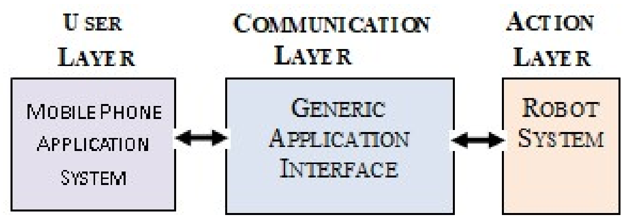

Figure 10 depicts the mobile robot controller system based on the architecture of mobile technology.

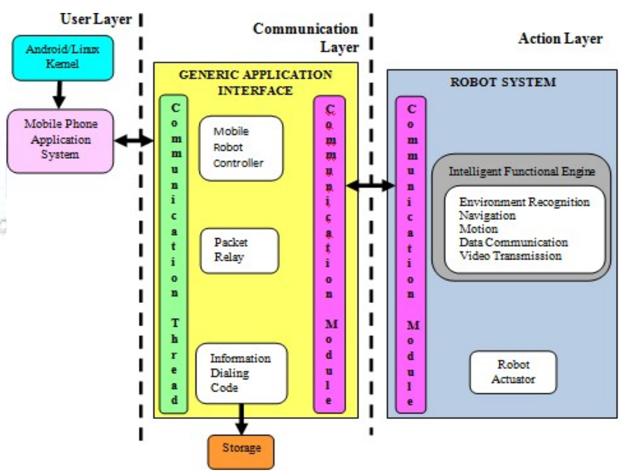

Fig. 11 System for mobile robot control based on the Mobile Technology Architecture

In particular, it may be broken down into the "user" level, the "communication" level, and the "action" level. The user layer is responsible for the interaction with the user, such as the remote. Using the visual data provided by the home gateway, the user can track the location of the mobile robot.

A mobile phone and a mobile robot may talk to one another thanks to the communication layer. The server system at this tier acts as the home gateway, linking the user's mobile phone to the network. It controls the majority of the status data for mobile robots and relays it to the user's phone. The mobile

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robot's status is recorded and kept in a database.

There is a robot system in the action layer. Constantly linked to the underlying communication layer, it exchanges any and all data with it. The robot's actuator regulates its motor and camera, among other physical operations. The intelligent functional engine issues commands, and the generic application interface receives the latest data. The algorithmic control and controller are built in.

After the prototype has been fully developed, testing can begin. In this stage, the use of mobile technology devices like mobile phones is secondary to the identification of an appropriate mobile robot controller. In order to determine how successful these tools are in preventing or reducing

The robot's movable parts in action. The viability of the methods utilised to transmit data from the mobile device to the robot will also be examined in this context. The robot's algorithm for directing its actions is also discussed

IV DISCUSSION

In this study, we present mobile robot control strategies that make it simpler for users to operate mobile robots remotely using their mobile devices. The anticipated outcomes of this study include an algorithm for the mobile robot's instructions, a method for transmitting data from a mobile device to a mobile robot, and novel technological adaptations for use with mobile robots.

Figure 12 depicts the planned system's flowchart. The robotic system's actuator is managed through a smartphone app. The programme cannot be utilised if the video call does not turn on the mobile robot. Make sure the mobile robot is fully operational, and this issue will disappear. Dr. Robot will play a role in this study. This moving robot has a CMOS camera that faces ahead and is linked wirelessly to a central server. The owner of the mobile robot may see its surroundings through smartphone video call. The vocal instructions for moving the mobile robot were heard by the user. The next step is for the user to choose a code to direct the mobile robot's movement. So, this code is used to transmit information from a mobile phone to a mobile robot. Communication layer generic application interface is crucial at this stage. In between the mobile phone and the mobile robot lies this layer. The key process is the exchange of data. Using a mobile phone, a user can navigate a mobile robot and link up with a standard application interface.

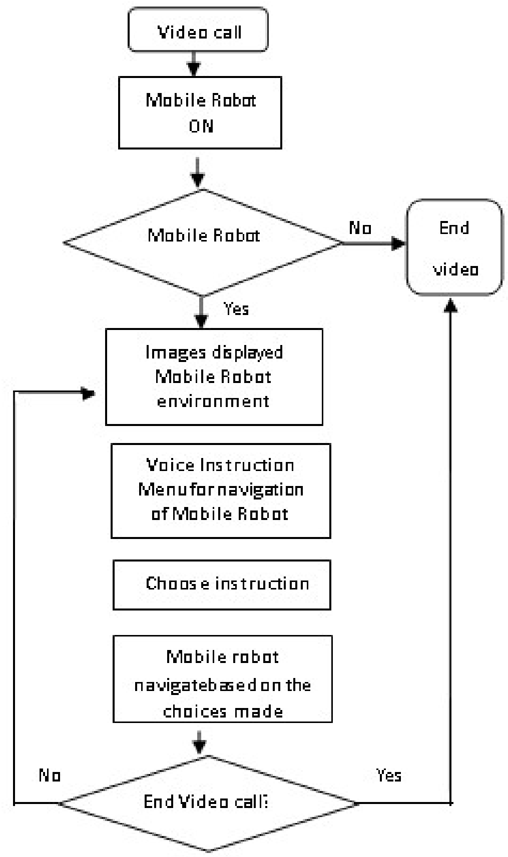

Fig. 12 Proposed Flow Chart

V CONCLUSION

One of the current mobile robots requires a more refined mobile robot control system that makes use of mobile technologies. As a result, it gives people more ways to operate mobile robots and makes the most of the mobility afforded by commonly-carried gadgets like smartphones. It will make it easier for businesses to use mobile robot control and provide new comms companies a chance to capitalise on the widespread adoption of smartphones

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