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AUTONOMOUS LEANING ROBOT BY USING BLUETOOTH

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Abstract**—** Clean Bot is a smart phone-controlled floor cleaning robot which cleans a dirty floor automatically using a set of commands given to your device by a smart phone. Clean Bot has two modes of cleaning – Mopping and Wiping. These two variations can be dedicatedly used in various applications in the cleaning industry and can break the manual labor in terms of cleaning is concerned. The device communicates through Bluetooth technology via a HC05 Bluetooth module that will be used to exchange commands to the microcontroller -Arduino UNO. The robot is given power by a 12V lead-acid battery, the apt voltage requirement used for all motors here. The driver motors uses 150 rpm type while the run with mops 60rpm plastic geared motors attached.

Essentially Clean Bot has a very discrete design in terms of compactness and usability as it is very handy and easy to operate. The mops and wipers are used out of discarded materials and hence cater to the object of smart innovation and environment friendliness. With the onset of age of technology, we have always been trying to bring down the amount of menial labor by substituting it with machines and devices. Thus, taking the similar case in the area of household cleanliness and hygiene, there has been very slow and gradual. Hence this is an attempt to create and explore in the area of household hygiene by taking mopping as our primary area of interest for our project, hence creating a Remote-Controlled Autonomous Floor Cleaning Robot, or CLEANBOT.

I. INTRODUCTION

Floor Cleaning has always been an integral part of the daily health and hygiene routine, be it a household or an industry. Floor cleaning is mainly of two types- Dry cleaning, which mainly involves removal of dust and particulate matter and Wet cleaning, which involves cleaning of the surface with the use of water and other floor disinfectants to clean the floor of liquid waste. But recent statistics have shown an increasing number of slip and fall incidents due to the unclean floor and have an alarming impact on the safety of the people walking on floors at public places. Slip and fall constitute about 15% of all accidental deaths per year. 1 in 6 workplace accidents is caused due to ineffective floor and surface cleaning. The reason behind ineffective floor cleaning is majorly it being considered as menial and being a very laborious task to do. If we talk about dry cleaning process, it has taken greater advancement leap with the introduction of vacuum cleaners. This enables a people to easily remove dust and particulate matter not just in industries and factories but also in households. But in the case of wet cleaning process or Mopping, there hasn't been any major technological advancement and thus makes it more unappealing to do. Thus, there is an emerging need of a paradigm shift in the field of mopping to more technologically sound machinery. Key factors that interviewees identified as direct and indirect causes of slip and trip accidents. Potential causal factor Explanation Public, patient and staff behaviour Signs and barriers being ignored or moved by the public, patients and hospital staff Staffing levels/time pressure Cleaning staff may 'cut corners' when the cleaning team is understaffed, which may result in an increase in accidents Building design Smooth flooring is potentially a greater slip hazard than carpet flooring.

Lack of space/cluttering of wards and corridors also increases trip hazards Weather Precipitation from outside hospitals can become transferred onto hospital flooring, increasing the risk of slipping. A good level of motivation is potentially needed to ensure work is completed to a high standard Damaged flooring Cracked or broken tiles have the potential to cause slip and trip accidents in hospitals "Freak" accidents For example, wearing unsuitable footwear may be the cause of a slip or trip accident Litigation culture Individuals

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identifying a slip or a trip as a causal factor of an accident to make a compensation claim, even if the accident was due to that individual's own carelessness Tardy reporting of spillages Slow reporting results in spillages remaining on floors for longer durations giving an increased opportunity for someone to slip on it.

II. LITERATURE SURVEY

1 N.-J. L. Doh, C.-K. Kim, and W.-K. Chung, "A practical path planner for the robotic vacuum cleaner in rectilinear environments," IEEE Trans. Consum. Electron., vol. 53, no. 2, pp. 519-527, May 2007 In this paper, we propose a path planner for a robotic vacuum cleaner (RVC). In the design of the planner, we consider two main issues: (1) human-friendly path generation and (2) low computational load. First, we analyze how human move and suggest a hypothesis that human navigate in a way that minimizes the sum of muscle and brain energy. By imitating the human path, we propose a humanfriendly path planner. Also, the designed planner requires a low amount of computations which not only extends the battery running time but also decreases the hardware cost of the RVC.

2. S.-W. Kim, J.-Y. Sim, and S.-J. Yang, "Vision-based cleaning area control for cleaning robots," IEEE Trans. Consum. Electron., vol. 58, no.2, pp. 685-690, May 2012 This paper provides a vision based HCI method for a user to command a cleaning robot to move to a specific location in home environment. Six hand poses are detected from a video sequence taken from a camera on the cleaning robot. AdaBoost based hand-pose detectors are trained with a reduced Haar-like feature set to make the detectors robust to the influence of the complex background.

3. M.-C. Chiu, L.-J. Yeh, and Y. C. Lin, "The design and application of a robotic vacuum cleaner," J. Info. Opt. Sci., vol. 30, no. 1, pp. 39-62,Jan. 2009 In this paper, an intelligent and interactive robotic vacuum cleaner is developed. By using awireless transport protocol (802.11b), the user can monitor the robot's path and remotely manipulate its movements with a pc interface. Research has developed two kinds of functions — an auto-vacuum-cleaning mode and a remote-manipulating mode.

III. SYSTEM ARCHITECTURE

In this proposed wireless A robot is an electromechanical machine that is constrained by computer program to perform different activities. Modern robots have intended to decrease human exertion and time to further develop efficiency and to diminish fabricating cost. Today human-machine cooperation is creating some distance from mouse and pen and turning out to be considerably more unavoidable and significantly more viable with the actual world. Android application have some control over the robot movement from a significant distance utilizing Bluetooth correspondence to interact regulator and android. Microcontroller ATMEGA328P-PU can be connected to the Bluetooth module however code is written in installed C language. According to the orders got from android application the robot movement can be controlled. The result movement of a mechanical vehicle is precise and repeatable. Pick and Place robots can be reprogrammable and apparatus can be traded to accommodate numerous applications. The motivation behind this work is to plan and carry out an Android Controlled Bluetooth Robot which is utilized for Surveillance, home robotization, wheelchairs, military and hostages rescue applications.

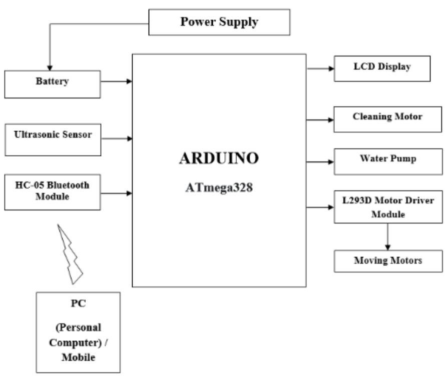

Figure: Proposed system Block diagram

HC-05 Bluetooth module. D.C. engine is constrained by DC voltages and moves in forward, in reverse, left and right, heading as indicated by the extremity of voltage applied. For the most part all mechanical development which robot performs is achieved by an electric engine. Electric machines are method for changing over energy into mechanical energy. Electric engine is utilized to control gadgets. An illustration of little engine applications, for example, engines utilized in vehicles, robot and hand power apparatuses.

Microcontroller can't supply the current expected to run DC engine. The L293 and L293D [9-10] are fourfold high-ebb and flow half - H drivers. The L293D gives bidirectional drive flows of up to 1A at voltage from 4.5V to 36V. The L293D is intended to give bidirectional drive flows of up to 600-MA at voltages from 4.5V to 36V. The two gadgets are intended to drive inductive loads like transfers, solenoids, dc and bipolar venturing engines, as well as other high-current/high voltage loads in certain stockpile applications. On the L293D, outside fast result clasp diodes ought to be utilized for inductive transient concealment. A Vcc1 terminal, separate from Vcc2, is obliged the reasoning commitments to restrict device power dispersing. The L293 and L293D are portrayed for activity from 0ɔC to 700C.

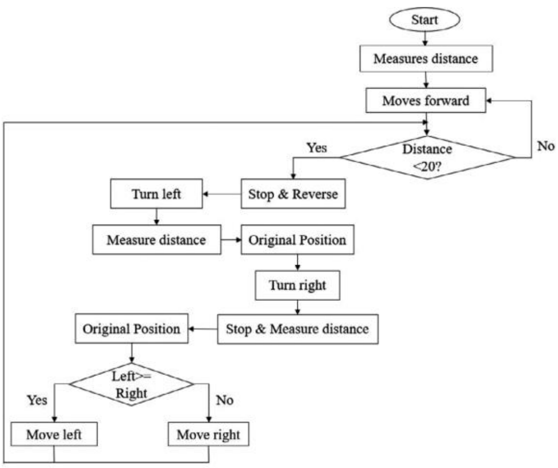

Figure: Flow chart

V. HARDWARE COMPONENTS

The design of any system consists of Hardware requirements and Software development. Hardware requirement is focused on the components which are used for designing the project and Software development is focused on the coding which is loaded into the hardware.

a) Arduino Uno

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); Ithas also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Figure: Arduino Uno

Table: Arduino Specifications

FEATURE	SPECIFICATION
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

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b) Liquid Crystal Display

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

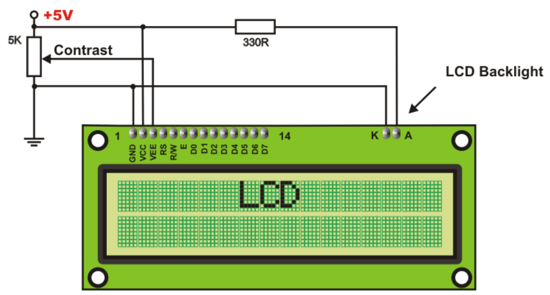

Figure: LCD Display

c) Dc Motor

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bearin motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.

Figure: DC Motor

d) ULN Driver

The ULN2003 internally employs high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channel rated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout. ULN2003A is of 5V TTL, CMOS. These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, thermal printheads and high power buffers. The ULN2003A are supplied in 16 pin plastic DIP packages with a copper leadframe to reduce thermal resistance.

Figure: ULN Driver

e) HC-05 Bluetooth Module

Bluetooth Module HC-05 used for the above mentioned and many other cases. Here we will be understanding the connection and working of a HC-05 module and also its interfacing with custom android app.

Wireless communication is swiftly replacing the wired connection when it comes to electronics and communication. Designed to replace cable connections HC-05 uses serial communication to communicate with the electronics. Usually, it is used to connect small devices like mobile phones using a short-range wireless connection to exchange files. It uses the 2.45GHz frequency band. The transfer rate of the data can vary up to 1Mbps and is in range of 10 meters. The HC-05 module can be operated within 4-6V of power supply. It supports baud rate of 9600, 19200, 38400, 57600, etc. Most importantly it can

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be operated in Master-Slave mode which means it will neither send or receive data from external sources.

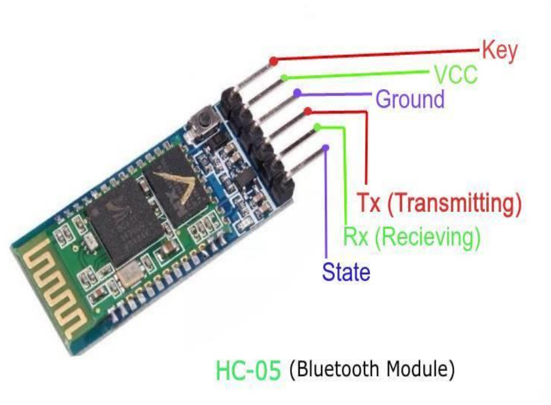

Figure: Bluetooth Module

Ultrasonic Module HC-SR04

The ultrasonic sensor works on the principle of SONAR and RADAR system which is used to determine the distance to an object.

An ultrasonic sensor generates high-frequency sound (ultrasound) waves. When this ultrasound hits the object, it reflects as echo which is sensed by the receiver as shown in below figure.

Figure: Ultrasonic sensors

BATTERY

A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used,including: leadacid, nickel cadmium (NiCd), nickelmetalhydride (NiMH), lithium ion(Li-ion), and lithium ion polymer (Li-ion polymer).

Figure: Lead Acid Battery

V. RESULTS

Finally, to make CleanBot is an essentially a compact remote controlled autonomous floor cleaning device which cleans the floor by a set of commands given from a smartphone using Bluetooth signals given through a Bluetooth module. Essentially CleanBot has a very discrete design in terms of the compactness and usability as it is very handy and easy to operate.

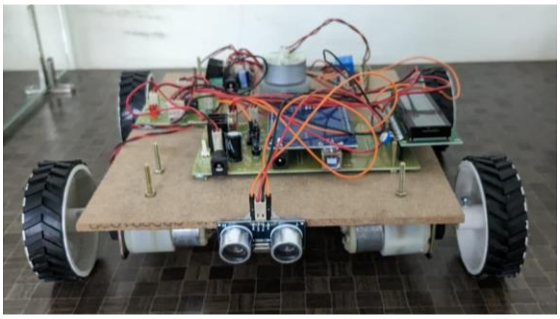

Figure: Hardware Prototype

CONCLUSION

In this paper, floor cleaning is and has been considered a menial job which also brings repercussions in society, which should not occur. In the end, hygiene and cleaning is a basic necessity of every individual and hence steps are needed to be taken so as to create and equality in terms how cleaning affects society and that to understand that hygiene is a basic life process which every individual should follow. This project has presented and described the Remote-Controlled Autonomous Floor Cleaning Robot. Additionally it is also an attempt to use and integrated sense of technology from different disciplines to scale technology down to the basic household requirements. We have mentioned and clarified the requirements of architecture and developed it to satisfy the requirements. This particular endeavor has allowed us to attach both the process of vacuuming and moping into a single device. Experimental results target task clearly showed that the developed strategy was useful for developing the autonomous service robots. In conclusion, robot operation can be and probably must be used in cooperation with human beings. The developed propositions were useful for both extending robot's ability and developing a new platform. We can make it avoid rugged surfaces and walls. As always, possibilities are endless.

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