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Multifunctional Self-balancing Mobile Platform with Smart phone

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ABSTRACT:A multifunctional self-balancing mobile platform is considered and implemented based on the navigation platform, which could carry both people and objects. Through the establishment and analysis of its motion, put forward the specific control scheme of the self-balancing mobile platform. Understand the platform angle, speed, direction control by feedback circuit. At the same time, the platform prepared with a comfortable body mechanics saddle chair and a display screens which could output real-time motion parameters of the platform. By using Wi-Fi remote control, realized the intelligent automation control. The platform is flexible, convenient, stable and reliable. It's also simple operational, environment-friendly. The platform can be used for daily short journeys, handling everyday objects, carry professional photographic equipment, realize the smooth track shoot. After adding intelligent sensor and processor, it can be used as the basic platform of two-wheels self-balancing service robot. Overall, the platformdesign is validated based on the positional accuracy of the platform given the relatively low quality components used to create it.

KEYWORDS: Multifunctional Self-balancing Mobile Platform,

I.INTRODUCTION

In recent years, with the deepening of wheeled mobile robot research and the increasing diversification of the waypeople traveling, two-wheeled self-balancing vehicle has gradually become a new means of transport which has been widely favoured. However, the current two-wheeled self-balancing vehicle on the market mostly has single function and some other problems, such as can't run smooth enough, not easy enough to use and so on. Designing a mobile robot with special capabilities has become a trend these days for a variety of universal human consumption. It also fits well with the needs and nature of the human lifestyle. Different forms and uses, mobile robots have been designed and are now in the market worldwide. A mobile robot comprises of three main parts including sensors, logical processing unit and actuator. In this project, a robot that can maintain an upright and balanced position on a platform is designed and developed. The robot consists of Inertial Measurement Units (IMU) sensors, microprocessor and motors. The design is designed with Matlab and the resulting parameters are used and burned into ARM controller. The main purpose of the controller is to fuse the wheel encoder, gyroscope and accelerometer sensors to estimate the attitude of the platform and then to use this information to drive there action wheel in the direction to maintain an upright and balanced position platform. If the platform system itself is not balanced, which means it keeps falling off away from the vertical axis, then a gyro chip is needed to provide the angle position of the inverted pendulum or robot base and input into the controller, which the program itself is a balancing algorithm. The PID controller will then provide a type of feedback signal through PWM control to turn the motor servo clockwise or anticlockwise, thus balancing the platform. These two measurements are summed and fed-back to the actuator which produces the counter torque required to balance the platform robot.

II.RELATED WORKS

Conducting initial review research is very critical in understanding self-balancing platform control techniques. The review of research about related literature conducted in this project summarizes some of topics related to the techniques used for the balancing of platform based on Dc motor position. Comparisons between the present project and the related topics of existing information will also be discussed. The methodologies and the techniques used by other researchers around the globe on the balancing platform topic will also be reviewed.

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Meena et al. (2011) proposed a design for a servo motor controller in discrete-time system to obtain the transfer function of the PID controller design. MATLAB / Simulink has been used to confirm the effectiveness of this newdesign method, which provides a simple and powerful way to design a speed controller for servo motor. It also extracted a DC servo motor mathematical model and equations and there were three different motion controllers that were designed and simulated to control the velocity of the motor. Popescu et al. (2011) did a comparison between PID and Fuzzy controllers used in mobile robot control. There is a significant problem for fuzzy controllers in which computing time is longer than the PID because a lot of complex operations such as requiring fuzzification, inference, and defuzzification.

Masakazu et al. (2005) proposed a tuning method for PID controller that considers changes in system characteristics. It is about the concept of using the optimization of PID controller tuning, depending on the obstacles on the control input derivatives and considering model uncertainties caused by changes in the system dynamics. Partial model matching method was used to evaluate performance and control while the reference referred to interference andrepression compared to the tracking properties.

Arpit et al. (2012) proposed a performance comparison of PID and Fuzzy logic controller using different defuzzification techniques for positioning control of dc motors. The result of the fine-tuned PID controller gives relatively less overshoot and settling time with no steady state error. The fuzzy logic controller with different defuzzification techniques gives zero % overshoot and lesser settling time. In a paper titled ‘Attitude Estimation Using Low Cost Accelerometer and Gyroscope’ written by Young Soo Suh (2003), it shows two different sensors which are the accelerometer and gyroscope that exhibit poor results when used separately to determine the attitude which is referred as the pitch angle or roll angle. However, the gyroscope can combine with accelerometer to determine thepitch or roll angle with much better result with the use of Kalman filter. Tomislav et al (2012) proposed self-balancing mobile robot filter. It provides a summary of work done in the field of electronic, mechanical design, software design, system characterization and control theory. Robotic system model and simulation results of various control methods required for the stabilization of the system were studied. Dynamic effects become increasingly important in assessing performance limits in robotic. The processes where the project was carried out including design and production of certain parts of the integration section, electronic, mechanical and software.

III.PROPOSED WORK

It will be prevented from falling by giving acceleration to the wheels according to its inclination from the vertical. If the bot gets tilts by an angle, than in the frame of the wheels, the center of mass of the bot will experience a pseudo force which will apply a torque opposite to the direction of tilt.

A. Mechanical Structure:

The bot consists of three platforms which have ARM, IMU, motor driver based on it. On the lower part of the bottom platform, the two high torque motors (100 rpm) are clamped. The whole bot gets balanced on two wheels having the required grip supplying sufficient friction (as there are large chances for wheels to skid).

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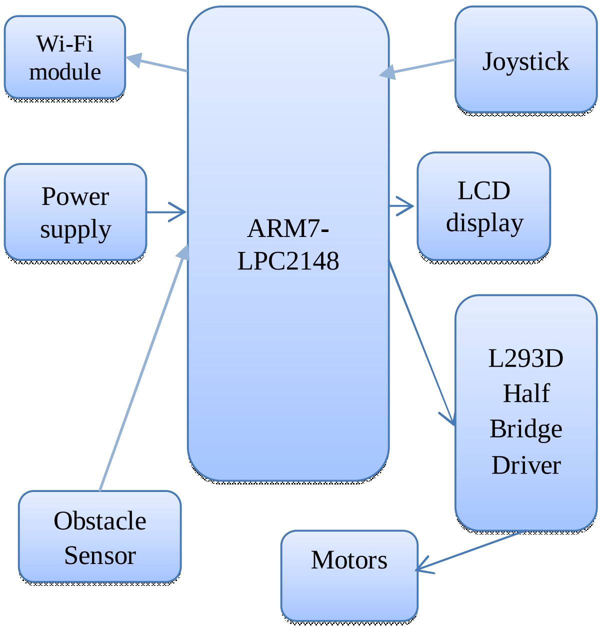

Fig.1 Block diagram

A. HARDWARE IMPLEMENTATION:

ARM Microcontroller: The microcontroller used in the present study is the LPC2148. Deploying LPC2148 series for the designing of an embedded system for dedicated application is reported by various investigators. Fig.4 depicts the pin configuration of microcontroller LPC2148.

The LPC2148 are based on a 16/32 bit ARM7TDMI-S CPU with real time emulation and embedded trace support, together with 128/512 kilobytes (KB) of embedded high speed flash memory. A 128 bit wide memory interface and unique accelerator architecture enable 32 bit code execution at maximum clock rate. For critical code size applications, the alternative 16 bit thumb mode reduces code by more than 305 with minimal performance penalty with their compact 64 pin package, low power consumption, various 32 bit timers,4 channel 10 bit ADC,USB port, PWM channels and 46 GPIO lines with up to 9 external interrupt pins [6]. Due to tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement. It has attractive features and is suitable for a wide range of applications. The important features are:

- 8 to 40 Kb of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.
- 128 bit wide interface/accelerator enables high speed 60 MHz operation.
- It has In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400ms and programming of 256 bytes in 1ms.
- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high speed tracing of instruction execution.
- Two 10-bit A/D converters provide a total of 6/14analog inputs, with conversion times as low as 2.44 μs per channel.
- Single 10-bit D/A converter provide variable analog output.
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power real-time clock with independent power and dedicated 32 kHz clock input.

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Infrared sensor: An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings.an IR sensor can measure the heat of an objects as well as detects the motion .these types of sensor measures only infrared radiation rather than emtting it that is called as a passive IR sensor. The IR Sensor-Single is a general purpose proximity sensor. Here we use it for collision detection. The module consists of a IR emitter and IR receiver pair. The high precision IR receiver always detects a IR signal.[5]

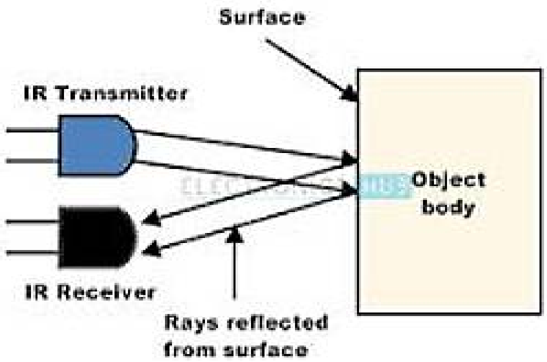

Fig.2.IR Sensor

DC Motor: The L293 and L293D are quadruple high-current half-H drivers. These devices are designed to drive a wide array of inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current and high voltage loads. All inputs are TTL compatible and tolerant up to 7 V. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications. [1]

Fig.3.DC Motor

LCD Interfacing to Microcontroller: A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text and integers. Its major features are its lightweight construction, and portability. Date and time are continuously displayed on LCD when the sensor values are being stored in EEPROM. Four data lines are used to send data on to the LCD. When RS=0 and EN pin is made high to low command is sent to LCD. When RS=1 and EN pin is made high to low data is sent to LCD. VEE is used to adjust contrast.

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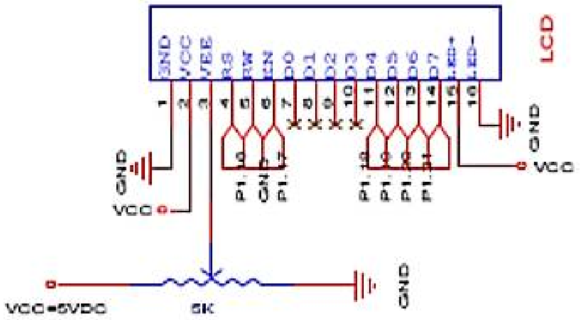

Fig.4. LCD connection

IV. RESULT AND DISCUSSION

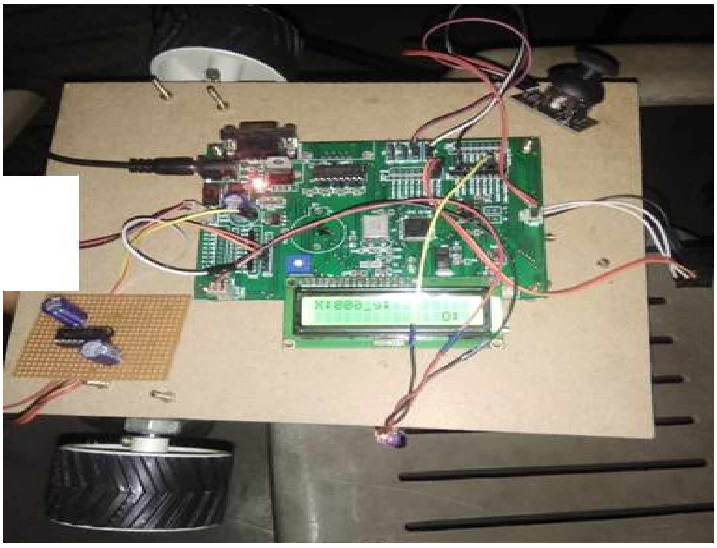

Fig.5. Hardware main unit

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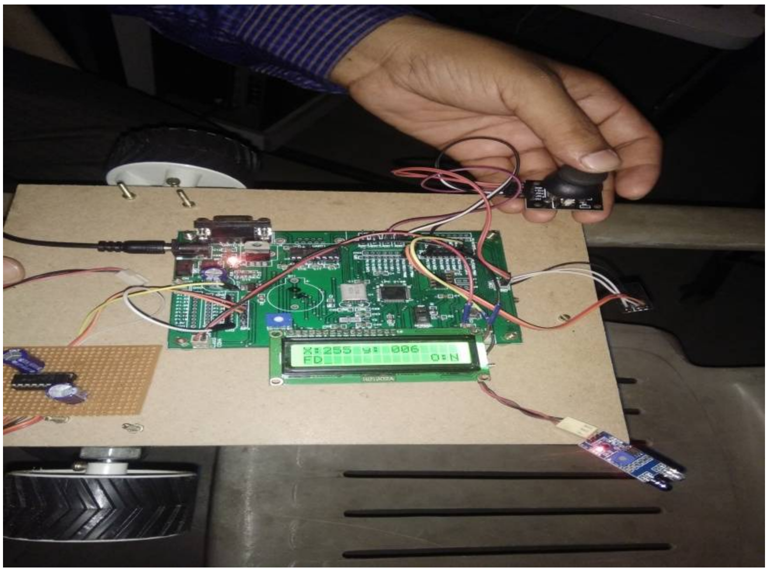

Fig.6. Hardware main unit with joystick

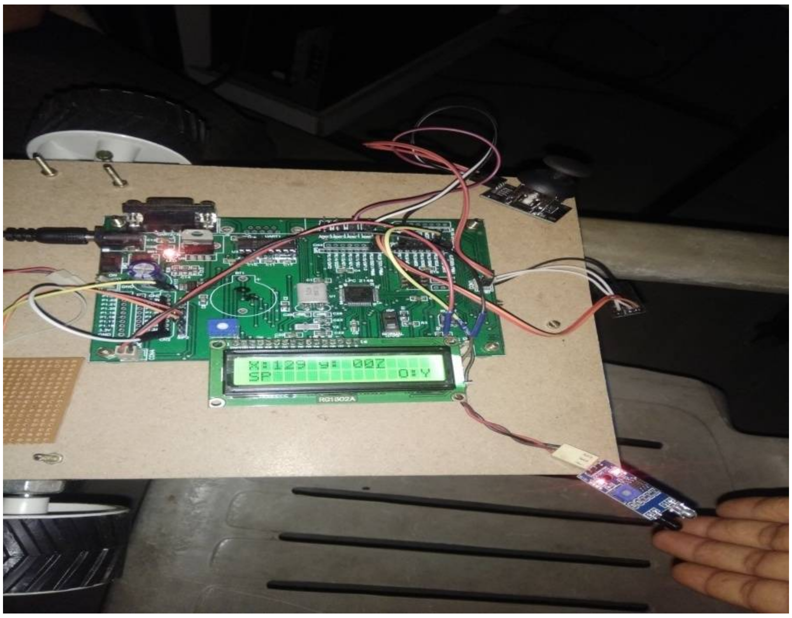

Fig.7. Hardware main unit with obstacle sensor

VI.CONCLUSION

In this paper, a multifunctional self-balancing mobile platform was introduced in terms of the platform assembly, hardware design, working principle, applications field .The project and implementation of a system for monitoring the object detection parameters using Wi-Fi scenario is accomplished. The system provides a low power solution for establishing a monitoring station. The system is tested in an indoor environment and it is successfully updated the object detection conditions from sensor data.

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REFERENCES

[1] R.S.Meena,Vikas Kumawat(2011) .Controller Design For Servo Motor Using MATLAB .In Proceeding of National Conferences on Advances & Research in Electrical System Technology (AREST 2011).
[2] A. Al-Ali, I. Zualkernan, and F. Aloul, “A mobile GPRS-sensors array for air pollution monitoring,” IEEE Sensors Journal, vol. 10, no. 10, pp.1666–1671, 2010.
[3] A. Ghobakhlou, S. Zandi, and P.Sallis, “Development of environmental monitoring system with wireless sensor networks,” 2011.
[4] R. Nallusamy and K. Duraiswamy, “Solar powered wireless sensor networks for environmental applications with energy efficient routing concepts: A review,” Information technology journal, vol. 10, no. 1, pp.1–10, 2011.
[5] D. Bhattacharjee, S. Kumar, A. Kumar and S. Choudhury, (2010) “Design and Development of Wireless Sensor Node”, International Journal on Computer Science and Engineering, Vol. 02, No. 07, pp 2431- 2438.
[6] M. U. Mahfuz and K. M. Ahmed, (2005) “A Review of Micro-Nano-Scale Wireless Sensor Networks for Environmental Protection: Prospects and Challenges”, Sci., & Techno. Advanced Mater, pp 6302-6306.
[7] QI Guangjing, XIE Gang, LIU Yingjie, Two-Wheeled Vehicle Self-Balancing Motion Control System. Shanxi, China, 2014.
[8] REN Hang, Two-wheel self-balancing vehicle control. No.10, 2014.
[9] ZHENG Hong, LIU Zhenqiang, Self- Calibration of Pan-Tilt Camera Based on Accurate Model. Vol.35, No.3, 326-338. 2013.

BIODATA

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